Baylor OB\Gyn Perinatal Guidelines

December 2025

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Key

New Guideline

Updated Guidelines

Guidelines Due for Revisions

Changes are highlighted in yellow within the document to point out changes made.

Hematology

Alloimmunization

[October 2025 (replaces December 2023)]
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Rhesus antigens were added to the tables; a critical titer for Anti-Kell and Anti-c (little c) was changed to ≥1:4. and cfDNA section was updated with an example of pretest counseling. The figures have been updated to reflect these changes and for increased visibility.

Highlights

- The threshold titer at which there is an increased risk of development of fetal hydrops is 1:16 for almost all antigens. The critical titer for Anti- Kell and Anti-Little c is 1:4.
- Titers should only be monitored for the first affected pregnancy (the pregnancy in which the antibodies are first detected). Titer monitoring is not recommended in subsequent affected pregnancies and MCA Doppler studies should be performed.
- Paternal Antigen status should be obtained (if possible) in the first affected pregnancy
- cfDNA for RhD status is a not recommended as the first line evaluation in an alloimmunized pregnancy.

Background and Definitions

Red cell alloimmunization refers to an immune response following exposure to foreign red cells, resulting in formation of red cell antibodies. It has become a rare event during pregnancy in the United States in recent years, with the prevalence reported for rhesus alloimmunization as 6.8 per 1,000 live births.[1,2] Other reported blood groups associated with mild to severe risk of fetal anemia include those listed in Table 1 and Table 2.

The formation of maternal RBC antibodies may lead to various degrees of transplacental passage of these antibodies into the fetal circulation; **note that IgG phase antibodies can cross the placenta, IgM do not to a large degree.** Lewis (Le^a and Le^b) and I antibodies do not cause HDFN because they are predominantly of the

IgM type, and thus do not require additional evaluation and management. Depending on the degree of antigenicity, amount and type of antibodies involved, this transplacental passage may lead to hemolytic disease in the fetus and neonate.[3] The terminology used in determining fetal risk involves discussion of **antigen status** (i.e., phenotype) and genotype and dosage of the implicated antigen (or zygosity) in the father's genome.

Titer threshold

Titers of antibodies are determined with indirect coombs tests to determine the degree of alloimmunization and therefore the risk of hemolytic disease in the fetus. Variation between laboratories is common, but in the same laboratory, the titers should not vary by more than one dilution. A critical titer is defined as the titer associated with a significant risk for fetal hydrops**. In our hospitals, 1:16 is a critical titer for all antigens except anti-Kell and anti-little c, which is critical at 1:4**. Notably, a rise of three or more titers can signify active immune sensitization.

Kell Alloimmunization

The Kell blood group is one of the most common of the minor RBC antibodies. Unlike RhD, the titer of anti-Kell antibodies may not correlate well with the degree of fetal anemia. Therefore, most experts recommend increased surveillance once a Kell titer of 1:4 is reached.[1,2,4,5] Anti-K antibodies are most commonly acquired through blood transfusion, therefore paternal testing is very important in determining fetal risk (i.e., if the father is Kell negative, then the fetus is not at risk as long as paternity is assured).

Table 1. Blood Groups with Mild Risk for Hemolytic disease of the fetus/neonate (HDFN)

Blood Group System	Antigens Related to Hemolytic Disease	Hemolytic Disease Severity
Kell	k	Mild
Duffy	By^3	Mild
Kidd	Jk^b	Mild
	Jk^3	Mild
Rhesus (Rh)	C	Mild
	e	Mild
MNSs	N	Mild
Lutheran	Lu^a	Mild
	Lu^b	Mild
Xg	Xg^a	Mild
	Yt^b	Mild
	Lan	Mild
	Ge	Mild
	Jr^a	Mild
	Co^{1-b-}	Mild
Private Antigens	Batty	Mild
	Becker	Mild
	Berrens	Mild
	Evans	Mild
	Gonzales	Mild
	Hunt	Mild
	Jobbins	Mild
	Rm	Mild
	Ven	Mild
	$Wright^b$	Mild

Adapted from ACOG Practice Bulletin and Creasy (3-4).

Table 2. Blood Groups with Moderate or Severe Risk for HDFN

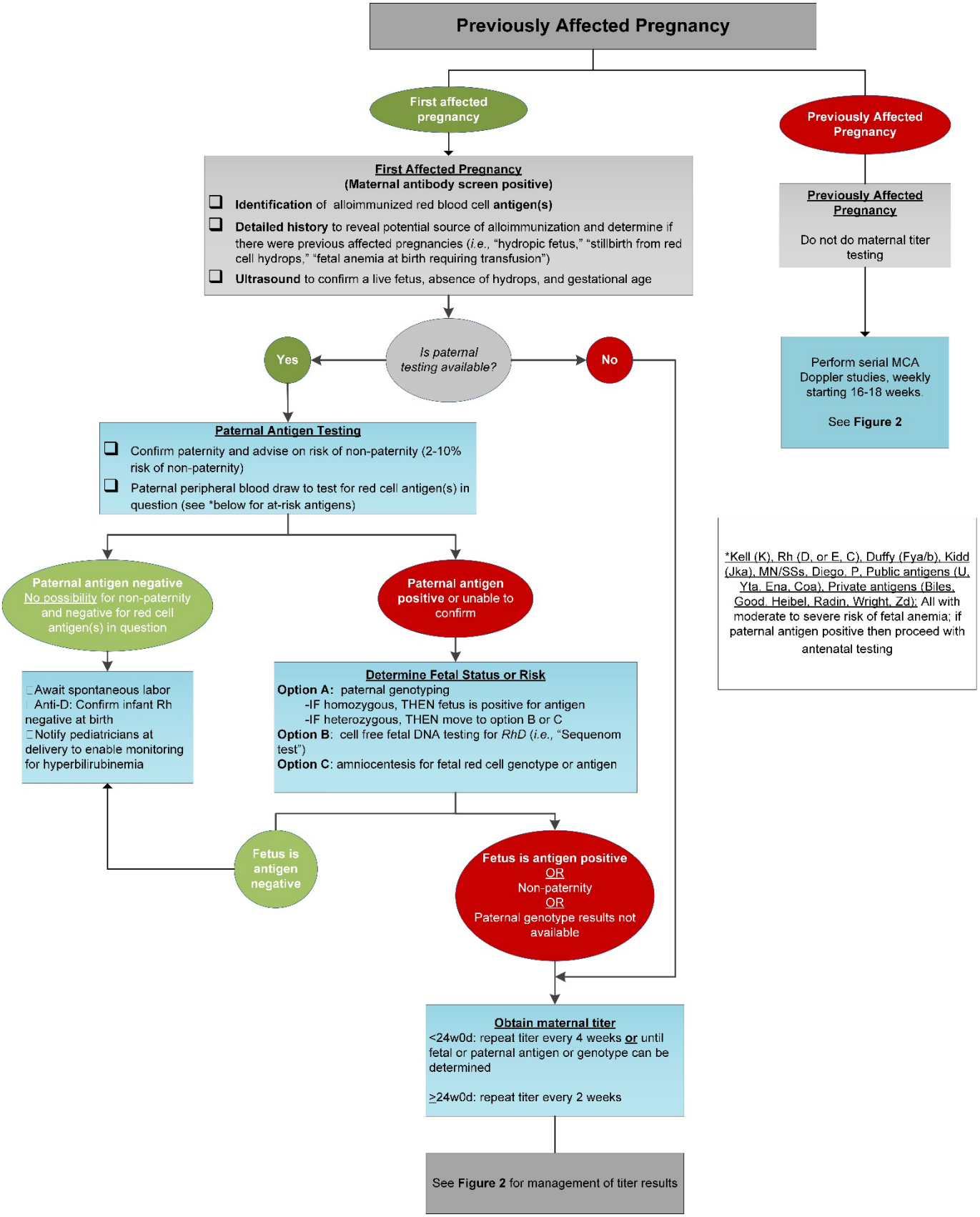
Blood Group System	Antigens Related to Hemolytic Disease	Hemolytic Disease Severity
Kell	K	Mild to Severe
Rhesus (Rh)	D	Severe
	c	Mild to Severe
	E	Mild to Severe
	C	Mild to Severe
Duffy	Fy^a	Mild to severe
Kidd	Jk^a	Mild to Severe
MNSs	M (only if IgG phase)	Mild to Severe
	S	Mild to Severe
	s	Mild to Severe
	U	Mild to Severe
	Mi^a	Moderate
MSSs	Mt^a	Moderate
Diego	$D1^a$	Mild to Severe
	Di^b	Mild to Severe
P	PP_{1pk}	Mild to Severe
Public Antigens	Yt^a	Moderate to Severe
	En^a	Moderate
	Co^a	Severe
Private Antigens	Biles	Moderate
	Good	Severe
	Heibel	Moderate
	Radin	Moderate
	$Wright^a$	Severe
	Zd	Moderate

Adapted from ACOG Practice Bulletin and Creasy (3-4).

Management[6]

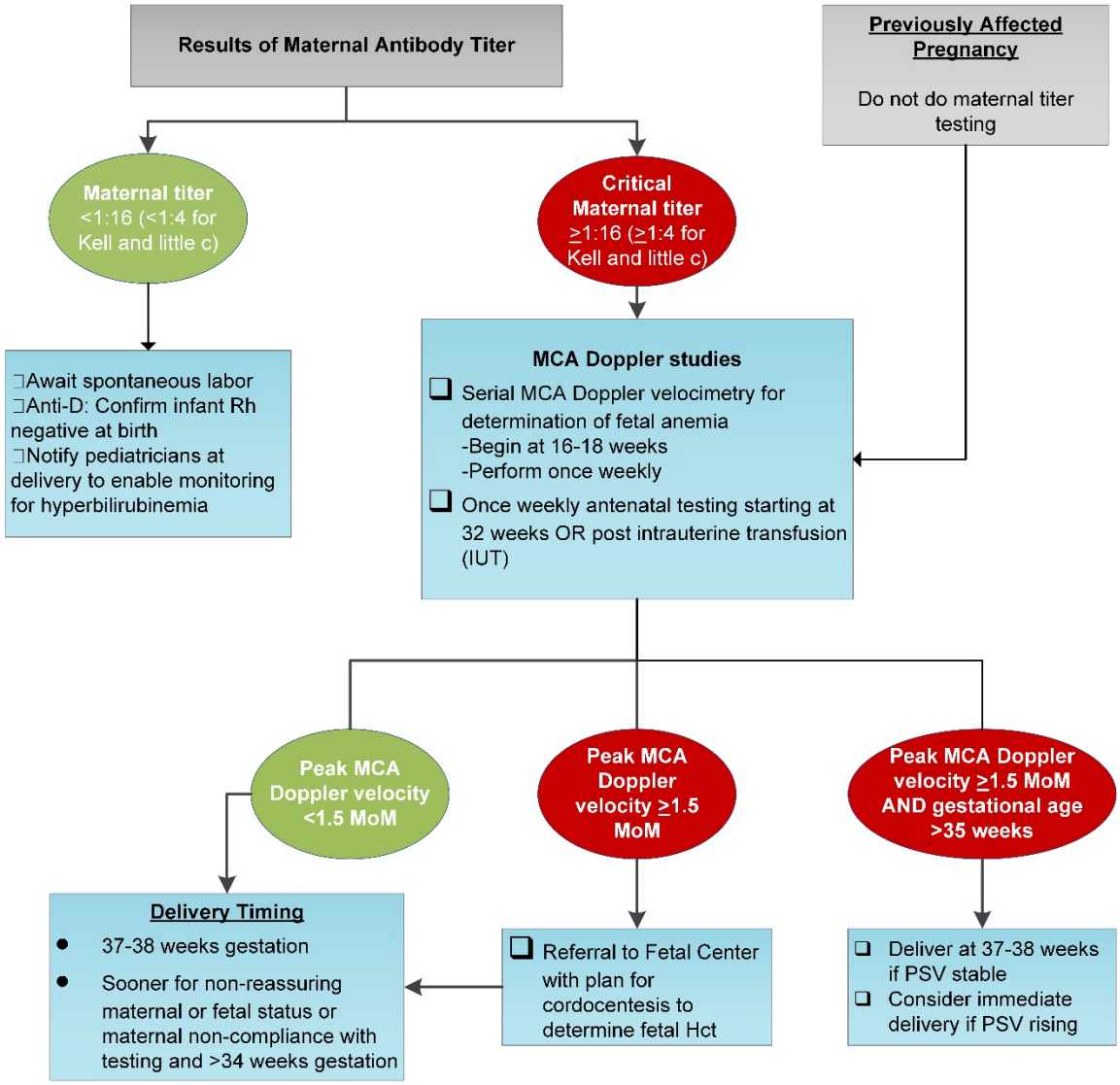
See Figure 1 and Figure 2 for an overview of management.

Figure 1. Management of Alloimmunization



[1] The first affected pregnancy is the pregnancy in which the anti-red cell antibody is first detected. A pregnancy does not require adverse sequelae or HDFN to be categorized as affected.

Figure 2. Management based on maternal antibody titers and in previously affected pregnancies



Testing

If the assessment of maternal type and screen reveals evidence of alloimmunization (i.e., a positive type and screen), the blood bank will reflexively report the red blood cell antigen and titers.

History and non-paternity

A detailed maternal history is important to identify potential sources of alloimmunization (i.e., previous blood transfusions, paternity, and previously affected pregnancies). Details such as a previous hydropic fetus, stillbirth, or fetal anemia requiring red cell or exchange transfusion indicate a previously affected pregnancy. It has been reported that there is a 2-10% risk of non-paternity, and as this is a sensitive topic patients should be counseled carefully on the fetal risks of such. The history can help determine the likelihood of non-paternity as well: if the patient has no prior history of transfusion and states she has never been pregnant with another partner, yet this partner is antigen negative, then non-paternity must be suspected.

Paternal antigen testing

Once maternal type and screen reveals evidence of alloimmunization, paternal antigen testing is recommended. In the case of RhD sensitization, the first step should be paternal antigen testing followed by paternal genotyping for RhD. Genotyping is recommended over paternal antigen status to provide dosage (homo- versus hetero-zygous) and due to the possibility of the RhD pseudogene. If the paternal antigen is positive, then genotyping is recommended for RhD zygosity. If the father is homozygous, then the fetus is presumed to be at risk. If the father is heterozygous, then the next recommended step is cell free fetal DNA testing. If this is not possible, then amniocentesis for fetal RBC RhD genotype should be offered/recommended. If the father is not available for testing, then we recommend proceeding directly to maternal antibody titers (if there is no history of previously affected pregnancies) and initiation of MCA Dopplers once a critical titer is reached.

For other RBC antigens, if the paternal antigen is positive for the RBC antigen in question, then genotype testing should be done. Homozygous paternal genotype indicates the fetus has a 100% chance of inheriting the antigen. Heterozygosity indicates a 50% risk and therefore the next steps include evaluation of the fetal antigen status via amniocentesis and/or MCA Dopplers.

Fetal non-invasive diagnostic testing

Cell Free Fetal DNA (cfDNA, aka NIPT for fetal RHD genotyping: This technique determines the fetal RhD status in maternal plasma. A recent meta-analysis[7] demonstrated that NIPT specifically for fetal *RhD* genotyping was estimated highly sensitive/specific beyond 11-weeks gestation. Two thoughts were of note: (1) amplifications from ≥2 exons are optimum to increase accuracy, and (2) the diagnostic accuracy of fetal RhD genotyping in non-white populations is unknown. This latter statement is supported by a second meta-analysis from 2019 (7) and follows the prior discussion in this guideline highlighting that the presence of the *RhD* pseudogene can vary by African descent. Ergo, prenatal detection of fetal RhD type from maternal blood could lead to higher rates of false positive results in this particular population; more research is needed in non-white populations.[7,8] Thus, while cfDNA permits cost-effectiveness, precious resources sparing, and low emotional stress testing, due to limited evidence, the accuracy of cfDNA in non-white people and multiple pregnancies is unclear at present.[7,8] When available and interpreted with confidence, this test replaces the need for amniocentesis or cordocentesis. It also circumvents issues with self-reported paternity assessment by directly assessing fetal status.[7] **While single gene cfDNA testing is available, there is currently not enough evidence to recommend it as a replacement for the current screening and testing algorithm.** Pre-test counseling is recommended before the use of the test and shared decision making regarding the clinical management of the result (Box 1).

Box 1. *Sample Counseling for Use of cfDNA for RhD genotyping*

We discussed the limitations of the cfDNA screening test and that amniocentesis is required for definitive testing. Alternatively, when paternity is certain, paternal testing can be performed. We also noted that cfDNA can yield false-negative results (indicating an RhD-negative fetus when it is actually positive) and false-positive results (indicating an RhD-positive fetus when it is actually negative).

In cases of false-negative testing, there is the risk of undetected fetal anemia and its associated risks. Conversely, a false-positive test poses a risk of unnecessary intervention. Another limitation discussed is that cfDNA is less accurate for certain RhD variants, especially in individuals of non-European ancestry who may have different genetic variations. Additionally, there is a relative lack of large-scale clinical validation studies demonstrating the test's effectiveness for detecting fetal RhD status in widespread clinical practice. Therefore, while NIPT is an excellent screening test, some potential limitations exist.

Lastly, we reviewed the standard management for women with RhD alloimmunization. Anti-D antibody levels are serially measured, usually monthly until 24 weeks of gestation, and then every two weeks. When a critical titer is reached, weekly antenatal testing is performed, and delivery planning is based on the outcome of this testing.

cfDNA is a good option for patients who feel comfortable with its limitations and wish to avoid the intensive surveillance involved. The patients' questions were answered, and she decided to proceed with standard surveillance.

Middle Cerebral Artery (MCA) Doppler Studies

Middle cerebral artery peak systolic velocity (MCA-PSV) Doppler >1.5 MoM have been found to have 100% sensitivity and a 12% false positive rate for predicting fetal anemia before 35 weeks. After 35 weeks, MCA Doppler appears to have reduced sensitivity and there are no evidence-based recommendations to guide management. **The SMFM algorithm for management of fetuses at risk for anemia includes continuation of MCA-PSV Doppler interrogation after 35 weeks, with delivery if the Dopplers are ≥1.5 MoM and the PSV trend is increasing.[6]**

Indications for delivery

As outlined in Figure 2, with the need to employ best clinical judgment.

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Anemia during Pregnancy

[October 2024 (replaces March 2021)]

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Editor: Dr. Ingmar Bastian

This guideline has been updated with gender inclusive language.

Summary

- All pregnant patients should have a screening CBC in the first trimester and 24-28 weeks gestation.
- All patients should have a hemoglobin electrophoresis in pregnancy if not yet done.
- Patients diagnosed with anemia should have screening for iron deficiency and/or other causes of anemia based on CBC indices and medical history.
- Screening for micronutrient deficiencies such as B12 and folate deficiencies should be considered for patients at increased risk based on medical/surgical history or dietary limitations.
- Iron deficiency is diagnosed if ferritin < 30 g/dL and/or transferrin saturation < 20%
- We recommend treatment with oral iron, daily or every other day, as a first line treatment for antenatally diagnosed iron deficiency anemia.
    - **More than once daily dosing of oral iron should not be administered.**
- IV Iron should be considered for
    1. **Patients <28 weeks with a Hgb of <9 g/dL or ≥ 28 weeks with a Hgb of < 10 g/dL**
    2. Patients who do not tolerate oral iron therapy.
    3. Patients with malabsorption syndromes (i.e. IBD, gastric bypass).
    4. Patients who are refractory to oral iron after 4 weeks of therapy.
    5. **For postpartum patients with hemoglobin of <9 g/dL (who do not meet criteria for a blood transfusion) and/or 3g/dL drop in hemoglobin.**

Background

Pathologic anemia in pregnancy is exceedingly common, affecting 40% of pregnant patients worldwide and nearly one third of pregnant people in the United States.[1] In a cohort from Baylor College of Medicine, the prevalence of anemia diagnosed by a hemoglobin 11.0 g/dL on admission to labor and delivery was 35%.[2]

Several studies have identified associations between maternal anemia and higher rates of preterm labor, low birth weight neonates, low neonatal 5-minute APGAR, preeclampsia, Cesarean delivery, postpartum hemorrhage, blood transfusion, perinatal death and maternal death.[1-5] Additionally, iron deficiency with or without anemia has been associated with an increased incidence of perinatal depression.

Iron deficiency is the leading cause of pathologic anemia in pregnancy. The Institute of Medicine and ACOG recommend 27mg of ferrous iron daily during pregnancy, an amount which is typically present in prenatal vitamins.[6,7] The goal is to prevent development of or worsening iron deficiency and/or anemia. A 2024 Cochrane review evaluated 57 trials to determine the effect of iron deficiency on pregnancy outcomes.[8] They found that treatment with iron supplementation reduced maternal iron deficiency anemia as well as incidence of having a neonate with low birthweight (weight < 2500g). Evidence is still uncertain about whether treatment of anemia improves other associated outcomes, particularly incidence of perinatal depression. However, it is also important to note that the symptoms associated with anemia and/or iron deficiency (fatigue, restless legs, headache, palpitations, syncope) can adversely affect quality of life.[9] Therefore, it is valuable to screen, treat and monitor anemia and iron deficiency during pregnancy to provide symptomatic benefit alone.

Other micronutrient deficiencies, such as B12 or folate deficiency, are rare and more often seen diagnosed in patients with malabsorptive syndromes, prior bariatric surgery, or specific dietary restrictions (vegan and vegetarian diets).[6,10] These deficiencies have also been associated with adverse perinatal outcomes as well as long term neurocognitive symptoms for the fetus.[10,11] Therefore, it is important to diagnose and treat these conditions although definitive evidence that repletion improves associated outcomes is lacking.[8]

Screening and Work Up

ACOG recommends screening for anemia for all pregnant people in the first trimester and at the end of the second trimester from 24-28 weeks.[6] **Anemia is diagnosed when hemoglobin levels of 11 g/dL in the first**

Iron Deficiency

1. Heavy menstrual cycle
2. Dietary
3. Short interpregnancy interval
4. Malabsorption (IBD, IBS, history of gastric surgery, chronic PPI use or metformin use)
5. Malnutrition (inadequate access to food, hyperemesis)

B12 Deficiency

1. Dietary (especially vegan and vegetarian diets)
2. Malabsorption (IBD, history of gastric surgery)
3. Malnutrition (inadequate access to food, hyperemesis)

Folate Deficiency

1. Dietary
2. Malabsorption
3. Malnutrition (inadequate access to food, hyperemesis)

and third trimesters or 10.5 g/dL in the second trimester are noted.[6] These same criteria should be applied to all pregnant people, regardless of race and/or ethnicity.

The cause of anemia should be investigated with additional laboratory evaluation and a detailed patient history. Anemia can be stratified into microcytic (MCV < 80 fL), normocytic (MCV 80-100 fL), and macrocytic (MCV >100 fL), which can help predict potential causes of anemia. **It is important to note, however, that mixed anemias (with more than one cause) can have a falsely normal MCV.** Therefore, review of a patient's medical, surgical and social histories can provide extra insight into potential causes of anemia. Figure 1 describes risk factors for common micronutrient deficiencies.

The BCM OB/Gyn Perinatal Guideline committee recommends screening with a complete blood count to review hemoglobin/hematocrit as well as MCV. Figure 2 illustrates the differential diagnosis based on MCV as well as the recommended work up for anemias. Additionally, per ACOG recommendations, **all** patients should have screening for hemoglobinopathies with a hemoglobin electrophoresis regardless of anemia status (if not done previously).[12]

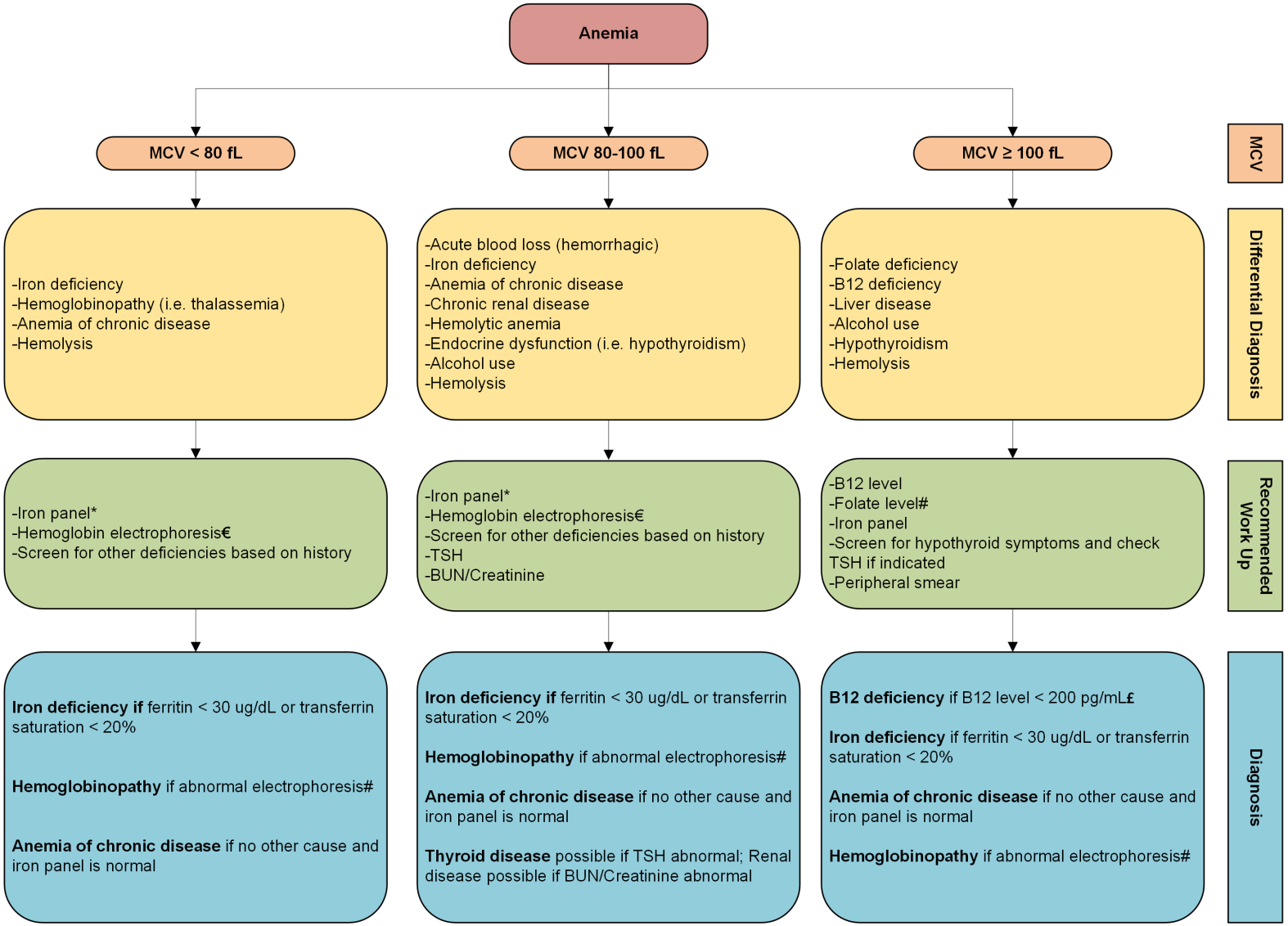


Figure 1. Differential Diagnosis and Work Up for Anemia

*** An Iron Panel should include Ferritin, Iron, TIBC, Transferrin Saturation. At Ben Taub, an iron profile does NOT include a ferritin so it must be added.**
# Serum folate levels are an inaccurate measure of true folate stores in patients taking a prenatal vitamin. Those at high risk of folate deficiency can be treated empirically.
€ Hemoglobin electrophoresis will only detect beta hemoglobinopathies (beta thalassemia, sickle cell trait or anemia). It will NOT detect alpha thalassemia. Therefore, if patient has microcytosis that does not resolve with iron supplementation, consider alpha thalassemia genetic testing
£ B12 levels between 200 and 300 pg/mL may still indicate a B12 deficiency. Diagnosis of B12 deficiency can be confirmed with an elevated methylmalonic acid level, although this may not be accurate in pregnancy. For patients with risk factors for B12 deficiency, recommend empiric treatment with B12 supplementation.

Treatment

Iron deficiency anemia

Figure 3 represents the recommended algorithm for iron supplementation during pregnancy.

Iron deficiency is diagnosed if ferritin is < 30 µg/L and/or transferrin saturation is < 20%.

Oral Iron Therapy

Oral iron supplementation is a safe, effective, readily available option for improving iron deficiency anemia. This is considered the first line management for iron deficiency anemia for a majority of patients.[6,13] However, limitations of oral iron include low rate of systemic absorption, slow improvement in parameters, and high incidence of gastrointestinal side effects such as nausea, gastric irritation, metallic taste and constipation. These adverse effects contribute to poor adherence with oral iron. Research suggests that once daily or every other day dosing may be the optimal method for iron supplementation. **More frequent dosing (BID or TID) is NOT recommended and should not be used** as this may reduce iron absorption and increase adverse side effects.[14] **Every other day dosing is as effective as daily dosing and reduces the side effect profile**.[15]

There are multiple different oral iron supplements, but studies suggest they all have similar efficacy and side effect profiles. **The BCM OB/Gyn Perinatal Guidelines Committee recommends ferrous sulfate 325mg daily or every other day x3-4 weeks with an assessment of medication adherence and side effects, as well as repeat lab work after that time.**

Parenteral Iron Therapy

Parenteral Iron is indicated in the setting of inability to tolerate oral iron, lack of improvement despite oral iron supplementation, and in patients with iron malabsorption syndromes (i.e. IBD, history gastric bypass surgery).[6] *

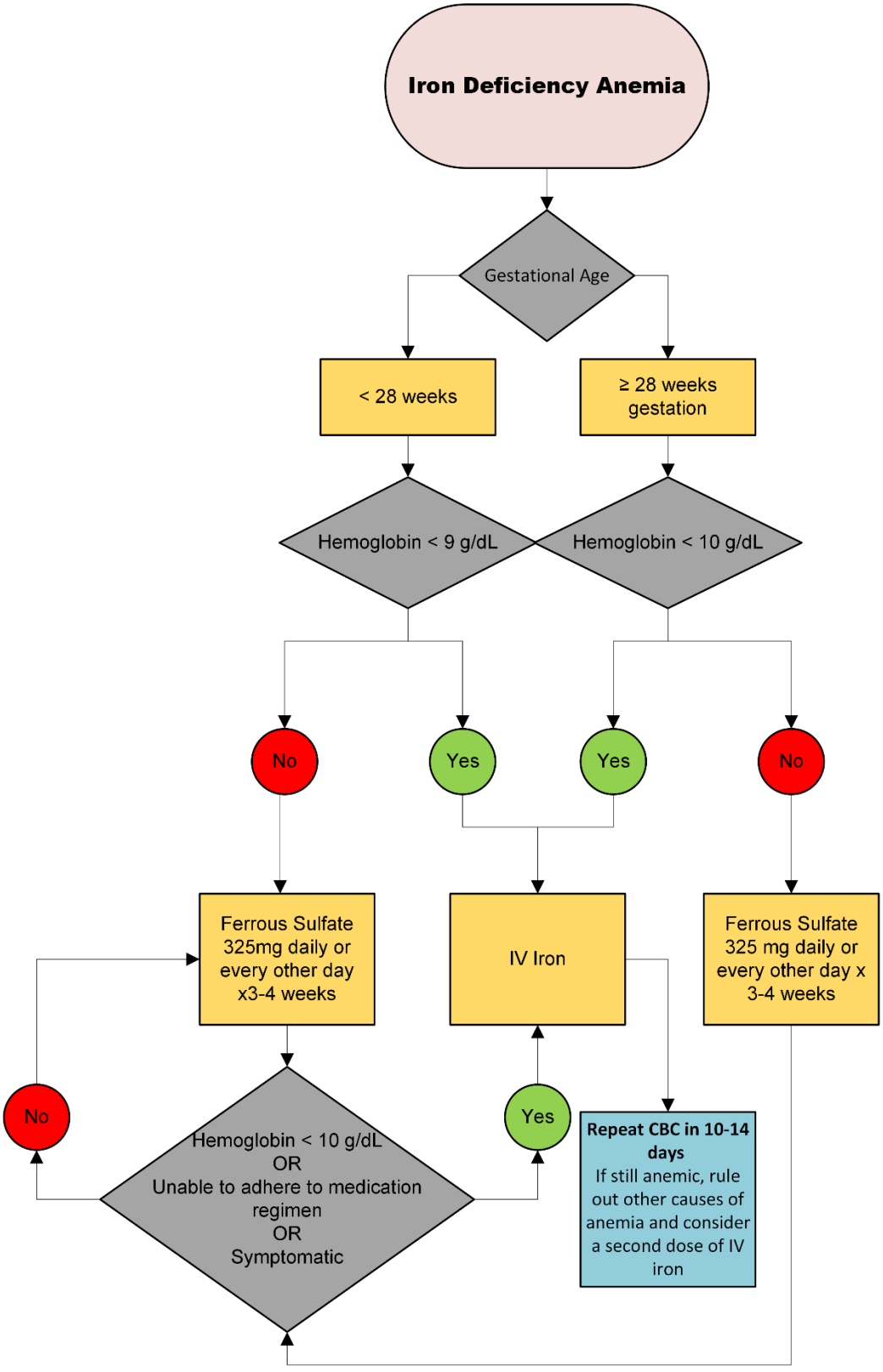
Several randomized trials have been conducted to compare oral versus intravenous iron use for maternal anemia, addressing clinical, hematologic parameters and adverse effects as outcomes. A systematic review and meta-analysis from 2019 included 20 of these randomized trials and revealed higher hemoglobin levels at delivery with intravenous iron, but fewer medical reactions and no difference in blood transfusion with this route compared to oral iron.[16] Similar comparisons have been made for postpartum anemia.[17,18] It should be noted that patients with hemochromatosis, thalassemia, porphyria or some infectious intestinal diseases may not be candidates for iron supplementation.

There are three main types of **reactions** to iron infusions, minor, moderate and severe (anaphylaxis), Minor infusion reactions to IV iron are due to labile iron and not to hypersensitivity.[19] **These minor reactions include chest and back pressure, flushing, itching and/or urticaria.** Notably, they are without accompanying hypotension, tachypnea, tachycardia, wheezing, and stridor or periorbital edema. Hypotensive reactions may occur, in particular with rapid infusions due to the labile iron content of IV iron formulations. Rarely (<1:250,000) iron infusion can be severe/life-threatening when it is a hypersensitivity reaction which can lead to anaphylaxis.[19] A recommended management algorithm for reactions during intravenous iron can be seen in Figure 4.

One study found that extravasation and skin staining occurred in approximately 1% of patients. This can be minimized by ensuring a patent IV prior to initiating the infusion, using an IV at a non-flexural site.[20]

* There is increasing evidence of safety and efficacy to suggest encouraging its use more readily in cases of severe iron deficiency and when more rapid replenishment is necessary. Intravenous iron administration carries a risk of transfusion reaction, with an incidence of anaphylaxis of approximately 1% with iron dextran; newer formulations such as iron sucrose have been suggested to have an improved side effect profile (18). Given overall safety profile with newer parenteral formulations, some authors have called for more liberal use of intravenous iron particularly in the third trimester of pregnancy (19).

Figure 3. Algorithm for IV vs. PO iron administration



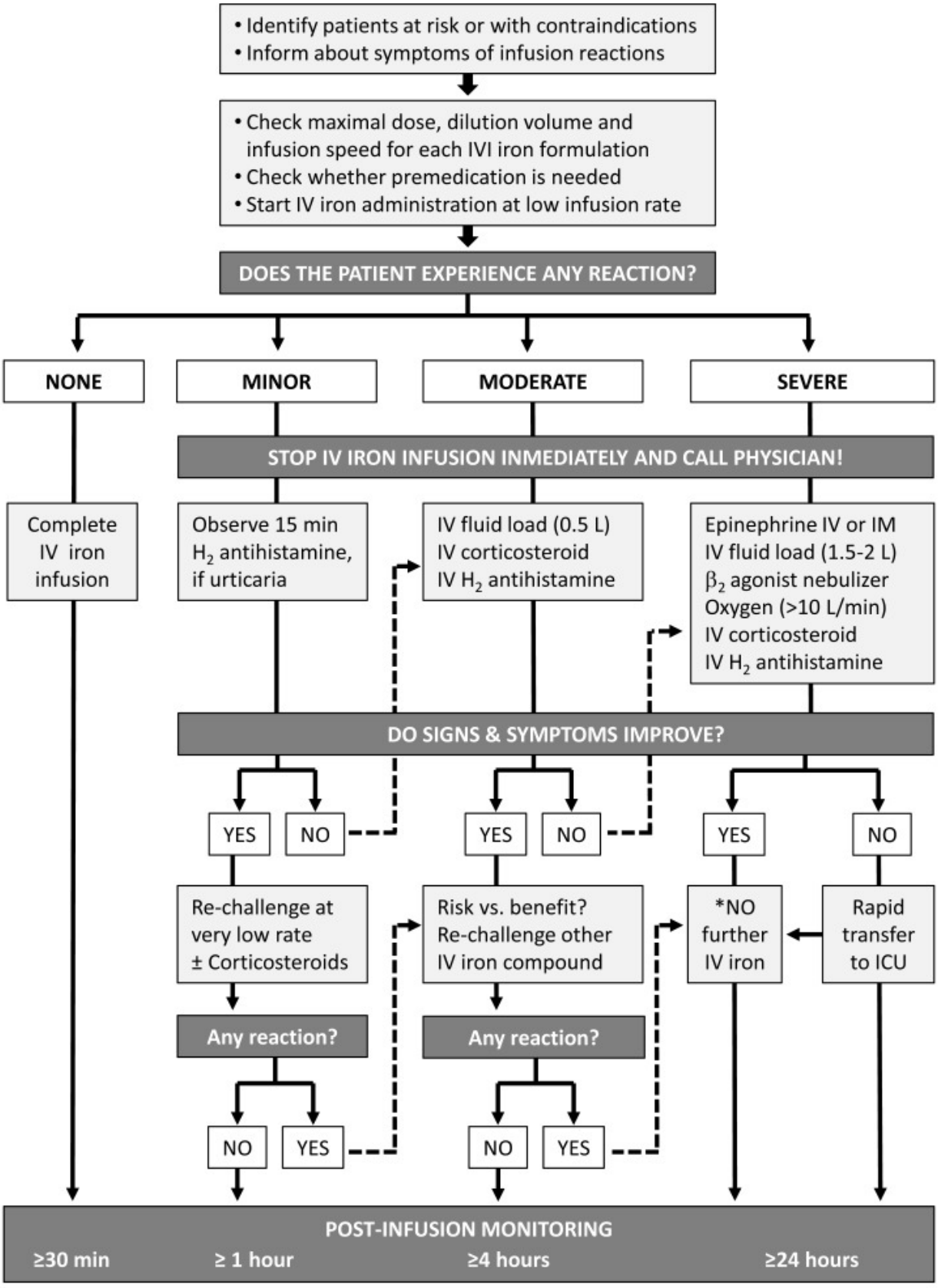
IV Iron Protocols

Ben Taub
The patient is admitted to antepartum for observation with administration as follows:

1. Admit to Ante for Obs
2. Administer Iron dextran 25mg test dose
3. Iron dextran 975mg IV over 6-8 hours
4. Recommend NST for the first dose of IV iron (including test dose) for all pregnancies >24 weeks' gestation.

Pavilion for Women
The patient is scheduled in the PFW Infusion Center and the recommended administration for IV iron is iron sucrose 300mg IV for 3 total doses (separated, daily, every other day or weekly).

Figure 4. Management of reactions during IV iron administration[19]



Other Treatments

There are limited and conflicting data regarding the use of erythropoietin (EPO) either as an adjunct or as therapy for antepartum anemia.[21] However, studies have shown that EPO is unlikely to cross the placenta due to its large molecular size and previous studies have used this with success in pregnancy.[22] EPO is also often used as an adjunct in patients with chronic kidney disease in pregnancy. **The use of EPO should be individualized.**

Blood transfusion has been recommended for severe anemia with Hgb levels less than 6g/dL.[6] This is based on evidence of associated poor fetal outcomes; a 2003 prospective observational study associated Hgb levels less than 6 g/dL with fetal outcomes such as non-reassuring fetal heart rate, low amniotic fluid index, abnormal fetal oxygenation and fetal death.[23] **Blood transfusion should also be considered in symptomatically anemic patients even at Hg levels greater than 6g/dL**.

Treatment Monitoring

Patients should have repeat CBC with consideration for a reticulocyte count within 3-4 weeks of oral iron therapy initiation. Providers should also assess side effects and medication adherence. For patients with an inadequate response, should consider IV Iron as listed in the Figure 3 algorithm. It is also important to reevaluate for other causes of anemia (other micronutrient deficiencies, hemolytic anemia, continued blood loss, etc) if the response has been less than adequate or the anemia has worsened.

Postpartum Management of iron deficiency or acute blood loss anemia

Management of anemia postpartum is mostly based on expert clinical opinion and there is no established threshold for repletion Iron repletion is effective by either oral or IV formulations. Multiple studies have shown that IV iron produces higher hemoglobin concentration postpartum compared with oral iron.[24,25] However, due to limited resources (i.e. staffing, hospital capacity, availability of IV formulations) this may not always be feasible.

Data indicate that maternal hemoglobin levels six weeks postpartum were approximately 1.0 g/dl higher in people who received intravenous iron compared to those who took oral iron as well as fewer gastrointestinal side effects in these patients.[18] The use of IV iron was also associated with an improvement in fatigue and reduction of anemia in postpartum patients.[26] Several studies have suggested an association between postpartum anemia and postpartum depression.[18,27] Erythropoietin (EPO) has also been studies in postpartum anemia. A randomized trial found that the combination of EPO and iron did not provide any additional benefits compared to iron alone.[28] However, some studies suggest benefit in EPO use in non-responders to IV Iron repletion.

Coadministration of IV iron and blood transfusion has not been studied. It is estimated that there is approximately 250mg of elemental iron in each unit of pRBCs. Therefore, a patient receiving > 3 units of pRBCs receives a typical dose of IV iron from the blood transfusions alone.[29] It is reasonable to consider IV iron for patients who receive ≤ 3 u pRBCs if they meet criteria based on postpartum hemoglobin.

BCM OB/Gyn Perinatal Guidelines Committee recommends offering IV Iron postpartum for patients with a hemoglobin of 6-9 g/dL and/or a 3g/dL drop in hemoglobin. Patients with Hemoglobin between 6 and 7 g/dL should be screened for anemia symptoms as transfused if symptomatic. IV iron should not be used in lieu of a blood transfusion if the patient meets criteria unless they do not accept the transfusion. If they do decline a transfusion, the timing of expected improvement in clinical symptoms (several weeks to months) should be discussed with the patient. IV iron is an option for patients who received 1-2 units of pRBCs, but we recommend against IV iron for patients who receive ≥3 units pRBCs. Oral supplementation should be offered to patients with hemoglobin of 9-11 g/dL.

B12 and/or Folate deficiencies

If folate deficiency is suspected based on risk factors (i.e. malabsorption, malnutrition), folate should be supplemented 1 gram daily.[6] These deficiencies are classically associated with macrocytosis; **however, an**

elevated MCV should *not* be considered diagnostic criteria for B12 deficiency, Many patients with this deficiency have a normal MCV especially with concomitant iron deficiency.[30]

Patients with B12 deficiency due to prior bariatric surgery (i.e. Roux-en-Y) or due to pernicious anemia should have lifelong B12 supplementation. Reversible causes of these deficiencies should be treated and have lab monitoring to determine the need for re-treatment. **It is therefore important to determine the cause of the B12 deficiency as this can have a long-term impact.**[31] B12 deficiency can be treated with oral or intramuscular administration. Symptomatic patients, those with severe anemia, and those with malabsorptive syndromes may benefit from IM administration. In general, the treatment regimen is either:

IM 1,000 weekly x4 weeks, monthly x4 months **– OR -**
PO 1,000 daily

A repeat CBC and B12 level (or Folate if deficient) should be reevaluated 4-8 weeks after initiation of the supplementation.

For less common micronutrient deficiencies, it is reasonable and recommended to consult Hematology for treatment planning.

Hemoglobinopathies

Treatment and management of hemoglobinopathies are outside the scope of this guideline. **BCM OB/Gyn Perinatal Guidelines Committee recommends treatment of coexisting micronutrient deficiencies and referral to Hematology if not already done**. Please refer to ACOG Practice Bulletin[32] and Practice Advisory[12] for further information on management of hemoglobinopathies.

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Individuals who Do Not Accept Administration of Blood or Human-Derived Products

[April 2025 (replaces September 2024)]
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Copy Edits: Dr. Stacy Strehlow

This guideline has been updated to include recommendations for respectful counseling as well as include legal considerations for pregnant minors who decline blood products. The BCM OB/Gyn Perinatal Guidelines Committee also upgraded the Transfusion Medicine antepartum consult from optional to *highly encouraged*.

Background

Jehovah's Witnesses is a Christian denomination who believes that certain passages from the Bible prohibit blood transfusion including but not limited to transfusions of donated or autologous whole blood, red blood cells, granulocytes, plasma, and platelets.[1] However, some individuals will accept blood components or minor fractions (albumin, clotting factors, fibrinogen, or immunoglobulins). The spectrum of acceptance of blood products may be wide-ranging within an obstetric Jehovah's Witnesses population.[2]

Therefore, a detailed discussion with each patient is warranted.

Counseling Recommendations

Since surgical or obstetric hemorrhage can occur abruptly and profoundly, resulting in the need for immediate action, conversations and planning should take place early in prenatal care and prior to the patient's admission

to the labor and delivery unit when possible. It is important to counsel the patient that maternal mortality is significantly increased for Jehovah's Witnesses obstetric patients.[3,4]

However, it is also important to begin the conversation in a way that is free from judgement and puts the patient at ease.
Conversation starting tips from the Ben Taub Transfusion Medicine department:

- Consider using language such as, "Our goals are to both understand your wishes and make sure we are allowing you to make an informed choice."
- Consider discussing the color, cellularity, and degree of processing for various blood products. Patients often want to know how closely each product resembles whole blood when they are making a decision.
- Patients often come with documents listing the products they will accept. These should be closely reviewed by a physician as the descriptions of blood products in these documents are not always accurate.

The Transfusion Medicine team (Blood Bank) is available for inpatient and outpatient consults at both the Pavilion for Women (PFW) and Ben Taub (BT) (see contact information below) if additional help is needed.

Frequently Asked Questions

What do Jehovah's Witnesses believe (generally)?
Once blood has been removed from the body, it should be disposed of and not returned to the body. Violating this prescription can lead to loss of eternal life.

What are the rights of patients?
Patients may have concerns in addition to physical well-being including emotional, spiritual, psychological, and social concerns. Based on the principle of patient autonomy, patients have the right to decline care if the following criteria are met.[1]

The patient:

1. is an adult
2. is mentally capable of making decisions
3. is free of coercion
4. is well-informed about the risks, benefits, and alternatives of the proposed treatment
5. understands the potential consequences of declining treatment including death

- **AND** - the decision will not:

6. cause harm or burden on an "innocent third party" such as a child (e.g. parent declining blood for a child) (note: fetus does not have the same legal rights as a child)
7. lead to greater use of medical resources

In the event that an adolescent/minor Jehovah's Witness is pregnant, the rights of the patient become less clear. Section 32.003 of the Texas Family Code states that a child may consent to medical treatment if the child "is unmarried and pregnant and consents to hospital, medical, or surgical treatment, other than abortion, related to the pregnancy." However, in the United States, the ability of an adolescent to decline blood products is generally determined on a case-by-case basis. Generally, it is not permitted for a younger child's parents to decline life-saving medical treatment, such as blood transfusion, on behalf of their child. ***Consider an ethics consult if a pregnant minor declines blood products****.*[5]

Do providers have rights?
Providers have moral obligations to act in the best interest of the patient. To withhold a blood transfusion in a life-threatening situation may violate a provider's ethical, moral, or religious convictions. Except in an emergency, a provider can decline to provide professional services to a patient, granted the care of the patient is transferred to another physician who is qualified, prepared, and willing to take on care of the patient.

Legal Components

Advance healthcare directive

(also known as a living will or healthcare declaration)
A written statement detailing an individual's desires regarding medical care

Medical power of attorney (POA)

(also called healthcare power of attorney or healthcare agent)
A legal document that states who should make medical decisions on behalf of the patient should the patient become incapacitated/incapable of making their own decisions. In the absence of a designated Medical POA, the following is the list of priority of surrogates:

1. Spouse (including common law spouse)
2. Adult children
3. Parents
4. Nearest relative

Definition of common law marriage in Texas

Section 2.401 of the Texas Family Code states that a common law marriage may be proved by evidence that the couple:

"Agreed to be married;" -**AND**-
"After the agreement they lived together in this state as husband and wife;" -**AND-**
"Represented to others that they were married**"**

It is a surrogate decision-maker's ethical responsibility to follow the wishes of the patient, if known. It does not matter how the patient made his or her wishes known. A surrogate decision-maker should not substitute his or her judgement for the judgement of the patient.

Legal Contacts

BCM Legal: On call pager 713-788-3628
Harris Health Ethics: On call pager 281-952-0603
TCH Risk Management: On call pager 832-824-2099

Pre-Delivery Optimization

The basic goals of care in the antepartum period include: [6,7]

1. Screening patients for willingness to accept blood products
2. Counseling patients on various blood products and fractions and the risks of declining blood. See Appendix for a blood product checklist to facilitate discussion.
3. Documenting and planning for patient wishes
4. Avoiding significant anemia.
   - The work-up of anemia is paramount for appropriate treatment. Please see guideline "Iron-Deficiency Anemia During Pregnancy" for information regarding work-up and management of anemia. In patients with severe anemia, there are several adjuncts to standard therapy that can be administered during prenatal care or arranged prior to scheduled delivery:
     - ***Erythropoietin*** is a glycoprotein produced by the kidneys that increases red blood cell production. Recombinant human erythropoietin may be used in cases of moderate to severe refractory anemia (generally, hemoglobin <10 g/dL not improved with iron). Erythropoietin can be dosed at 100 units/kg intravenously or subcutaneously 3 times weekly.[8,9]

- ***Normovolemic hemodilution*** is a technique that can be performed prior to expected blood loss (generally before Cesarean delivery) to minimize red cell loss and may be acceptable to Jehovah's Witnesses patients if blood is maintained in a closed system. The objective is to lower the hemoglobin concentration of circulating blood volume so that the blood lost is "diluted" and later replaced with "normal" whole blood. Blood bank may help in gathering necessary "blood bags" for the procedure. Please contact the blood bank at least 24 hours prior to planned procedure.[10]
  - The process involves removal of blood from the patient that is maintained in a closed system. Typically, 1-3 units of blood (approximately 300 cc per unit) is withdrawn and replaced 1:1 with colloid or 1:3 with crystalloid fluids. Blood is kept in closed circulation by continuous flow system and given back to the patient during or after the procedure.
- ***Intraoperative cell salvage (Cell Saver®)*** may be an option for Cesarean delivery, particularly if at risk of excessive blood loss. Generally, Cell Saver® only retrieves about 10% of blood loss. Recognize that the perfusionist/transfusionist for Cell Saver® is not in-house and anticipate 30-60 minutes before arrival; therefore, this option will only be feasible for scheduled or non-urgent Cesarean.
  - At BT, Cell Saver® can be arranged via discussion with the labor and delivery charge nurse and Anesthesia.
  - At PFW, Cell Saver® should be requested at the time of scheduling a planned Cesarean. For non-urgent intrapartum Cesareans, Cell Saver® should be requested when posting the case with the charge nurse.

Intrapartum Management

1. Limit blood draws and volume for laboratory testing (may use pediatric phlebotomy tubes).
2. Early and aggressive identification and management of postpartum hemorrhage with examination, uterotonics, tranexamic acid, uterine tamponade, evacuation of retained placenta, and laparotomy with compression/hemostatic sutures or hysterectomy when required.
3. Supplemental oxygen administration to optimize oxygen delivery during hemorrhage.
4. Judicious use of non-blood volume expanders (Lactated Ringer's, Normal Saline).
5. Avoid hypothermia if coagulopathic or hemorrhaging.
6. Early identification and reversal of coagulopathy with liberal use of patient-approved hemostatic agents (see Appendix for treatment options that do not contain any human blood or components).
7. Normovolemic hemodilution (requires 24 hours preparation time) and/or Cell Saver® if appropriate.
8. Meticulous hemostatic surgical technique and use of hemostatic instruments (e.g. electrocautery, LigaSure).

Delivery Admission Checklist

(Epic Smartphrase: .DLCJWADM – Owned by Dr. Danielle Chirumbole)
Please see the Antepartum Checklist and Blood Product Acceptance Checklist in the Appendix

- ☐ Screen all patients for the willingness to accept blood products.
- ☐ If the patient does not accept blood products, review and update the "**Blood Product Acceptance Checklist**" or complete the Checklist if this has not been completed already AND have the patient sign the "**Blood Refusal Form**".
- ☐ Obtain baseline CBC, coagulation profile (PT/INR, PTT, and fibrinogen), AND a type and screen.
- ☐ Obtain a type and screen even if the patient declines blood products, as they could change their mind.
  a.

Blood bank contact information

Contacts for Blood Bank Consults:

PFW: Dr. Jun Teruya or On-call pathologist (found in SPOK call schedule under pathology, blood bank)
BT: Dr. Sarah "Kate" Hartman

PFW Blood Bank: 832-826-3641 and ask for on-call pathologist

BT Blood Bank: 713-873-3250 or on-call pathologist 713-327-2640
BT on call Perfusionist: 1-800-521-9757

Resources

May contact the local Chaplain Services to assist with contacting the Jehovah's Witnesses Hospital Liaison

Jehovah's Witnesses Hospital Liaison Committee
Hospital Information Services (United States)
(718) 560-4300
Free service is available 24 hours a day to healthcare professionals who treat Witness patients

https://www.jw.org/en/medical-library/strategies-downloads/

Appendix

Antepartum Checklist

(Epic Smartphrase: DLCJWANTE – Owned by Dr. Danielle Chirumbole)

All patients	
Accepts blood products	y/n
Risks of bleeding specific to pregnancy reviewed[a]	y/n
Personal/family history Bleeding disorders[b] Medication concerns[c]	 y/n y/n
Patients who decline blood products	
Risks of declining blood products reviewed	y/n
Has patient spoken to religious liaison? Living Will Healthcare power of attorney	y/n y/n y/n
Blood Product Acceptance Checklist complete Wishes Documented in Chart	y/n y/n
Blood Refusal Form (site specific) complete	y/n
Baseline Labs[d] CBC DIC panel[e] Ferritin	Results (date)
Treatment of anemia required (goal Hgb >11)?[f] Treatment (date)	y/n
Repeat CBC (32-36w, pending delivery timing)	
Recommended Consults Anesthesia HROB/MFM Transfusion Medicine (strongly encouraged)	 y/n y/n y/n
Optional Consults (complex pt, refractory anemia, possible bleeding disorder) Hematology	 y/n
Contraception	

[a] Risks for bleeding specific to pregnancy include placental abruption, placenta previa, placenta accreta, uterine rupture, Cesarean delivery, and postpartum hemorrhage

[b] Also consider personal/family history of perioperative bleeding, menorrhagia, obstetric bleeding

[c] Medications that may affect hemostasis include aspirin, NSAIDs, herbal medications

[d] Limit number and volume of blood draws if possible. Consider pediatric phlebotomy tubes

[e] A DIC panel should include PT/INR, PTT, fibrinogen

[f] Optimize red blood cell mass by correction of anemia with oral or IV iron supplementation, erythropoietin, and/or vitamin B12 and folic acid where deficient.

Blood Product Acceptance Checklist

(Epic Smartphrase: DLCJWCHECKLIST)

COMPONENTS OF HUMAN BLOOD	ACCEPT	DO NOT ACCEPT
Red blood cells	_____	_____
Fresh frozen plasma	_____	_____
Platelets	_____	_____
Cryoprecipitate	_____	_____
Albumin	_____	_____
MEDICATIONS THAT CONTAIN A FRACTION OF HUMAN BLOOD		
RhIg (Rhogam)	_____	_____
Erythropoietin	_____	_____
TECHNIQUES FOR BLOOD CONSERVATION		
Cell Saver	_____	_____
Autologous blood	_____	_____
Normovolemic hemodilution	_____	_____

Adapted From: California Maternal Quality Care Collaborative

Available Products for Coagulopathy or Hemostasis

Products that CONTAIN components of human blood

Systemic
- Erythropoietin (Epogen/Procrit)
- Prothrombin complex concentrate (Beriplex/Kcentra)
- Fibrinogen concentrate (RiaSTAP)
- Factor VIII and von Willebrand factor concentrate (Humate-P)
- Other human-derived factors

Topical hemostatic agents
- Thrombin
- Tisseel
- Surgiflo (not available at Ben Taub)
- Evarrest (not available at Ben Taub)
- Floseal (not available at Ben Taub)
- Evicel (not available at Ben Taub)
- Gelfoam PLUS (contains thrombin) (not available at Ben Taub)

Products that DO NOT CONTAIN components of human blood

Systemic
- Vitamin K
- Tranexamic acid
- Vasopressin
- Desmopressin (DDAVP)
- Recombinant factor VIIa (NovoSeven RT)
- Recombinant erythropoietin (r-HuEPO)
- ε-aminocaproic acid (Amicar)

Topical hemostatic agents
- Collagen hemostat (Avitene, Instat)
- Recombinant thrombin (Recothrom)
- Oxidized cellulose (Surgicel, Oxycel)
- Gelatin foam/sponges (Gelfoam, Surgifoam)
- QuikClot sponges
- Tissue adhesives/fibrin glue

↑

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Sickle Cell Anemia in Pregnancy

[September 2024 (Replaces May 2018)]

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Editor: Dr. Hayden Latham

August 2025 edit includes a change to the title from Sickle Cell Disease to Sickle Cell Anemia to ensure that there is no confusion between sickle cell anemia and sickle cell trait.

Background

Sickle cell anemia (SCA), is an abnormality of red blood cells (RBCs) that may result in circulatory impairment, tissue infarction, marked anemia, infection, fetal growth restriction, preterm delivery, preeclampsia, and stillbirth. **Acute complications of SCA** include vaso-occlusive pain crises, tissue ischemia, tissue infarction and osteomyelitis, acute chest syndrome, increased cardiac output with subsequent cardiomegaly, stroke, splenic sequestration, acute renal failure, ocular complications (conjunctival vessel changes, vitreous hemorrhage), venous thromboembolism (VTE), and cholecystitis. **Chronic complications include** chronic pain, narcotic dependence, cholelithiasis, renal dysfunction, cardiomegaly, hypertension, pulmonary hypertension, pulmonary fibrosis, iron overload, folate deficiency, and red cell alloimmunization. Neonatal complications include preterm birth, fetal growth restriction, anemia (especially if there is maternal alloimmunization), hyperbilirubinemia, and neonatal withdrawal syndrome.

Recommended Vaccines

Annual
- Influenza
- COVID
- RSV

If not done previously or non-immune
- Pneumococcal: PCV 20
- Haemophilus influenzae type B
- Meningitis vaccines
  - Men ACWY (due every 5 years)
  - Men B* (due every 2-3 years)
- Hepatitis A (two doses 4 weeks apart)
- Hepatitis B (three doses, at 0, 1 and 6 months)

*Men B has not been extensively studied in pregnancy. Therefore, recommend vaccination when benefits outweigh the risks of unknown complications

Antepartum Management

Prenatal Care

Patients with (SCA) should be managed by a multidisciplinary team including a Maternal-Fetal Medicine specialist, Hematologist, and Pain Management specialist if available.

Table 1 lists the initial evaluation that should be started at the onset of prenatal care if not done previously.[1] Patients should be asked about their pain management pln, and Texas PMP Aware should be reviewed in early pregnancy. **Important for patients cared for by BCM practice**: Narcotic flowsheet (in EPIC) for outpatient medications/current dosages.

Please see Society for Maternal-Fetal Medicine Consult Series #68: Sickle cell disease in pregnancy for further clinical guidance on management of sickle cell disease during pregnancy.[1]

Table 1. *Baseline maternal assessment for patients with SCA*[1]

Baseline assessment	Assessment and management principles
BP	Baseline assessment of BP to permit BP assessment throughout gestation relative to patient's baseline, acknowledging that BP in patients with SCD is often lower than individuals without SCD.
Iron stores	Baseline assessment of iron and iron stores (serum iron, transferrin, total iron-binding capacity, transferrin saturation, ferritin). Prenatal vitamins without iron should be the default. Iron administration is strictly reserved for patients with iron deficiency.
Anemia	Complete blood count to assess baseline hematocrit level and platelet count. Type and screen to assess for alloimmunization.
Leukocytes	Patients with SCD often have elevated leukocytes. Noting the WBC count at baseline may assist later in pregnancy if a leukocyte abnormality is noted; some data suggest a higher WBC is associated with poorer SCD outcomes.[42,43]
Neurologic	Obtain thorough neurologic history, including history of headaches and strokes. Obtain past records where indicated. Understanding patient's headache history may assist later in pregnancy to differentiate between patient's baseline headaches and a severe feature of preeclampsia.
Ophthalmologic	Baseline assessment of previous visual complications. Eye examinations are recommended every 1—2 y.[37] If patient is not up to date, expedited referral should occur during pregnancy.
Dental	Patients with SCD have an increased risk of dental complications that can adversely affect the mother's health and pregnancy outcomes. Routine dental care during pregnancy is strongly recommended. Dental referral for routine maintenance should be expedited during pregnancy if patient does not have a provider and/or if dental maintenance is not current.[44,45]
Cardiac	In accordance with ASH guidelines, providers should have a low threshold to obtain a screening echocardiogram for patients with SCD with comorbidities (chronic hypertension, lupus, etc.) and/or cardiopulmonary symptoms given the risks of pulmonary hypertension and cardiomyopathy. Specific cardiopulmonary symptoms[38] that should trigger screening with echocardiography include: • Dyspnea at rest or with exertion that is out of proportion to known condition, increased compared with baseline or unexplained • Hypoxemia at rest or with exertion that is out of proportion to known condition, increased compared with baseline or unexplained • Chest pain at rest or with exertion that is out of proportion to known condition, increased compared with baseline or unexplained • Increase in exercise limitation compared with baseline that is unexplained by other factors • History of recurrent hypoxemia at rest or with exertion • Evidence for sleep-disordered breathing with or without hypoxemia • History of syncope or presyncope • Evidence for loud P2 component of second heart sound or unexpected or new murmur on examination • Signs of heart failure and/or fluid overload on examination • History of pulmonary embolism
Vascular	Baseline assessment of previous thromboembolic events and anticoagulation, if indicated, per national guidelines.[46,47]
Pulmonary	Baseline assessment of O2 saturation. If <95%, obtain CXR and echocardiogram. Consider pulmonary function tests if symptoms persist.
Hepatic	Baseline assessment of liver function panel. Note that most patients with SCD have unconjugated hyperbilirubinemia at baseline.[48]
Renal	Baseline assessment of renal function and assessment of proteinuria.
Urine	Baseline urine culture at the initial prenatal visit and a urine assessment (dipstick, urinalysis, or other) at each prenatal visit.
Vitamin D	Baseline assessment of vitamin D.

ASH, American Society of Hematology; *BP*, blood pressure; *CXR*, chest x-ray; *SCD*, sickle cell disease; *WBC*, white blood count.

Society for Maternal-Fetal Medicine. Sickle cell disease in pregnancy. Am J Obstet Gynecol 2024.

Sickle Cell Crisis[1-4]

The following checklist is recommended for the initial work up and management of patients who present with symptoms concerning for a sickle cell crisis. Crises can be triggered by many situations, including infections, environmental changes (i.e. weather), dehydration, labor. However, a heightened level of suspicion is necessary in patients with SCD as crises can lead to organ injury, acute chest syndrome (ACS), stroke, and/or heart failure, among other potentially life-threatening conditions.

Initial Evaluation

The goal of the initial evaluation is to determine if this is a **simple isolated vaso-occlusive crisis (VOC)** or a **complicated VOC** that is associated with end-organ dysfunction and injury. See Figure 1 for summary.

- ☐ Common vital sign changes (MEWS should be activated for all usual triggers)
  - Blood Pressure: Hypertension
  - Heart Rate: Tachycardia
  - Respiratory Rate: Tachypnea
  - Oxygen Saturation (SpO2): Hypoxemia
  - Temperature: Mild to moderate fever of 37.8C or greater (can be due to tissue ischemia but must have a heightened suspicion for infection)
- ☐ Patient History
  - Review of systems
    - Respiratory symptoms concerning for possible pneumonia vs. acute chest syndrome
    - Other symptoms that point to an infectious cause (i.e. UTI, pyelonephritis, pneumonia, osteomyelitis)
  - Increased need for pain medication
  - Recent environmental changes, stress, dehydration
  - **Evaluate home pain regimen to determine potential patient pain management needs**
- ☐ Laboratory Assessment and Common Findings
  - CBC with differential
    - WBC: Leukocytosis (due to tissue ischemia and/or infection)
    - Hgb: Anemia
    - Plt: variable
    - LDH: Elevated > 600 indicating hemolysis
  - Hemoglobin electrophoresis: High HbS (can be used for treatment monitoring but should not be relied on for initial management)
  - Reticulocyte count
  - Peripheral smear
  - CMP
  - LDH
  - Type and screen
  - Urine culture
  - Other cultures based on patient symptoms (sputum, vaginal, blood)

Symptoms of Sickle Crises

Vaso-occlusive pain crisis: Musculoskeletal pain (back, chest, extremity) that commonly follows a pattern from prior crises

Acute Chest Syndrome: imaging findings consistent with a new pulmonary infiltrate and one additional item, which may include oxygen desaturation, cough, temperature of 38.5C, tachypnea, or wheezing

Hepatic Crisis: Vaso-occlusion of hepatic microvasculature simulates acute cholecystitis with fever, RUQ pain, leukocytosis and elevations in ALT/AST & bilirubin

- Imaging (should be based on symptoms)
  - Chest X-Ray with pulmonary symptoms
  - Fetal imaging as needed
- Fetal assessment (CEFM + Toco until stable)
  - May see non-reassuring fetal heart tones that often improve with maternal stabilization
  - Significantly increased risk of IUFD in patients with SCA

Initial Management prior to admission

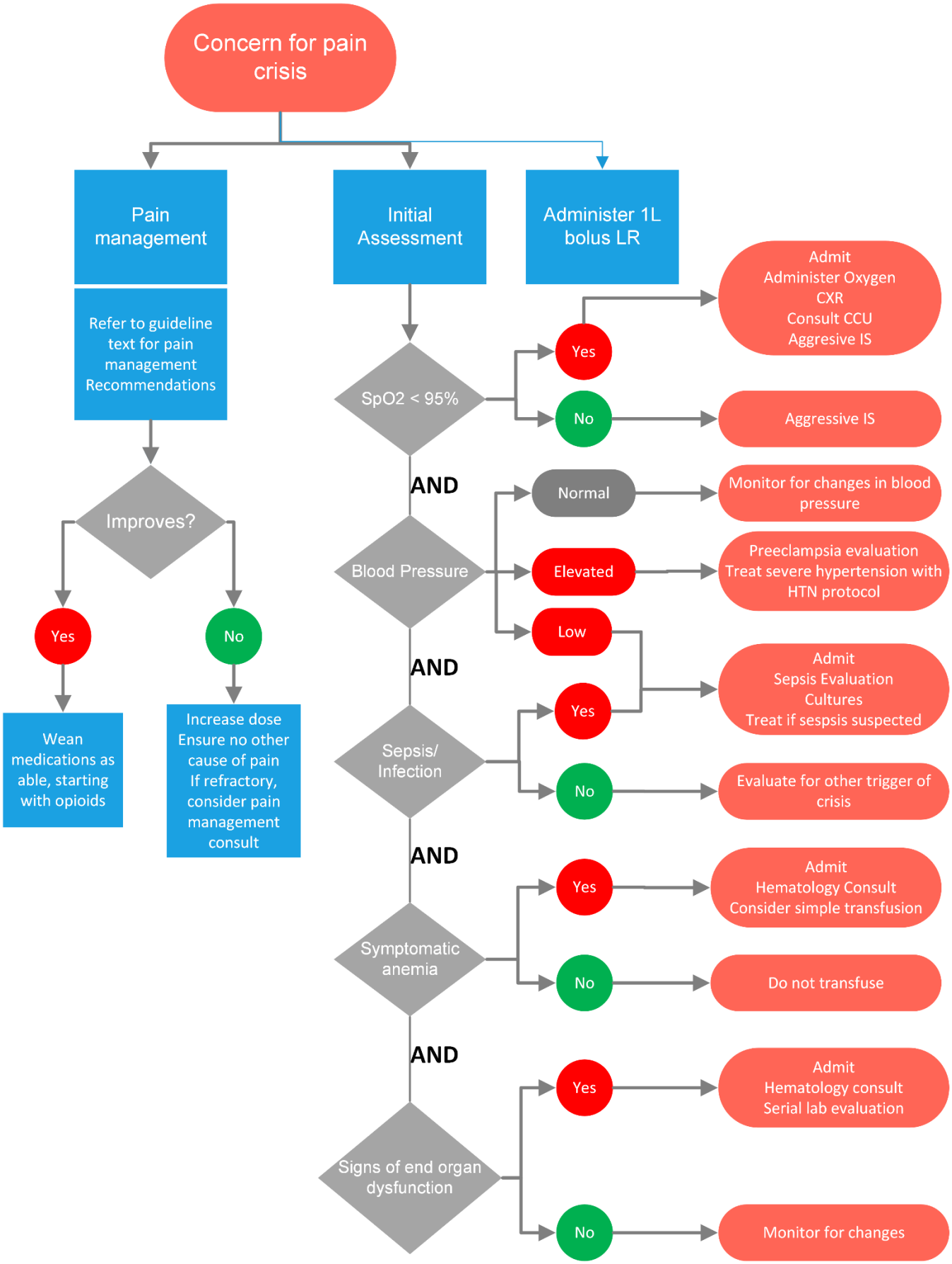
- See Figure 1 for recommended management
- Pain medication (Table 2)
  - First line is a trial of **Ketorolac** 15-30mg in the second trimester (and with no other contraindications such as peptic ulcer disease or chronic kidney disease)
  - Acetaminophen 650 mg q6H PO or 1g IV (contraindicated if AST/ALT significantly increased)
  - **Opioids** should not be withheld
    - Chronic opioid regimen (if applicable) should be continued, and additional opioids may still be necessary
- Acute Chest Syndrome
  - Consult Critical Care and admit to CCU
  - Consult Hematology
  - Initiate broad spectrum antibiotics (community-acquired pneumonia coverage if no other source of infection identified)
  - Consider simple blood transfusion (pending discussion with Hematology)
  - Oxygen administration may be given for patients with dyspnea or respiratory distress and saturations above 95%.
- Have a **low** threshold for hospital admission for patients with persistent VOC requiring additional pain medication, frequent crises, and/or signs of end-organ dysfunction

Table 2. *Pain management for sickle crisis in pregnancy*[2]

Medication	Oral	Parenteral	Side effects	Teratogenicity
Morphine	10–30 mg every 3–4 h	5–10 mg every 2–4 h	Sedation, constipation, pruritus, and respiratory depression	No human reports of birth defects. NAS
Hydromorphone	7.5 mg every 3–4 h	1.5 mg every 3–4 h	Sedation, constipation, pruritus, and respiratory depression	No human reports of birth defects. NAS
Codeine	15–60 mg every 3–6 h	NA	Sedation, constipation, pruritus, and respiratory depression	Reports in human pregnancies inconsistent. NAS
Ibuprofen[b]	600–800 mg every 6–8 h	NA	Dyspepsia, GI bleeding, nausea, and tinnitus	Inconsistent reports suggest increased risk for miscarriage. Concerns for premature ductal closure.
Ketorolac[b]	10 mg every 4–6 h	30 mg every 6–8 h	Headache, nausea, abdominal pain, dyspepsia, and GI bleeding	Concerns for premature ductal closure
Acetaminophen	300–1000 mg every 4–6 h	NA	Nausea, rash, headache, and hepatotoxicity	Considered safe although some inconsistent reports of association with childhood asthma or cryptorchidism

NAS: neonatal abstinence syndrome.
[a] Data on cost obtained from drugstore.com and does not necessarily reflect inpatient costs.
[b] Can consider occasional use in the second trimester as an adjuvant to opiate treatment (not first line).

Figure 2. *Management of Pain Crisis*[2]



Inpatient care

Antepartum patients should be admitted to either Antepartum service or ICU depending on patient stability.

- ☐ Rest
- ☐ VTE Prophylaxis (Lovenox 40 mg daily)
- ☐ Strict Intake and Output monitoring (due to risk for pulmonary edema)
- ☐ Oxygen supplementation if SpO2 ≤95%
- ☐ Complete infectious work up if not done
- ☐ Pain Management
  - First line is a trial of **Ketorolac** 15-30mg q6 hr in the second trimester (and no other contraindications such as peptic ulcer disease or chronic kidney disease)
  - Acetaminophen 650 mg q6H PO or 1g IV (contraindicated if AST/ALT significantly increased)
  - **Opioids** should not be withheld
    - Chronic opioid regimen (if applicable) should be continued, and additional opioids may still be necessary
    - IV Morphine sulfate loading dose 4 mg IV plus an **antihistamine** such as Hydroxyzine 50 mg IM (favor) q6 hr PRN or Benadryl 25-50 mg IV q6 hr PRN
    - Maintenance during acute phase of Morphine sulfate 1-2 mg IV q4 hrs or low-dose PCA pump
      - Plan for 24-48 hours of basal and demand and then change to 24-48 hours of demand only
  - Sedation assessments should be performed frequently for patients receiving narcotics, especially if other sedating agents are co-administered.
  - Avoidance of agents with codeine (Tylenol 3 or 4) for postpartum people who are breastfeeding
- ☐ Prevent/Treat constipation
  - Daily stool softener, laxatives as needed
- ☐ Antibiotics if an infection is suspected
- ☐ Blood transfusion only if complicated VOC (Table 3)
- ☐ Exchange transfusion indications (Table 3)

Table 3. Indications for therapeutic blood transfusion

Consult hematology and consider a simple vs. an exchange transfusion if patient presents with any of the following
Hemodynamic instability
Acute chest syndrome
Acute stroke
High-output cardiac failure
Multi-organ failure
Symptomatic anemia (dyspnea, marked fatigue)
Severe, refractory pain crisis (>10 days)
Persistence of preeclampsia sequelae despite delivery
Reticulocytopenia (common after Parvovirus B19 infection; can occur with any infection)

Acute chest syndrome (fever, tachypnea, chest pain, hypoxia, and radiologic chest infiltrates).
High-output cardiac failure (characterized by an elevated resting cardiac index beyond the normal range of 2.5–4.0 L/min/m^2).

Criteria for hospital discharge

- ☐ Resolving crisis
- ☐ Adequate pain control on PO medication
- ☐ Treatment of infection if present
- ☐ Reassuring Fetal status

Follow up plan

a. OB visits
    i. Antepartum
    ii. Postpartum – contraception: progestin IUDs, progestin-only OCPs owing to risk of VTE with combined hormonal methods containing estrogen
b. Hematology visit
c. Pain control – transition to Hematology

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Venous Thromboembolism in Pregnancy and Postpartum

[December 2025 (replaces December 2022)]
Authors**: Dr. Mary Taylor Winsten**, Dr. Martha Rac
Editor: Dr. Ipsita Ghose

Highlights

- CT Pulmonary Angiography is the gold standard for diagnosis of pulmonary embolism
- Low molecular weight heparin (LMWH, Lovenox) is the first line anticoagulant during pregnancy for prophylactic and therapeutic dosing for most conditions.
- Anticoagulation to prevent venous thromboembolism (VTE) during pregnancy and postpartum should be based on medical history including prior VTE, and presence of thrombophilia.
- Recommend scheduling delivery at or after 39w0d (or sooner as clinically indicated) and discontinuing LMWH anticoagulation 24 hours prior to admission for those who are on adjusted-dose (full anticoagulation) and 12 hours for those on prophylactic dosing of LMWH.[4-6]
- **Patients who were receiving antepartum anticoagulation should continue anticoagulation postpartum for at least 6 weeks**. This dose should always be equal to or greater in dose than antepartum anticoagulation for any given patient.

Diagnosis

The diagnosis of Deep Vein Thrombosis (DVT) and/or Pulmonary Embolism (PE) requires thorough history, physical exam, and imaging. See Figure 1 for diagnostic work up for DVT and see Figure 2 for diagnostic work up for PE.

Figure 1. Evaluation of a patient with findings concerning for DVT

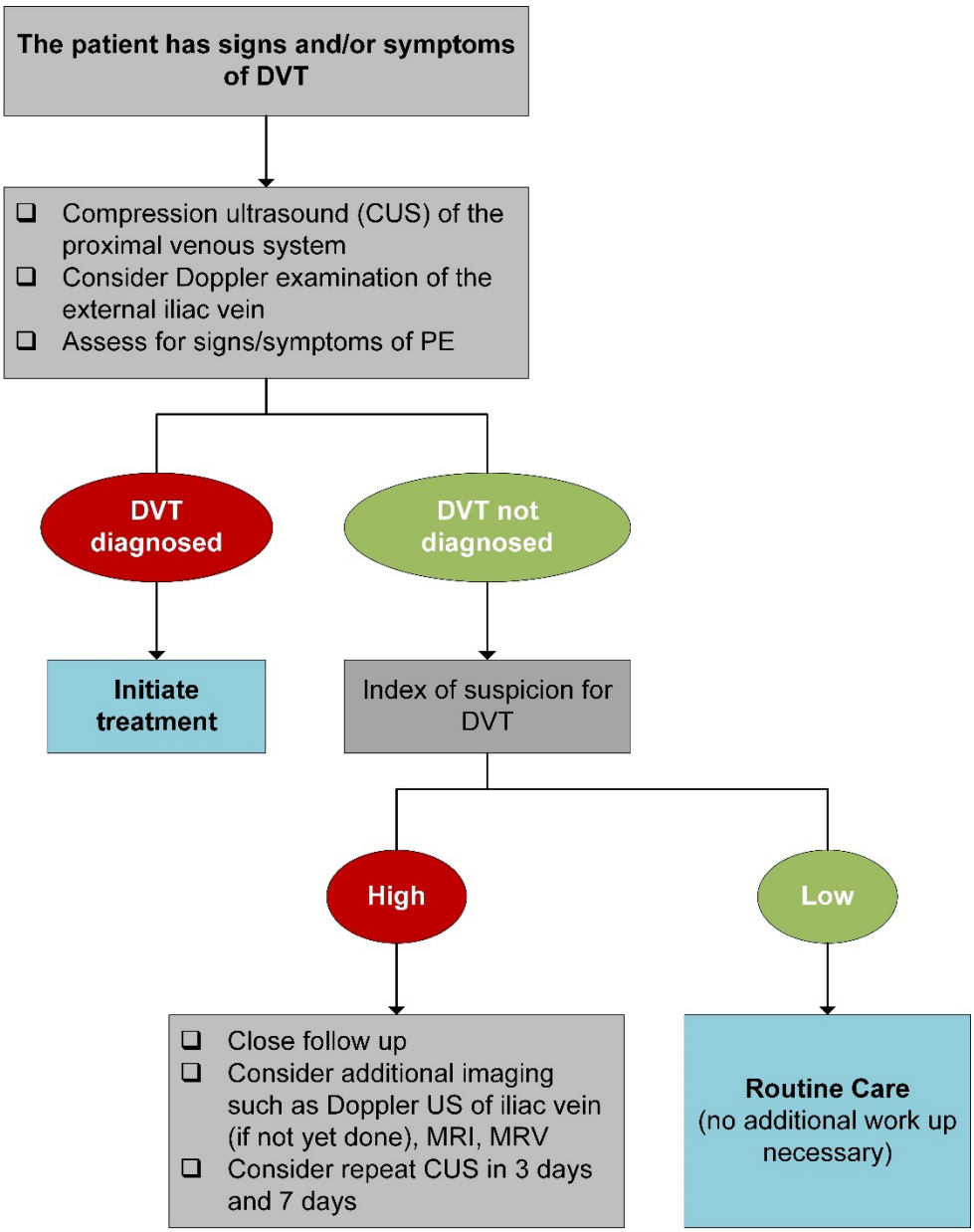
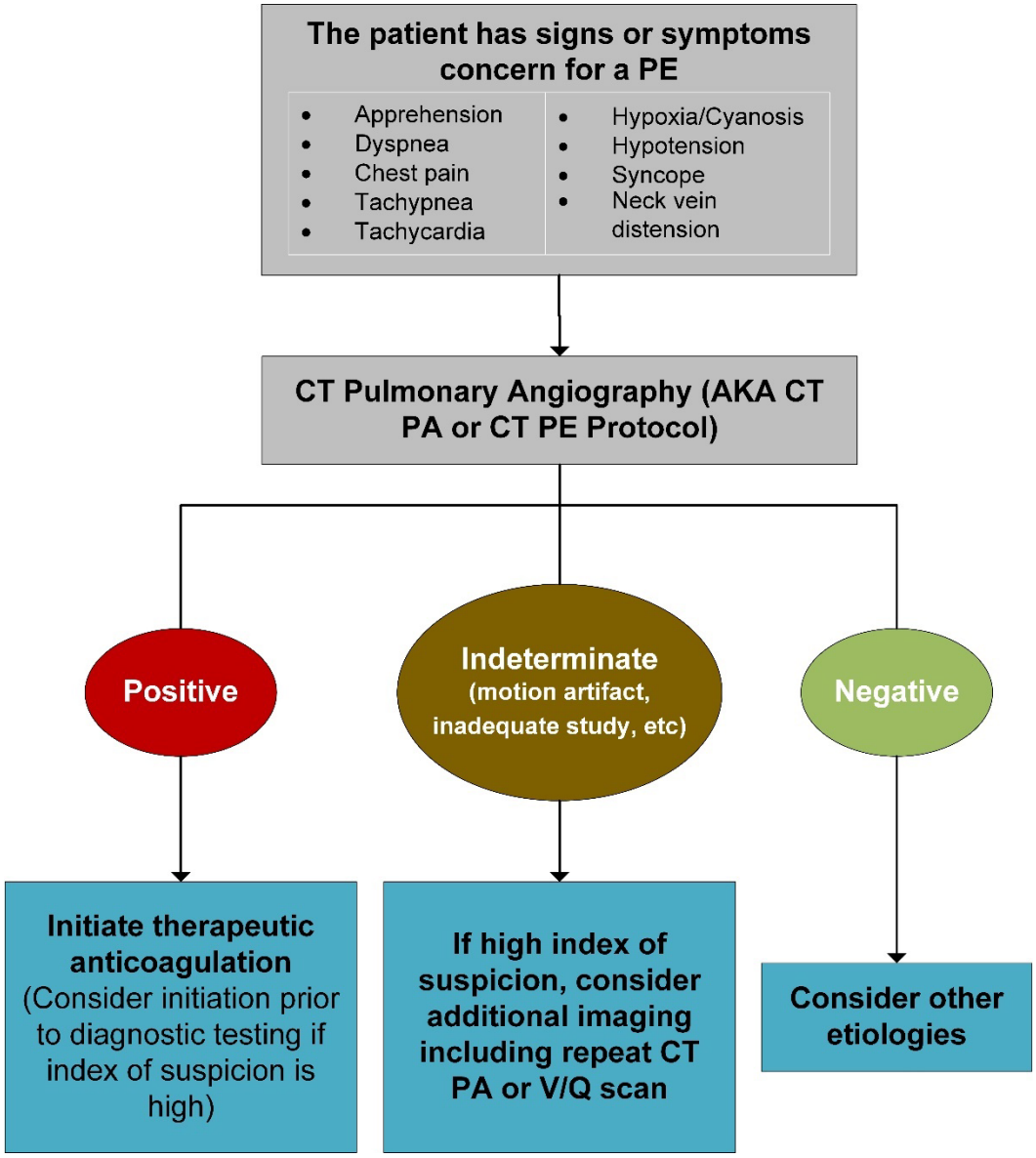


Figure 2. Evaluation of a patient with findings concerning for a PE



Antepartum thromboprophylaxis

Need for outpatient VTE prophylaxis during pregnancy depends on risk factors including prior history of VTE, family history, and presence of inherited thrombophilia (Table 1).

Table 1. Anticoagulation during pregnancy based on risk (outpatient)

Clinical Scenario		Antepartum Recommendations	Postpartum Recommendations[a]
No history of DVT, No Thrombophilia		Anticoagulation therapy not indicated	Individualize
VTE diagnosed during pregnancy		Adjusted	Adjusted for a minimum of 6 weeks
History of SINGLE prior <u>provoked</u> VTE • Identified precipitating event (i.e. trauma, surgery, immobility) • Unrelated to estrogen/pregnancy		Anticoagulation therapy not indicated	Surveillance without anticoagulation therapy if **no** additional risk factors[b] Prophylactic if additional risks factors[b]
History of SINGLE prior VTE (<u>unprovoked</u> OR estrogen/pregnancy-related)		Prophylactic	Prophylactic if **no** additional risk factors[b] Intermediate or Adjusted if additional risks factors present[b]
Low risk thrombophilia • Heterozygous Factor V Leiden (FVL) • Heterozygous Prothrombin Gene Mutation (PGM) • Protein C or S deficiency • Antiphospholipid Antibody Positive (without APLS)	**No personal or 1st degree relative with VTE**	Anticoagulation therapy not indicated	Surveillance without anticoagulation therapy if no additional risk factors[b] Prophylactic if additional risks factors[b]
	First degree relative with a history of VTE	Anticoagulation therapy not indicated	Prophylactic
	Personal history of single VTE, not requiring lifelong AC	Prophylactic	Prophylactic if **no** additional risk factors[b] Intermediate if additional risks factors present[b]
High risk thrombophilia • APLS • Antithrombin III deficiency (ATIII) • Homozygous FVL or PGM • Combined Heterozygous FVL and PGM	**No personal or 1st degree relative with VTE**	Prophylactic	Prophylactic if **no** additional risk factors[b] Intermediate if additional risks factors present[b]
	First degree relative with a history of VTE	Prophylactic	Prophylactic if **no** additional risk factors[b] Intermediate if additional risks factors present[b]
	Personal history of single VTE, not requiring lifelong AC	Prophylactic, intermediate, or adjusted dose	Prophylactic if **no** additional risk factors[b] Intermediate if additional risks factors present[b]
Two or more prior VTE (regardless of thrombophilia)	**Not on long term AC**	Intermediate	Intermediate if **no** additional risk factors[b] Adjusted if additional risks factors present[b]
	On Long term AC	Adjusted	Adjusted

Adapted from ACOG Practice bulletin No 196 Obstetrics and Gynecology Vol 132 (1) Pg e7. July 2018[4]

[a]The use of Rivaroxaban (Xarelto), a Direct Oral Anticoagulant, can be considered postpartum even in breastfeeding patients as there are studies supporting its safety. This should be done with Hematology consultation.

[b]Risk factors include Cesarean delivery, postpartum hemorrhage, blood transfusion, preeclampsia, heart disease, systemic lupus erythematosus, immobility for at least 1 week antepartum, BMI > 40, smoking, multiple gestation.

Hospitalized Patients

- All hospitalized antepartum patients should wear SCD's while in bed.
- For hospitalized antepartum patients already receiving anticoagulation or who meet criteria per Table 1, continue anticoagulation during hospital stay
- For patients NOT already on subcutaneous anticoagulation who do not meet the indications in Table 1, antepartum admission is not a sole indication to start anticoagulation.

Anticoagulation Recommendations

First line agent

Low molecular weight heparins (LMWH), such as enoxaparin, are the preferred agents for VTE prophylaxis and treatment during pregnancy.[5]

Dosing recommendations are based on ACOG and SMFM guidelines. Where ACOG allows for options in dosing, **BCM OB/Gyn Perinatal Guidelines Committee recommends the lowest dose regimen (i.e., prophylactic over intermediate, intermediate over adjusted) to minimize risk of bleeding complications at delivery and increase the likelihood of neuraxial anesthesia/analgesia**. Management can be individualized, as clinically indicated.

BCM OB/Gyn Perinatal Guidelines Committee recommends continuation of LMWH therapy until delivery rather than conversion to unfractionated heparin.

Dosing

Adjusted (therapeutic) dosing should be used to treat an acute DVT and/or PE.
See Table 2 for information on all dosing considerations.

***Table 2**. Anticoagulation Dosing*[4,6-9]

Anticoagulation	Drug	Dosing	Monitoring
Prophylactic	Heparin	Trimester Dependent: 1st trimester: 5000 units subcutaneous q12H 2nd trimester: 7500 units subcutaneous q12H 3rd trimester: 10000 units subcutaneous q12H	Consider platelet count periodically for HIT (heparin induced thrombocytopenia)
	LMWH	40mg subcutaneous daily	None
Intermediate	LMWH	40mg q12H	None
Adjusted dose (therapeutic)	Heparin SC	333 units/kg subcutaneous followed by 250 units/kg subcutaneous q12H	Titrated to target of 1.5-2.5x baseline aPTT 6 hours after injection (if acute VTE goal minimum of 2x baseline)
	Heparin IV	80 units/kg (or 5000 units) IV bolus followed by infusion 18 units/kg/hr	Maintain aPTT at least 2x baseline OR heparin Anti Xa level 0.3-0.7 units/mL 6 hours after dose adjustment
	LMWH	1mg/kg subcutaneous q12H (round to nearest 10mg)	Anti Xa level 4-6 hours after dosing. Goals: 0.8-1.2 units/mL for mechanical heart valves 0.6-1.2 units/mL for all other indications *Consider Anti-Xa level monitoring for renal dysfunction, obesity, or other high-risk conditions (ex: increased risk of bleeding)*
** **CrCl < 30mL/min: contact clinical pharmacist**			

Duration of treatment

Optimal duration of anticoagulation for treatment of VTE is unknown but is most commonly 3 months in duration at minimum. If VTE treatment course ends before or during the post-partum period, anticoagulation should continue for at least 6 weeks postpartum.[4-6]

Peripartum Anticoagulation Recommendations

See Figure 3 for timing of discontinuation of anticoagulation prior to delivery.
See Figure 4 for timing of resumption of anticoagulation following delivery.

Figure 3. Anticoagulation Management During Delivery

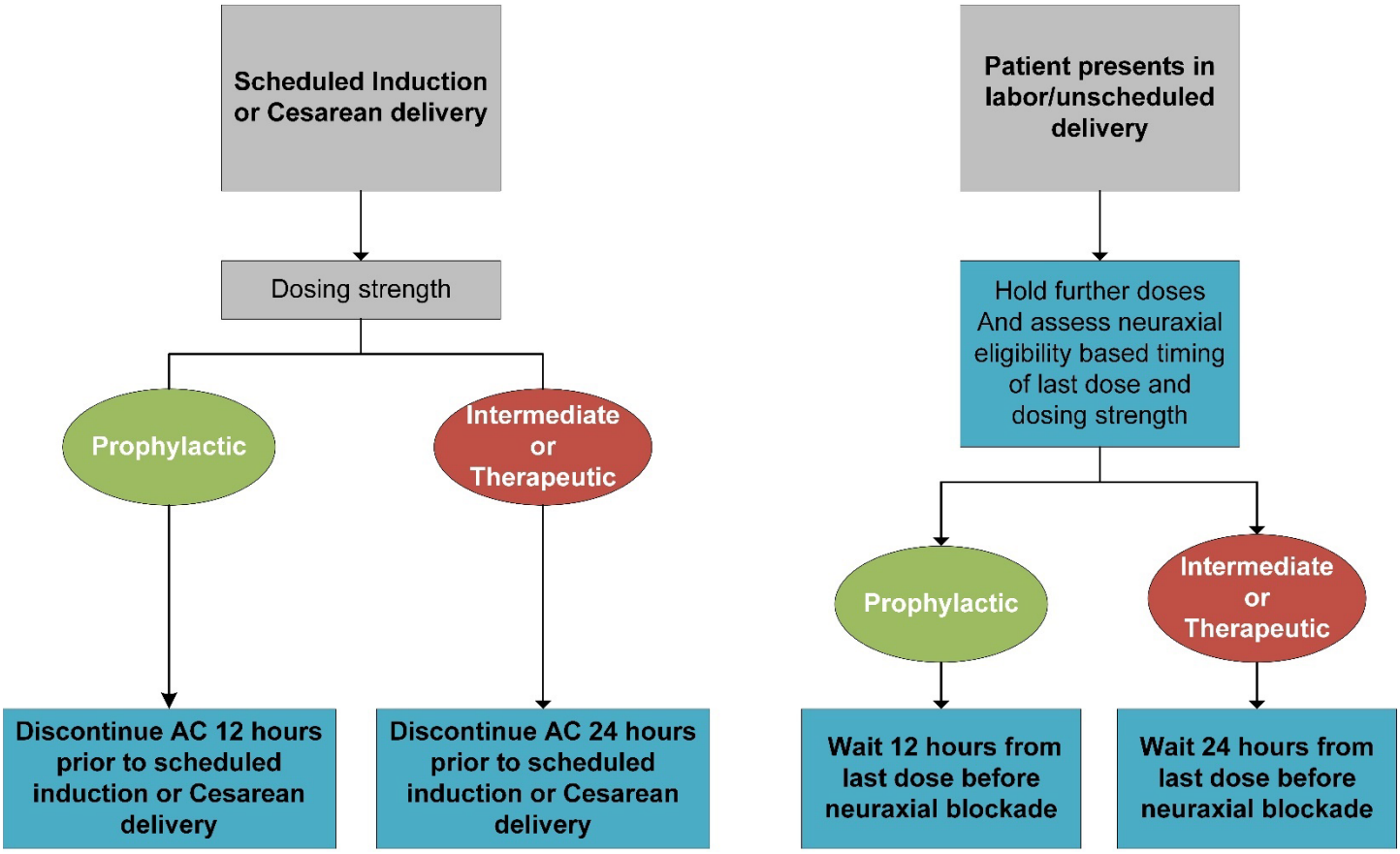
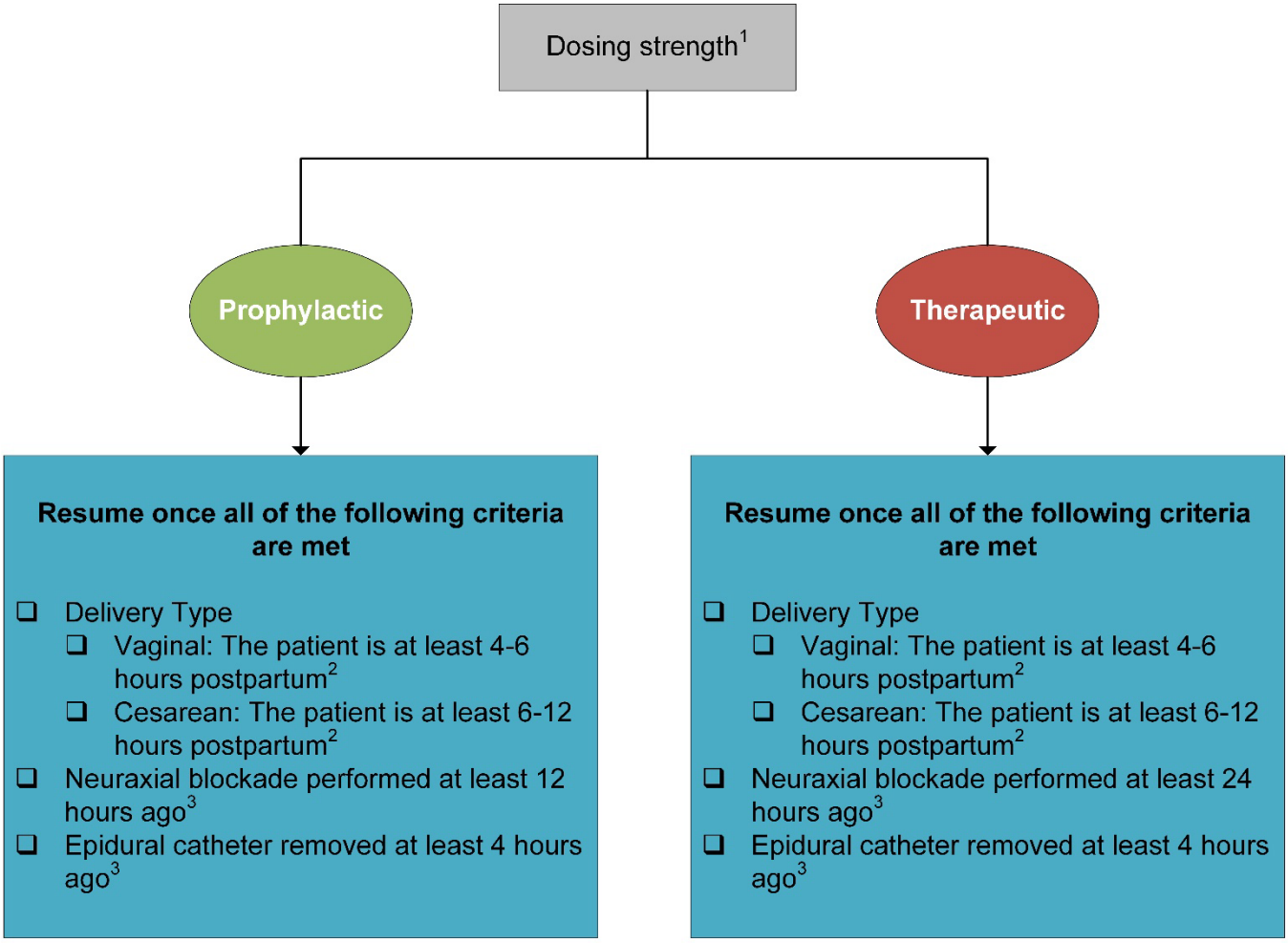


Figure 4. Timing of anticoagulation resumption postpartum is based on LMWH dosing strength, delivery type, and timing of neuraxial anesthesia



[1]The postpartum dose should always be equal to or greater than antepartum anticoagulation dose for any given patient.
[2]Consider delay if the patient experienced a postpartum hemorrhage or there is an ongoing concern for bleeding
[3]Can resume IV unfractionated heparin 1 hour after blockade and removal if there is a high risk for VTE

Postpartum Anticoagulation[2,4-6]

- The risk of VTE is particularly elevated during the postpartum period, and especially after Cesarean delivery or for patients who have an underlying condition that can cause increased risk for clotting (ex. Sickle Cell Anemia, high risk thrombophilia, prior history of a VTE or PE).
- **Patients who were receiving antepartum anticoagulation should continue anticoagulation postpartum for at least 6 weeks.** The postpartum dose should always be equal to or greater than antepartum anticoagulation dose for any given patient.
- Table 1 provides postpartum recommendations for patients at increased risk of VTE based on medical history. The checklist in Figure 5 can also be used to help select the appropriate method for post-Cesarean anticoagulation.
- Figure 4 provides an algorithm for resumption of anticoagulation postpartum. As use of UFH antepartum is increasingly uncommon, this figure focuses on LMWH timing.

Figure 5. Thromboembolism Prophylaxis after Cesarean Delivery[2,3]

BOX

Thromboembolism prophylaxis after cesarean delivery checklist

Thromboembolism Prophylaxis After Cesarean Delivery
Checklist following the Guidelines of SMFM Consult Series #51
This checklist is a SAMPLE only and does not dictate an exclusive course of action for individual patients.

For all cesarean deliveries:
- ☐ Pneumatic sequential compression devices (SCDs) placed prior to surgery start
- ☐ SCDs continued until patient is fully ambulatory

For women with personal history of deep venous thrombosis or pulmonary embolism:
- ☐ SCDs as above
- ☐ Prophylactic low-molecular-weight heparin (eg, enoxaparin 40 mg SC daily); see section below for starting time; continue for 6 weeks postoperatively

For women with inherited or acquired thrombophilia[a] and no previous thrombosis:
- ☐ SCDs as above
- ☐ Prophylactic low-molecular-weight heparin (eg, enoxaparin 40 mg SC daily); see section below for starting time; continue for 6 weeks postoperatively

For women with body mass index (BMI) 40 kg/m^2 or greater (class 3 obesity) who have thrombophilia[a] or history of deep venous thrombosis or pulmonary embolism:
- ☐ SCDs as above
- ☐ Intermediate-dose low-molecular-weight heparin (eg, enoxaparin 40 mg SC every 12 hours); see section below for starting time; continue for 6 weeks postoperatively

For women with combinations of the above risk factors:
- ☐ SCDs as above
- ☐ Individualized management, such as intermediate-dose low-molecular-weight heparin (eg, enoxaparin 40 mg SC every 12 hours) or adjusted-dose (therapeutic) low-molecular-weight heparin (eg, enoxaparin 1 mg/kg SC every 12 hours); see section below for starting time; continue for 6 weeks post-operatively

Appendix

Example Smartphrase

@NAME@ is taking her Lovenox daily at X and Y. I counseled @NAME@ on anticoagulation around delivery and timing of delivery. I explained that she will remain on therapeutic/prophylactic anticoagulation until at least 6 wks postpartum due to her VTE during pregnancy. I explained that regional anesthesia cannot be placed within 12 hours of prophylactic Lovenox and 24 hours of intermediate or therapeutic Lovenox. For this reason, I explained that our general approach is to offer IOL at 39 weeks and plan to hold her last Lovenox dose the day prior to IOL to facilitate neuraxial. I explained that indicated/spontaneous delivery prior to her scheduled IOL may result in inability to receive regional analgesia/anesthesia during labor, resulting in the potential for increased bleeding complications and general anesthesia if CD becomes necessary. I also counseled her to present to the hospital for regular contractions and/or LOF and to hold her Lovenox dose prior to coming to hospital if around the time of scheduled administration.

Plan as follows:

1. Continue twice daily therapeutic Lovenox/Continue once daily prophylactic Lovenox
2. IOL at 39 weeks.
3. Hold Lovenox the day prior to scheduled IOL
4. Resume Lovenox after delivery: if prophylactic Lovenox, can resume 12 hours after neuraxial blockade and at least 4 hours after catheter removal; if intermediate or therapeutic Lovenox, wait at least 24 hours after neuraxial blockade and at least 4 hours after epidural catheter removal. Additionally, Lovenox should not be started sooner than 4-6 hours after uncomplicated vaginal delivery and 6-12 hours after uncomplicated CD.
5. Consider use of a Direct Oral Anticoagulant for postpartum thromboprophylaxis, but should be based on discussion with Hematology (Xarelto is compatible with breastfeeding).
6. Recommend continuation of LMWH therapy until delivery rather than conversion to unfractionated heparin since unfractionated heparin doses of 7,500 units subcutaneous twice a day or more also require discontinuation at least 12 hours before scheduled induction of labor or cesarean delivery and therapeutic levels can be difficult to achieve with Heparin.

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Cardiology

Hypertensive Disorders of Pregnancy

[October 2025 (Replaces April 2025)]

Authors: Tara Barrick, **Dr. Sarah Detlefs**, Dr. Christina Davidson
Editor: Dr. Stacy Strehlow

This guideline has been updated with updates to multiple algorithms including hypertensive emergency and eclampsia, considerations for management of preeclampsia with elevated transaminases, and management of postpartum hypertension.

Highlights

- Preeclampsia without severe features/Gestational hypertension
  - Preeclampsia without severe features and gestational hypertension should be managed in the same fashion.
  - Patients with preeclampsia *without* severe features or gestational hypertension may qualify for outpatient management which includes weekly prenatal visits, weekly preeclampsia labs, twice weekly antenatal testing, and ability to perform home blood pressure monitoring.
  - Oral antihypertensive therapy should **NOT** be initiated in patients with preeclampsia without severe features or gestational hypertension managed as an outpatient.
- Preeclampsia with severe features
  - Patients with a diagnosis of preeclampsia with severe features who qualify for expectant management should be offered delivery as an alternative to inpatient expectant management.
- Postpartum Management
  - Management of postpartum patients with a diagnosis of any hypertensive disorder of pregnancy (HDP) during pregnancy or postpartum may include initiation of long acting antihypertensive to keep blood pressures < 150/110.
  - Postpartum patients may benefit from resumption of their pre-pregnancy antihypertensive medications.
  - The use of furosemide for postpartum patients with HDP should be individualized.

Background

Preeclampsia and/or chronic hypertension affect at least 10% of patients and the prevalence is increasing. In fact, chronic hypertension increased by 67% between 2000 and 2009. Sadly, 16% of maternal deaths are caused by or associated with hypertension. Therefore, accurate and prompt diagnosis and management are critical to prevent severe morbidity and even mortality. The purpose of this document is to summarize the diagnosis and management of each cause of hypertension in pregnancy.

Hypertension in pregnancy is divided into the following categories:

1. Preeclampsia: pregnancy-specific hypertensive disease with multisystem involvement that occurs after 20 weeks' gestation.
   a. Eclampsia: convulsive phase of the disorder.

2. Gestational hypertension: new-onset elevations of blood pressure (BP) after 20 weeks in the absence of proteinuria or systemic findings.
3. Chronic hypertension: hypertension that predates conception or is detected before 20 weeks. **This document does NOT discuss prenatal management of chronic hypertension.**
4. Chronic hypertension with superimposed preeclampsia: chronic hypertension with additional evidence of preeclampsia

While preeclampsia and gestational hypertension have different definitions, they fall within the same spectrum of **hypertensive disease of pregnancy (HDP)**.

Please see Table 1 for specific definitions and Figure 1 and Figure 2 for diagnostic algorithms.

Blood pressure diagnostic criteria for preeclampsia

For PFW, please see TCH PolicyTech for the policy on how to obtain an accurate blood pressure measurement to ensure that blood pressure measurement is standardized.

Severe range:* 160/110

Mild range:* 140/90

*Only one number needs to be above the threshold (systolic or diastolic) to meet criteria

Laboratory evaluation for preeclampsia

This document will refer to recommended labs as “Preeclampsia labs”, which include:

- Complete blood count (CBC) with platelets
- Complete Metabolic Panel **or** individual components of:
  - BUN and creatinine
  - Liver transaminases (AST, ALT)
- +/- Uric acid and LDH (does not aid in diagnosis)
- Urine protein evaluation

Proteinuria

Studies suggest that a protein: creatinine (P:C) ratio is highly predictive of 24-hour urine protein measurement and is useful in the detection of proteinuria.[1-4] While previous studies recommended a 24-hour urine protein as the gold standard to account for fluctuations in proteinuria throughout the day, newer data suggest that it may be unnecessary in most settings for diagnosis of preeclampsia. In fact, there are disadvantages to a 24-hour urine protein compared to a P:C ratio including expense, inconvenience, risk for inaccurate collections, and sensitivity to storage temperature which could lead to bacterial growth and interference in protein evaluation.[3] The P:C ratio has been reported to be predictive of total 24-hour protein results among patients with non-nephrotic range proteinuria.[5] However, it is important to note that the sensitivity and specificity have been

reported to be in the 75-80% range.[6] Thus, if the presence of proteinuria would change clinical management (e.g. previable gestation or diagnosis of superimposed preeclampsia), a 24-hour urine may still be appropriate.

- Proteinuria can be defined as either of the following:
  - ≥300 mg of protein in a 24-hour urine collection
  - P:C ratio ≥0.3 (each measured as mg) in a random sample
- Qualitative determination (dipstick test) is discouraged for diagnostic use due to its variability.[7]

The PFW TexasAIM Hypertension Workgroup and BCM Ob/Gyn Perinatal Guidelines Committee recommend a P:C ratio rather than 24-hour urine protein in evaluation of proteinuria in the context of preeclampsia for most clinical situations. NOTE: For patients with preeclampsia, a delivery decision should not be based solely on the amount of proteinuria or change in the amount of proteinuria.

Severe features of preeclampsia

- Persistent cerebral or visual disturbances (e.g. headache not responsive to routine medications)
- Pulmonary edema
- Persistent RUQ or epigastric pain (not otherwise accounted for and unresponsive to treatment)
- Thrombocytopenia (platelets <100,000/uL)
- Renal insufficiency (in absence of other renal disease: creatinine > 1.1 mg/dL OR doubling of creatinine from baseline)
- Impaired liver function (ALT/AST greater than twice upper limit of normal)

Preeclampsia diagnostic criteria

Table 1: Diagnostic criteria for the hypertensive disorders of pregnancy

Figure 1: Diagnostic algorithm for patients **without** a history of chronic hypertension

Figure 2: Diagnostic algorithm for patients **with** a history of chronic hypertension

Table 1. Diagnostic criteria for the hypertensive disorders of pregnancy

Diagnosis	Gestational Age	Blood Pressure	Proteinuria	Signs/Symptoms
Gestational Hypertension	≥20 weeks gestation (no hypertension prior to 20 weeks)	SBP ≥140 or DBP ≥90 mmHg on two occasions at least 4 hours apart[a]	P:C ratio <0.3	Must have none
Preeclampsia without severe features	≥20 weeks gestation (no hypertension prior to 20 weeks)	SBP ≥140 or DBP ≥90 mmHg on two occasions at least 4 hours apart without severe range blood pressures	P:C ratio ≥0.3	Must have none
Preeclampsia with severe features (includes patients with **gestational hypertension with severe range blood pressures**)[7]		SBP ≥140 or DBP ≥90 mmHg on two occasions at least 4 hours apart WITH signs/symptoms OR SBP ≥160 or DBP ≥110 mmHg on two isolated occasions at least 4 hours apart OR OR SBP ≥160 or DBP ≥110 mmHg requiring acute antihypertensive therapy	Variable	Any of the following: • Severe hypertension as described to the left • Pulmonary edema • Cerebral or visual disturbances • Thrombocytopenia (platelet count <100K) • Renal insufficiency: serum creatinine >1.1 mg/dL OR doubling creatinine (in absence of other renal disease) • Impaired liver function: LFTs 2X normal AND/OR severe, persistent RUQ or epigastric pain (not otherwise accounted for and unresponsive to treatment) • HELLP Syndrome
Chronic hypertension	Hypertension prior to pregnancy or diagnosed prior to 20 weeks' gestation	Variable[b]	Stable[c]	None
Chronic hypertension with superimposed preeclampsia *without* severe features		SBP <160 and DBP <110 mmHg	New-onset proteinuria or significant increase in baseline proteinuria	Absence of symptoms
Chronic hypertension with superimposed preeclampsia *with* severe features		May see SBP ≥160 or DBP ≥110 mmHg despite escalation of antihypertensive therapy	May see new-onset proteinuria or increase from baseline proteinuria, but not required	Any of the following: • Rapidly escalating antihypertensive therapy • Pulmonary edema • Cerebral or visual disturbances • Thrombocytopenia (platelet count <100K) • Renal insufficiency: serum creatinine >1.1 mg/dL OR doubling creatinine (in absence of other renal disease) • Impaired liver function: LFTs 2X normal AND/OR severe, persistent RUQ or epigastric pain (not otherwise

				accounted for and unresponsive to treatment) • HELLP Syndrome
Chronic hypertension exacerbation		SBP ≥160 or DBP ≥110 mmHg requiring treatment (initiation or increase of long-acting antihypertensive medication)	Stable[c]	Absence of symptoms

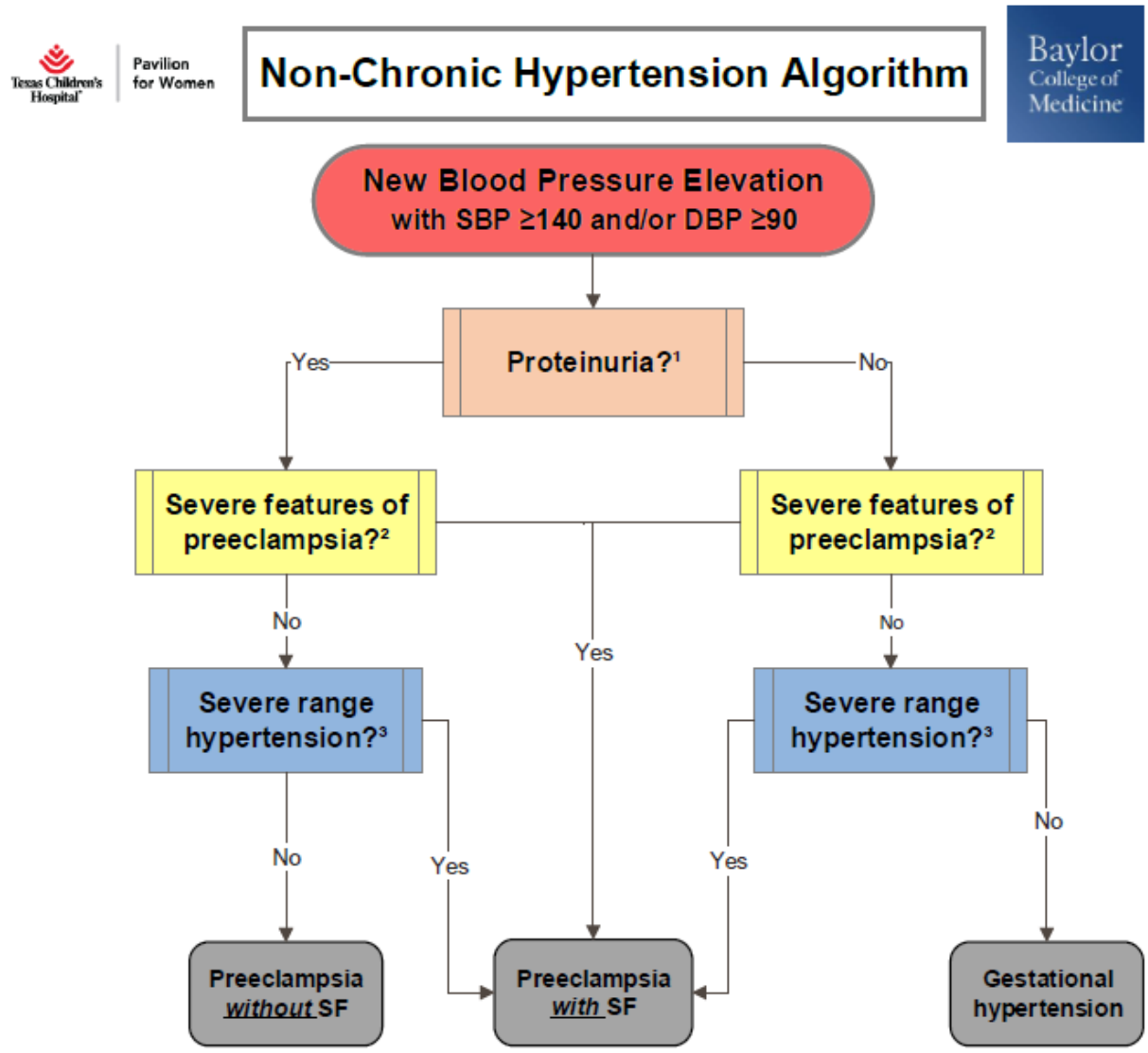
SBP= systolic blood pressure; DBP= diastolic blood pressure

[a]Patients who have severe range hypertension and no proteinuria should be diagnosed with preeclampsia with severe features and NOT gestational hypertension.

[b]Blood pressure may be normal in patients with a diagnosis preceding pregnancy. For patients diagnosed during pregnancy, they must have SBP ≥140 or DBP ≥90 mmHg on two occasions at least 4 hours apart.

[c]A P:C ratio should be evaluated upon diagnosis. A sudden worsening in proteinuria should be considered suspicious for superimposed preeclampsia.

Figure 1. Diagnostic algorithm for patients with<u>OUT</u> a history of chronic hypertension



SF, severe features; Rx, therapy; CHTN, chronic hypertension
[1] **Proteinuria:** Proteinuria is defined as P:C >0.3.
[2] **Severe features of preeclampsia:** Pulmonary edema, Persistent headache or persistent visual changes, thrombocytopenia (platelet count <100K), renal insufficiency: serum creatinine >1.1 mg/dL OR doubling creatinine (in absence of other renal disease), impaired liver function: LFTs 2X normal AND/OR severe, persistent RUQ or epigastric pain (not otherwise accounted for and unresponsive to treatment), HELLP Syndrome.
[3] **Severe range hypertension:** Either severe range blood pressures requiring acute antihypertensive therapy OR at least two non-sustained severe range blood pressures measured at least 4 hours apart.

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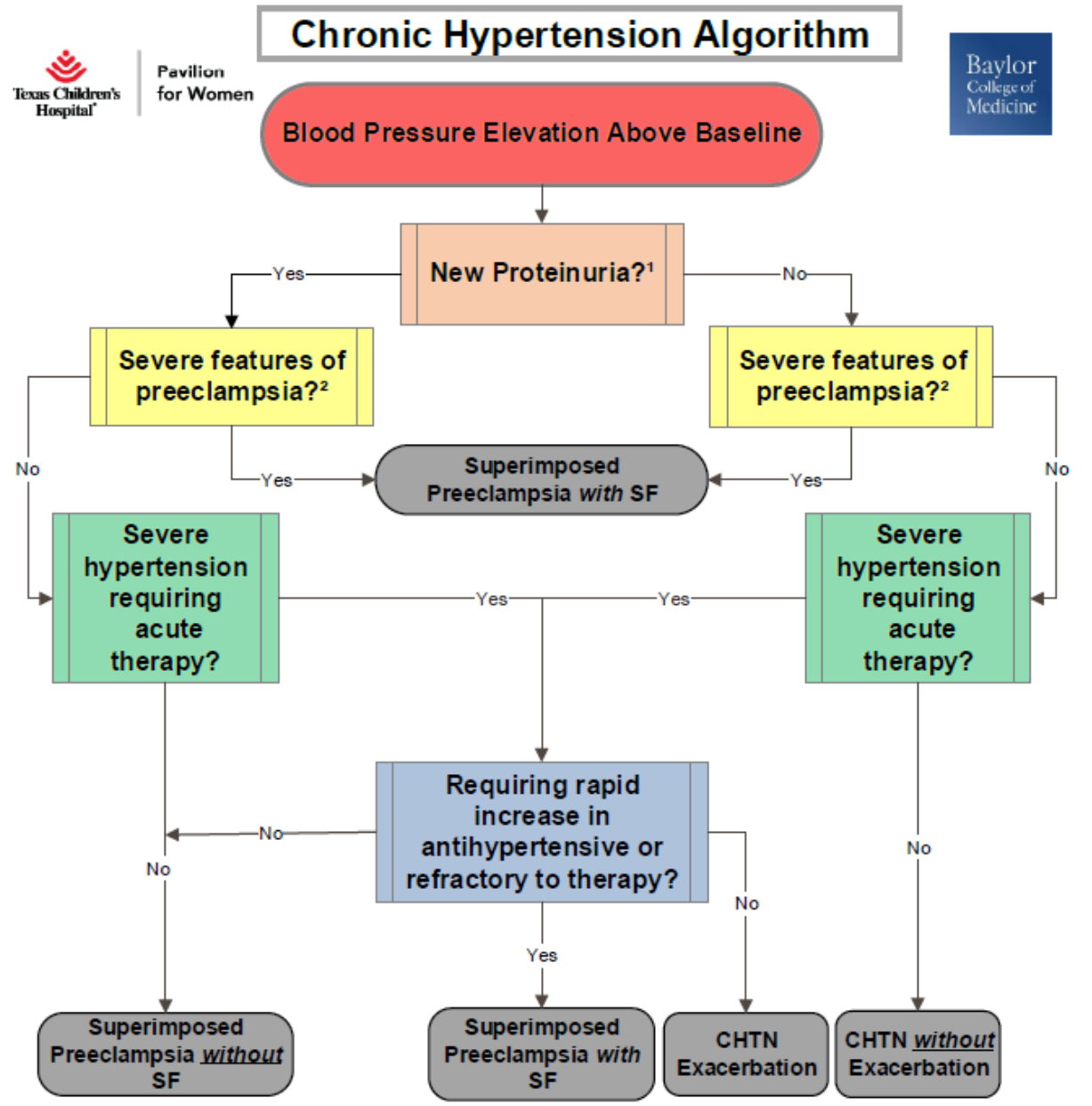
Figure 1

Figure 2. Diagnostic algorithm for patients with a history of chronic hypertension



SF, severe features; Rx, therapy; CHTN, chronic hypertension

[1]**New Proteinuria:** If baseline proteinuria evaluation was < 300 mg/24hour or P:C < 0.3 and now 24 hour urine protein is > 300mg/24hour or P:C >0.3 then this abnormal and meets criteria for "new proteinuria". Similarly, if the patient has previous proteinuria or preexisting renal disease, then a 2-fold increase is abnormal and meets criteria for "new proteinuria"

[2] **Severe features of preeclampsia:** Pulmonary edema, Persistent headache or persistent visual changes, thrombocytopenia (platelet count <100K), renal insufficiency: serum creatinine >1.1 mg/dL OR doubling creatinine (in absence of other renal disease), impaired liver function: LFTs 2X normal AND/OR severe, persistent RUQ or epigastric pain (not otherwise accounted for and unresponsive to treatment), HELLP Syndrome

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Figure 2

Preeclampsia *without* severe features and gestational hypertension (includes superimposed preeclampsia w/o severe features)

Initial Triage Evaluation

If there is concern for preeclampsia without severe features or gestational hypertension (GHTN) from an outpatient visit, the patient should be sent to triage. Maternal and fetal evaluation in triage should consist of the following:

- Maternal evaluation
  - **Blood pressure** Q 15-30 min initially then individualize
  - Ask about **symptoms** consistent with severe features
  - Preeclampsia Labs

- Fetal evaluation
  - Ultrasonographic evaluation for estimated fetal weight (EFW) if none on record within the previous 2 weeks and amniotic fluid index (AFI) with umbilical artery Doppler interrogation if EFW <10th percentile
  - **Nonstress test (NST)**

- **Hospitalization** for patients < 37 weeks' gestation with new-onset hypertension for approximately 24 hours can be considered initially. **Delivery** is indicated for patients ≥ 37 weeks' gestation.

  Goals of such management include early identification of worsening preeclampsia and development of a management scheme that includes a plan for timely delivery. ***If no severe features manifest after an initial period of inpatient observation, then discharge and outpatient management can be considered.***

- For patients who are sent to **Ben Taub OBI** for evaluation of a hypertensive disorder of pregnancy, discharge from OBI and follow up may be considered in those with a NON-SEVERE diagnosis who meet ALL the following criteria:
  - 2 mild-range BPs at least 4 hours apart (1st BP can be the one from their referring clinic) and NO severe-range BPs
  - Normal preeclampsia labs: Cr, AST, ALT, Hgb/Hct, Platelet count (the presence of proteinuria does not preclude discharge)
  - Reassuring fetal testing: no late decels, normal AFI/MVP
  - Normal fetal growth (EFW and AC >10th%) on bedside ultrasound in OBI or documented within prior 2 weeks
  - No preeclampsia symptoms

- Patients should be discharged with the following plan
  - Follow up in High-Risk Ob clinic or their OB provider at PFW within 1 week
  - Antenatal testing within 1 week (ideally on same day as prenatal visit)
  - Pre-clinic preeclampsia labs
  - Home BP monitoring (if patient able to get home cuff)
  - Return precautions (symptoms, severe-range BPs)
  - If the patient is within 1 week of 37w0d, they should leave with a scheduled delivery date for 37w0d
  - If all the above cannot be accomplished at the time of discharge, ensure you have a valid phone number for the patient and call the patient within 24-48 hours to give them these appointments

Outpatient Management

Outpatient management is only acceptable for patients who have reliable transportation to and from the hospital, can come in for twice weekly testing and are felt to be capable of monitoring their blood pressure and symptoms.

In patients with GHTN, the progression to severe disease often develops within 1-3 weeks after diagnosis; whereas in patients with preeclampsia without severe features, the progression to severe disease could happen within days.[7]

The PFW TexasAIM Hypertension Workgroup and BCM Ob/Gyn Perinatal Guidelines Committee recommend identical outpatient management and timing of delivery for both GHTN and preeclampsia without severe features, as outlined below.

Medication

ACOG **recommends against use of antihypertensive medication in the setting of preeclampsia without severe features OR gestational hypertension**.[7] If the patient has severe hypertension requiring antihypertensive therapy, they should be managed in the same approach as with severe disease.

Laboratory evaluation

Preeclampsia labs should be repeated **at least weekly** while the patient remains outpatient. If any laboratory values meet criteria for severe features, the patient warrants admission. Admission for less severe lab abnormalities may be warranted but should be individualized.

Fetal Testing

Twice weekly antenatal testing at diagnosis.

At home blood pressure monitoring

The patient should monitor blood pressures **2 times per day and keep a log**. This should be sent into the provider via MyChart and/or reviewed at visits.

Bed Rest

Recommend against bedrest as it is not an effective treatment, does not prevent worsening of hypertension, and may cause adverse outcomes, such as deconditioning and increased risk of venous thromboembolism.[8]

Progression of disease

Patients should be counseled about signs and symptoms of disease progression (headache, visual disturbances, right upper quadrant or epigastric pain, etc.) **and when to return to the hospital and/or call their doctor's office (see patient education section)**. Patients who develop severe range blood pressures or any symptoms concerning for severe features should be admitted to the hospital.

Delivery timing

ACOG recommends delivery at 37 0/7 weeks' gestation or at diagnosis if diagnosed later.[7]

Intrapartum Management

- ☐ Initial maternal evaluation:
  - Evaluate for evidence of severe features.
  - Blood pressure Q 15-30 min initially then individualize
  - Preeclampsia Labs
    - **Repeat labs on admission and at least every 24 hours until delivery**
  - Physical exam and assessment of volume status
  - Strict intake and output monitoring

- ☐ Fetal Evaluation
  - Continuous fetal heart rate monitoring

- ☐ Magnesium sulfate is not recommended for patients without severe features.[7]
  If at any point the patient develops clinical or laboratory evidence consistent with preeclampsia with severe features, they should be started on Magnesium sulfate and the severe feature algorithm should be followed.

Preeclampsia with severe features (includes superimposed preeclampsia with severe features)

Preeclampsia with severe features can lead to lifelong morbidity and mortality. There is risk for damage to multiple organ systems including, but not limited to, the brain, kidneys, and liver. Therefore, a careful risk/benefit analysis must be performed when determining delivery timing. **ACOG recommends delivery** at 34 0/7 weeks or later if diagnosed later **for patients with severe features, as the maternal risk outweighs fetal benefit.** However, these patients are often delivered sooner due to worsening of symptoms, lab abnormalities, or blood pressures.

Patients with new onset severe range hypertension and no proteinuria (formerly severe gestational hypertension) should be diagnosed with preeclampsia with severe features.

Initial Evaluation and Management

Pregnancies ≥ 34 0/7 weeks gestation

- Admit for delivery.
  - ☐ Initial Maternal evaluation:
    - Blood pressure q15-30 minutes then individualize
    - Evaluate for symptoms consistent with severe features
    - Preeclampsia labs
    - Physical exam and assessment of volume status
    - Urine output

  - ☐ Fetal evaluation:
    - Continuous fetal heart rate monitoring

  - ☐ Administer acute antihypertensive therapy as needed for persistent severe hypertension
    Link to Figure 3: Hypertensive Emergency Checklist
  - ☐ Administer IV magnesium sulfate (4-6 g load over 20-30 minutes followed by 2 gm/hour with normal renal function)

  - ☐ Administration of corticosteroids should be individualized depending on length of anticipated labor. Can consider late preterm corticosteroids if delivery is expected to occur 12 hours or later after administration.[9] However, delivery should not be delayed in order to administer corticosteroids.

For more information regarding intrapartum management of preeclampsia with severe features, please see section entitled "Intrapartum management"

Pregnancies <34 0/7 weeks gestation

1. Admit to L&D or antepartum unit for initial evaluation

   - ☐ Maternal evaluation:
     - Blood pressure q15-30 minutes then individualize
     - Evaluate for symptoms consistent with severe features
     - Preeclampsia Labs
     - Physical exam and assessment of volume status
     - Urine output

- ☐ Fetal evaluation for viable pregnancies (gestational age of at least 23 0/7 weeks gestation):
    - Continuous or intermittent fetal heart rate monitoring (continuous monitoring recommended while on magnesium sulfate)
    - Ultrasonographic evaluation for:
        - EFW if none on record within the previous 2 weeks
        - Amniotic fluid volume assessment (AFI and/or max vertical pocket)
        - Umbilical artery Doppler interrogation if EFW and/or AC <10th percentile
        - Biophysical Profile (BPP) as clinically indicated

- ☐ Administer acute antihypertensive therapy as needed for persistent severe hypertension
  Link to Figure 3: Hypertensive Emergency Checklist

- ☐ Administer IV magnesium sulfate (4-6 g load over 20-30 minutes followed by 2 g/hour with normal renal function)

- ☐ Administer corticosteroids for fetal maturity if eligible (betamethasone 12mg IM every 24hrs x 2 doses).

2. After initial clinical and laboratory evaluation, a decision must be made for immediate delivery versus expectant management (**Table 2**). **For more information regarding inpatient expectant management of preeclampsia with severe features, please see section entitled "Expectant Management prior to 34 0/7 weeks"**

   Previously, fetal growth restriction was considered an indication for delivery. In the setting of normal parameters (i.e., amniotic fluid volume, Doppler findings, antenatal fetal testing), continuation of expectant management may be reasonable in the absence of other maternal-fetal criteria.

Table 2. Immediate Delivery vs. Expectant Management for Preeclampsia with Severe Features (contraindications to expectant management)

Category	
Immediate delivery (can await antenatal corticosteroid benefit, depending on gestational age and maternal severity of illness)[7]	• ≥34 0/7 weeks gestation • Labor • Uncontrolled severe hypertension not responsive to antihypertensives • Persistent headaches refractory to treatment • Persistent visual disturbances • Epigastric pain or RUQ pain unresponsive to repeat analgesics • Eclampsia • Stroke • Pulmonary edema • Myocardial Infarction • HELLP Syndrome • New-onset or worsening renal dysfunction (serum creatinine greater than 1.1 mg/dL or a doubling of the serum creatinine concentration in the absence of other renal disease) that does not improve with hydration • Nonviable fetus • Abnormal fetal testing • Fetal demise • Fetal umbilical artery Doppler velocimetry with persistent reversed end-diastolic flow
Expectant management	• <34 0/7 weeks gestation • Absence of persistent symptoms • Stable disease and does not meet any of the criteria for immediate delivery (as above)

While elevated transaminases is a diagnostic criterion for preeclampsia with severe features, they are not a contraindication to expectant management. In this setting, management should be individualized. MFM consultation should be considered.

Intrapartum management

☐ Maternal Evaluation
- Reevaluate regularly for clinical evidence of worsening disease (e.g. pulmonary edema)
- Blood pressure monitoring
- Preeclampsia Labs
  - **Repeat labs every 6-12 hours while in labor or sooner as clinically indicated**
- Physical exam and assessment of volume status
- Strict Intake/Output monitoring

☐ Fetal Evaluation
- Continuous fetal heart rate monitoring for viable pregnancies (gestational age of at least 23 0/7 weeks gestation)

☐ Administer acute antihypertensive therapy as needed for persistent severe hypertension
Link to Figure 3: Hypertensive Emergency Checklist

☐ Administer IV magnesium sulfate (4-6 g loading dose over 20-30 minutes followed by 2 g/hour with normal renal function)

- If Cesarean delivery is performed**, ACOG recommends the continued intraoperative administration of IV magnesium sulfate**.[7]
- Magnesium sulfate dosing will differ if there is evidence of renal dysfunction. Please see section on "Management of Preeclampsia Complications" for more information
- Magnesium sulfate is most often administered for 24 hours postpartum. Earlier discontinuation should be individualized.

Expectant Management prior to 34 0/7 weeks

After an initial 24-hour observation period on magnesium sulfate, patients at 23 0/7-33 4/7 weeks of gestation with adequately controlled BP, no persistent symptoms, and reassuring fetal testing can have their **magnesium sulfate discontinued** and can be monitored on the antepartum unit up to 34 0/7 weeks of gestation or are delivered for the development of a maternal or fetal indication (**Table 2**).

Expectant management should be performed only after maternal counseling regarding the benefits and risks of such treatment by the attending physician using principles of shared decision making and only after patient acknowledgement of acceptance of those risks. The benefits of expectant management are for fetal maturity only. There are no maternal benefits to expectant management. The maternal risks of expectant management include, but are not limited to, ICU admission, HELLP syndrome, recurrent severe hypertension, abruptio placentae, eclampsia, subcapsular liver hematoma, myocardial infarction, and stroke.[7] The perinatal risks of expectant management include stillbirth, neonatal death, perinatal asphyxia, and small for gestational age infant. Consultation with MFM, neonatology and anesthesiology should be considered.

Blood pressure

Blood pressure should be evaluated per the antepartum unit standard.

Any severe range blood pressure should trigger MEWS activation and timely treatment. **Goal blood pressures in this population are SBP 140-150s/DBP 80-100** using the Hypertensive Emergency Checklist.

Antihypertensive medication

Long-acting oral antihypertensive medications can be administered to maintain mild-range blood pressures in an effort to prolong the period of expectant management.[7]

Table 3. *Oral medications for management of hypertension in pregnancy*

Medication	Dose	Contraindications/Cautions
Labetalol	200-2,400mg/day orally in 2-3 divided doses, commonly initiated at 100-200 mg po q 12 hours	Avoid in patients with poorly controlled asthma or myasthenia gravis Use with caution in patients with heart disease or congestive heart failure
Nifedipine Extended Release (Procardia XL)	30-120mg/day in 1-2 divided doses, commonly initiated at 30-60 mg po once daily	Do NOT use sublingually

Symptom Monitoring

Assess for worsening disease that may preclude expectant management. New lab abnormalities, headaches that do not resolve with routine medication, new onset epigastric/RUQ pain, retrosternal pain or pressure, shortness of breath, visual changes, or other concerning symptoms warrant transfer to L&D for possible delivery.

Lab monitoring

Preeclampsia labs should be repeated daily for at least the first three days of expectant management and can then be transitioned to 2-3 times per week if they remain normal. More frequent monitoring may be indicated depending on patient status.

Fetal Monitoring

- ☐ Twice weekly antenatal testing (can be modified BPP or 10-point BPP)
- ☐ Ultrasonographic evaluation for EFW q3 weeks
- ☐ Weekly umbilical artery Doppler interrogation if EFW <10th percentile (more frequently if abnormal; please refer to BCM Ob/Gyn Perinatal Guideline on “Antepartum Surveillance Management Guidelines”)

Bed Rest

Recommend against bedrest as it is not an effective treatment, does not prevent worsening of hypertension, and may cause adverse outcomes, such as deconditioning and increased risk of venous thromboembolism.[8]

Delivery

Patients with preeclampsia with severe features undergoing expectant management should be delivered by 34 0/7 weeks’ gestation and may require delivery sooner due to development of worsening disease.

Maternal Fetal Medicine consultation

Consider consulting Maternal Fetal Medicine for further recommendations on frequency of lab monitoring, medication management, and delivery timing.

Maternal Fetal Medicine consultation is **required** if:

- ICU admission
- Antihypertensive drip (i.e. Nicardipine drip)

Figure 3. Hypertensive Emergency Checklist

Texas Children's Hospital Pavilion for Women

Hypertensive Emergency Checklist

Baylor College of Medicine

Recognize

If a patient has a severe range blood pressure (SBP ≥ 160 and/or DBP ≥ 110)

- ❑ Ensure blood pressure cuff appropriate size and blood pressure taken at the level of the heart with patient reclining at a 45-degree angle (NOT supine or lateral positioning)
- ❑ Repeat blood pressure in 5 minutes. If still severe range, initiate protocol below.

Respond

- ❑ Activate MEWS
- ❑ Team Huddle
- ❑ Call for assistance PRN (place IV, checklist)

Treat

- ❑ Place IV
- ❑ Send preeclampsia labs (CBC, CMP or AST/ALT and BUN/Cr, LDH, P:C ratio)
- ❑ Begin continuous fetal monitoring if viable gestational age (at least 23 0/7 weeks)
- ❑ Ensure side rails up (and padded)
- ❑ Repeat blood pressure 15 minutes after initial severe range. **If still severe, administer acute antihypertensive therapy**
- ❑ Follow antihypertensive therapy algorithm **on back of page**
- ❑ Consider initiation of Magnesium Sulfate 4-6 g bolus over 20-30 minutes then Magnesium sulfate 2g/hr maintenance therapy
- ❑ Consider initiation or uptitration of long acting antihypertensive

Monitor Blood Pressure

Even if blood pressures no longer severe range:

- ❑ Repeat every 15 minutes for 1 hour then
- ❑ Every 30 minutes for one hour then
- ❑ Every 1 hour for 4 hours
- ❑ Reactivate MEWS as necessary

Other considerations:

- ❑ Consider need for ICU consultation for refractory severe range blood pressures (may need Nicardipine gtt, which requires ICU admission and cardiac monitoring)
- ❑ Head imaging if unrelenting headache or neurological symptoms (CT or MRI)
- ❑ Give Antenatal Corticosteroids (if indicated)

Debrief

- ❑ Debrief with patient and family
- ❑ Debrief with Obstetric team

Document

- ❑ Physicians: use "MEWS" smart note. Fill out all fields, including medication given
- ❑ Nursing: use the "MEWS" flowsheet in the electronic medical record (EMR). Fill out all fields, including final disposition.

Figure 3 cont'd

Hypertensive Emergency Checklist

Medication protocols:

Immediate Release (IR) Nifedipine Protocol*

(Consider as initial agent due to ease of access and administration on any unit)

- ❑ Administer 10 mg PO IR Nifedipine
- ❑ Repeat BP in 20 minutes and record result
- ❑ If either BP is still severe-range, administer 20 mg PO IR Nifedipine
- ❑ Repeat BP measurement in 20 minutes and record result
- ❑ If either BP is still severe-range, administer 20 mg PO IR Nifedipine
- ❑ Repeat BP measurement in 20 minutes and record result
- ❑ If either BP is still severe-range, proceed with Labetalol or Hydralazine administration.

*Nifedipine has been associated with overshoot hypotension and tachycardia. (Do NOT administer sublingually, crush or chew)
*When used with magnesium sulfate, monitor maternal vital signs with specific attention to heart rate
***Nifedipine should be avoided in women with heart rate > 100 bpm and used with caution in women with heart failure**

IV Labetalol Protocol*

- ❑ Administer 20 mg IV Labetalol pushed over 2 minutes
- ❑ Repeat BP in 10 minutes and record result
- ❑ If either BP is still severe-range, administer 40 mg IV Labetalol pushed over 2 minutes
- ❑ Repeat BP in 10 minutes and record result
- ❑ If either BP is still severe-range, administer 80 mg IV Labetalol pushed over 2 minutes
- ❑ Repeat BP in 10 minutes and record result
- ❑ If either BP is still severe-range, proceed with Hydralazine administration (if not yet given).

*Labetalol should be used with caution in women with severe asthma (history of intubation, weekly symptoms, regular inhaler use or steroid use during pregnancy), and **avoided in women with a heart rate of < 70 bpm and/or heart failure**
***Maximum IV Labetalol dose: 300 mg in 24 hours**

IV Hydralazine Protocol*

- ❑ Administer 5-10 mg IV Hydralazine pushed over 2 minutes
- ❑ Repeat BP in 20 minutes and record result
- ❑ If either BP is still severe-range, administer 10 mg IV Hydralazine pushed over 2 minutes
- ❑ Repeat BP in 20 minutes and record results
- ❑ If either BP is still severe-range, proceed with Labetalol administration (if not yet given).

*Parenteral Hydralazine can increase the risk of overshoot hypotension and tachycardia
***Maximum IV Hydralazine dose: 25mg in 24 hours**

Antihypertensive Approach: Drugs and Thresholds for Treatment

- Acute-onset severe hypertension = (1) SBP of 160 mm Hg or more and/or DBP of 110 mm Hg or more that is confirmed on repeat ≥ 15 minutes later) OR (2) One or more repeat severe range blood pressures are documented at 15-60 min after episode onset, even if interspersed with non-severe BPs.
- Severe hypertension should be treated expeditiously with antihypertensive agents to prevent congestive heart failure, myocardial ischemia, renal injury or failure, and ischemic or hemorrhagic stroke.
- **The TexasAIM and PFW goal is to initiate treatment for acute-onset severe hypertension as soon as reasonably possible, and no later than 60 minutes from the first severe-range BP.**

  However, it is recommended to administer antihypertensive therapy as soon as reasonably possible after the criteria for acute-onset severe hypertension are met.

References:
Chronic Hypertension in Pregnancy, ACOG Practice Bulletin #203, January 2019; Gestational Hypertension and Preeclampsia, ACOG Practice Bulletin #222, June 2020. Society for Maternal-Fetal Medicine Special Statement: A quality metric for evaluating timely treatment of severe hypertension.

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Management of preeclampsia complications

Common complications of preeclampsia include renal insufficiency/dysfunction with or without oliguria and pulmonary edema.

Renal Dysfunction

Renal Insufficiency due to preeclampsia is defined as a creatinine of >1.1 mg/dL OR a doubling of baseline creatinine (for patients without a history of renal disease) OR oliguria, defined as < 30mL/hour x 4 hours OR less than 0.5 cc/kg/hour (actual body weight).

Renal dysfunction in the setting of preeclampsia is a **contraindication to expectant management**. Therefore, delivery is indicated.

- No Oliguria

  - ☐ Strict intake and output monitoring

  - ☐ Check serum magnesium levels every 4-6 hours
    Goal magnesium level is 4.8-9.6 mg/dL[7]

  - ☐ Check preeclampsia labs every 6 hours

  - ☐ Total IV fluid intake should not exceed 125mL/hr

  - ☐ Alter magnesium sulfate administration:
    If creatinine abnormal but ≤ 1.5 mg/dL, can administer magnesium sulfate 4-6g bolus and 1g/hr maintenance. *STOP maintenance if the patient becomes symptomatic or magnesium level is > 9.6 mg/dL.*[7]

    If creatinine > 1.5 mg/dL, only administer magnesium sulfate 4-6g bolus and do **NOT** administer maintenance infusion. Re-bolus as necessary to maintain therapeutic magnesium levels.

  - ☐ Continuous pulse oximetry
    Please see section on pulmonary edema if this diagnosis is suspected

  - ☐ Care should be taken when ordering nephrotoxic agents (i.e. gentamicin, NSAIDs)

- Oliguria

  Oliguria may be present secondary to intrarenal vasospasm related to preeclampsia. This is common during labor and delivery and typically resolves within 24 hours postpartum.[7] Close monitoring of fluid status and labs is recommended.

  - ☐ Evaluate the patient's fluid status

    Evaluate thirst, mucous membranes, heart and lung auscultation, recent intake and output, urine output trend.
    Can consider point of care ultrasound to evaluate the inferior vena cava diameter (< 2cm is considered intravascular depletion)

- **If evidence of hypovolemia**, a fluid challenge of 500-1,000 mL of normal saline or lactated Ringer's solution may be administered over 30 minutes. If urine output does not respond to an initial fluid challenge, additional challenges should be withheld pending delivery as this may increase the risk for pulmonary edema.[10]
- **If no evidence of hypovolemia**, do NOT administer fluid bolus as this may place the patient at increased risk for pulmonary edema.
- **Do not administer a diuretic solely to increase the urine output as this may lead to further depletion of intravascular volume**

☐ Strict intake and output monitoring

☐ Check serum magnesium levels every 4-6 hours
Goal magnesium level is 4.8-9.6 mg/dL[7]

☐ Check preeclampsia labs every 4-6 hours

☐ Alter magnesium sulfate administration:

Administer magnesium sulfate 4-6g bolus over 20-30 minutes only. Do NOT administer maintenance**.** Re-bolus as necessary to maintain therapeutic magnesium levels.

☐ Continuous pulse oximetry
Please see section on pulmonary edema if this diagnosis is suspected

☐ Care should be taken when ordering nephrotoxic agents (i.e. gentamicin, NSAIDs)

Pulmonary Edema

Patients with preeclampsia are at higher risk of developing pulmonary edema due to endothelial damage with subsequent third spacing of fluid. This risk substantially increases with fluid over-resuscitation.

Pulmonary edema in the setting of preeclampsia is a **contraindication to expectant management**. Therefore, delivery is indicated.

☐ Perform physical exam

☐ Continuous pulse oximetry

☐ Provide and titrate oxygen to maintain saturations > 95%

☐ Order stat chest X-ray

☐ Administer 20mg IV Furosemide and re-administer as indicated
Diuresis should not be delayed for benefit of obtaining a chest X-Ray as pulmonary edema can be treated while awaiting radiographic confirmation. Demonstration of B-lines on point of care ultrasonography (if available) can also guide initial clinical management.

- ☐ Magnesium sulfate therapy should be individualized in this setting

- ☐ If the patient is unresponsive to diuresis or clinical status declines, consider ICU consultation and work up for other causes of hypoxemia such as cardiac dysfunction or pulmonary embolus.

Isolated Elevated Transaminases

The liver transaminases, AST and ALT, are commonly elevated in patients and are markers of hepatocellular injury (NOT dysfunction). Elevation diagnostic of preeclampsia with severe features is diagnosed as 2x the upper limit of normal (based on lab reference ranges). These are commonly called "LFTs" in clinical practice, but it important to remember that this is a misnomer as they are markers of liver injury and not markers of liver function or liver dysfunction. However, liver injury can lead to liver dysfunction and elevated transaminases are considered severe features.

There is currently no ACOG or SMFM guidance regarding management of elevated transaminases as few studies have addressed this clinical question. While they are not listed as a contraindication to expectant management, they do warrant close monitoring to ensure that worse hepatic injury does not develop.

The BCM OB/Gyn perinatal guidelines committee suggests that management of patients with preeclampsia with severe features and elevated transaminases be individualized based on shared decision making with the patient and provider concern. This may warrant delivery even prior to 34 weeks gestation.

Initial Evaluation

- ☐ Evaluate other severe features that would make expectant management contraindicated
- ☐ Evaluate liver function (platelets, PT/INR, glucose)
- ☐ Evaluate for markers of hemolysis that would suggest the patient is developing HELLP syndrome (peripheral smear, LDH)
- ☐ MFM Consultation is recommended

Eclampsia: Diagnosis, management and prevention

Eclampsia is defined by "new-onset tonic-clonic, focal, or multifocal seizures in the absence of other causative conditions such as epilepsy, cerebral arterial ischemia and infarction, intracranial hemorrhage, or drug use."[7]

The key components of eclampsia prevention are delivery and magnesium sulfate. Magnesium sulfate is recommended for the treatment of eclampsia as well as for prevention of eclampsia in patients with preeclampsia with severe features and patients with chronic hypertension with superimposed preeclampsia with severe features.

The most common preeclampsia symptoms that precede a seizure are neurologic in nature: severe occipital or frontal headache, visual changes, or altered mental status (at least 75% of the time). **Approximately 36 symptomatic patients would need to be treated with magnesium sulfate to prevent one seizure (NNT =36).**[7] At least 20% of patients who develop eclampsia do NOT demonstrate signs or symptoms of preeclampsia before their initial seizure.

Acute Management during seizure

Link to Figure 4: Eclampsia Checklist Protocol

Persistent Seizure Activity Unresponsive to Magnesium

If seizures recur/persist despite additional boluses of magnesium sulfate:

☐ Consult neurology

☐ Anesthesia should be called to bedside for consideration of an advanced airway

☐ Add another anticonvulsant agent as a single dose:

- Lorazepam (Ativan): 2-4 mg IV
- Midazolam (Versed): 1-2 mg IV or IM
- Diazepam (Valium): 1-10 mg IV

☐ Consider other causes of seizure activity

- Stat neuroimaging

Management following seizure

- Continue magnesium sulfate 2g/hr for at least 24 hours postpartum depending on symptoms
- Continuous fetal heart rate monitoring
  - During the seizure, fetal bradycardia can occur due to maternal hypoxia and hypercarbia. Following seizure activity, Sibai (2005) states, "fetal heart rate changes can include bradycardia, transient late decelerations, decreased beat-to-beat variability, and compensatory tachycardia. Changes in uterine activity can include increased frequency and tone. These changes usually resolve spontaneously within 3–10 minutes after the termination of convulsions and the correction of maternal hypoxemia. **The patient should not be rushed for an emergency Cesarean delivery based on these findings**, **especially if the maternal condition is not stable**. It is advantageous to the fetus to allow in utero recovery from hypoxia and hypercarbia due to maternal convulsions. However, if the bradycardia and/or recurrent late decelerations persist beyond 10–15 minutes despite all resuscitative efforts, then a diagnosis of abruptio placentae or non-reassuring fetal status should be considered."[11]
- Treatment of severe range blood pressures: vital signs during a seizure can be erroneous, therefore we recommend repeating the measurement and treating promptly once persistent severe range blood pressures are validated after the seizure has resolved.
- Delivery
  - An eclamptic seizure is not an indication for Cesarean delivery. Route of delivery should depend on gestational age, anticipated length of induction and maternal and fetal clinical status.
- Follow up laboratory assessment
  - Labs should be repeated every 4-6 hours until they show signs of stability/improvement
- Neuroimaging should be considered for persistent neurologic symptoms (e.g. severe headache).
- Debrief with patient, family, and obstetric team

Figure 4. Eclampsia Checklist Protocol

Texas Children's Hospital
Pavilion for Women

ECLAMPSIA CHECKLIST PROTOCOL

Baylor College of Medicine

Recognize

New-Onset tonic-clonic, focal or multifocal seizure activity without other known cause

Respond

- ❑ Activate Rapid Response Team
- ❑ Notify **covering** physician immediately
- ❑ Designate team roles
  - -Team leader
  - -Recorder
  - -Primary RN
  - -Records reviewer

Protect Patient and Airway

- ❑ Ensure side rails up
- ❑ Place patient in left lateral decubitus position
- ❑ Continue pulse oximetry
  - -Provide supplemental oxygen with 10 L non-rebreather mask
- ❑ Obtain code cart, Ambu bag, and suctioning equipment

Treat

- ❑ Start two large bore peripheral IVs (PIV) and draw labs
- ❑ Treat severe hypertension per the Hypertensive Emergency Checklist
- ❑ Initiate magnesium sulfate
- ❑ Continuous fetal monitoring *following* the eclamptic seizure
- ❑ Deliver if still pregnant
  - -Develop a delivery plan
  - -Move to operating room if fetal bradycardia persists

Recommended Labs

1. Complete Blood Count (CBC)
2 .Complete Metabolic Panel (CMP)
3. PT/INR, PTT, Fibrinogen
4. Type and Cross x2 units pRBCs

Escalation of care

If persistent seizure activity:

- ❑ Administer second line anticonvulsant agent if seizures persist >2-3 min
  - -Lorazepam (Ativan): 2-4mg IV **(readily available on all units)** OR
  - -Midazolam (Versed): 1-2mg IV or IM *OR*
  - -Diazepam (Valium): 1-10mg IV
- ❑ Consult
  - -Critical Care Team
  - -Neurology
  - -Anesthesiology for an advanced airway
- ❑ Obtain advanced airway (consult anesthesiology)

Initial Magnesium Sulfate Dosing

With peripheral IV

- ❑ Magnesium 4-6g loading dose over 30 minutes
- ❑ 2g/hr maintenance *if* normal renal function; if creatinine is ≥ 1.1 mg/dL start 1 g/hour

No peripheral IV access

Magnesium Sulfate 10g IM (5g in each buttock- 2 vials)

Location: Pedi/Adult Code Cart

Contraindication to Magnesium: Myasthenia Gravis

Debrief

- ❑ Team Huddle (during event and post event)
- ❑ Debrief with patient and family

Document

- ❑ Nursing: use the "RRT" flowsheet in the electronic medical record(EMR). Fill out all fields, including final disposition.

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Postpartum care of all patients with hypertension in pregnancy

Postpartum BPs and symptoms of preeclampsia **should continue to be managed in the same manner as during the antepartum and intrapartum period.**

Blood pressure usually decreases within 48 hours after delivery but increases again 3-6 days postpartum.[12,13] In patients with chronic hypertension, blood pressure in the postpartum period is often higher compared with antepartum levels, particularly in the first 1–2 weeks postpartum.[14] Even patients who were not treated during pregnancy may require treatment with antihypertensive medication in the postpartum period.

Postpartum inpatient management

- Long-acting antihypertensive therapy should be initiated/increased in the postpartum period when the SBP is ≥ 150 mm Hg and/or DBP ≥ 100 mm Hg with the goal of maintaining SBP ≤ 140 mm Hg and DBP ≤ 90 mm Hg.[14,15] **The decision to start medications for people with SBP between 140-150 mm Hg and DBP between 90-100 mm Hg should be based on provider preference**.

  See **Figure 5** for Management of Postpartum Hypertension in Patients **not** Already Taking Long-Acting Antihypertensive Medication

  Therapy should be initiated for SBPs ≥ 150 mg Hg and/or DBP ≥ 100 mm Hg.

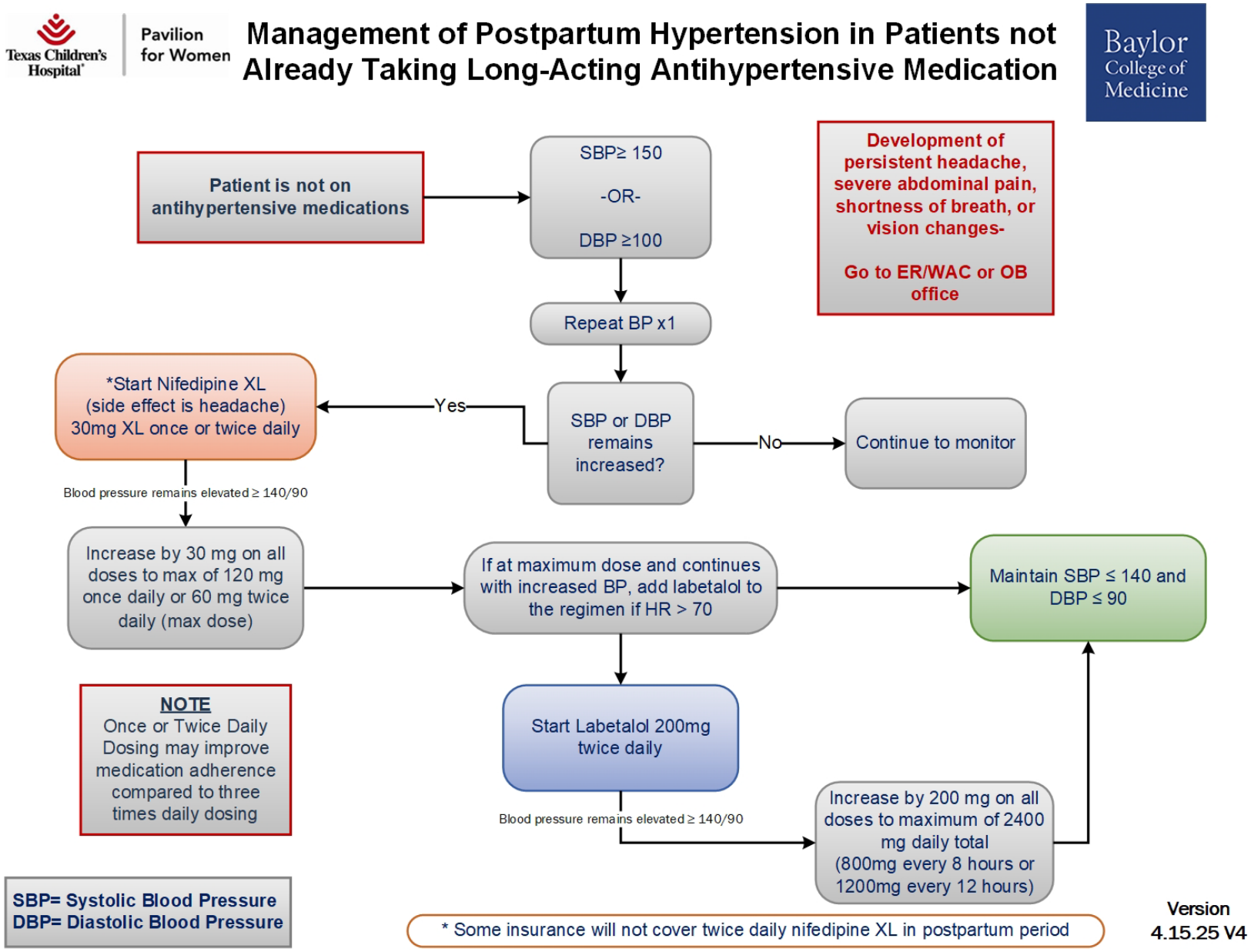
  See **Figure 6** for Management of Postpartum Hypertension in Patients Already Taking Long-Acting Antihypertensive Medication

  Therapy should be adjusted postpartum to maintain a SBP < 140 mm Hg and a DBP < 90 mm Hg.

- Nifedipine XL and Labetalol are the agents of choice for postpartum HTN (see **Figure 5** **and** **Figure 6** for dosing). **However, Nifedipine monotherapy has been associated with lower incidence of readmission and should be considered first line**.[16,17 *]
- Other antihypertensive agents may be necessary depending on the patient's history (e.g. chronic kidney disease). Reinitiation of pre-pregnancy antihypertensives, such as ACE inhibitors, can be considered. Consider MFM or Cardiology/IM consultation for guidance on these medication adjustments.
  - *ACE inhibitors are safe to use during breastfeeding.*
  - *Avoid Methyldopa secondary to its association with depression.*
- There is conflicting evidence regarding the efficacy of routine oral diuretic use in patients with hypertensive disorders of pregnancy. Given that there may be some patients who do benefit, use should be individualized. **The BCM OB/Gyn Perinatal Guidelines Committee recommends discussion with MFM regarding utility, route and dosage**.

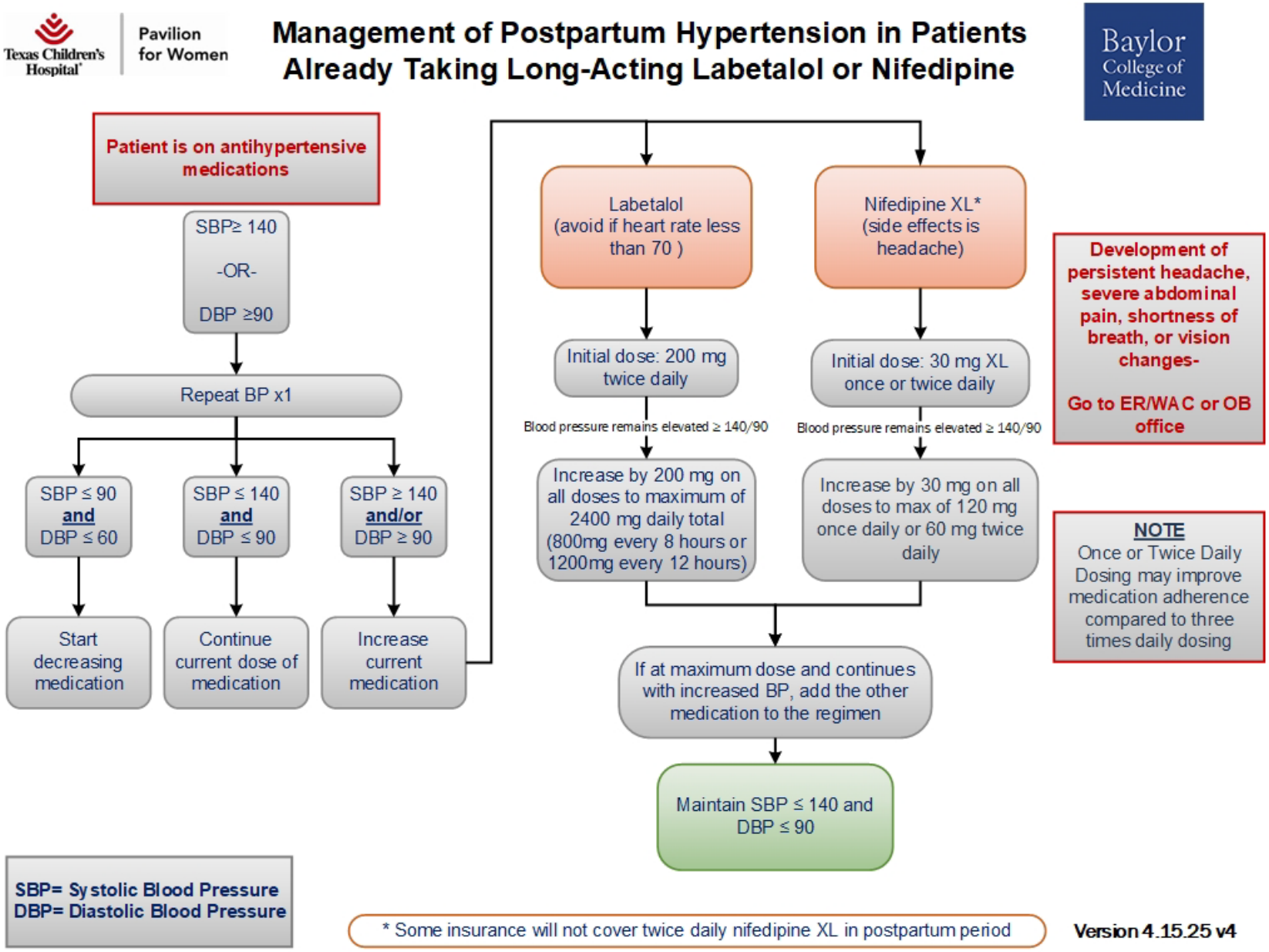
[*] A 2025 RCT evaluating 323 patients randomized to receive labetalol or Nifedipine to treat postpartum hypertension. After controlling for confounders the adjusted Odds Ratio for readmission was 0.12 (95% CI 0.02-0.56) for the Nifedipine group. A 2024 retrospective study demonstrated that discharge with a prescription for labetalol only was associated with a 63% greater incidence of postpartum readmission than discharge without a prescription for antihypertensive medication. In contrast, discharge with a prescription for nifedipine only and discharge with a prescription for multiple antihypertensive medications were associated with 26% and 47% lower incidence rates of postpartum readmission, respectively. This was true even after adjustment for clinical and demographic factors, including last inpatient blood pressure and type of hypertensive disorder of pregnancy. In models with labetalol monotherapy as the reference group, nifedipine and 2 or more antihypertensive medications were associated with 50% and 62% lower incidence rates of readmission, respectively.

Figure 5. *Management of Postpartum Hypertension in Patients not Already Taking Long-Acting Antihypertensive Medication*



Adapted from Hoppe, et al.[15]

Figure 6. *Management of Postpartum Hypertension in Patients Already Taking Long-Acting Antihypertensive Medication*



Adapted from Hoppe, et al.[15]

Discharge Planning

- Patients with hypertensive disorders of pregnancy should not be discharged until they are asymptomatic and BPs are well-controlled for at least 24 hours (SBPs <150 mmHg and DBPs <100, with or without long-acting antihypertensive therapy). See **Figure 7** for **Discharge Checklist**. [*18]
- All patients should receive **education** on preeclampsia, even if they don't have a diagnosis of a hypertensive disorder of pregnancy.
- Efforts should be made to ensure that all patients with hypertension have access to a home BP cuff prior to discharge. This may include consulting Social Work to assist with barriers to access.

Outpatient Follow Up

Follow up should occur within 3-5 days of discharge (ideally within 72 hours of discharge) for patients with any of the following:

- Received rapid-acting antihypertensive medication(s) during the delivery hospitalization
- Preeclampsia with severe features (including superimposed)
- Eclampsia

Follow up should occur within 7-10 days of discharge for patients with a hypertensive disorder who do not meet criteria for earlier follow up.

Refer to **Figure 7** for timing of scheduled outpatient follow up for patients with Hypertension.

Refer to **Figure 8** for triage during Postpartum In person/Telemedicine Visit for Hypertension

Refer to **Figure 9** for triage during OB Triage Visit for Patients with Hypertension in the Postpartum Period

[*]A 2021 study by Bruce et al. evaluated the features of those with hypertension readmissions postpartum. They found that 90% of patients were readmitted within 10 days of delivery (median readmission was day 5). Patients with one elevated BP within 24 hours prior to discharge (either SBP≥140 mm Hg or DBP≥90 mm Hg) had nearly twice the odds of readmission. Those with two or more elevated BPs had 3 times the odds of readmission. Those who had severe features, were ≥30 years old, or who received magnesium sulfate and/or acute antihypertensive therapy were also more likely to be readmitted. The authors conclude that **high risk patients should have contact with a physician after discharge by postpartum day #5.**[18]

Figure 7. *Postpartum Discharge Checklist for Patients with Hypertension*

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Checklist for Postpartum Discharge of Women with Hypertensive Disorders

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Adapted from SMFM Special Statement: Checklist for postpartum discharge for women with hypertensive disorders

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Figure 7

Patient Education *(provided at discharge and document in the electronic medical record)*

- ❑ Provide all education in patient's own language and reinforce education handouts (via interpreter if necessary).
- ❑ Review warning symptoms and when to seek medical care.
- ❑ Discuss antihypertensive medications including dosage, schedule, potential side effects, hold parameters, and impact on breastfeeding.
  - ○ Ideally, facilitate prescription refill prior to discharge and confirm mother has medications in hand before discharge
- ❑ Discuss the diagnosis, recurrence risk in future pregnancy, and recommendation for low-dose aspirin to reduce recurrence risk.

When to call clinic:

- ❑ SBP ≥150 mmHg and/or DBP ≥100 mmHg on two occasions 4 hours apart with no symptoms

When to go to hospital:

- ❑ SBP ≥140 mmHg and/or DBP ≥90 mmHg with headache not improved with acetaminophen, vision changes, chest pain, shortness of breath, or upper abdominal pain
- ❑ No ability to take BP at home with symptoms of headache not improved with acetaminophen, vision changes, chest pain, shortness of breath, or upper abdominal pain
- ❑ SBP ≥160 mmHg or DBP ≥110 mmHg on two readings 5 minutes apart with or without symptoms
- ❑ Seizure (call 911)

Follow-up

- ❑ Ensure patient has contact information for obstetrical provider (phone, electronic patient portal).
- ❑ Ensure patient has scheduled follow-up (in-person or telehealth).
- ❑ Patients with the following should have a schedule office visit/telehealth* for BP check within 3-5 days of discharge (ideally within 72 hours):
  - ▪ Received rapid-acting antihypertensive medication(s) during delivery hospitalization
  - ▪ Preeclampsia with severe features (including superimposed)
  - ▪ Eclampsia
- ❑ All other patients should have a scheduled office visit/telehealth* for BP check at 7 to 10 days after delivery and 6 weeks after and delivery (comprehensive postpartum follow up), sooner if necessary
- ❑ Evaluate and address barriers to care, such as:
  - o Transportation and childcare for visit(s)
  - o Access to telephone if needed to call provider or reschedule appointments
  - o Access to interpretation services if needed
  - o Resources to fill/pick up prescription(s)
  - o **If any barriers are identified, consult Social Work prior to discharge**
- ❑ If patient has home blood pressure cuff:
  - o Provide instruction on how to measure blood pressure.
  - o Ensure literacy, ability to read and interpret numbers
  - o Review frequency of home BP monitoring: patients should take BP 1-2 times daily after discharge until at least 7-10 days postpartum.
  - o Discuss target blood pressures (systolic less than 150 mm Hg; diastolic less than 100 mm Hg).
  - o Discuss blood pressures requiring prompt notification (systolic 160 mm Hg or greater; diastolic 110 mm Hg or greater).
- ❑ Create a postpartum check-in plan for the first 2-3 weeks postpartum:
  - o Ask mother to identify 1 or 2 people who can call her at least once daily after discharge from the hospital if she will be home alone.
  - o Advise mother and family to post emergency contact information in a readily available place at home; make sure key family members are aware.

**Telehealth visits are only appropriate if the patient has a home blood pressure cuff upon discharge.*

Figure 8. *Telemedicine/Ambulatory Postpartum Hypertension Visit*

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Telephone/Telehealth/Office Visit Triage

Postpartum Signs and Symptoms of Hypertensive Disorders of Pregnancy

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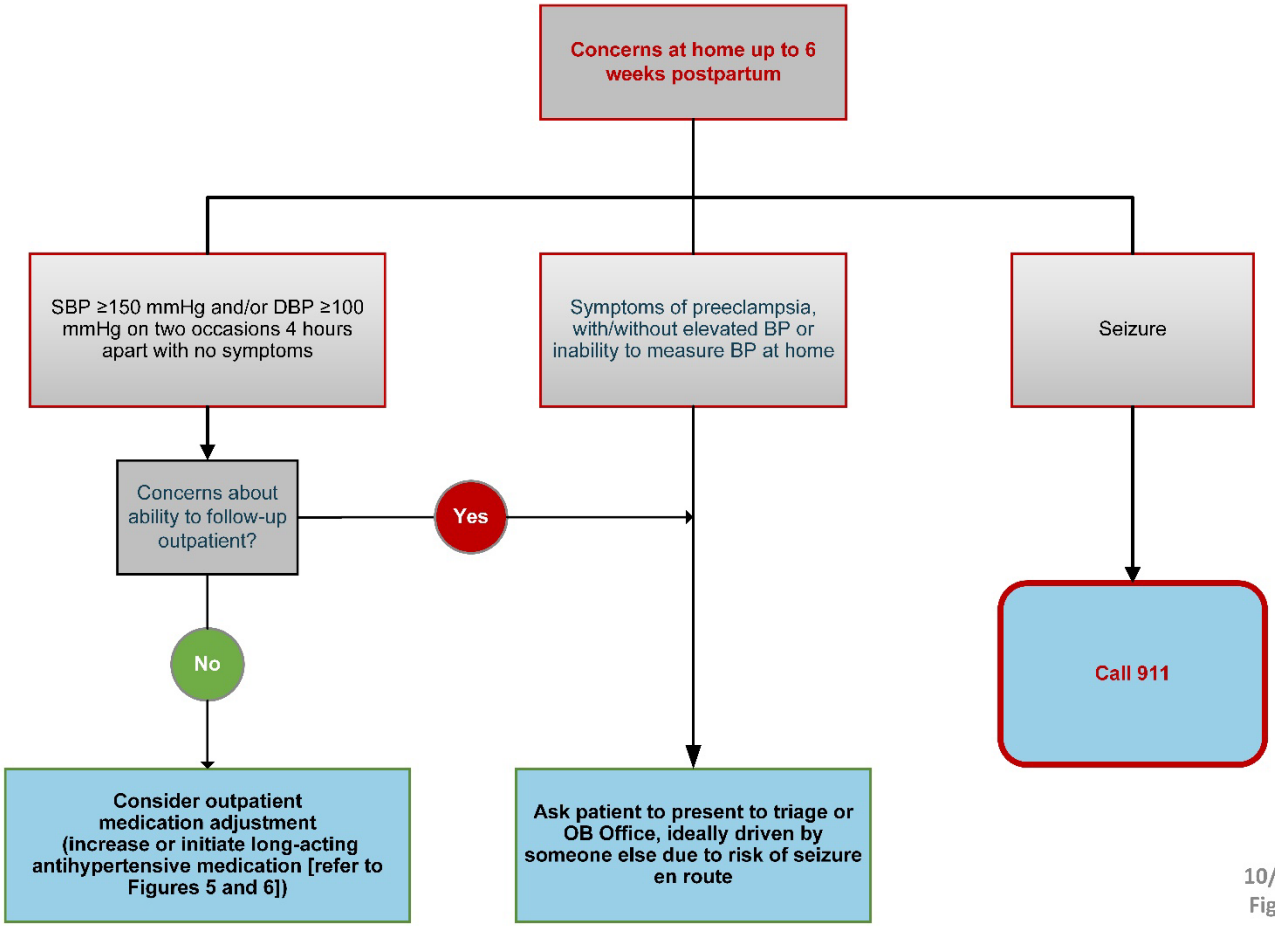
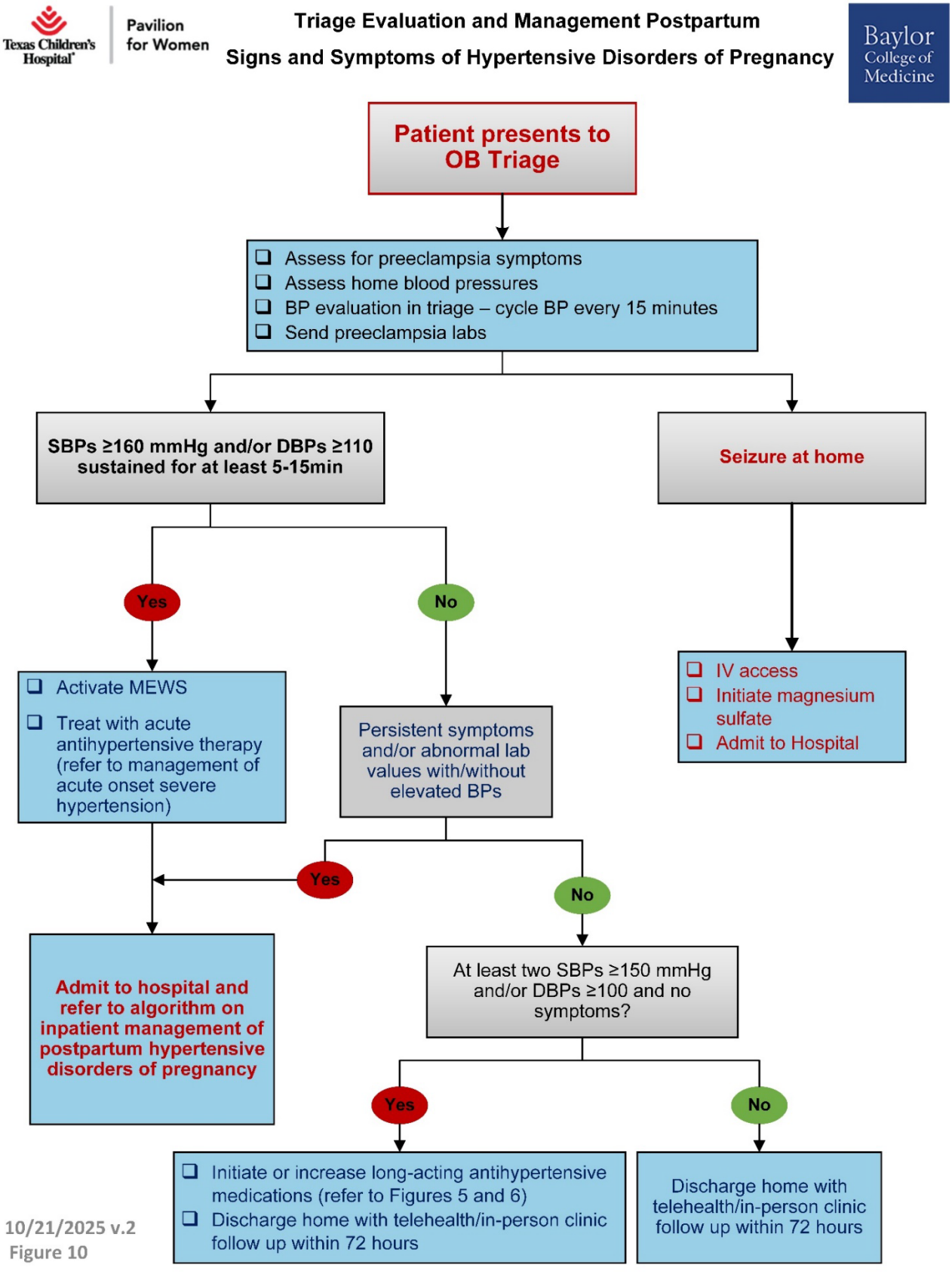


10/21/2025
Figure 9

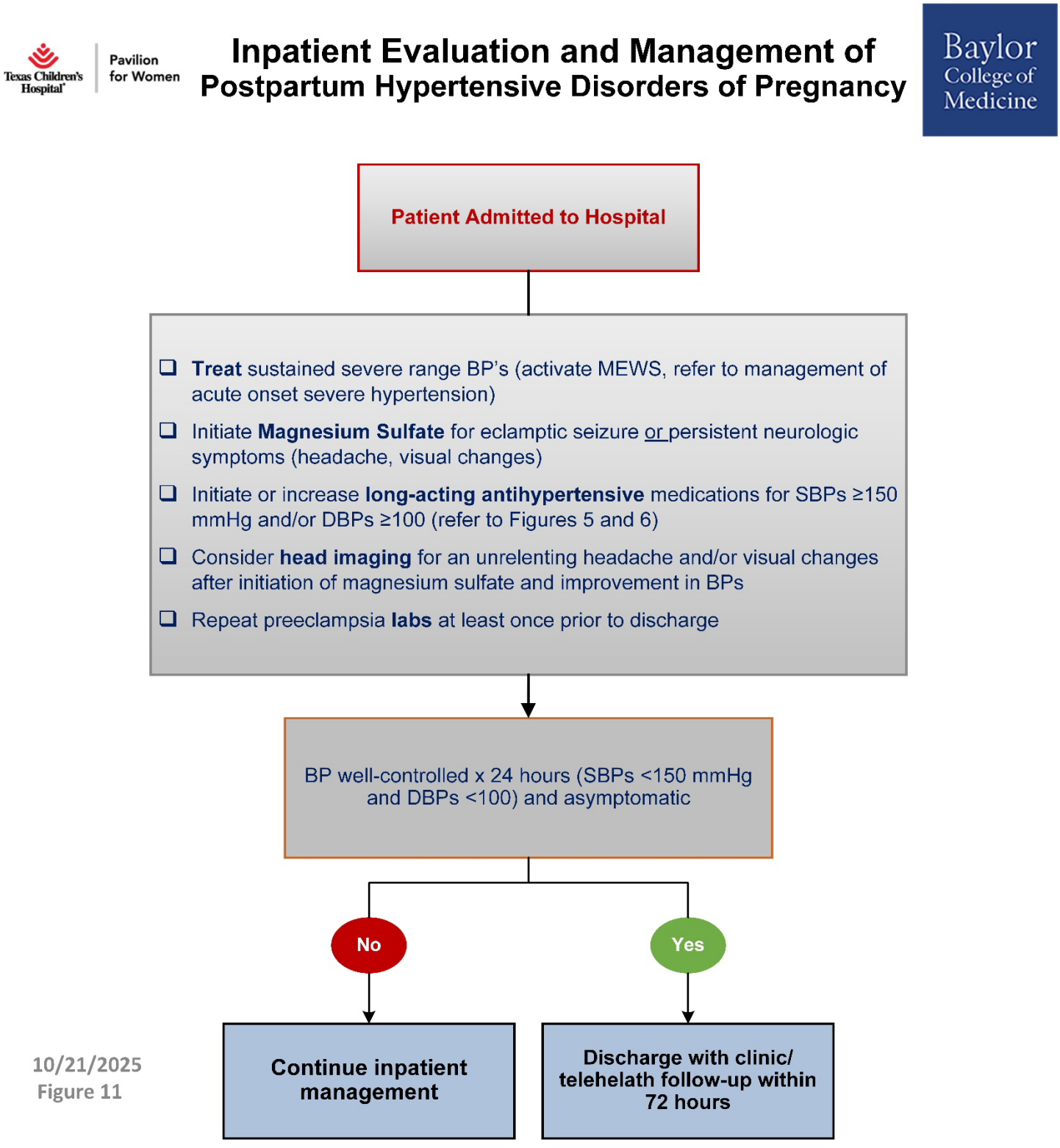
Figure 9. *OB Triage Evaluation of Patients with Postpartum Hypertension*



Readmission and Follow Up

Refer to **Figure 10** to guide the clinical management of patients readmitted for management of hypertension.

Figure 10. *Inpatient Management of Patients admitted with Postpartum Hypertension*



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Infectious Disease

Chorioamnionitis and Endometritis

[October 2025 (replaces September 2024)]
Authors: Dr. Carey Eppes**, Dr. Jennifer McKinney**
Copy Edits: Dr. Jennifer McKinney

Contents

This update emphasizes need for sepsis evaluation in patients with chorioamnionitis or endometritis who have a positive sepsis screen.

Summary of Recommendations

- Chorioamnionitis
  - Definition of suspected chorioamnionitis: maternal fever PLUS one of the following: maternal leukocytosis (> 15,000/mm^3), purulent cervical drainage, or fetal tachycardia; however ACOG notes that diagnosis of suspected intraamniotic infection *may also be made in the absence of maternal fever* when other associated clinical signs and symptoms are present.[6]
  - Antibiotics: Ampicillin 2g IV q6h (not allergic to PCN) **PLUS** gentamicin 5mg/kg IV q24h (IBW) x 1 dose

- Duration of treatment: No additional postpartum doses with vaginal delivery; give single postpartum dose with Cesarean delivery.
- Endometritis
  - Clindamycin 900mg IV q8 hours **PLUS** gentamicin 5mg/kg IV q24 hours, based on IBW **PLUS** ampicillin 2g IV q6h (for suspected enterococcus or GBS colonization with clindamycin resistant organism)
  - Duration of treatment: Give until the patient is afebrile for 24 hours
- **Patients that have a positive sepsis screen and chorioamnionitis or endometritis should receive a full sepsis evaluation per the hospital sepsis protocol/algorithm.**

Chorioamnionitis

Background

Chorioamnionitis complicates approximately 4% (1-10%) of term deliveries and 15-41% of preterm deliveries.[1]

Risk factors include:

a. Nulliparity
b. Longer length of labor/membrane rupture
c. Meconium-stained amniotic fluid
d. Genital tract pathogens such as group B strep

Both number of vaginal exams and intrauterine pressure catheters (IUPC) have been disproven as risk factors for the development of chorioamnionitis.[2,3]

Diagnosis

ACOG recommends three categories for classification of intraamniotic infection: 1) isolated maternal fever, 2) suspected intraamniotic infection, and 3) confirmed intraamniotic infection.[4,5]

Intrapartum fever *

a. Single oral temperature >39°C *or*
b. An oral temperature of 38-38.9°C that persists for greater than 30 minutes

Other causes of fever can include of neuraxial anesthesia, prostaglandins, and other sources of infection (i.e. pyelonephritis, influenza)

Suspected intraamniotic infection

Maternal fever *plus one or more* of the following:
a. Maternal leukocytosis (WBC >15,000/mm^3)
b. Purulent cervical drainage
c. Fetal tachycardia

It is important to note that absence of maternal fever does not rule out intraamniotic infection, and delay in treatment due to lack of fever can significantly worsen the patient's clinical course. **The diagnosis of suspected intraamniotic infection may also be made in the absence of maternal fever when other associated clinical signs and symptoms are present.[6]**

Confirmed intraamniotic infection:

Either of the following:

a. Positive amniotic fluid test result obtained before or at the time of delivery [#]
   i. Glucose <15mg/dL
   ii. WBC >30 cells/mm^3
   iii. LDH > 400
   iv. Organisms on Grams Stain or culture
b. Placental pathology demonstrating placental infection or inflammation
c. Patients who have a Positive Sepsis Screen and chorioamnionitis should receive a full sepsis evaluation.

Management

Once chorioamnionitis has been diagnosed clinically, antibiotics should be administered. Typical pathogens are polymicrobial, with the most common being group B strep, gram negative anaerobes and vaginal flora.[7] **If patients meet suspected sepsis criteria, full sepsis evaluation should be performed, similar to any other infection source.**

Antibiotic Selection

Recommended regimen[8-11]

Ampicillin [*] 2g IV q6h (not allergic to PCN) **PLUS** gentamicin [#] 5mg/kg IV q24h (IBW) x 1 dose

- See Ideal Body Weight (IBW) in appendix

Mild penicillin allergy

Cefazolin 2g IV q6h **PLUS** gentamicin 5mg/kg IV q24h (IBW) x 1 dose

Severe penicillin allergy

Gentamicin 5mg/kg IV q 24h **PLUS** [clindamycin 900mg IV q8h **OR** Vancomycin [€] 1g IV q12h]

Duration of treatment

- Post-vaginal delivery: no additional doses are required; but if given anyway, clindamycin is NOT indicated.
- Post-Cesarean delivery: one additional dose of chosen regimen is indicated to reduce the risk of post-operative endometritis, add clindamycin 900mg IV OR metronidazole 500mg IV for at least one additional dose.

Additional Work Up and Management

Sources have evaluated the need for routine blood cultures in the setting of chorioamnionitis. In general, they do not appear to change the management or course of illness and therefore **blood cultures should not be obtained routinely *unless the patient has a Positive Sepsis Screen***.[9] Patients that have a positive sepsis screen and chorioamnionitis should receive a full sepsis evaluation per the hospital sepsis protocol/algorithm.

[#] *Even in combination, these tests have reported false positive rates of 67%.[6] Often culture can take >24-28 hours to return, making amniocentesis impractical in the diagnosis and management of chorioamnionitis. Therefore, the use of amniocentesis is likely only useful in very premature gravidas with an uncertain clinical diagnosis.*

[*] If patients have previously been on penicillin for GBS, it is reasonable to continue PCN (dosing unchanged) and add gentamicin OR change the regimen to ampicillin and gentamicin. While PCN has reasonable gram-positive coverage, ampicillin has broader gram positive and negative coverage. The addition of gentamicin, however, also covers these gram-negative bacteria.

[#] Numerous studies have evaluated gentamicin dosing in pregnancy, and it appears the 24 hour dosing is superior to the q 8 hours regimen. Ideal body weight (IBW) is a more accurate measure than total body weight in determining gentamicin dosing. See appendix for IBW formula.

[€] Vancomycin should be used if patient is colonized with GBS that is resistant to clindamycin or erythromycin, or with GBS where no sensitivities are available.

Due to potential neonatal benefits, antenatal corticosteroids and magnesium sulfate for neuroprotection can be considered for patients with preterm chorioamnionitis, **although delivery should not be delayed** for these interventions.[12]

In general, a patient's labor course need not be dramatically altered by a diagnosis of chorioamnionitis.[13 £]

Complications

Complications related to chorioamnionitis include:

1. Increased rates of operative delivery or cesarean delivery
2. Hemorrhage (atony)
3. Postpartum infection
4. Sepsis
5. ICU admission
6. Neonatal sepsis, pneumonia, meningitis and increased rates cerebral palsy

The leading risk factor for preterm *neonatal sepsis* is clinical chorioamnionitis, with an odds ratio of 25.[14] In the setting of PPROM, chorioamnionitis increases the neonatal morbidity rate from 18-55%.[15] Additional adverse outcomes have been reported, including 5-minute Apgar score of 3 or less, sepsis, and seizures.[13,16] Data regarding association between chorioamnionitis and cerebral palsy and long-term neurodevelopmental outcomes is conflicting.[12]

£ In 2004, the MFMU evaluated whether there is an optimal duration between diagnosis of chorioamnionitis and need to deliver. They evaluated term patients, all of whom underwent cesarean, with a 12% incidence of chorioamnionitis. While maternal complications such as uterine atony, need for blood transfusion and ICU admission did increase with increasing duration between diagnosis and delivery, after logistic regression, the only factor remaining significant was atony. The only neonatal factor that was significant with duration of chorioamnionitis was 5-minute Apgar <3.

Postpartum Endometritis

Postpartum endometritis is an infection of the decidua. It is typically a polymicrobial infection[17] that develops within the first week postpartum. In 15% of cases, it can be late in onset and develops 1-6 weeks postpartum. It can rarely also include pathogens such as HSV and CMV.

Definition and Diagnosis

Postpartum fever over 38 ˚C in association with one or more of the following: uterine tenderness, foul smelling lochia and leukocytosis of >12,000 after exclusion of another site of infection, which develop within the first 5 days after delivery.[18] It has also been defined as a single temperature of over 38.3˚C, (101 ˚F) on a single occurrence or two temperatures over 38˚C on two separate occasions, in addition to the above associated clinical symptoms .[19] *Clinical judgment should be applied, and therapy not delayed in gravidas who are febrile with systemic symptoms suggestive of infection.*

Route of delivery is a strong predictor of the likelihood of developing endometritis, with rates reported after vaginal delivery (<3%), non-laboring cesarean (7%), and cesarean delivery after trial of labor (30%).[20]

Risk factors

- Cesarean delivery
- Prolonged rupture of membranes
- Chorioamnionitis
- Bacterial vaginosis
- Long duration of labor
- Meconium-stained amniotic fluid
- Manual removal of the placenta
- Maternal diabetes
- Maternal anemia
- Preterm delivery
- Operative vaginal delivery
- Immunosuppression
- Colonization with GBS
- Nasal colonization with Staph Aureus

Symptoms:

- Postpartum fever >38.0˚ C
- Maternal tachycardia
- Fundal tenderness, midline abdominal pain
- Purulent lochia

Differential Diagnosis

Other causes of postpartum fever should be evaluated and excluded, based on physical exam and evaluation, including but not limited to:

- Urinary tract infection/pyelonephritis
- Pneumonia
- Mastitis/breast abscess
- Surgical site infection

- Deep venous thrombosis/pulmonary embolus
- Infections unrelated to pregnancy: influenza, COVID, appendicitis, C Difficile, Gastritis
- Septic pelvic thrombophlebitis

Prevention

- Antibiotic prophylaxis prior to skin incision in cesarean deliveries reduced the prevalence of post-cesarean endometritis.[21] Please refer to the perinatal guideline entitled “Timing of Prophylactic Intravenous Antibiotics for Cesarean Delivery” for more details.
- Spontaneous placenta extraction.[22] *

* Data are lacking whether antibiotic prophylaxis in the setting of manual extraction of the placenta decreases postpartum febrile morbidity.

Management

Broad spectrum coverage is recommended, to include gram positive, gram negative, and anaerobic bacteria. Recent antibiotic exposure should also be taken into account.[23,24] **Patients that have a positive sepsis screen and endometritis should receive a full sepsis evaluation per the hospital sepsis protocol/algorithm.**

Antibiotic selection

Recommended regimen:

- Clindamycin 900mg IV q8 hours **PLUS** gentamicin 5mg/kg IV q24 hours, based on IBW **PLUS** ampicillin 2g IV q6h (for suspected enterococcus or GBS colonization with clindamycin resistant organism) until the patient is afebrile for 24 hours

Penicillin allergy:

- Clindamycin 900mg IV q8 hours **PLUS** gentamicin (5mg/kg IV q24 hours, based on IBW) **PLUS** Vancomycin 1.5gm IV q12h (PCN allergic patients with GBS colonization with clindamycin resistant organism or suspicion of MRSA) [#]

Renal dysfunction

- Consult Infectious Disease

Duration of treatment

- The optimal duration of treatment has not been demonstrated in randomized controlled trials. **BCM OB/Gyn Perinatal Guidelines Committee recommends continuation until the patient is afebrile for 24 hours.**
- Oral therapy is not required after successful parenteral therapy.[25,26]
- If bacteremia was discovered by blood cultures, treatment should be as appropriate for that pathogen (ie extended oral antibiotic treatment for 7-14 days is often recommended).

Considerations if treatment fails

Defined as persistent fever without improvement 48 hours after *actual* initiation of treatment. Complete history and physical exam should be reviewed, and further workup dictated by these findings. This may include:

- Evaluation of the incision
- CT scan
- Blood cultures
- Echocardiogram
- Ultrasound

Possible sources of the persistent fever may include:

- Other etiologies of the fever (abscess, wound infection, septic pelvic thrombophlebitis, retained products of conception)
- Resistant organisms or secondary infection (see above section on addition/changing of antibiotics)
- Bacteremia
- Inappropriate antibiotic dosing (i.e., if the patient is receiving Gentamicin q 8 hours, levels may be non-therapeutic)
- Drug Fever

There are other, less typical causes of endometritis that can be potentially lethal. **These include Group A Strep infection, Staph Toxic Shock Syndrome (TSS), and Clostridium.** These tend to have onset within 24-48 hours of delivery, and require aggressive fluid resuscitation, antibiotics and source control.[27,28]

[#] Vancomycin is not appropriate coverage alone for enterococci.

- Group A strep endometritis/sepsis is typically associated with high fever, hypotension, and multi-organ failure.[23] Historical data indicates that hysterectomy is required to clear this infection due to the microabscesses created by the bacteria. However, more recent case reports exist indicating in some circumstances aggressive medical treatment and/or IVIG may be successful without operative management.
- Staph TSS is characterized by high fever, hypotension and diffuse rash and desquamation. It is often accompanied by multi-organ involvement.
- *Clostridium sordelli* is often rapid in onset of shock with progressive refractory hypotension, generalized massive edema and evidence of hemoconcentration, in the absence of fever.
- *Clostridium perfringens* can be considered in a severely ill person with evidence of intravascular hemolysis. It may cause myonecrosis ('gas gangrene') which can be identified on imaging.

Appendix

Ideal Body Weight Calculations:

Ideal Body Weight = 45.5 kg + 2.3kg for each inch over 5 ft

For obese individuals: IBW + 0.4(TBW-IBW)

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Endocrine

Diabetes in Pregnancy for Ben Taub Patients

[July 2024]

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American Diabetes Association (ADA) Diabetes Classifications

Table 1. Diabetes Definitions

Type 1 DM (T1DM)	Type 1 DM diagnosed *prior* to the current pregnancy	Presence of insulin antibodies predictive for T1DM, and differentiate between T1 and T2DM: anti-GAD-65 (found in 80% of patients with T1DM at clinical presentation), Insulin autoantibodies (IAA), Islet Cell Antibodies, protein tyrosine phosphate, ZnT8
Type 2 DM (T2DM)	T2DM diagnosed *prior* to the current pregnancy	Marked insulin resistance
Suspected Pregestational T2DM	Patients meet criteria for pre-gestational diabetes using standard ADA screening prior to 24 weeks. See Early Diabetes Screening section for screening criteria and recommendations.	
Gestational DM (GDM)	Either of following present at 24w0d or later: 1. Two or more abnormal values on 3-hour 100g OGTT OR 2. A 1-hour 50g oral glucose challenge test > 200 mg/dL	A1DM: glycemic control is achieved with nutrition therapy and exercise. A2DM: glycemic control is NOT achieved with nutrition therapy and exercise; generally, medication treatment is initiated.

Screening for gestational and pregestational DM during pregnancy and postpartum

Due to the lack of consistent evidence to indicate neonatal and maternal benefit of early diagnosis and treatment of GDM, **ACOG does not recommend universal screening for GDM prior to 24 weeks**. However, due to the increasing proportion of pregnant individuals with undiagnosed T2DM in the setting of increasing prevalence of obesity and challenges of access to glucose screening, **ACOG continues to recommend screening for pregestational diabetes in patients with risk factors**.[1]

Early Diabetes Screening (prior to 24 weeks)

- **For pregnant people with risk factors for pregestational DM (Table 2), screen with a hemoglobin A1C at the first prenatal visit** (Figure 1).
- The 2-step screening process using a 1-hour glucola and 3-hour GTT is NOT recommended for screening for pregestational DM.
- If pregestational DM is diagnosed at <24 0/7 weeks, treatment should be the same as those with a diagnosis established prior to pregnancy (Table 4).
- If pregestational DM is not diagnosed early in pregnancy, screening for GDM should be performed at 24-28 weeks gestation.
- For those with evidence of impaired glucose tolerance without pregestational DM (eg, A1c value 5.7–6.4% or 2-hour glucose value between 140 and 199 mg/dL on the 75-g OGTT), nutrition counseling can be offered where resources are available. Screening for GDM is still recommended at 24–28 weeks of gestation in this population.[1]

***Table 2**. Criteria for Early Screening for Pregestational Diabetes*

Testing should be considered in adults with overweight or obesity (BMI ≥25 kg/m² or ≥23 kg/m² in Asian Americans) who have one or more of the following factors:
• First-degree relative with diabetes
• Black, Hispanic, Native American, Asian American, and Pacific Islander individuals (i.e., non-White)
• History of cardiovascular disease
• Hypertension (≥140/90 mmHg or on therapy for hypertension)
• Prior history of hyperlipidemia - HDL cholesterol level <35 mg/dL (0.90 mmol/L) and/or a triglyceride level >250 mg/dL (2.82 mmol/L)
• Polycystic ovary syndrome
• Physical inactivity
• Other clinical conditions associated with insulin resistance (e.g., severe obesity, acanthosis nigricans)
• Prediabetes (A1C ≥5.7% [39 mmol/mol], impaired glucose tolerance, or impaired fasting glucose)
• Previous gestational diabetes diagnosis.
• Age 35 years or greater
• HIV
• Or other factors suggestive of an increased risk for pregestational diabetes

At this time, there are insufficient data to support the best screening modality for pregestational diabetes in pregnancy, but consideration can be made to use the same diagnostic criteria as for the nonpregnant population, understanding the limitations of these criteria as they have not been validated in pregnancy.[2]

- A1C ≥ 6.5%, or
- Fasting plasma glucose* ≥ 126 mg/dl, or
- Random plasma glucose ≥ 200 in patients with classic hyperglycemia symptoms, or
- 2-hour plasma glucose value ≥ 200 following a 75 g OGTT

**Due to altered relationship between A1C and glycemia with HIV, hemoglobinopathies, and G6PD deficiency, plasma glucose levels are the preferred screening modality for patients with these diagnoses.*[3]

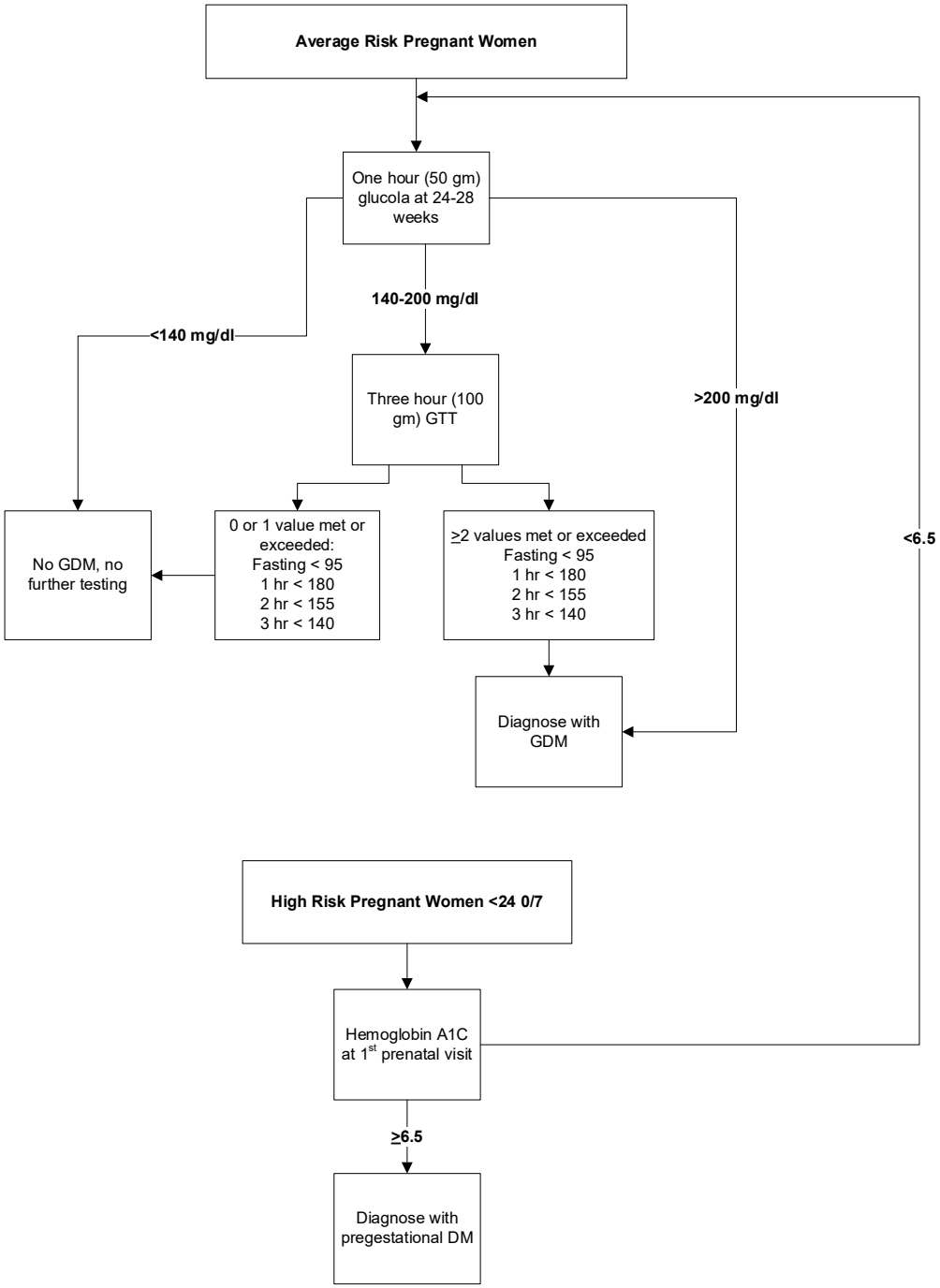
Patients diagnosed with T2DM should be treated following the checklist from Table 4.

Standard GDM Screening

Patients who have not been diagnosed with pregestational diabetes should be screened at 24–28 weeks for GDM.

- For pregnant people with no high-risk factors (Table 2) or for those with high-risk factors that were not diagnosed with pregestational DM prior to 24 weeks, perform 2-step screening with the 1-hour and 3-hour GTT (Figure 1).[1]
- Carpenter and Coustan criteria should be used for diagnosis.
- If GDM is diagnosed, refer to
- Table 5 for pregnancy management.

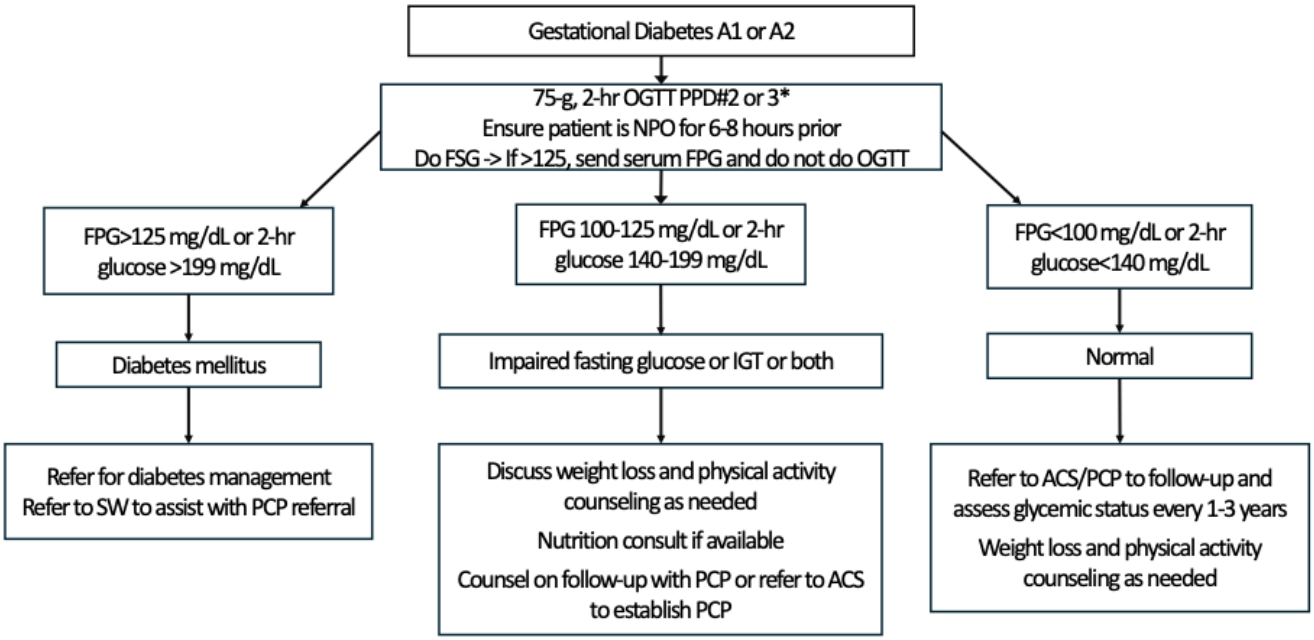
Figure 1. Diagnosis of GDM and Pregestational DM in Pregnancy[1,4-7]



Postpartum T2DM Screening

- Based on two studies published in 2020 that evaluated women diagnosed with GDM who underwent the 75g OGTT during the delivery hospitalization, **screening with the 75g OGTT for type 2 DM during the delivery hospitalization in the immediate postpartum period is now considered a reasonable alternative in lieu of performing the 75g OGTT at 4-12 weeks postpartum**.[1]
- **For patients with GDM during their pregnancy, screen for T2DM on post-partum day #2 using the 75g GTT (Figure 2). †[1,6,8]**
- If T2DM is diagnosed postpartum, counsel patient on diagnosis and arrange for primary care appointment.
- If the 75g GTT is unable to be performed during the delivery hospitalization, plan to perform 4-12 weeks postpartum.

***Figure 2**. Postpartum T2DM Screening*



Adapted and modified from ACOG Practice Bulletin #190 (6). Management of postpartum screening results. FPG = fasting plasma glucose; OGTT = oral glucose tolerance test; ICT = impaired glucose tolerance; ACS = ambulatory care services (Harris Health). Avoid in patient unable to tolerate glucose load (eg, gastric bypass).

†Two studies published in 2020 evaluated women diagnosed with GDM who underwent the 75g OGTT during the delivery hospitalization followed by repeat testing at 4–12 weeks postpartum. Both studies demonstrated high negative predictive values (greater than or equal to 97.5%) for excluding type 2 DM via the postpartum day two OGTT compared to the 4–12-week postpartum OGTT. The study that further evaluated women for type 2 DM one-year postpartum showed similar diagnostic value of the postpartum day two OGTT as the 4–12-week postpartum OGTT in predicting impaired glucose metabolism and diabetes at one year after delivery. This study also noted nearly 100% adherence to the postpartum day two OGTT compared to 68% for the 4–12-week OGTT. Given that fewer than half of women with GDM receive postpartum OGTT screening 4-12 weeks postpartum and based on recent studies, screening with the 75g OGTT for type 2 DM during the delivery hospitalization in the immediate postpartum period is now considered a reasonable alternative in lieu of performing the 75g OGTT at 4-12 weeks postpartum.

Diabetes Management in Pregnancy[4,5]

Blood glucose targets during pregnancy:

Timing	Blood glucose
Fasting	<95 mg/dL and >60 mg/dL
1 hour postprandial	<140 mg/dL and >100 mg/dL
2 hours postprandial	<120 mg/dL and >100 mg/dL

Pregnancy Management

Refer to Table 4 and Table 5 for antenatal care checklists
Refer to Table 6 for the pre-conception consultation checklist
Refer to Table S2 for Harris Health diabetic supplies funding information

Medication Management and Special Considerations

Type 1 DM[4,5,9-12]

- **Insulin is the only recommended management option for patients with T1DM**
- **Patients with T1DM need insulin therapy AT ALL times (either basal and/or prandial) to prevent precipitation of diabetic ketoacidosis (DKA)**
- In times of decreased oral intake, illness, anticipated NPO status for a procedure, etc., intermediate-acting or long-acting basal insulin must still be administered, along with dextrose containing IV fluids, if needed to maintain euglycemia. The basal insulin dosing can be temporarily decreased for these situations, and the prandial doses may be held if patient is not eating.
- A **carbohydrate-counting method** can be used to determine prandial insulin. This may be considered in consultation with Endocrinology.
  - The 500 Rule: Insulin-carb ratio (ICR) = 500/TDD = number of carbs covered by 1 unit of insulin
  - The 1500 Rule (short acting insulin): Insulin sensitivity factor (ISF) = 1500/TDD = amount of blood glucose reduced by 1 unit of *short* acting insulin
  - The 1800 Rule (rapid acting insulin): Insulin sensitivity factor (ISF) = 1800/TDD = amount of blood glucose reduced by 1 unit of *rapid* acting insulin
- **Continuous subcutaneous insulin infusions** (CSII, or "insulin pumps"):
  - CSII are becoming common for patients with T1 and T2DM outside of pregnancy, and are often used in conjunction with continuous glucose monitors (CGMs).
  - If a patient is well-controlled with a CSII outside of pregnancy and comes into pregnancy on a CSII, it is reasonable to continue CSII with the assistance of Endocrinology and an MFM provider comfortable with management of CSII.
  - **The BCM OB/Gyn Perinatal Guidelines Committee does not recommend starting a CSII for the first time in pregnancy.**

T2DM

Insulin is the preferred treatment. In patients who decline insulin therapy or for whom the obstetricians/obstetric care providers believe will be unable to safely administer insulin, **metformin is a reasonable alternative choice** in the context of discussion with the patient the limitations of the safety data and a high rate of treatment failure, which requires insulin supplementation.

- Sample smart phrase for documentation of counseling: *I counseled @NAME@ on the recommendation for medical management due to her persistent hyperglycemia. I counseled her on the risks and benefits of insulin vs metformin. I explained that insulin, which does not cross the placenta, is considered the preferred treatment for diabetes in pregnancy. I explained that metformin crosses the placenta and is lacking long-term data in exposed offspring. While*

metformin is considered a reasonable alternative choice to insulin, I further counseled that it has a max dose and may require ultimate conversion to insulin if euglycemia is not achieved or sustained. After counseling, @NAME@ elected to start insulin/metformin.

GDM

Pharmacologic treatment is recommended if glucose targets cannot be achieved with nutrition therapy/dietary modifications and exercise alone.

- **The BCM OB/Gyn Perinatal Guidelines committee recommends pharmacologic therapy when 50% or more of fasting and/or post-prandial values are above goal-range.**
- **Insulin is first-line therapy** and it should be used for all patients initiating medical therapy for GDM in pregnancy, unless a significant barrier prevents insulin from being safely initiated (e.g. patient cannot store insulin safely, patient unable to inject themselves, etc.).
- In patients who decline insulin therapy or for whom the obstetricians/obstetric care providers believe will be unable to safely administer insulin, **metformin is a reasonable alternative choice**. However, metformin does cross the placenta and has been shown to have increased levels in fetuses, and the long-term safety/metabolic influence on exposed offspring of metformin remains unclear.
- **Glyburide should not be recommended as a first-choice** pharmacologic treatment.
- CNM patients with GDM requiring medication and all patients with pre-gestational DM will be transferred to the Ben Taub High Risk Ob clinic (HROB) for management. Per patient preference, they may continue with Centering Pregnancy for educational purposes at their CNM clinic, but all clinical management will be provided by HROB.

***Table 3**. Pregnancy Considerations for Insulin and Metformin Use*[4,5]

Medication	Class/Mechanism	Dosing	Notes
	First Line Agent		
Insulin	Insulin Anabolic hormone Stimulates: glucose uptake into muscle, fat, & liver Inhibits: glucagon release	Recommended starting doses 0.7-0.8 U/kg/day actual body weight in the 1st trimester 0.8-1.0 U/kg/day in the 2nd trimester 0.9-1.2 U/kg/ day in the 3rd trimester	• Only FDA-approved agent for gestational diabetes mellitus • ACOG recommends as first line therapy of diabetes in pregnancy requiring medical therapy • Most evidence regarding efficacy and safety • Easy, rapid titration • Does not cross the placenta • **REQUIRED for T1DM**
	Second Line Agent		
Metformin	Biguanide Inhibits: hepatic gluconeogenesis &, glucose absorption Stimulates: glucose uptake in peripheral tissue	Starting dose: *500 mg q HS for 1 week* Titrate up to 500 mg BID and then in increments of 500 mg weekly to a maximum dose of 2,500-3,000 mg daily (to minimize GI symptoms)	• 15 – 30% will require insulin eventually • **Crosses placenta**, and is renally excreted (risk for fetal bioaccumulation) • **DO NOT USE in T1DM**

Initiation of Insulin Therapy[4,5]

- **The total daily dose (TDD) of insulin should be calculated based on actual body weight and trimester (Table 3).**
- The TDD is divided with a regimen of multiple injections using long-acting (Lantus) or intermediate-acting (NPH) insulin in combination with rapid-acting (Lispro) or short-acting (Regular) insulin.
  - Common insulin combinations:
    - NPH and Regular
    - Lantus and Lispro
  - **Consider decreasing calculated TDD by ~ 20% in insulin naive patients**, especially when initiating insulin as an outpatient
  - Once the TDD is calculated, use the Figure 3 and Figure 4 to break down how the doses should be administered.
  - **A single agent intermediate- or long-acting basal insulin regimen may be considered if only fasting hyperglycemia is present.**
- Insulin formularies for PFW and Ben Taub are found in Table S1
- Lispro/Lantus Regimen (Figure 3) – **PREFERRED**

- **Four separate injections:**

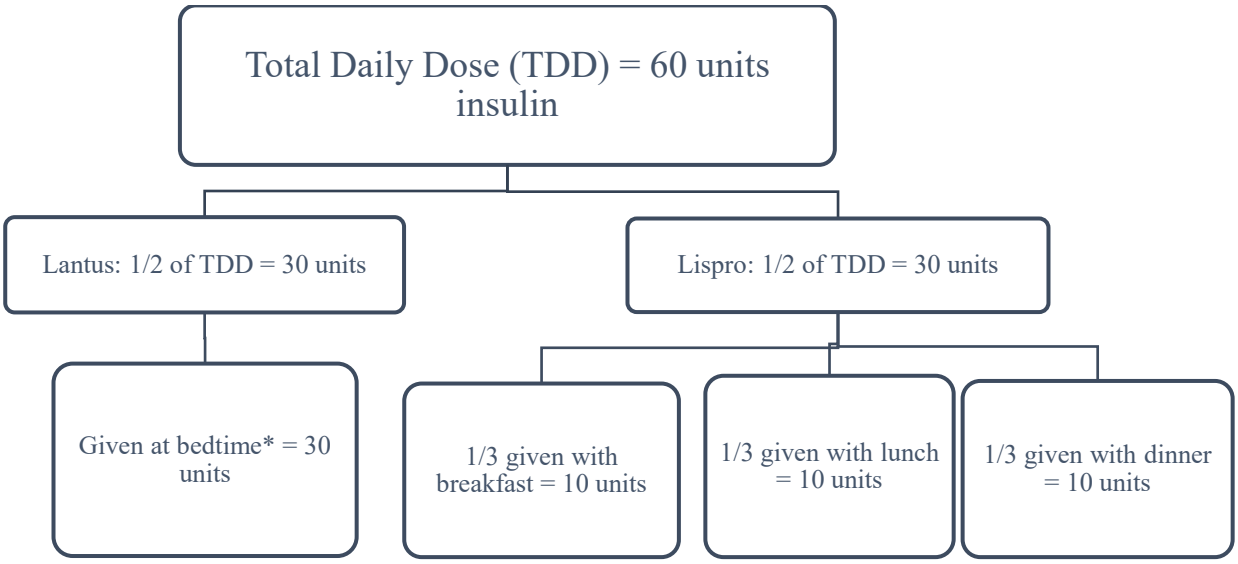
Breakfast	Lispro targets postprandial glucose
Lunch	Lispro targets postprandial glucose
Dinner	Lispro targets postprandial glucose
Bedtime	Lantus targets fasting glucose

- NPH/Regular Regimen (Figure 4)
  - **Three separate injections:**

Breakfast	Regular targets postprandial *breakfast* glucose; NPH targets postprandial *lunch* glucose
Dinner	Regular targets postprandial dinner
Bedtime	Targets fasting glucose

Figure 3. *Glargine (Lantus) and Humalog (Lispro) insulin example regimen (**PREFERRED**)*

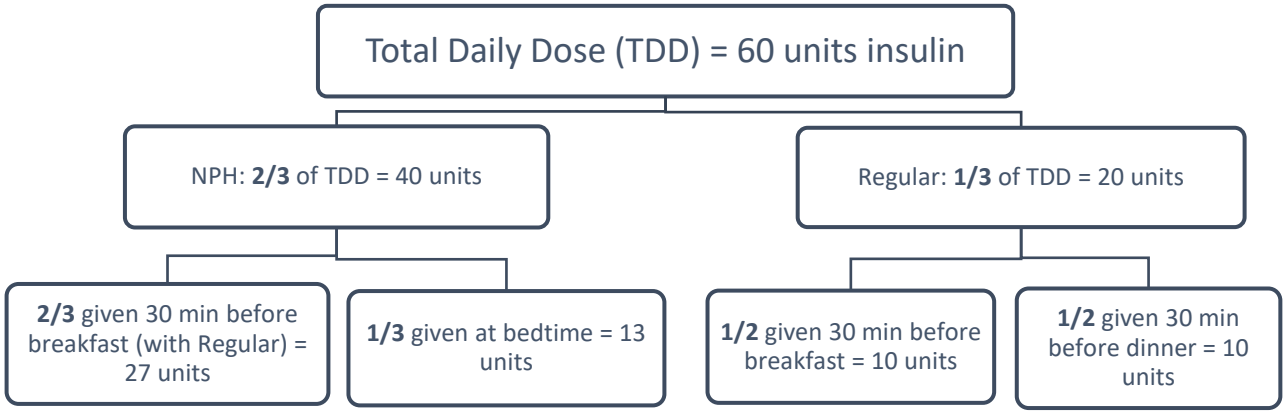
Example: 16 weeks, actual body weight of 75 kg at 0.8 units/kg/day X 75 kg = TDD of 60 units per day



*Consider split dosing AM/PM if Lantus dose is ≥ 60 units.

Figure 4*. NPH and Regular insulin example regimen*

Example: 16 weeks, actual body weight of 75 kg at 0.8 units/kg/day X 75 kg = TDD of 60 units per day



Adjustment of Insulin Therapy

- Once initiated, insulin should be increased or decreased by ~20% at a time when ~50% or more of BG values are higher or lower than target values.
- Insulin adjustments should target the insulin that will impact the high or low BG values. For example:
  - If only post-prandial breakfast values are elevated, only increase the morning Regular or Lispro insulin.
  - If only fasting values are elevated, only increase the bedtime NPH or Lantus insulin
  - If all BG values are elevated, all doses should be increased.
- **Consider split dose AM/PM for long-acting doses > 60 units as there is impaired absorption with large injections.**
- Insulin conversion is listed in Table S3.

Antepartum Checklists

Table 4. *Checklist for antepartum care of Type 1 or 2 DM*

Initial prenatal visit

☐ Record age at onset of DM

☐ History of DM complications:

[ ] Ketoacidosis [ ] Retinopathy [ ] Nephropathy
[ ] Hypoglycemia [ ] Hypertension [ ] Coronary artery disease
[ ] Gastroparesis [ ] Neuropathy [ ] Arterial occlusive disease

☐ Physical exam

☐ Refer for retinal examination (if not performed in past year)

☐ Refer to Nutrition and Certified Diabetic Educator (CDE)

☐ Review medications

- T1DM: should be on insulin
- T2DM:
  - If not taking medications, initiate insulin if elevated BG values
  - If taking insulin, adjust as needed
  - If taking metformin, counsel on risks and benefits of continuing metformin vs. switching to insulin
  - If taking a medication other than insulin or metformin, discontinue agent and initiate insulin

☐ Consider Endocrine consultation in patients with type 1 DM or persistent hyperglycemia despite medication adjustments.

☐ Patient education/counseling

[ ] Relationship between glycemic control and adverse pregnancy outcomes (miscarriage, birth defects, fetal growth restriction, macrosomia, stillbirth, preterm birth)
[ ] Maternal adverse effects (hypertension/preeclampsia, worsening retinopathy or nephropathy)
[ ] Impact of pregnancy hormones on glycemic control and likelihood of increasing medication needs throughout pregnancy despite nutrition and exercise adherence
[ ] Home blood glucose (BG) monitoring and BG goals
  - QID BG checks – fasting (upon awakening) and 2 hours after the start of every meal
  - BG Goals: fasting 60-95 mg/dL, 2-hr postprandial (PP) 100-120, 1-hr PP <140

☐ Family education on recognition and management of hypoglycemia

☐ Fetal ultrasound for dating and early anatomy

☐ Baseline labs and assessment of end-organ damage (include date of test):

Lab	Value
Hemoglobin A1C	
Comprehensive metabolic panel	
TSH (for T1DM)	
Urinary protein/creatinine ratio	
Electrocardiogram (ECG)	
Maternal echo if other co-morbidities and/or abnormal ECG findings	

Second Trimester

☐ Aspirin 81 mg daily (start between 12 and 28 weeks of gestation, optimally before 16 weeks)

☐ Comprehensive fetal anatomy ultrasound at 20 weeks
☐ Pneumococcus vaccine (PCV20)
☐ Fetal echocardiogram

At every prenatal visit

☐ Review:
- BG log
- Nutrition and exercise regimen/adherence
- Medication adherence as prescribed (review medications taken and time of day taken)
- Adequacy of supplies (lancets, test strips, medication refills)
- Weight gain/loss
- Barriers to any of the above

☐ Consider food diary (record all foods and time eaten) and use it to counsel on potential dietary modifications
☐ Obtain BG in clinic and correlate with glucometer to ensure accuracy.
Consider reviewing glucometer values if discrepancy noted.
☐ Review/provide hypoglycemia education including signs/symptoms and management strategies
☐ Assess glycemic control:
- Increase/decrease insulin or metformin as needed to achieve goal BG values
- In patients with T1DM, avoid large (~20%) increases in insulin due to high sensitivity/responsiveness to insulin adjustments and risk for hypoglycemia
- If euglycemia cannot be achieved with max-dose metformin, discontinue metformin and initiate weight-based insulin (see Figure 3 and Figure 4)
- Follow up 3-7 days after medication changes (can be done via telemedicine) to evaluate response
- Consider inpatient admission for marked hyperglycemia and/or concern for DKA

Third Trimester

☐ Twice-weekly antepartum fetal surveillance starting at 32 weeks
☐ Ultrasound assessment of fetal growth every 4 weeks, beginning at 28 weeks

Delivery Planning

☐ Offer cesarean delivery if estimated fetal weight (by recent ultrasound and/or Leopold maneuvers) expected to be ≥4500 g at time of delivery
☐ Delivery timing:
- Type 1or 2 DM, well-controlled: 39 0/7 to 39 6/7 weeks
- Type 1or 2 DM with poor glycemic control, vascular complications, or prior stillbirth: 36 0/7 to 38 6/7 weeks

Intrapartum/Day of Delivery

☐ Insulin Management:
- Usual dose of short-acting insulin with dinner the night before scheduled induction of labor or cesarean
- Usual dose of intermediate-acting or long-acting insulin at bedtime the night before scheduled induction of labor or cesarean. Alternately, long- or intermediate-acting insulin dosing may be cut in half, to reduce the risk of hypoglycemia from being NPO prior to surgery
- Morning dose of insulin is withheld or reduced based upon the timing of admission for delivery

☐ Check BG q 4 hours in latent labor and q 1-2 hours in active labor
☐ T2DM: initiate insulin drip for BG >110 mg/dL (goal range of 70-110 mg/dL) to minimize risk of neonatal hypoglycemia (See Intrapartum Management)
☐ T1DM: continuous insulin (insulin drip) infusion used in labor
- Home insulin pumps should be discontinued during labor
- **A subcutaneous long-acting injectable insulin dose must be given PRIOR TO DISCONTINUING the continuous insulin infusion used in labor**

Postpartum

☐ T2DM:
- Check BG q 6 hours while NPO and use sliding scale insulin to cover hyperglycemia
- Restart insulin at ½ pregnancy regimen or pre-pregnancy regimen once eating regular diet

☐ T1DM:
- Check BG q 6 hours while NPO and use sliding scale insulin to cover hyperglycemia
- Continue long/acting basal insulin even while NPO

- Ensure long-acting insulin is administered PRIOR TO DISCONTINUING the continuous insulin infusion used in labor

☐ Ensure transition of care to endocrinology or primary care provider
☐ 4-6 week postpartum clinic visit
☐ BG goals in a non-pregnant setting are 80-130 mg/dL pre-prandial and <180 mg/dL post-prandial[9]

Table 5. *Checklist for antepartum care of gestational DM (A1 or A2)*

At time of diagnosis of GDM

- ☐ Counsel on nutrition and exercise and refer to Nutrition Counselor.
- ☐ Counsel on blood glucose (BG) monitoring at home and BG goals and refer to Diabetic Educator:
  - QID BG checks – fasting (upon awakening) and 2 hours after every meal
  - BG Goals: fasting 60-95 mg/dL, 2-hr postprandial (PP) 100-120mg/dL, 1-hr PP <140 mg/dL
- ☐ Schedule clinic follow-up within 7 days (can be done via telemedicine) to ensure patient able to monitor BG at home, identify and address any barriers if present, and review BG log

At every prenatal visit

- ☐ Review:
  - BG log
  - Nutrition and exercise regimen/adherence
  - Medication adherence as prescribed (review medications taken and time of day taken)
  - Adequacy of supplies (lancets, test strips, medication refills)
  - Weight gain/loss
  - Barriers to any of the above
- ☐ Consider food diary (record all foods and time eaten) and use it to counsel on potential dietary modifications
- ☐ Obtain BG in clinic and correlate with glucometer to ensure accuracy. Consider reviewing glucometer values if discrepancy noted.
- ☐ Review/provide hypoglycemia education including signs/symptoms and management strategies
- ☐ **Initiate medication when >50% of BG values (fasting and/or post-prandial) are higher than goal range** after a sufficient attempt (~2 weeks) of nutrition therapy/dietary modifications and exercise
  - Insulin is the preferred treatment, metformin is a reasonable alternative (see Table 3)
  - Assess glycemic control 3-7 days after medication initiation (can be done via telemedicine)
- ☐ Assess response to insulin or metformin:
  - Increase/decrease insulin or metformin as needed to achieve goal BG values
  - If euglycemia cannot be achieved with max-dose metformin, discontinue metformin and initiate weight-based insulin (see Figure 3 and Figure 4)
- ☐ Follow up 3-7 days after medication changes (can be done via telemedicine) to evaluate response

Third Trimester

- ☐ Antepartum fetal surveillance starting at 32 weeks
  - Once weekly for well-controlled A2DM
  - Twice weekly for poorly-controlled A2DM (eg, frequent increases in insulin or metformin, consistently >50% BG values above target)
  - None for A1DM
- ☐ A2DM: ultrasound assessment of fetal growth at 32 and 36 weeks
- ☐ A1DM: ultrasound assessment of fetal growth around 36-37 weeks

Delivery Planning

- ☐ Offer cesarean delivery if estimated fetal weight (by recent ultrasound and/or Leopold maneuvers) expected to be ≥4500 g at time of delivery
- ☐ Delivery timing:
  - A2DM, well-controlled: 39 0/7 to 39 6/7 weeks
  - A2DM with poor glycemic control: late preterm/early term (individualized)
  - A1DM: 39 0/7 to 40 6/7 weeks

Intrapartum/Day of Delivery

- ☐ Medication Management:
  - Usual dose of short-acting insulin with dinner the night before scheduled induction of labor or cesarean
  - Usual dose of intermediate-acting or long-acting insulin or metformin at bedtime the night before scheduled induction of labor or cesarean. Alternately, long- or intermediate-acting insulin dosing may be cut in half, to reduce the risk of hypoglycemia from being NPO prior to surgery
  - Morning dose of insulin or metformin is withheld
- ☐ Check BG q 4 hours in latent labor and q 1-2 hours in active labor
- ☐ Initiate insulin drip for BG >110 mg/dL(goal range of 70-110 mg/dL) to minimize risk of neonatal hypoglycemia (see Intrapartum Glucose Protocol)

Postpartum
☐ Stop insulin or metformin ☐ **Administer 75 gm OGTT on postpartum day #2** ☐ 4-6 week postpartum clinic visit • Administer 75 gm OGTT if not done during delivery admission ☐ Ensure transition of care to endocrinology or primary care provider if positive 75 gm OGTT

Table 6. *Checklist for pre-conception consult of Type 1 or 2 DM*

Preconception visit
☐ Record age at onset of DM ☐ History of DM complications: [ ] Ketoacidosis [ ] Retinopathy [ ] Nephropathy [ ] Hypoglycemia [ ] Hypertension [ ] Coronary artery disease [ ] Gastroparesis [ ] Neuropathy [ ] Arterial occlusive disease ☐ Physical exam ○ Cardiopulmonary auscultation ○ Lower extremity Exam Perfusion (color, pulses): _____ Sensory exam (touch, pain): _____ Proper fit of footwear: _____ ☐ Referral for retinal examination ☐ Pneumococcus vaccine (PCV20) ☐ Start a prenatal vitamin ☐ Review of medications and safety of use peri-conception/1st trimester ☐ Ensure adequate contraception if not planning pregnancy immediately ☐ Plan to optimize Hemoglobin A1C (<6.0%) ☐ Patient education/counseling: [ ] Relationship between pre-conception glycemic control and adverse pregnancy outcomes (miscarriage, birth defects) [ ] Pregnancy-related risks of maternal/fetal/neonatal adverse effects: fetal anomalies, preterm delivery, preeclampsia, fetal macrosomia, mode of delivery, neonatal complications, hyperglycemia, worsening diabetic retinopathy and nephropathy [ ] Continued use of insulin or metformin once pregnancy confirmed

Intrapartum Management

- During labor, maternal hyperglycemia can be controlled with an IV infusion of regular insulin, titrated to maintain hourly readings of blood glucose levels less than 110 mg/dL.
- Avoiding intrapartum maternal hyperglycemia prevents fetal hyperglycemia and reduces the likelihood of subsequent neonatal hypoglycemia.
- For patients with T1DM, a subcutaneous insulin dose MUST be given ~15-30 minutes before IV insulin is discontinued. A continuous insulin infusion pump with continuous short acting insulin meets these criteria. For patients NOT on a continuous insulin infusion pump, long/intermediate acting insulin will be necessary as part of a comprehensive insulin regimen.
- This protocol[13,14] is an example for the management of IV insulin continuous infusions for **intrapartum patients and is based on their total daily dose of insulin on day of delivery.**
    - **For patients with A2DM on metformin, use the medium dose algorithm (applicable to pregnant individual who weigh 61-120 kg)**

Low Dose Insulin Drip

Low Dose Algorithm: Total Daily Dose of Insulin ≤ 60 units/24 hours

Hourly	Continuous Infusion	Initial Dose of Insulin	
Glucose Level (mg/dL)	D5W (ml/hr)	Bolus IV Push (units)**	Basal (units/hr)
<70*	100	0	0
70-110	100	0	0
111-130	100	0	0.5
131-160	100	1	0.5
161-190	0	2	0.5
191-220	0	3	0.5
>220	0	4	0.5

Hourly	Continuous Infusion	BG UNCHANGED or INCREASING	
Glucose Level (mg/dL)	D5W (ml/hr)	Bolus IV Push (units)**	Basal (units/hr)
<70*	100	0	**Stop**
70-110	100	0	No Change
111-130	100	0	↑ 0.5
131-160	100	1	↑ 0.5
161-190	0	2	↑ 0.7
191-220	0	3	↑ 0.7
>220	0	4	↑ 0.8

Hourly	Continuous Infusion	BG DECREASING	
Glucose Level (mg/dL)	D5W (ml/hr)	Bolus IV Push (units)**	Basal (units/hr)
<70*	100	0	**Stop**
70-110	100	0	↓ 0.3
111-130	100	0	No Change
131-160	100	0	↑ 0.5
161-190	0	1	↑ 0.5
191-220	0	2	↑ 0.8
>220	0	3	↑ 0.8

*If blood glucose is <70, **STOP** insulin infusion, notify physician **and** give D50W 50ml (25g) IV push. If infusion is turned off for more than 1 hour notify physician.
** Do NOT bolus from IV pump

BG: Blood Glucose; D5: Dextrose 5% in water
Max Total IV fluids: 150 ml/hour. If max total IV fluids are ≥ 150 ml/hour, notify physician.
Max Insulin rate is 10 units/hour. Further increases need to be ordered by physician.

Medium Dose Insulin Drip

Medium Dose Algorithm: Total Daily Dose of Insulin 61- 120 units/24 hours

Hourly	Continuous Infusion	Initial Dose of Insulin	
Glucose Level (mg/dL)	D5W (ml/hr)	Bolus IV Push (units)**	Basal (units/hr)
<70*	100	0	0
70-110	100	0	0
111-130	100	0	1
131-160	100	2	1
161-190	0	3	1
191-220	0	4	1
>220	0	5	1

Hourly	Continuous Infusion	BG UNCHANGED or INCREASING	
Glucose Level (mg/dL)	D5W (ml/hr)	Bolus IV Push (units)**	Basal (units/hr)
<70*	100	0	**Stop**
70-110	100	0	No Change
111-130	100	0	↑ 0.6
131-160	100	2	↑ 0.6
161-190	0	3	↑ 0.8
191-220	0	4	↑ 0.8
>220	0	5	↑ 1

Hourly	Continuous Infusion	BG DECREASING	
Glucose Level (mg/dL)	D5W (ml/hr)	Bolus IV Push (units)**	Basal (units/hr)
<70*	100	0	**Stop**
70-110	100	0	↓ 0.4
111-130	100	0	No Change
131-160	100	0	↑ 0.6
161-190	0	2	↑ 0.6
191-220	0	3	↑ 0.8
>220	0	4	↑ 0.8

*If blood glucose is <70, **STOP** insulin infusion, notify physician **and** give D50W 50ml (25g) IV push. If infusion is turned off for more than 1 hour notify physician.
** Do NOT bolus from IV pump

BG: Blood Glucose; D5: Dextrose 5% in water
Max Total IV fluids: 150 ml/hour. If max total IV fluids are ≥ 150 ml/hour, notify physician.
Max Insulin rate is 10 units/hour. Further increases need to be ordered by physician.

High Dose Insulin Drip

High Dose Algorithm: Total Daily Dose of Insulin 121 -180 units/24 hours

Hourly	Continuous Infusion	Initial Dose of Insulin	
Glucose Level (mg/dL)	D5W (ml/hr)	Bolus IV Push (units)**	Basal (units/hr)
<70*	100	0	0
70-110	100	0	0
111-130	100	0	1.5
131-160	100	3	1.5
161-190	0	4	1.5
191-220	0	5	1.5
>220	0	6	1.5

Hourly	Continuous Infusion	BG UNCHANGED or INCREASING	
Glucose Level (mg/dL)	D5W (ml/hr)	Bolus IV Push (units)**	Basal (units/hr)
<70*	100	0	**Stop**
70-110	100	0	No Change
111-130	100	0	↑ 0.8
131-160	100	3	↑ 0.8
161-190	0	4	↑ 1
191-220	0	5	↑ 1
>220	0	6	↑ 1.2

HOURLY	Continuous Infusion	BG DECREASING	
Glucose Level (mg/dL)	D5W (ml/hr)	Bolus IV Push (units)**	Basal (units/hr)
<70*	100	0	**Stop**
70-110	100	0	↓ 0.5
111-130	100	0	No Change
131-160	100	0	↑ 0.8
161-190	0	3	↑ 0.8
191-220	0	4	↑ 1
>220	0	5	↑ 1

*If blood glucose is <70, **STOP** insulin infusion, notify physician **and** give D50W 50ml (25g) IV push. If infusion is turned off for more than 1 hour notify physician.
** Do NOT bolus from IV pump

BG: Blood Glucose; D5: Dextrose 5% in water
Max Total IV fluids: 150 ml/hour. If max total IV fluids are ≥ 150 ml/hour, notify physician.
Max Insulin rate is 10 units/hour. Further increases need to be ordered by physician.

Very High Dose Insulin Drip

Very High Dose Algorithm: Total Daily Dose of Insulin >180 units/24 hours

Hourly	Continuous Infusion	Initial Dose of Insulin	
Glucose Level (mg/dL)	D5W (ml/hr)	Bolus IV Push (units)**	Basal (units/hr)
<70*	100	0	0
70-110	100	0	0
111-130	100	0	2
131-160	100	4	2
161-190	0	5	2
191-220	0	6	2
>220	0	7	2

Hourly	Continuous Infusion	BG UNCHANGED or INCREASING	
Glucose Level (mg/dL)	D5W (ml/hr)	Bolus IV Push (units)**	Basal (units/hr)
<70*	100	0	**Stop**
70-110	100	0	No Change
111-130	100	0	↑ 1
131-160	100	4	↑ 1
161-190	0	5	↑ 1.2
191-220	0	6	↑ 1.2
>220	0	7	↑ 1.6

Hourly	Continuous Infusion	BG DECREASING	
Glucose Level (mg/dL)	D5W (ml/hr)	Bolus IV Push (units)**	Basal (units/hr)
<70*	100	0	**Stop**
70-110	100	0	↓ 0.6
111-130	100	0	No Change
131-160	100	0	↑ 1
161-190	0	4	↑ 1
191-220	0	5	↑ 1.2
>220	0	6	↑ 1.2

*If blood glucose is <70, **STOP** insulin infusion, notify physician **and** give D50W 50ml (25g) IV push. If infusion is turned off for more than 1 hour notify physician.
** Do NOT bolus from IV pump

BG: Blood Glucose; D5: Dextrose 5% in water
Max Total IV fluids: 150 ml/hour. If max total IV fluids are ≥ 150 ml/hour, notify physician.
Max Insulin rate is 10 units/hour. Further increases need to be ordered by physician.

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Table S1. Types of Insulin

Generic Name	Brand Name	Onset	Peak	Duration	Dosing Notes	How Supplied
Rapid Acting						
Insulin lispro*	Humalog	<15 minutes	2 – 3 hours	5 – 7 hours	Bolus: give at time of meal	• Vial and Kwikpen • 75/25 vial and Kwikpen • 50/50 vial and Kwikpen • KwikPen U-100 pen: 100 units/mL • Junior KwikPen U-100 pen: 100 units/mL • U-100 cartridge: 100 units/mL • U-100 vial: 100 units/mL
Insulin aspart	Novolog	<15 minutes	1 – 3 hours	3 – 7 hours	Bolus: give at time of meal	• FlexPen U-100 pen: 100 units/mL • PenFill U-100 cartridge: 100 units/mL • U-100 vial: 100 units/mL
Short Acting						

Insulin regular*	Humulin R (SQ)	30 minutes	1.5 – 3.5 hours	8 hours	Bolus: **give 30 minutes** before a meal	• Novolin R® vial
						• U-500 (Humulin R U-500) - KwikPen and vial
						• KwikPen U-100 pen: 100 units/mL
						• U-100 cartridge: 100 units/mL
						• U-100 vial: 100 units/mL
						• If >200 total insulin units needed per day
						  ○ KwikPen U-500 pen: 500 units/mL
						  ○ U-500 vial: 500 units/mL

	Humulin R (IV)	10-20 minutes	5 hours	1.5 hours after stopping infusion	Transition from IV to SQ: continue IV insulin for 1-4 hours after the first SQ dose to avoid rebound hyperglycemia or ketoacidosis	• Standard concentration (continuous infusion): 1 unit/mL in NS
Intermediate Acting						
Insulin NPH*	Humulin N	1 – 2 hours	4 – 12 hours	14 – 24 hours	Basal: give in the morning and/or at bedtime	• Vial • KwikPen U-100 pen: 100 units/mL • U-100 vial: 100 units/mL
Long-Acting						
Insulin glargine*	Lantus	3 – 4 hours	None	24 hours	Basal: give in the morning and/or at bedtime	• SoloStar pen • SoloStar U-100 pen: 100 units/mL • U-100 vial: 100 units/mL
	Toujeo	6 hours	None	24 hours	Basal: give in the morning and/or at bedtime	• SoloStar U-300 pen: 300 units/mL
Insulin degludec*	Tresiba	30 – 90 minutes	None	>24 hours	Basal: give in the morning and/or at bedtime	• FlexTouch U-100 pen: 100 units/mL • U-100 vial: 100 units/mL • FlexTouch U-200 pen: 200 units/mL

***PFW formulary; Harris Health outpatient formulary = Yellow highlight**; adapted from Dana Elder, PharmD and Harris Health Pharmacy and Therapeutics Committee Memo, 2/24/2023

Table S2: Funding and Diabetic Supplies in Harris Health

FUNDING & DIABETIC SUPPLIES

INSULIN PENS ARE NOW COVERED BY CHIP/MEDICAID!

	UNFUNDED OR FAP (GOLD CARD)	MEDICAID/CHIP
PREFERRED PHARMACY FOR INSULIN	HARRIS HEALTH PHARMACY ($15 FOR 3 MONTH SUPPLY OF INSULIN INCLUDING PENS)	RETAIL PHARMACIES (WALGREENS/CVS MOST COST EFFECTIVE; WALMART MOST EXPENSIVE AT $300/MO)
DIABETIC SUPPLIES (GLUCOMETER/LANCETS/STRIPS)	HARRIS HEALTH PHARMACY	RETAIL PHARMACY (WALGREENS/CVS PREFERRED)
LANCETS QUANTITY (COMES IN BOXES OF 100)	200 EACH FOR ONE MONTH SUPPLY	200 EACH FOR ONE MONTH SUPPLY
STRIPS QUANTITY (COMES IN BOXES OF 50)	150 EACH FOR ONE MONTH SUPPLY	150 EACH FOR ONE MONTH SUPPLY
INSULIN PEN 31G X 3/16" NEEDLES QUANTITY IF ORDERING PENS (COMES IN BOXES OF 100)	200 EACH FOR ONE MONTH SUPPLY	200 EACH FOR ONE MONTH SUPPLY

- REMINDERS -

- ORDER DIABETES EDUCATION & NUTRITION FOR ALL NEWLY DIAGNOSED/NEWLY REFERRED PATIENTS WITH GDM OR T2DM
- CONTACT DIABETES EDUCATOR, MARTHA PENA, BY INBASKET OR EPIC CHAT FOR PATIENTS WHO NEED HELP ACCESSING SUPPLIES/INSULIN, APPEAR NON -ADHERENT W/ CARE PLAN, OR WITH SIGNIFICANT BARRIERS TO CARE

Slide courtesy of Chamaine Penright, NP

Table S3. Insulin conversion chart

Clinical Scenario	Recommendation/Comments
NPH to long-acting	
NPH to insulin glargine U-100 (*Lantus*, *Basaglar*, *Semglee*, *Rezvoglar* [US]) NPH to insulin glargine U-300 (*Toujeo*)	• NPH once daily: convert unit-per-unit to U-100 insulin glargine and give once daily. • NPH twice daily: reduce total daily dose by 20% and give insulin glargine once daily. • It may take ≥5 days to see the maximum effect of the selected dose of *Toujeo*. Do not increase the *Toujeo* dose more often than every 3 to 4 days. • Do not mix insulin glargine with other insulins.
Long-acting to NPH	
Insulin glargine U-100 (*Lantus*, *Basaglar*, *Semglee*, *Rezvoglar* [US]) to NPH Insulin glargine U-300 (*Toujeo*) to NPH	• Insulin glargine U-100*:* convert unit-per-unit, or reduce dose by 20%. • *Toujeo*: reduce dose by 20%. • Give NPH twice daily (e.g., 50:50 or 2/3 in AM and 1/3 before dinner or at bedtime).
Long-acting to long-acting	
Insulin glargine U-100 (*Lantus*) to/from insulin glargine U-100 (*Basaglar*, *Semglee*, *Rezvoglar* [US])	• Convert unit-per-unit.
Insulin glargine U-100 (*Lantus*, *Basaglar*, *Semglee*, *Rezvoglar* [US]) to insulin glargine U-300 (*Toujeo*)	• Convert unit-per-unit and give once daily. • Expect that a higher daily dose (about 10% to 18%) of *Toujeo* will be needed to maintain control. • It may take ≥5 days to see the maximum effect of the selected dose of *Toujeo*. Do not increase the *Toujeo* dose more often than every 3 to 4 days. • Do not mix insulin glargine with other insulins.
Long-acting to long-acting	
Insulin glargine U-300 (*Toujeo*) to insulin glargine U-100 (*Lantus*, *Basaglar*, *Semglee*, *Rezvoglar* [US]) or insulin detemir (*Levemir*)	• Reduce dose by 20%.

Clinical Scenario	Recommendation/Comments
NPH or long-acting to ultra-long acting	
NPH, insulin glargine U-100 (*Lantus*, *Basaglar*, *Semglee*, *Rezvoglar* [US]), or insulin glargine U-300 (*Toujeo*) to insulin degludec (*Tresiba*)	• Convert total daily dose unit-per-unit and give once daily, or reduce dose by 20% (for patients with type 1 diabetes [Canada], twice-daily basal insulin [Canada], or pediatrics [US]) and give once daily. • Do not increase the *Tresiba* dose more often than every 3 to 4 days.
Ultra-long acting to NPH or long-acting	
Insulin degludec (*Tresiba*) to NPH, insulin glargine U-100 (*Lantus*, *Basaglar*, *Semglee*, *Rezvoglar* [US]), or insulin glargine U-300 (*Toujeo*)	• Reduce dose by 20%. • Give once daily, or divide *Levemir* twice daily. ○ If converting from *Tresiba* >80 units/day, divide U-100 insulin twice daily. • Give NPH twice daily (e.g., 50:50 or 2/3 in AM and 1/3 before dinner or at bedtime).
Regular to rapid-acting	
Regular human insulin (*Humulin R* [US], *Novolin R* [US], *Novolin ge Toronto* [Canada], *Myxredlin* [Canada], *Hypurin Regular* [Canada]) to rapid-acting insulin analog (insulin aspart [*NovoLog* (US), *NovoRapid* (Canada), *Trurapi* (Canada), *Fiasp*, *Kirsty* (Canada)], insulin glulisine [*Apidra*], insulin lispro [*Humalog*, *Admelog*, *Lyumjev*])	• Convert unit-per-unit. • Rapid-acting insulin analogs have a faster onset of action and a shorter duration of action than human regular insulin.
Rapid-acting to regular	
Insulin aspart (*NovoLog* [US], *NovoRapid* [Canada], *Trurapi* [Canada], *Fiasp*, *Kirsty* [Canada]), insulin glulisine (*Apidra*), or insulin lispro (*Humalog*, *Admelog*, *Lyumjev*) to regular human insulin (*Humulin R* [US], *Novolin R* [US], *Novolin ge Toronto* [Canada], *Myxredlin* [Canada], *Hypurin Regular* [Canada])	• Convert unit-per-unit. • Rapid-acting insulin analogs have a faster onset of action and a shorter duration of action than human regular insulin.
Rapid-acting to rapid-acting	
Insulin aspart (*NovoLog* [US], *NovoRapid* [Canada], *Trurapi* [Canada], *Fiasp*, *Kirsty* [Canada]),	• Convert unit-per-unit.

Clinical Scenario	Recommendation/Comments
insulin glulisine (*Apidra*), or insulin lispro (*Humalog*, *Admelog*, *Lyumjev*) to insulin aspart (*NovoLog* [US], *NovoRapid* [Canada], *Trurapi* [Canada], *Fiasp*, *Kirsty* [Canada]), insulin glulisine (*Apidra*), or insulin lispro (*Humalog*, *Admelog*, *Lyumjev*)	
Regular to long-acting or ultra-long acting	
Regular human insulin (*Humulin R* [US], *Novolin R* [US], *Novolin ge Toronto* [Canada], *Myxredlin* [Canada], *Hypurin Regular* [Canada]) to insulin glargine U-100 (*Lantus*, *Basaglar*, *Semglee*, *Rezvoglar* [US]), insulin glargine U-300 (*Toujeo*), insulin detemir (*Levemir*), insulin degludec (*Tresiba*), or NPH	• Calculate the average of the daily insulin requirement over the past five to seven days. Start with 70% to 75% as basal insulin. • Cover meals with oral antidiabetics or mealtime insulin.
U-100 insulin to U-500 insulin	
All types of U-100 insulin to *Humulin R U-500* (US) or *Entuzity* (Canada)	• U-500 insulin is only for patients needing >200 units of insulin daily. • Determine the total daily dose from all insulin sources combined.Round down to the nearest 5 units. • If A1c is ≤8%, reduce the dose by 20%. • Divide the dose two or three times daily, given 30 minutes before a meal. Recommended dosing ratios are 60:40 (for breakfast/dinner dosing) or 40:30:30 (for breakfast/lunch/dinner dosing). Other ratios may be appropriate. • It is recommended that daily doses of ≥300 to 750 units be divided three times daily. For doses >750 units, divide four times daily (with meals and at bedtime), with the bedtime dose being smaller than the mealtime doses. • For a titration algorithm, see https://www.humulin.com/hcp/dosing-titration#insulin-activity.

Reference: https://pharmacist.therapeuticresearch.com/en/Content/Segments/PRL/2016/Dec/How-to-Switch-Insulin-Products-10473

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Obesity

[December 2022 (replaces June 2020)]

IN PROCESS OF REVISIONS

Preconception Care of the Obese Patient

Overview

Obesity is the most common health problem in women of reproductive age with significant health risks over their lifetime. It is also associated with decreased fertility and adverse pregnancy outcomes. Obstetrician-gynecologists are the most common physician that women of reproductive age will see, resulting in an opportunity for OB/GYN's to make an impact on the future health of women with obesity.

The most recent prevalence of obesity in 2017 among women age 20-39 years is 36.5% and disproportionately affects minority women. The highest rate of obesity is seen in non-Hispanic black women (54.8%) and Hispanic women (50.6%). The lowest rate was in non-Hispanic Asian women (14.8%) followed by non-Hispanic white women (38%) (1). It is estimated that if the rate of obesity increases at its current rate one half of all reproductive age women will be obese by 2030 (2).

Since obesity is a common condition among reproductive-aged women who may not see other health care providers, OB/GYN's should attempt to address weight issues with their obese patients (3,4). Asking women whether they are worried about their weight or interested in weight loss will help identify those who are receptive to a discussion about weight management. If an obese woman is considering pregnancy (or not using contraception) ACOG recommends preconception counseling about the maternal and fetal risks of obesity in pregnancy including GDM, hypertension, preeclampsia, Cesarean delivery, and postpartum weight reduction (3). Counseling should be conducted in a nonjudgmental, honest and respectful manner.

Definition

The WHO defines Obese BMI categories as (5):

CATEGORY	BMI
Class I	30-34.9
Class II	35-39.9
Class III (severe)	40 or greater

Additionally, super obesity is defined as a BMI of **50 or greater** (6).

Health risks of obesity

In 2008 the Obesity Society defined obesity "as a chronic disease with extensive and well-defined pathologies, including illness and death." (7). This position was then adopted by the AMA in 2013 (Obesity Act of 2013). Some of the leading causes of preventable death among adults are obesity-related conditions such as heart disease, stroke, type 2 diabetes, hypertension, GERD, NASH, and some types of cancer (endometrial, breast, colon) (8). Excess weight also increases the risk of liver and gallbladder disease, obstructive sleep apnea (OSA), osteoarthritis, and gynecologic problems such as PCO, anovulation, and infertility (3).

Obese women are also at increased risk of many pregnancy related complications. Hypertension, preeclampsia, and GDM are twice as likely to occur in obese women. Preterm birth is increased, although this is likely due to obesity related complications. Labor induction, labor dysfunction, and risk for Cesarean delivery are also higher in obese women. Women who undergo surgery are at increased risk of blood loss (> 1000 ml), infection, thromboembolism, wound dehiscence, and complications from anesthesia (3).

Fetuses of obese women are also at higher risk of complications. Rates of macrosomia are double for obese women (14%) compared to nonobese women (8%). Congenital anomalies have also been reported to occur more commonly, in particular neural tube defects (NTD's) (9). Stillbirth among obese women is also higher than normal weight women, although the mechanism for this is not clear.

Long-term risks for the offspring of obese women include an increased risk of metabolic syndrome and childhood obesity. Maternal obesity has also been linked to altered behavior in children including an increased risk of autism spectrum disorders, childhood developmental delay, and ADHD (9).

Super obesity

The prevalence of super-obese women (BMI > 50) is reported to be 1.8% in non-diabetic and 2.3% in diabetic patients in the U.S. (10). Additionally, the number of super obese individuals is growing 5 times faster than the other obese categories.

Maternal super obesity is associated with a significant increase in maternal complications including preeclampsia (10-14%), GDM (20%), failed TOLAC, Cesarean delivery (50-60%), and ICU admission (1.3 – 6%) compared to women who were obese (BMI 30-49.9) (6, 10-13). Women undergoing a Cesarean have an increased risk for failed intubation, increased risk of general anesthesia (7%-10) and increased operative time. However, there is no increase in intraoperative complications, transfusions rate, or return to the OR (10, 14-15). Fetal complications are also greater in superobese women including macrosomia, neonatal hypoglycemia, and admission to the NICU (6,10,14). They are at increased risk for VTE and wound infection (9).

BMI and Infertility

Obesity in women is associated with ovulatory dysfunction, including PCOS, altered oocyte and endometrial functions, and reduced ovarian responsiveness to agents that induce ovulation. Obesity also appears to alter the endometrial receptivity during IVF as women with a BMI > 35 have a 25% lower live birth rate compared to women with a BMI < 35 (16). Because of the pregnancy related complications associated with maternal obesity, the American Society of Reproductive Medicine suggests that obese women wishing to conceive should consider a weight management program that focuses on preconception weight loss to a BMI < 35 (16). The most recent Committee Opinion on Obesity and Reproduction states “weight management is best achieved through a lifestyle modification program that combines dietary modification, physical activity, and behavioral interventions, including psychological, behavioral, and stress management strategies.” (16).

Lifestyle intervention

Lifestyle modification is the first line approach for managing obesity. Individuals with a BMI of 30 or higher should be counseled regarding diet and exercise and referred to a comprehensive lifestyle physician or program that includes behavioral interventional treatment (17-20). The American College of Lifestyle Medicine (ACLM) certifies providers in evidence-based lifestyle therapeutic approaches to prevent, treat, and oftentimes reverse lifestyle -related chronic disease. The lifestyle medicine approach includes a predominately whole food plant-based diet, regular physical activity, adequate sleep, stress management, and avoidance of risky substances that promote health and prevent disease (21). The most successful programs promote an intensive therapeutic lifestyle change meeting weekly for several months and model a team approach including the provider, nurse, behavioral coach, dietician, and cooking demonstrations (22-24).

Other aspects of caring for the obese patient include screening for OSA and metabolic diseases and referral to other specialists as needed (e.g. cardiologist, endocrinologist, REI, physical therapy, occupational therapy). Women should also be counseled to engage in moderate intensity physical activity (such as brisk walking) 5 times a week for at least 30 minutes each time (25).

ACOG and IOM recommend that women obtain a BMI < 30 before attempting pregnancy in order to reduce the maternal and fetal complications associated with obesity (26-27).

The American College of Lifestyle Medicine (ACLM) recommends 6 months of treatment with a lifestyle modification program before referring patients for surgical intervention for weight loss. Lifestyle change treatments should not be considered failed without trying an intensive immersion program or the patient having declined it. Modest reduction in weight can have significant impact on chronic disease. Weight loss of 3-5% can lead to improvements in triglycerides, glucose, HgA1C, and lower the risk of developing diabetes. And a weight loss of greater than 5% can improve hypertension, dyslipidemia, and reduce the need for medications even in patients with diabetes (19).

Bariatric surgery has been used in patients with whom lifestyle management has failed or who decline lifestyle management as a means of reducing weight prior to conception. Although it does reduce the incidence of preeclampsia and fetal macrosomia, it does not reduce the risk of obesity related adverse pregnancy outcomes

to the level of non-obese women (28). Currently, it is recommended that women postpone pregnancy for one year after bariatric surgery, when the rapid weight loss period has stabilized. Bariatric surgery is not currently recommended during pregnancy or breastfeeding, due to the increased nutritional demands of breastfeeding.

Pregnancy, however, provides a unique window of opportunity to offer lifestyle interventions to women, as part of prenatal care. The ability to improve outcomes on behalf of their babies provides some women the added intrinsic motivation to engage and actively participate in lifestyle changes.

Evidence based recommendations for preconception counseling in obese women (3,9,17-20, 25-27)

- Provide information concerning maternal fetal risks of obesity
- Reduce weight to a BMI < 30
- Screen for OSA with referral for a sleep study with a positive screen
- Refer to a lifestyle physician/program
- Refer to other specialties as needed
- Engage in moderate physical activity totaling 150 min/week
- Obtain screening labs: TSH. Free T4, HgA1C, CBC with diff, CMP, total cholesterol, LDL, HDL, triglycerides, hsCRP, Vitamin D and folic acid level

Adverse Pregnancy Outcomes

Maternal mortality in a large cohort was reported to be 50% higher in obese women than among non-obese mothers (29). In addition, there are numerous maternal and fetal adverse outcomes which are summarized in the Table below (9):

MATERNAL	FETAL
Cardiac dysfunction	Congenital anomalies
Gestational Hypertension	Macrosomia
Preeclampsia	Spontaneous abortion
Preterm Delivery	Birth trauma
Labor dysfunction	Stillbirth
Cesarean Delivery	
Postpartum Hemorrhage	
Endometritis	
Wound rupture/infection	
GDM	
VTE	

Numerous congenital anomalies are increased in obese women with the most common reported to be NTD's (9).

Table 2. Increases in Congenital Anomalies in Obese Versus Nonobese Gravidas ⇦

Congenital Anomaly	Increased Risk
Neural tube defects	OR, 1.87; 95% CI, 1.62–2.15
Spina bifida	OR, 2.24; 95% CI, 1.86–2.69
Cardiovascular anomalies	OR, 1.30; 95% CI, 1.12–1.51
Septal anomalies	OR, 1.20; 95% CI, 1.09–1.31
Cleft palate	OR, 1.23; 95% CI, 1.03–1.47
Cleft lip and palate	OR, 1.20; 95% CI, 1.03–1.40
Anorectal atresia	OR, 1.48; 95% CI, 1.12–1.97
Hydrocephaly	OR, 1.68; 95% CI, 1.19–2.36
Limb reduction anomalies	OR, 1.34; 95% CI, 1.03–1.73

Pregnancy Management

Labs

Obese women should be screened for diabetes in the first trimester and again at 24-26 weeks' gestation if the initial screen is negative (9). In addition to the normal prenatal lab's consideration should be given to obtaining a TSH, folic acid and vitamin D level if not done in the prior 6-12 months. If the patient is obese with a history of bariatric surgery, please refer to the ACOG practice bulletin on Bariatric Surgery and Pregnancy (No. 105, June 2009).

Referrals

i. Dietician- Discuss healthy food choices/lifestyle, possible need for protein/nutrient supplementation if overall diet is nutrient deficient or if s/p gastric bypass
ii. Pulmonologist- Sleep Study/OSA study
iii. Occupational Therapy- for patients with morbid obesity who may have difficulty with self-care, they can recommend long-handled reachers/brushes, etc, to aid in self-hygiene, even prior to delivery. This may be mandatory after delivery, esp. if by cesarean.
iv. Physical Therapy- especially if having increase in low back/joint pain or for post-surgical recovery
v. Anesthesiology consult- For all patients with BMI of 40 or greater, 35 or greater, with comorbidities (HTN, Diabetes, Cardiac disease), as the anesthesia risk class increases with these conditions
vi. Psychiatry- if needed (esp. if anxiety/depression)
vii. Other specialists as needed by comorbidities (cardiology, endocrinology, etc.)

Gestational weight gain

Pregnant women should be counseled that excessive weight gain is associated with an increased risk of adverse outcomes, in particular, preeclampsia, macrosomia, Cesarean delivery, and postpartum weight retention, and that limiting weight gain can lower those risks. The 2009 IOM guidelines currently recommends no more than a 11-20- lb. weight gain for women with a singleton and a BMI > 30 (27). Obese women with a twin gestation should limit weight gain to 25-42 lbs. Dietary consultation should be considered for all pregnant women to facilitate achievement of IOM goals for weight gain during pregnancy.

Exercise during pregnancy

All pregnant women should be encouraged to engage in 150 minutes/week of moderate intensity exercise (25). Safe exercises in pregnancy include walking 30 min daily, running, swimming, gentle low-impact aerobics (as long as no risk of falls). Exercise may help limit weight gain, improve glycemic control if diabetic, reduce stress, and improve fitness for labor/recovery if cesarean required. If not previously exercising at all, the patient may

start with smaller increments of walking, and slowly add to her distance/time. Maintain adequate hydration, stop if having chest/abdominal pain, contractions, etc.

Genetic Screening

Obesity limits the interpretation of first and second trimester screening. An increased BMI hinders the ability to accurately measure a nuchal translucency (NT) or nasal bone and increases the need for transvaginal ultrasound. Studies report up to a 20% failure rate in obtaining a NT measurement in morbidly obese women (30).

Second trimester screening is also affected by maternal obesity due to the dilutional affects by larger blood volumes in obese women, leading to lower analyte levels with increasing maternal weight. Detection of ONTD's and trisomy 18 improve when maternal serum analytes are adjusted for maternal weight (31) However, weight adjustment does not improve the detection of Down syndrome. Many laboratories adjust for weight up to 270 lbs. Women weighing more than 270 lbs. are adjusted using coefficients for 270 lb women, thus theoretically decreasing the detection rate of NTD's and increasing false positives for trisomy 18 (31).

Obese women are also more likely to have low fetal fraction of cell free DNA or failed testing, especially at an early gestational age. Since failed testing increases the probability of fetal aneuploidy, obese women should be counseled about the limitations of cell free DNA testing and its implications prior to testing.

In general, traditional aneuploidy screening with serum analytes should be considered in the obese gravida because there is a much lower risk of test failure than with cell free DNA testing.

Diagnostic testing with either CVS or amniocentesis appears to have similar loss rates in women with a BMI < 40. However, in women with a BMI > 40, compared to women with a BMI < 25, the loss rate after amniocentesis is higher (OR 2.2) after adjusting for maternal age (32). Thus, women with a BMI > 40 should be counseled that amniocentesis may expose them to a higher risk of fetal loss.

Ultrasound imaging

Confirmation of gestational age using first trimester ultrasound is key in the obese patient due to limitations in confirming uterine size on physical exam.

And due to the increased risk of congenital anomalies in women with a BMI > 30, a detailed fetal anatomic survey should be done no earlier than 20 weeks' gestation (76811). Obesity also limits the effectiveness of visualization of congenital anomalies with suboptimal visualization noted in greater than 50% of initial studies (33). Suboptimal visualization of the heart anatomy (4-chamber view and outflow tracts) is particularly difficult in obese gravida (34). The detection of fetal anomalies also diminished with increasing BMI (33).

Techniques that can help improve the ability to have adequate visualization of fetal anatomic structures include: using lower transmission frequencies and harmonic imaging, Sims left lateral position scanning from the flank or groin, scanning under the panniculus above the pubic bone, scanning at the periumbilical or iliac fossa area, and transvaginal approach to visualize intracranial anatomy with cephalic presentation (35). Additionally, improvement in the visualization of intracardiac anatomy (4-chamber, outflow tracts, 3VTV) has been demonstrated using a combination of first trimester ultrasound (13 0/7 to 15 6/7 weeks) with transabdominal and/or transvaginal approach combined with second trimester ultrasound in 96% of women with a BMI > 40 (36).

AIUM does not recommend referral for a fetal echocardiogram unless an abnormality is suspected in obese women in whom there is suboptimal visualization of the normal 4-chamber view and outflow tracts (AIUM Practice Paramenter for the Performance of Fetal Echocardiography 2019-online only). However, ISUOG does recommend referring the patient for a fetal echocardiogram in the same situation. Finally, consideration should be given to fetal MRI in women who have suboptimal visualization of fetal anatomy related to abnormal aneuploidy testing (37). The BCM Perinatal Guidelines committee recommends considereation of referral for a fetal echocardiogram if 2 attempts to assess fetal cardiac anatomy have resulted in suboptimal visualization.

Antepartum Surveillance

An increase in BMI is associated with an increased risk of still birth with the adjusted odds ratio ranging from 1.37 in overweight women to 3.14 in women with a BMI ranging 40-49.9 (38). The highest risk is in women with super obesity (BMI >50) with an adjusted OR of 5.04. In addition, the risk of stillbirth in obesity increases with increasing gestational age. Compared with normal weight women, the fetal death rate among obese women at 28-36 weeks using hazard ratio was 2.1, for 37-39 weeks the hazard ratio was 3.5 and at 40 weeks or more the hazard ratio was 4.6 (39). At this time, it is unknown what the pathophysiology is of unexplained fetal demise in obese women. The most recent ACOG Practice Bulletin on Obesity states "even though stillbirth rates are higher in obese gravidas, there is no clear evidence showing a clear improvement in pregnancy outcomes with antepartum surveillance, and a recommendation cannot be made for or against routine antenatal fetal surveillance in obese women" (9). The BCM Perinatal Guidelines Committee recommends the following (please refer to "Antepartum Surveillance Management Guidelines"):

	GA to initiate testing	**Frequency**	**Delivery Time**
Obesity -Prepregnancy BMI 35 - 39.9 kg/m^2 -Prepregnancy BMI ≥ 40 kg/m^2	 37 weeks 34 weeks	Once weekly	individualized to situation (can await spontaneous labor)

Delivery recommendations

Obesity alone is not an indication for induction of labor, however retrospective data suggest that elective labor induction after 39 weeks is associated with reduced maternal and infant morbidity among obese women without other comorbidity and is not associated with an increased risk of Cesarean delivery (40,41). Medically indicated cesareans should be scheduled no sooner than 39 weeks, earlier for standard medical indications based on comorbidities. When scheduling inductions/cesareans, the L&D Charge RN should be informed, as special equipment may be used (such as the inflatable mattress to facilitate transfers), and additional nursing/ancillary staff may be needed to safely care for the patient during labor and delivery.

Intrapartum management

Increasing BMI, particularly in the nulliparous patient has been associated with a longer first stage of labor, increased risk for birth trauma (even when adjusted for macrosomia and diabetes), increased risk of Cesarean, and increased risk for postpartum hemorrhage after vagina delivery (but not Cesarean)(9). In a large multicenter cohort study of obese women, it was observed that the majority of obese women attempting vaginal delivery were successful, especially if they had previously delivered vaginally (42). Obese women desiring TOLAC have a lower success rate of 68% compared to 79.9% in normal weight women (9).
Special equipment, preparation and additional personnel are required to safely care for patients and a high BMI, especially when moving a patient is necessary. During labor and delivery, patients may require emergent Cesarean delivery, positional adjustment for fetal resuscitation, skin or leg retraction. If an epidural is in place, staff must often move the patient due to loss of motor function. The Occupational Safety and Health Administration (OSHA) recommends that no employee lift over 35 lbs. without assistance. The following are strategies to help safely move and transition patients:

- Ensure availability of appropriate birthing beds/other equipment to care for obese patients (e.g. large chairs and wheelchairs, larger BP cuffs, motorized lifts for gurneys)
- Use labor beds and stirrups designed to accommodate the obese patient
- Place inflatable air-mattresses under the patient to assist with movements from one bed to another (such as from a labor bed to OR table)
- Ensure adequate staff to patient ratio to permit assistance with leg support, skin retraction, suprapubic pressure if needed

- Utilize wide elastic bands to keep external monitors in place to avoid discomfort and skin irritation

Anesthesia

Maternal obesity also presents a challenge for management of anesthesia. Historically, up to 75% of anesthesia-related maternal deaths occurred among obese women, with the greatest risk being failed intubation (43). Outpatient consultation with anesthesia service should be considered in the 3rd trimester for obese women with obstructive sleep apnea and/or a BMI > 40 (> 35 at TCH PFW).

The risk of epidural failure is greater in obese women; therefore, early labor epidural placement should be considered. General anesthesia also poses a risk due to potential for difficult intubation. Preoxygenation and fiberoptic equipment to help with intubation should be considered and available should they be needed (9).

Operative Intervention

Antibiotic prophylaxis is routinely recommended prior to skin incision, although the optimal dosing in obese patients is unclear. Specific recommendations are difficult to establish because of lack of evidence of decreased surgical site infection with higher dosage strategies in obese women (9). Surgical prophylaxis for Cesarean deliveries performed at Ben Taub Hospital and Texas Children's Pavillion for Women recommend Cefazolin 3 gms in patients weighing > 120 kg (see hospital-specific infection reduction bundles).

If cesarean is required counsel the patient early that it may require a periumbilical vertical skin incision. The optimal skin incision for primary Cesarean in Class II and III obese patients is still debated and is left to the discretion of the surgeon. Most authors favor a transverse incision after either retracting the panniculus cephalad or caudad depending on the individual patient. In order to get better surgical exposure, one author recommends the Alexis-O self-retaining retractor (43). Closure of the subcutaneous tissue with a depth > 2 cm significantly decreases the incidence of wound infection. However, the use of subcutaneous drains is linked with a greater incidence of post-operative wound infections (9).

Postpartum Considerations

Immediate routine care

All obese women should use SCD's until there is adequate ambulation. Patients with a BMI > 35 at delivery who have a Cesarean birth and those with a BMI > 40 at delvery who have a vaginal birth and a prolonged hospitalization should receive prophylactic Lovenox for VTE prevention if there are no contraindications (see perinatal guideline: Venous Thromboembolism in Pregnant/Postpartum Women: Prevention, Early Diagnosis and Treatment [May 2019]).

viii. Patients with Cesarean should have a 1 week wound check. PT/OT consults should be considered for ambulation, transfers, ADL/IADL (including peri/wound care and basic hygiene). If the patient has OSA consider placing on BiPAP while in the hospital. All patient should be encouraged to breastfeed as there are additional benefits of reducing weight retention

ix. Sleep
    1. In accordance with the American Academy of Pediatrics, safe sleep habits should be encouraged (Avoid co-sleeping).
    2. Co-sleeping increases the risk of neonatal suffocation and may be increased in patients with OSA.

x. Postpartum visit
    1. Labs outlined in Table 1 should be obtained. If the patient had GDM a 2-hour GTT is recommended at 6 weeks.
    2. Contraception

Women with obesity can be offered all hormonal contraceptive methods with reassurance that efficacy of hormonal contraception is not significantly affected by weight (44). Consideration should be given to progestin-only and LNG-IUD in obese women who are older than 35 years of age. These methods may also be beneficial

if the patient has AUB or endometrial hyperplasia by stabilizing and protecting the endometrium (44). In general, the IUD is most reliable, but higher dose DepoProvera may be considered. Norethindrone only pill may be used in early postpartum period, but likely higher risk of failure.

Women who have had bariatric surgery that compromises the absorption of oral medications (Roux-en-Y or biliopancreatic diversion) should not use oral contraception (combined hormonal or progestin-only) because efficacy may be impaired (44). There are no concerns for use of oral contraception in women who had a restrictive type of bariatric surgery (banding, sleeve gastrectomy). Non oral methods of contraception can be used without restriction.

Lifestyle interventions

Postpartum is a critical period for intervention to prevent long term weight gain, as excess weight gain during pregnancy and weight retention at one year postpartum, are strong predictors of obesity in the next 10 years (45). Pregravid obesity is associated with early termination of breastfeeding, postpartum anemia, and depression (9).

Obese women should be counseled regarding the risks of postpartum weight retention and referred for a lifestyle modification program that includes dietary counseling, exercise, and behavioral counseling including stress management. Postpartum counseling should also encourage breastfeeding and the long-term benefits of weight loss and reduction of adverse pregnancy outcomes should they desire for more children.

How to approach an obese patient in a nonjudgemental way (46)

b. General
    i. Avoid stigmatizing language
        1. The terms “morbidly obese”, “fat”, and “obese” have been found to be the most stigmatizing language
        2. Instead use terms such as “weight problem”, “unhealthy weight”, and “high BMI” which have been found to be the least offensive language
    ii. Exhibit empathy, sensitivity, and support
    iii. Use motivational interviewing to encourage healhy lifestyle changes
        1. Express emphathy and avoid arguments
        2. Develop discrepancies
            a. Example: “You have told me you want to avoid having to take insulin for your diabetes but you also told me you don’t have time to exercise. Why do you think its hard for you to find time to do any physical activity? Can you think of some ways of increasing your physical activity in smaller intervals throughout the day?
        3. Roll with resistance and provide feedback
            a. When patients express reasons for not changing behavior, help them find ways to succeed
            b. Example: “I know you are tired but could you walk 5-10 minutes at a time during break time and your lunch break?”
        4. Support self -efficacy
            a. “Lets talk about what you can do to be more physically active”
    iv. Convey your support no matter what decisions they make about their health
c. Ask the patient questions that lead to a meaningful conversation about her current or future health concerns
    i. Questions to assess if the patient is concerned about her current or future health
        1. What concerns do you have about your health?

2. Tell me about your current lifestyle. How would you describe your eating habits? What type of physical activity do you do and how often? How are you sleeping? How do you handle stress?
3. What are your health goals for this coming year? And how can I support you in meeting your goals?
4. Are you planning to get pregnant in the near future and if so, are you interested in leaning more about how to have a healthier pregnancy?

ii. Questions to assess if the patient is concerned about the future health of her child and pregnacy outcomes
1. What does a healthy pregnancy look like for you?
2. What are your concerns about your pregnnacy?
3. How can I support you during your pregnnacy?
4. Are you interested in learning more about lifestyle changes that can improve your health and the health of your baby?

d. Use current health concerns as a segway to assess interest in lifestyle modification
i. Current co-morbidity such as DM, HTN, autoimmune disease, etc.
1. Are you interested in learning more about how lifestyle change can help you get off your medications or even reverse disease?
2. If they are not interested use the opportunity to educate them about your concerns for the health of their fetus, adverse pregnancy outcomes, and future health of the woman

e. When patients indicate interest in modifying their lifestyle:
i. Be supportive of their goals and desire to change
ii. Work with each woman to help ensure she meets her health goals
iii. Refer to online resources, apps, dietician, and other physicians as needed

Table 2: Evidence-based recommendations for management of obesity in pregnancy

Timing in Pregnancy	Recommendations	References
Initial Visit	• Use BMI at first visit to counsel regarding weight gain (BMI > 30 target weight gain is 11-20 lbs) • Counsel regarding adverse pregnancy outcomes • Screen for GDM during first trimester and again at 24-28 weeks if initial screen is negative • Screen for depression • Screen for OSA-refer for sleep study if positive • Refer for OT/PT or other specialties as needed • Labs-TSH, vitamin D, folate level • Low dose ASA (initiate between 12-28 weeks) • Counsel regarding moderate intensity exercise 150 min/week	6, 9, 17, 25, 47
Ante-partum	• First trimester US to document heart anatomy (4-chamber, 3VTV); use TVUS as needed • 20 week detailed scan (76811)-counsel about limitations of US in BMI > 30 • Consider referral for fetal echocardiogram if heart anatomy is not visualized • Consider 3rd trimester growth scan • Weekly antenatal testing beginning at 36 weeks gestation • Anesthesia consult for women with OSA or BMI > 50 • Deliver after 39 weeks gestation, or earlier for standard medical indications	9, 36-37, 48
Intra-partum	• Anesthesia consult on admission to L&D if BMI > 40 or BMI >35 with co-morbidities • Have fiberoptic equipment available to help with intubation when indicated	9
Operative Delivery	• Skin incision is surgeon preference • Retract panniculus cephalad or caudad • Consider Alexis O self-retaining retractor • Avoid subcutaneous drains • Have inflatable mattress available to facilitate patient transfers	9, 43
Post-partum	• Use SCD's until patient has adequate ambulation • Prophylactic Lovenox, if no contraindications, based on delivery BMI and mode of delivery • Refer for OT/PT to facilitate ambulation • Consider BiPAP while in the hospital for patients with OSA • Encourage patient to breastfeed • Wound check at 1 weeks postop for cesarean delivery • Hormonal contraception is not significantly affected by weight • Women with Bariatric surgery that affect absorption of oral meds (Roux-en-Y or biliopancreatic diversion) are not candidates for OCP • Consider progestin only and LNG-IUD in obese women> 35 years of age • Screening labs 6 weeks postpartum: TSH, Free T4, HgA1C, CBC with diff, CMP, total cholesterol, LDL, HDL, triglycerides, hsCRP, Vitamin D, and folic acid level • Counsel patients on risks of postpartum weight retentions with goal of BMI < 30 prior to her next pregnancy • Refer patient to a lifestyle medicine physician/program	9, 17-20, 26-27, 44

Resources

Food

WIC	800-942-3670

BrighterBites (www.brighterbites.com). Brighter bites delivers free fresh fuit and vegetables to area schools.

Houston Food Bank (www.houstonfoodbank.com)	713-223-3700

Lifestyle Medicine Physicians

Bellaire- Bandana and Munush Chawla MD (Int Med)	713-592-8900
Cypress- Dorothy Serna MD (FP)	281-807-5300
Lufkin- Charles Evans MD (FP)	936-699-5433
Houston-Baxter Montgomery (Cardiologist)	713-599-1144

BCM Sleep Medicine

713-798-3300

Baylor Pulmonology

(BTGH OSA) Minkyung Kwon MD 713-798-2400

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Gastrointestinal

Intrahepatic Cholestasis of Pregnancy (ICP)

September 2024 (Replaces March 2021)
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Editor: Dr. Hayden Latham

This document utilizes gender inclusive language

Summary of recommendations

- Serum bile acid and liver transaminase levels with consideration of liver function analysis (total bilirubin, PT/INR, platelets) should be drawn in patients with suspected intrahepatic cholestasis of pregnancy
- Ursodeoxycholic acid (Ursodiol) should be used as first-line agent pharmacologic treatment of maternal symptoms. Typical regimens include 300mg twice or three times daily or 500mg twice daily.
- Patients with the diagnosis of ICP should being antenatal fetal surveillance at a gestational age when delivery would be performed in response to abnormal testing.
- Patients with a total bile acid level of ≥100 µmol/L should be offered delivery at 36 0/7 weeks given that the risk of stillbirth increases substantially around this gestation.
- Patients with clinical diagnosis of ICP without laboratory confirmation of elevated bile acids should not be delivered before 37 0/7 weeks gestation.

Background

Epidemiology and Etiology

In non-pregnant patients, cholestasis is often a sign of underlying liver disease including biliary tract disease and autoimmune disease. In pregnancy it is most often self-limited and resolves after delivery. The incidence is estimated between 0.2-0.3%.[1-3] It is characterized by pruritus without evidence of rash (though excoriations are often present) and is thought to be a consequence of high circulating estrogens.[1] Pruritus is most pronounced on the palms of hands and soles of feet and more severe at night. Risk factors for ICP include preexisting hepatobiliary disease including hepatitis C, nonalcoholic liver cirrhosis, gallstones, cholecystitis,

and nonalcoholic pancreatitis, as well as history of ICP. Risk of ICP development is associated with multiple gestation, advanced maternal age, and family history suggesting a genetic component.[1,4,5]

Pregnancy Risk

Within pregnancy, ICHP poses the greatest risk to the fetus. Risks include meconium-stained amniotic fluid, respiratory distress syndrome, stillbirth, and preterm birth. The incidence of stillbirth after 37 weeks attributable to ICP is approximately 1.2% (compared to the rate for the entire United States population of 0.1-0.3% at 37 weeks).[6-8] Stillbirth risk is thought to be associated with total bile acid levels with significantly increased risk at bile acid levels ≥40 µmol/L and highest risk for stillbirth in ≥100 µmol/L.[9,10] The pathophysiology of stillbirth in ICP is poorly understood but has been hypothesized to be related to the development of a fetal arrhythmia or vasospasm of the placental chorionic surface vessels induced by high levels of charged bile acids.[11-13] Increased rates of both iatrogenic and spontaneous preterm birth have been reported in cases of ICP. Maternal risk is mainly that of recurrence in a subsequent pregnancy (up to 90%).[14] However, although most cases are self-limited, patients with a history of ICP are also at increased risk for hepatobiliary diseases or chronic hepatitis, and liver fibrosis or cirrhosis. The risk appears to be greatest in the first year after diagnosis of ICP. Therefore, it is important to consider re-evaluation of liver function test results after delivery in patients with persistent pruritus after 4-6 weeks postpartum, or with other signs or symptoms of hepatobiliary disease. If tests remain abnormal, subspecialist referral is recommended.[15,16]

Evaluation

Pertinent History: Severity, aggravating and alleviating factors, onset, medical history, medications (narcotic use), allergies, environmental or allergen exposure, history of intravenous drug use (and other risk facts for HIV and hepatitis), history of ICP.

Physical Exam:

Favors ICP: absence of rash, excoriations.
Does not favor ICP: Presence of rashes, dark urine color, abdominal or right upper quadrant pain, jaundice.

Laboratory Evaluation:

Random total serum bile acid testing should be performed in any patient with suspected ICP. Results are usually obtained within 7 days at both hospitals. Transaminase evaluation is also recommended as well as consideration for evaluation of liver function testing (total bilirubin, coags [PT/INR], and platelet count)

Table 2. Other causes of elevated bile acids

Primary biliary cholangitis
Obstructive bile duct lesion
Primary sclerosing cholangitis (associated with inflammatory bowel disease)
Drug-induced cholestasis (trimethoprim-sulfamethoxazole, phenothiazines, ampicillin)
Liver tumor
Bacterial, fungal, and viral infections (eg, Ebstein-Barr virus and cytomegalovirus)
Hepatic amyloidosis
Lymphoma and solid organ malignancies
Hepatic sarcoidosis
Autoimmune hepatitis
Idiopathic adulthood ductopenia
Total parental nutrition
Viral diseases
Familial intrahepatic cholestasis
Cirrhosis
Sickle cell intrahepatic cholestasis
Hepatic congestion from heart failure
Crohn disease

Society for Maternal-Fetal Medicine. SMFM Consult Series #53: Intrahepatic cholestasis of pregnancy. Am J Obstet Gynecol 2021.

Diagnosis

The diagnosis of ICP is based on pruritic symptoms and supported by the presence of elevated total serum bile acid. It is important to rule out other conditions with similar presentations (see Table 1).[2] A total bile acid level greater than the upper limit of normal in a lab that reports a reference range, or a level >10 µmol/L is diagnostic for ICP.[17,18] Fasting is not required. Elevated

AST/ALT are sometimes seen in the setting of ICP, although this is not necessary for the diagnosis. **Approach to diagnosis and management of ICP are listed in Algorithm 1.**

Bile acid levels can increase during pregnancy and may increase rapidly near term. Given that higher total serum bile acid levels are associated with adverse perinatal outcomes, repeat bile acid measurement is suggested and may guide management. **The BCM OB/Gyn Perinatal Guidelines Committee recommends repeating bile acids if the patient has worsening or refractory symptoms despite usual management.** However, weekly testing is not recommended. Treatment and delivery timing is dictated by the peak total bile acid level.[19-21]

Treatment

The goals of treatment are: 1) reduce the maternal symptoms of pruritus, and 2) reduce the risk of adverse pregnancy outcomes.

Pharmacologic:

Ursodeoxycholic acid (UDCA, or Ursodiol) is the first-line treatment for ICP as it can improve maternal symptoms. However, data regarding improvement in perinatal outcomes are less conclusive.[22-24] Three meta-analyses have summarized the data from randomized trials and have reported benefits in improve maternal symptoms.[22-24] However, data regarding improvement in perinatal outcomes are less conclusive.[22-24]

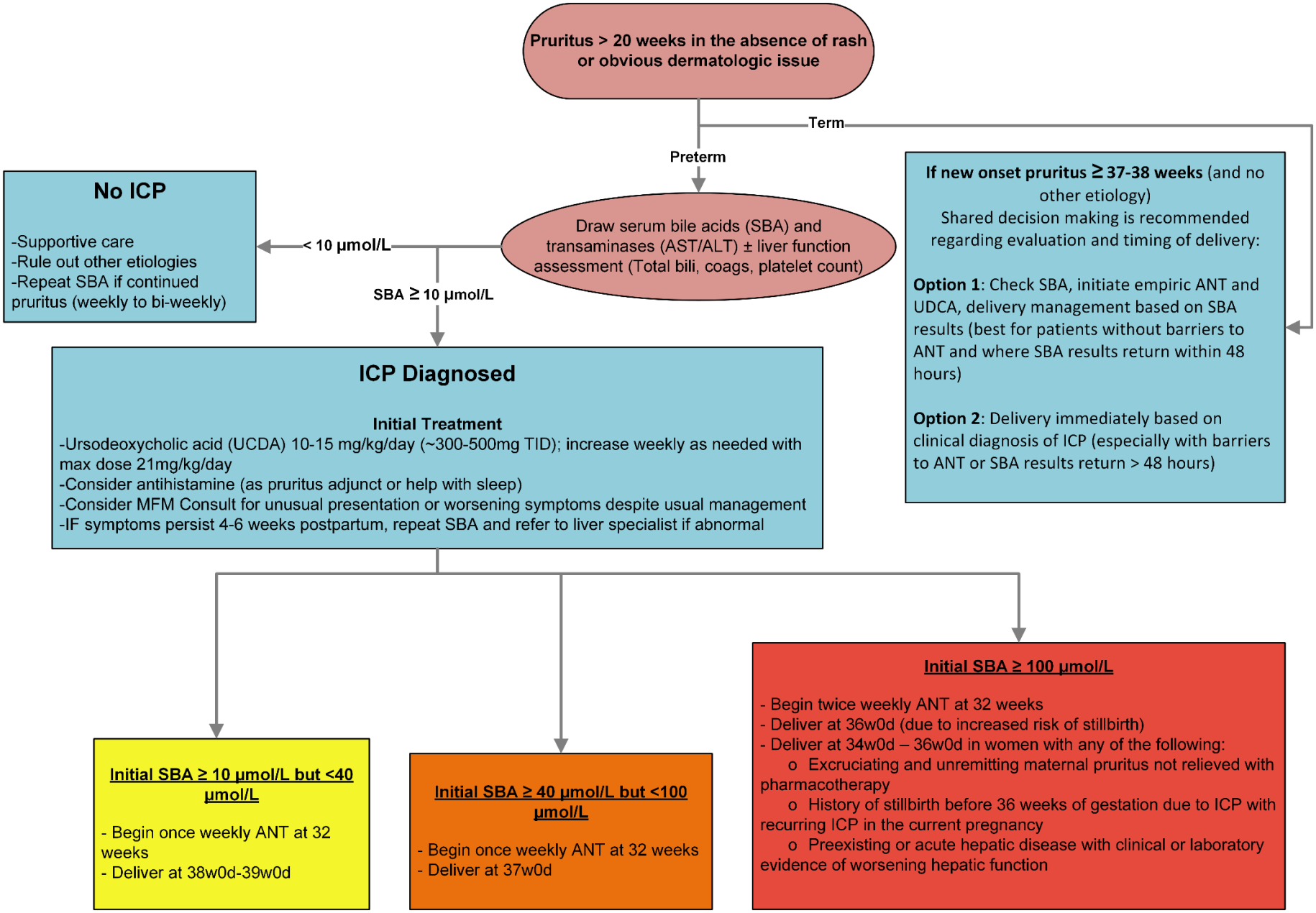
The typical starting dose of Ursodiol is 10-15 mg/kg per day which can be divided into 2 or 3 daily doses. Common regimens are 300mg twice or three times daily or 500mg twice daily. The medication is typically well tolerated although mild cases of nausea and dizziness have been reported in up to 25% of patients. A decrease in pruritus is typically noted within 1-2 weeks. If pruritus is not relieved, Ursodiol can be titrated to a **maximum dose of 21 mg/kg daily**. Biochemical improvement is usually seen within 3-4 weeks. Oral and topical antihistamines and topical antipruritics may be used as adjuncts, although these may have limited benefit.

Antenatal Fetal Surveillance

The efficacy of antepartum fetal testing to prevent stillbirth in the setting of ICP is unknown. Several studies and case reports have reported stillbirths occurring within a few days of a reactive stress test.[25-29] It is theorized that testing is unhelpful because the mechanism of stillbirth is a sudden event, rather than a chronic placental vascular process. However, some meta-analyses support the use of fetal surveillance, potentially due to more intensive monitoring leading to late preterm or early-term delivery.[21-23] Therefore, patients with a diagnosis of ICP should begin antenatal fetal surveillance at a gestational age when delivery would be performed in response to abnormal results, or at the time of diagnosis if this is made later in gestation. **The optimal frequency of testing is listed in the antepartum surveillance perinatal guideline.**

The timing of delivery should be approached using risk-stratification based on specific factors as described in Algorithm 1.

Algorithm 1. Diagnosis and management of ICP



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Psychiatry

Substance Use Disorder in Pregnancy

[October 2025 (Replaces June 2023)]

Authors: Dr. Sarah Detlefs, Dr. Carey Eppes, Dr. Cathy Gannon, Dr. Jennifer McKinney, Dr. Andres Ojeda, Ashley Sperber, Dr. Sonal Zambare
Copy Edits: Dr. Stacy Strehlow

This update includes edits to the MPAT team contact information as well as the Opioid Use Disorder management, breastfeeding recommendations for patients with a valid amphetamine prescription.

Background & Epidemiology

Several state Maternal Morbidity and Mortality Review Committees (MMMRC) have found that mental health, inclusive of substance use and drug overdose, is the leading cause of maternal death.[2] A recent summary review of these state committee findings found 4 common patterns[3]:

1. Obstetric providers are not screening systematically for substance use, misuse, and addiction.
2. Obstetric providers are not well prepared to treat patients with substance use disorder (SUD).
3. Primary attention to patient level factors may place blame on patients for their own deaths.
4. The postpartum period is a critical time for drug-related deaths and health care systems may be missing the warning signs.

Vital statistics data from Texas maternal deaths mirror the findings of other states. In Texas, mental health, inclusive of substance use and drug overdose, is tied with cardiovascular disorders as the leading cause of

maternal death. Most of the drug overdose-related deaths occur between 45 and 365 days after delivery. The postpartum period is recognized as a high-risk period due to returning to pre-pregnancy physiology, mental health changes, child welfare involvement and stressors, relationship and financial stressors that occur during this time.

Studies indicate that pregnant patients with SUD have an increased risk of severe maternal morbidity (SMM) during pregnancy.[4] The etiologies are not specifically known but have been hypothesized to include biologic factors (such as the cardiovascular risks with opioid use disorder [OUD] and stimulant use disorder), infectious diseases, poor nutrition, stigma and socioeconomic factors (i.e., housing instability). Conversely, people who have had a delivery complicated by SMM have an increased risk of developing a SUD in the first year postpartum.[5]

A common bias is that SUD is a choice and not a medical condition. Trauma-informed care has become a hallmark of pregnancy-related care as well as SUD treatment and is critical in understanding the challenges the patients we care for face and how to optimize outcomes during pregnancy. The stigma and bias involved with SUD are important contributors to these patients' outcomes.

This guideline includes recommendations for screening for substance use disorders as well as care of patients with SUD during pregnancy, intrapartum, and postpartum. Additionally, this document discusses neonatal care of babies born to parents with SUD. This is not an exhaustive guideline, but it endeavors to introduce considerations for substance use comprehensive care.

Terminology and Pharmacology of Illicit Substances

In the United States, 25% of pregnant patients have used substances (inclusive of nicotine, alcohol, or illicit drugs) in the previous month and 15% meet criteria for SUD. **Appendix A** displays the intoxication symptoms, withdrawal symptoms, and medications to avoid in hospital (or outpatient) settings based on the substance involved. **Appendix B** displays the pharmacokinetics of commonly encountered substances.

Use of modern terminology is important, as many of these changes were made to reduce the stigma and bias associated with older labels. **Table 1** describes current DSM-5 terminology for substance use, misuse, SUD, and recovery. For a full table of current terminology, please see: https://nida.nih.gov/. Table 2 describes stigmatizing language and appropriate alternatives.

Acronym and Terminology dictionary

We recognize that this perinatal guideline includes specific acronyms and terms that can become confusing. Please refer to this section or contact the MPAT team if there are any questions.

Abbreviation/Acronym	Definition
42 CFR Part 2	Federal regulations that serve to protect patient records created by federally assisted programs for the treatment of substance use disorders.
BUP	Buprenorphine
COWS	Clinical Opiate Withdrawal Scale
DAST	Drug Abuse Screening Test Verbal screening tool used to identify patients at high risk of SUD
FCP	Family CARE Portfolio, previously called Plan of Safe Care.

	CARE stands for *Coordinate. Advocate. Record. Empower.*
MAT	Medication Assisted Therapy
MOM	Maternal Opioid Misuse (MOM) Model Grant funded by Center for Medicare and Medicaid Innovation
MOUD	Medication for Opioid Use Disorder
MPAT	Maternal Perinatal Addiction Treatment
OTP	Opioid Treatment Provider
OUD	Opioid Use Disorder
SDoH	Social Determinants of Health
SMH	Santa Maria Hostel Substance use treatment program in Houston that is described in detail on Page 13
SUD	Substance Use Disorder
UDS	Urine Drug Screen
WHO	Women Helping Ourselves 180-day residential substance use treatment program at SMH that is an alternative to incarceration for patients with a history of SUD
WWC	Women With Children Specialized female and single women intensive and supportive residential treatment program at SMH

Table 1. Appropriate Terminology of Substance Use and Addiction

Term	Definition
Substance Use	Sporadic use of psychoactive substances
Substance Misuse	Excessive use of psychoactive substances, which may lead to physical, social, or emotional harm
Addiction	A treatable, chronic medical disease involving complex interactions among brain circuits, genetics, the environment, and an individual's life experiences. People with addiction use substances or engage in behaviors that become compulsive and often continue despite harmful consequences. Prevention efforts and treatment approaches for addiction are generally as successful as those for other chronic diseases
Substance Use Disorder	DSM-5 uses the same overarching criteria for all substances to diagnose mild (2-3 symptoms), moderate (4-5 symptoms), and severe (6 or more) Impaired control • Use in larger amounts or longer periods than intended • Persistent desire or unsuccessful efforts to decrease or stop use • Craving or strong desire to use • Excessive time spent obtaining or using substances or recovering from the effect Social impairment • Failure to fulfill major role obligations at work, school, home • Persistent or recurrent social or interpersonal problems exacerbated by use • Reduction or cessation of important social, occupational or recreational activities because of use Risky Use • Use in psychically hazardous situations • Continued use despite knowledge of persistent physical or psychological problems arising from use Pharmacologic properties • Tolerance • Withdrawal symptoms • Note: solely pharmacologic symptoms are not sufficient to meet criteria for SUD
Recovery	A process of changing through which individuals improve their health and wellness, live a self-directed life and strive to reach their full potential
Trauma-informed care	Practices that promote a culture of safety, empowerment, and healing by recognizing how common trauma is, and understanding that every patient may have experienced serious trauma.

Table 2. Stigmatizing and Preferred Language[6]

Stigmatizing Language	Preferred Language
Substance abuse	Substance use or misuse, substance use disorder
Abuser, addict, alcoholic	Person with a substance use disorder
Smoker	Person with cannabis or tobacco or nicotine use disorder
Addicted baby	Neonate with neonatal abstinence syndrome or with in utero exposure to [named substance]
Clean or sober	Abstinent, in remission, toxicology "negative" for [substance]
Dirty	Using [substance], toxicology "positive" for [substance]
Drug of choice, habit	Substance of use
Getting or being high	Intoxicated, under the influence of [substance]
Shooting up	Intravenous drug use, injection drug use
Replacement or substitution treatment for opioid use disorder, opioid replacement, medication-assisted treatment	Medications for opioid use disorder, medications for addiction treatment
Relapse	Return to use, symptom recurrence

Screening for Substance Use

Universal verbal screening

ACOG, SMFM and AAP recommend utilizing a validated screening tool for universal substance use screening, performing a brief intervention, and sending a referral to treatment for all patients at risk for complications related to substance use. This process is known as Screening, Brief Intervention, and Referral to Treatment or "SBIRT".

The screening tool utilized at Harris Health for all pregnant and postpartum women is the Drug Addiction Screening Tool (DAST). DAST should be performed at obstetric intake for all patients. If a patient has a score >6, they are at risk for complications for substance use and the provider should do a brief intervention inclusive of motivational interviewing and assessment of the patient's readiness for change. These tools are built into the Harris Health Epic as a best practice alert "BPA" whenever a patient scores >6 on the DAST.

Urine toxicology screening: NOT recommended.

Risk-based screening is highly subject to bias and often predominantly tests Black or Hispanic patients and those with reduced access to prenatal care. Universal screening with urine drug screen (UDS) has the risk of false positives, which occur in 5-10% of samples, and can result in Child Protective Services referrals based on hospital, state or federal requirements. Finally, many hospital urine drug screens do not test for methadone, buprenorphine, or fentanyl so may miss a subset of patients with SUD if used as a primary screening tool. **These tests must be ordered separately.**

Because of the high risk of false positives, patients who test positive and do not report a history of substance use should have "confirmatory testing" via mass spectrometry. Examples of medications that cause false positive results on UDS include:

1. Benzodiazepines: efavirenz, sertraline
2. THC: dronabinol, efavirenz, PPI, NSAIDs, hemp seed oil
3. Amphetamines: cold medications, Wellbutrin, TCA antidepressants
4. Opioids: quinolone antibiotics

Of note, while not appropriate for screening, UDS can and should be used in the routine management of patients with known SUDs.

Individuals who screen positive for SUD

Patients at Harris Health, Pavilion for Women (PFW) and community sites can all be offered referral to treatment in the MPAT clinic at Ben Taub. The patient should be given an appointment and a "warm handoff" provided to the place of referral.

For patients who report active treatment for OUD, such as currently taking suboxone or methadone, they should continue this medication and be referred for MPAT. If there is any evidence of withdrawal or desire to initiate MOUD, the patient should be sent to the ER or OB Intake (triage) at Ben Taub.

Treatment of co-occurring mental health conditions

There is significant burden of mental health conditions in patients with SUDs, and treatment of mental health conditions is associated with improved SUD outcomes for these patients.[7] Screening for mental health conditions should be performed at obstetric intake, in the third trimester and after delivery. Patients should be offered medical management and referral to therapy, psychology and psychiatry services. PeriPAN is an excellent resource that can help with triage and initial treatment while awaiting specialty services. For urgent questions, please **call PeriPAN directly at 1-888-901-2726,** Monday through Friday from 0800-1700.

Ben Taub Perinatal Substance Use Program Contact Information

For patients in the outpatient setting or at PFW, please email maternalSUD@harrishealth.org for patient referrals. For patients in the inpatient setting at Ben Taub, please use the BT Epic Chat group "BT MOM". This chat message will be sent to the MPAT program manager, nurse navigator, and community health worker.

You can also give patients the Ben Taub MPAT Program Cell Phone: 281-224-7926 so they can call or text the MPAT team. Staff will respond during business hours.

MPAT Clinic occurs on Wednesday Mornings

Primary MPAT Providers:

Dr. Carey Eppes
Dr. Sarah Detlefs

Opioid Use Disorder (OUD)[8]

Opioids are natural or synthetic substances that act on one of three main opioid receptors (mu, kappa, delta). Opioids have analgesic and CNS depressant effects, and can be used intranasal, intravenous, subcutaneous, intramuscular. Opioid Use Disorder (DSM-5) is a problematic pattern of opioid use leading to clinically significant impairment or distress, as manifested by at least two criteria seen in **Appendix C** in a 12-month period. Recently, there has been an increase in the use of synthetic opioids, including fentanyl, which have quick onset to action and high potential for overdose. Medications for opioid use disorder (MOUD) include methadone, buprenorphine, and naltrexone.

Patients with OUD are at risk for several complications including:

1. Localized infections at injection sites
2. Systemic infections including hepatitis C virus (HCV).
3. Bowel changes
4. Hyperalgesia
5. Liver fibrosis
6. Leukoencephalopathy
7. Amnestic syndrome

Opioid Withdrawal and Treatment[9]

Patients with opioid withdrawal typically present with symptoms such as agitation, rhinorrhea, muscle aches, sweating, yawning, abdominal cramping, diarrhea, nausea, vomiting and dilated pupils. Treatment options include supported withdrawal with either detoxification or transition to medication-assisted therapy (MAT). Obstetric and non-obstetric literature supports transitioning to MAT as a harm reduction approach with a lower chance of relapse.[8] **Figure 1** shows the recommended protocol for supportive withdrawal from opioids, especially while awaiting induction with suboxone. Please note, when searching the Texas PMP, methadone will not show up in the registry because it is prescribed only by licensed treatment facilities.

Initial Evaluation

The recommended evaluation for all pregnant and postpartum patients presenting with opioid withdrawal upon admission is listed in **Table 3**.

Table 33. *Admission Evaluation for Patients Presenting with Opioid Withdrawal*

- ☐ Perform DAST or other clinical screening if not done previously, utilizing a motivational interviewing approach to offering treatment.
  - Assess the patient's readiness for change
- ☐ Labs
  - If not done previously, order prenatal labs including HCV, HIV, GC/CT, HbsAg, and syphilis testing.
  - CBC, CMP[1], UDS[2] with consent.
- ☐ Additional Tests
  - EKG[3]
  - Daily NST during withdrawal for viable pregnancies
- ☐ Treat any identified sexually transmitted infections
- ☐ Evaluate the Texas PMP for last prescriptions for opioids and any previous MAT use
- ☐ If they were previously on methadone, call the methadone clinic and verify the last dose time and amount
- ☐ Order Clinical Opiate Withdrawal Scale (COWS) assessment q4-6 hours[4]
- ☐ Treat symptoms of opioid withdrawal with the medications in Clinical Treatment of Opioid Withdrawal Symptoms.

[1]CMP to evaluate for renal or hepatic disease, in which the dosing should be adjusted.
[2]UDS to determine timing of last use and concurrent substance use that may change induction timing (example: Benzo)
[3]EKG to evaluate for prolonged QT prior to methadone initiation.
[4] The COWS score is an 11-item clinician administered scale assessing opioid withdrawal and can be found in appendix F.[2]

Clinical treatment of Opioid Withdrawal symptoms

Mainstay of Therapy
Administer Clonidine 0.1-0.3 q 4-6 hours for any withdrawal symptoms (Give only 0.05 – 0.025 mg *if* BP < 100/60 and/or HR < 60)

Adjunctive Therapies (Administer Based on Symptoms)

Anxiety	Diphenhydramine 50mg PO q4-6h PRN Hydroxyzine 20-100mg PO q6-8h PRN
Abdominal Cramping	Dicyclomine 10-20mg q6-8H PRN
Diarrhea	Loperamide 4mg x1 then 2mg after each loose stool (max 16 mg daily)
Nausea and Vomiting	Ondansetron ODT or IV q6-8h PRN Promethazine 25mg PO or IM (only use as a second line due to addiction properties)
Insomnia	Trazodone 50mg qHS PRN (may repeat once after 2 hours if persistent insomnia)
Muscle Aches/Joint Pain	Rehydration Warm shower Stretching Acetaminophen 650mg q4-6h PRN

Smart phrase for Ben Taub Epic: .OUDwithdrawal

Figure 1. *Clinical Opioid Withdrawal Scale (COWS)*[10]

Wesson & Ling, J Psychoactive Drugs. 2003 Apr-Jun;35(2):253-9.

COWS Clinical Opiate Withdrawal Scale

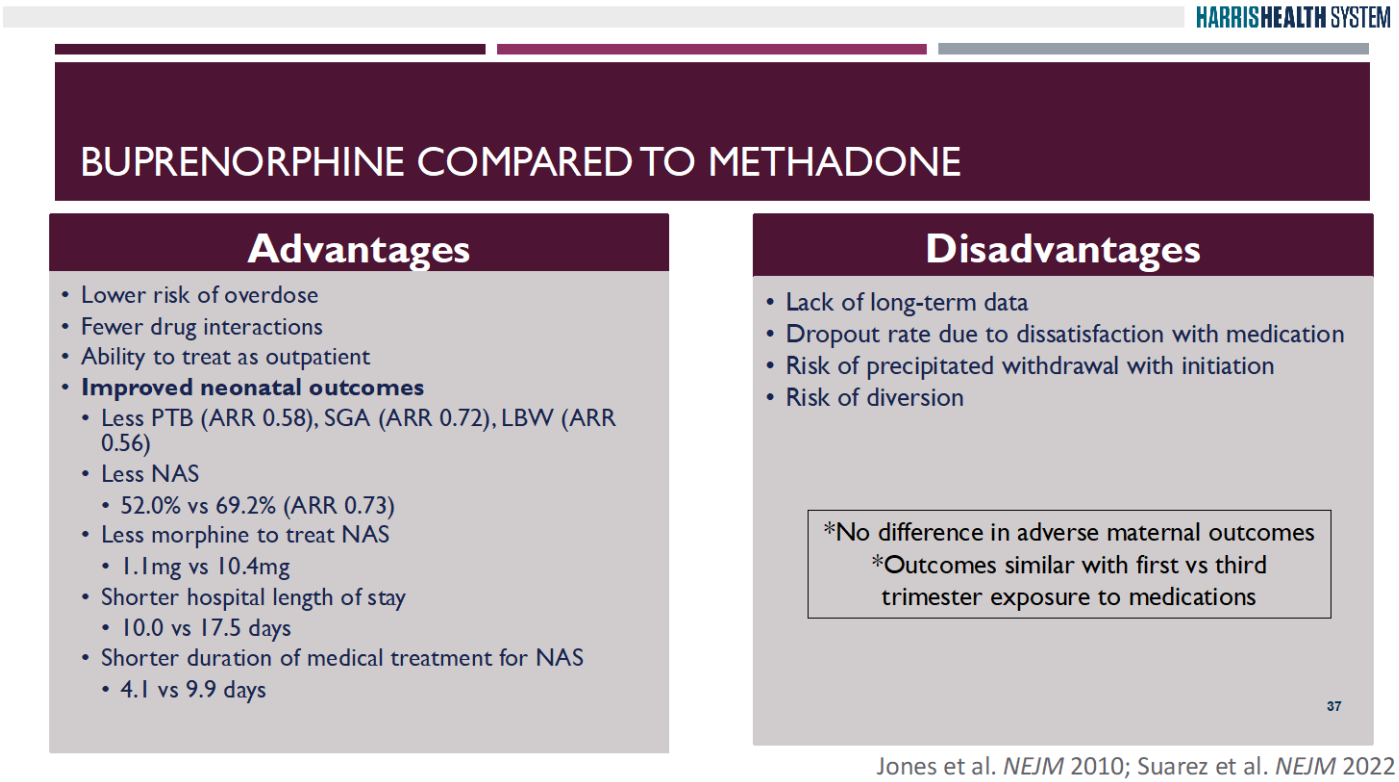
Resting Pulse Rate: _____beats/minute *Measured after patient is sitting or lying for one minute* 0 Pulse rate 80 or below 1 Pulse rate 81-100 2 Pulse rate 101-120 4 Pulse rate greater than 120	GI Upset: *over last 1/2 hour* 0 No GI symptoms 1 Stomach cramps 2 Nausea or loose stool 3 Vomiting or diarrhea 5 Multiple episodes of diarrhea or vomiting
Sweating: *over past 1/2 hour not accounted for by room temperature or patient activity.* 0 No report of chills or flushing 1 Subjective report of chills or flushing 2 Flushed or observable moistness on face 3 Beads of sweat on brow or face 4 Sweat streaming off face	Tremor *observation of outstretched hands* 0 No tremor 1 Tremor can be felt, but not observed 2 Slight tremor observable 4 Gross tremor or muscle twitching
Restlessness *Observation during assessment* 0 Able to sit still 1 Reports difficulty sifting still, but is able to do so 3 Frequent shifting or extraneous movements of legs/arms 5 Unable to sit still for more than a few seconds	Yawning *Observation during assessment* 0 No yawning 1 Yawning once or twice during assessment 2 Yawning three or more times during assessment 4 Yawning several times/minute
Pupil size 0 Pupils pinned or normal size for room light 1 Pupils possibly larger than normal for room light 2 Pupils moderately dilated 5 Pupils so dilated that only the rim of the iris is visible	Anxiety or irritability 0 None 1 Patient reports increasing irritability or anxiousness 2 Patient obviously irritable anxious 4 Patient so irritable or anxious that participation in the assessment is difficult
Bone or Joint aches *If patient was having pain previously, only the additional component attributed to opiates withdrawal is scored* 0 Not present 1 Mild diffuse discomfort 2 Patient reports severe diffuse aching of joints/ muscles 4 Patient is rubbing joints or muscles and is unable to sit still because of discomfort	Gooseflesh skin 0 Skin is smooth 3 Piloerrection of skin can be felt or hairs standing up on arms 5 Prominent piloerrection
Runny nose or tearing *Not accounted for by cold symptoms or allergies* 0 Not present 1 Nasal stuffiness or unusually moist eyes 2 Nose running or tearing 4 Nose constantly running or tears streaming down cheeks	Total Score _____ The total score is the sum of all 11 items Initials of person completing Assessment:_____

Score: 5-12 mild; 13-24 moderate; 25-36 moderately severe; more than 36 = severe withdrawal

Medications for Opioid Use Disorder

There are two primary agents used as MOUD, which are described in detail below. The agent chosen for MOUD should be individualized (**Table 4**).

***Table 4**. Comparison of MOUD agents*



Jones et al. *NEJM* 2010; Suarez et al. *NEJM* 2022

Methadone

Methadone is a full mu opioid receptor agonist used to treat OUD. Methadone is a unique opioid receptor agonist as it dulls the euphoria from illicit opiate use and reduces or eliminates craving for opiates. Methadone treatment is strictly regulated and can only be administered by licensed treatment facilities. These facilities typically have strict criteria for entry into a methadone treatment program and require daily (early morning) visits to outpatient treatment centers. **Methadone treatment can be started immediately (regardless of recent opioid use).** For patients already taking methadone, all providers can continue the medication during admission and verification of the patient's dose should be performed by calling the treatment facility. **This can be challenging as they often close before noon**.

The typical effective dose is 60-80 mg per day. However, pregnancy-related increases in circulating blood volume and glomerular filtration rate (GFR) often mean that increased dose and/or or split (BID) dosing are needed, particularly in the third trimester.

It is important to note that for patients in the Harris County Jail system**, methadone is the only available MOUD.** Patients transitioning to this form of MOUD will need to initiate methadone therapy inpatient and then connect with the Texas Clinic for ongoing dosing. An intake should be scheduled for ongoing dosing *PRIOR* to returning to jail.

Methadone Induction

Methadone induction should be done in conjunction with a substance use specialist. The Ben Taub Protocol for methadone induction is explained in **Table 5**.

Table 5. Protocol for Methadone Induction

- ☐ Ensure QTc is < 450 prior to starting methadone[1]
- ☐ Check UDS and Fentanyl urine screen[2]
- ☐ Induction:
  - Start with 30-40mg methadone as a single dose.[3]
  - Repeat vital signs in 1-2 hours after first dose.
  - Repeat COWS scoring q4 hours. If the score is consistently >5, add an additional 10mg methadone on day 2.
  - If the patient has emesis:
    - <15 min from methadone dose: replace with 50% dose.
    - 15-30 min from methadone dose: replace 25% dose.
    - >30 min from methadone dose: do not replace dose.

[1]Caution with QTc 450-500
[2]Do not initiate methadone while a patient's UDS remains positive for benzodiazepines due to the risk of overdose.
[3]For patients already receiving methadone but with unknown dosing, please initiate 30mg daily and follow this same protocol (EKG, UDS, etc). Add 10mg if COWS > 10 on the same day.

Buprenorphine (Suboxone, Subutex)

Buprenorphine (BUP) is a partial agonist at mu receptor. Formulations include Suboxone (buprenorphine + naloxone) and Subutex (buprenorphine). It is available as an outpatient prescription (no daily clinic visits needed) and comes in sublingual films, tablets, patches or SQ injection (Sublocade). There are a few instances where buprenorphine may not be as effective as methadone: for patients requiring treatment of acute or chronic pain and for patients with very high opiate tolerance (due to ceiling effect of partial agonist pharmacology).

Administration of buprenorphine to patients with recent opioid use can precipitate withdrawal. **Patients must be in mild/moderate withdrawal prior to initiation. This correlates with COWS scores ≥12, which is typically 6-12 hours after heroin use and 24-48 hours after methadone use. It is important to treat withdrawal symptoms using adjunctive non-opioid therapies while waiting for COWS score to rise and appropriate BUP initiation.**

Buprenorphine Induction

The Ben Taub protocol for Buprenorphine induction is described in **Table 6.** This should be performed in conjunction with a provider who is certified to prescribe buprenorphine agents.

Table 6. Protocol for Buprenorphine Induction

1. Initial dose: 2-4mg BUP films
2. Repeat vital signs q60-90 min and COWS q4 hours
3. Give an additional 2-4mg if needed (maximum daily dose is 24 mg) if the next COWS score is elevated

Recommendations for discharge and follow up following MOUD induction

After admission and induction of MOUD, all patients should be offered ongoing substance use treatment. Outcomes are improved for patients that engage in treatment activities in addition to MOUD therapy. Resources such as Santa Maria Hostel provide inpatient and outpatient programs. The Ben Taub MPAT program has a relationship with Santa Maria, and patients should be directly transferred to Santa Maria whenever possible. The MPAT nursing team or the inpatient social work team can coordinate referrals. A discharge checklist is described in **Table 7**.

Santa Maria Hostel (SMH)

One of Texas' largest multi-site residential and outpatient substance use disorder treatment centers for women, and one of a very few to offer a full continuum of services for women who are pregnant or parenting.

SANTA MARIA
SUCCESS THROUGH RECOVERY

2605 Parker Road
Houston, TX 77093
tel **713.691.0900**
fx **713.691.0910**

OUR MISSION

The mission of Santa Maria Hostel is to empower women and their families to lead healthy, successful, productive and self-fulfilling lives.

***Table 7**. Checklist for discharge following MOUD induction*

- ☐ Prescribe Narcan regardless of substance used[1]
  - ☐ Perform education on Narcan use
- ☐ Ensure they have pharmacy or methadone clinic access (**do not** discharge those on methadone on a weekend without ensuring the clinic will see them the next day)
  - ☐ Nursing staff will need to provide patient with printed documentation of their inpatient administration of methadone doses because this will be requested when they present to their methadone clinic following discharge
- ☐ Schedule follow up in MPAT within 1 week of discharge
- ☐ If on buprenorphine: follow up with Dr. Ojeda in 1 week
- ☐ Offer Santa Maria Hostel services (and give warm handoff via social work or a direct call)
- ☐ Ensure the patient has transportation to clinic visits prior to discharge

[1]An increasing number of substances are "laced" or cut with Fentanyl resulting in overdose from opioids.

Substance Use-Focused Prenatal Care

Pregnancy is an opportune time to address SUD and provide adequate therapy. This requires a multidisciplinary approach that includes utilizing trauma informed care methodology and providing addiction medicine, psychiatry, psychology, obstetric, care coordination, and social work support. Prenatal care for this patient population should include enhancements to prenatal visits, initiation of the Family CARE Portfolio, and consultations with anesthesiology and neonatology.

Prenatal Visits

The MPAT clinic is a specialized, grant-funded clinic that treats patients with a history of current or prior SUD. **Table** 8 describes the prenatal visit checklist to specifically address substance use.

Family CARE Portfolio (FCP)

The FCP, previously termed The Plan of Safe Care (POSC), is a federally required document for all states. This should include information regarding the pregnant patient's recovery journey, support system, and mental health and substance use treatment plan to facilitate hand-off between social work and CPS teams. As there is no federal generic tool used as the FCP, each state is expected to create their own. Beginning in late 2019, a multidisciplinary team in Houston including Santa Maria Hostel, the Harris County drug and family court, Department of Family and Protective Services (DFPS, CPS) and MPAT team at Ben Taub collaborated to develop the current FCP.

The FCP used at Ben Taub can be found in **Appendix D**. The document includes instructions on which individual should fill out each section (patient vs OB/GYN vs Addiction medicine, etc).

Anesthesia Consultation

All patients with SUD should be offered a pre-delivery anesthesia consult. The goal of this consult is primarily creating a pain management plan that includes safe and effective analgesia (and anesthesia if needed) and minimizing opioid use.

The following should be reviewed, using a trauma-informed care methodology:

- Planning for admission early anesthesia consultation and documentation.
- Non-judgmental review and assessment of the patient's concerns, previous history and goals.
- Develop of individualized peri-delivery analgesia and anesthesia plans.
- Create contingency planning.
- Coordinate expectations of the patient, family and the care teams.

Anesthesia labor considerations are discussed below.

Neonatology Consultation

Neonatology consultation is recommended in the third trimester to discuss expectations for newborn care after delivery. This includes discussing neonatal withdrawal symptoms and treatment. The model recommended for neonatal support is the Eat Sleep Console program and is detailed in the neonatal section below.

In the event that the parent is discharged prior to the infant, they are potentially eligible to stay in the "Care-by Parent" suite. This is a location where parents can stay in the NICU in an apartment-like setting after discharge and continue to care for their infant while the infant is admitted for observation for Neonatal Abstinence Syndrome (NAS), sometimes called Neonatal Opioid Withdrawal Syndrome (NOWS).

It is important to determine whether the patient is a candidate for the Care-by Parent suite in the third trimester. Candidacy is based on engagement in care, incidence of relapses during pregnancy, and UDS screens, as well as baby medical needs. This should be documented in the care coordination note.

Social Work Consultation

Social work should be involved in care of patients with SUD throughout their prenatal care. This includes evaluating specific social determinants of health, provide psychosocial support, and assisting with access to care.

Table 8. *Prenatal Visit Checklist in MPAT Clinic*

First Visit:

- ☐ Introduce the multidisciplinary care team and treatment model
- ☐ Offer peer support via Santa Maria Peer and Parenting coaches
- ☐ Prescribe Narcan
- ☐ Introduce the Family CARE Portfolio (see below)
- ☐ Social work assessment
    - Screen for social determinants of health (SDoH) needs (utilizing the accountable care communities tool, found in epic flowsheets under ACH SDOH)
    - Assess for intimate partner violence or history of trafficking
- ☐ Head to toe skin exam (evaluation for skin infections, especially at injection sites)
- ☐ Screen for STIs
- ☐ Evaluate for history of IV or subcutaneous use and perform full skin examination
- ☐ Patient Activation Measure Screening (PAM) if in MOM model
- ☐ CFR 42 consent form completion (this allows release of information between everyone involved in the patient's care)
- ☐ DAST screening if not done previously
- ☐ EDPS screening
- ☐ Create care coordination note

Every visit:

- ☐ UDS is recommended to document the recovery journey
- ☐ Update care coordination note
- ☐ Update Family CARE Portfolio/POSC
- ☐ Provide coordinated care with social work and SMH as needed to address individual patient concerns and/or needs

Third trimester:

- ☐ Scan Family CARE Portfolio/POSC into epic chart at 36 weeks
- ☐ Confirm methadone dose from treatment facility and put in Epic problem list
- ☐ Anesthesia consultation
- ☐ Neonatology consultation
- ☐ For patients who qualify for the "Care-by Parent" suite (see below)
    - Document in care coordination note that patient is cleared / permitted to stay in suite (consider how recent last substance use, if there are stipulations for those justice-involved / WHO clients, etc.)
    - Request "take home doses" for patients who will be discharged to the Care-by Parent Suite
    - Ensure adequate Buprenorphine doses with Dr. Ojeda for Care by Parent Suite

Intrapartum Management

There are several recommendations for management of patients with SUD on labor and delivery:

1. **UDS/Fentanyl screen** with every admission: a negative UDS will help with their recovery documentation.
2. Patients on **MOUD** (Buprenorphine or Methadone) should continue the same doses while admitted. All providers can continue these medications.
3. Patients with SUD may have **pain management** challenges during labor, which is discussed in detail below.

Pain management

During labor, the agonist-antagonist drugs such as nalbuphine (Nubain), butorphanol (Stadol), pentazocine and naloxone (except when used to treat opioid overdose) should be avoided for patients on MOUD because they precipitate withdrawal. Higher than usual opioid doses may be needed as μ receptors are blocked and patients often have opioid-induced hyperalgesia. Other considerations are listed in **Table** 9. As described above, all patients with SUD should be offered a pre-delivery anesthesia consultation.

During labor, epidural and spinal anesthesia can be safely performed. For intraoperative anesthesia, neuraxial analgesia is the preferred method, particularly with use of preservative free Morphine (duramorph).

Table 9. *Anesthesia considerations during labor for patients with SUD*

Challenge	Recommendation
Acute opioid use/ overdose	Reduced requirements of analgesics/sedatives Watch for impaired airway protection and respiratory depression
Long term opioid use	Increased requirements of anesthetic agents due to tolerance and hyperalgesia
Medication interactions	Avoid synergistic drugs
Difficult IV access	Central/midline access may be needed
Cellulitis/abscess on back	Contraindication to neuraxial anesthesia
MOUD	**Continue MOUD at prior prescribed doses**, avoid opioid antagonists
Co-occurring conditions	Ensure all other medical conditions are optimized (pre-delivery consultation is helpful)

Postpartum Care

Post-Vaginal Delivery pain control

Post- SVD considerations to optimize pain control and minimize opioid use include:

1. Use a multi-modal approach including Acetaminophen and non-steroidal anti-inflammatory agents (ibuprofen).
2. Routine perineal care including ice packs, cooling spray, and tucks pads.
3. Do not order routine opioids, but these may be necessary. The patient should be evaluated if pain is not managed by the above therapies.
    a. If opioids are required, order single agents (i.e., oxycodone versus narcotic/acetaminophen combinations) at the lowest effective dose for the shortest duration of time.

Post-Cesarean delivery pain control

Postoperative considerations to optimize pain control and minimize opioid use include:

1. Use of a multi-modal approach including alternating Acetaminophen with non-steroidal anti-inflammatory agents (primarily Ketorolac followed by ibuprofen); then adding opioids if necessary.
2. Utilization of a PCEA for at least 24 hours after delivery.
3. Local anesthetic infiltration or patches.
4. Continuous wound infiltration of local anesthetics.
5. Truncal blocks.
6. If opioids are required, order single agents (i.e., oxycodone versus narcotic/acetaminophen combinations) at the lowest effective dose for the shortest duration of time.
    a. **Importantly, the MOUD alone should not be considered treatment for labor or acute post-operative pain**.
    b. Evidence has **not** shown that short-term peri-operative use of opioids will lead to relapse of opioid use disorder.

Inpatient considerations

Patients on MOUD or with active substance use should be managed on the antepartum service postpartum for care coordination. Postpartum management for other patients with SUD or history of SUD should be individualized based on clinical situation. The infants will room-in with mom unless otherwise indicated by MPAT care coordination or NICU team. If the parent is ready for discharge prior to infant's discharge related to MOUD or opioid exposure, they are potentially eligible for the "Care-by Parent Suite" as described above.

Preparing for discharge

1. Discharge home: routine medication and discharge orders, ensure has prescription for BUP (usually 1 week until next appt with Addiction Medicine), ideally delivered via meds to beds before discharge.
2. Discharge to SMH: coordinate with SMH
3. Discharge to care by parent suite: ensure they have enough BUP or methadone on hand for the care by parent suite, as they typically do not leave for medications once discharged to the suite. Patients seen in the MPAT clinic and determined to be a good candidate for the suite will have this note in their care coordination section of the EMR. Patients who are members of the Santa Maria WHO program (jail diversion) will need approval for the suite, which is established ahead of delivery.
    a. If the parent does not have enough take home doses and needs to return to the methadone clinic, the neonatology team should be alerted and the nurses will care for baby in the Level 2 nursery until the parent returns.

4. Discharge to jail: For patients on methadone, do not discharge on a Saturday (they cannot get their methadone dose on a Sunday typically). Please ensure they are established with the Texas clinic (methadone facility) prior to transition to jail.
5. For patients on methadone, it is critical to ensure continuity of their dosing upon discharge to avoid withdrawal and readmission. These patients should not be discharged over a weekend without confirming the methadone clinic is open. Nursing staff will need to provide patient with printed documentation of their inpatient administration of methadone doses because this will be requested when they present to their OTP for dosing after discharge. Patients on Buprenorphine should have meds to beds delivery medications before discharge.

Postpartum Follow Up

Patients should have scheduled follow up prior to discharge. This includes routine postpartum obstetric care as well as substance use care. Through the MPAT grant, patients qualify for substance use care for up to 1 year postpartum.

All MPAT patients should have the following appointments:

- ☐ 2 week follow up in MPAT with OB and Dr. Ojeda.
- ☐ 4-6 week follow up in MPAT with OB and Dr. Ojeda.
- ☐ Coordination with Santa Maria for discharge for those leaving directly to their residential treatment program.
- ☐ Continue with Dr. Ojeda through 12 months postpartum (or longer).

If the discharge team has difficulty scheduling these follow-up appointments, they should contact the MPAT team via Epic Chat at BT MOM.

CPS referral requirements:

Many patients are fearful of CPS referrals which can affect their engagement in prenatal care. Caution should be used in CPS referrals. The literature supports the ongoing perpetuation of racial inequalities, with black and American Native children removed at 2-10 times the rate of white children in the setting of substance use. The literature also indicates that maternal mortality is highest in those who have had their parental rights removed in this setting.

A recent ACOG Expert publication states that the role of ob-gyns in the child welfare system process should be twofold: To provide support for pregnant and postpartum individuals with child welfare system involvement, and to advocate for public policy reforms that **eliminate punitive approaches to substance use in pregnancy and improve access to resources individuals need to meet their parenting and life goals.**[11]

The Pavilion for Women and Harris Health System do not have a set policy regarding reporting to CPS for maternal SUD. There are several federal and state requirements with which treatment teams should be familiar:

1. Child Abuse Protection and Treatment Act (CAPTA): Sets forth a federal definition of child abuse and neglect.
   https://www.congress.gov/bill/93rd-congress/senate-bill/1191
   https://www.acf.hhs.gov/sites/default/files/documents/cb/capta.pdf

2. Comprehensive Addiction and Recovery Act (CARA): Requires facilities to produce information concerning best practices on developing plans for the safe care of infants born with substance use disorders or showing withdrawal symptoms. This section also requires that a State plan addresses the health and SUD treatment needs of the infant, among others.

3. Texas Requirements as specific in the following link:
   http://benchbook.texaschildrenscommission.gov/pdf/Bench%20Book%202021%20Substance%20Use%20Disorders.pdf

Neonatal Management of Substance-Exposed Infants

It is important to recognize that newborns are not born "addicted". However, withdrawal symptoms are anticipated after prolonged exposure to certain medications or illicit substances. **Table 10** lists the agents associated with withdrawal symptoms.

***Table 10**. Substances associated with withdrawal symptoms*

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OTHER SUBSTANCES MAY CAUSE WITHDRAWAL SYMPTOMS

- Tobacco ~ 20% newborns exposed
- Selective serotonin reuptake inhibitors (SSRIs), SNRIs and Gabapentin- 5 to 13%
  - 30% increased risk of neonatal withdrawal symptoms when used with opioids
- Alcohol ~ 15% newborns exposed; 3% chronic exposure
- Marijuana ~ 7% newborns exposed in states with legal use; 3% chronic exposure
- Cocaine
- Methamphetamines (Meth) and metabolites (MDMA - ecstasy; Speed)
- Sedatives – Benzodiazepines and barbiturates
- Hallucinogens - PCP

A few factors increase the risk of withdrawal, including co-exposure to psychotropic medication(s) close to delivery such as benzodiazepines, SSRI/SNRIs and gabapentin. Use of a single psychotropic medication increases the risk of significant neonatal withdrawal symptoms by 30%, whereas two or more psychotropic co-agents doubles this risk.

For MOUD, the incidence and duration of NAS does NOT differ based on the maternal methadone dose. Lower doses are not associated with milder or shorter neonatal symptoms although some data support lower rates of NAS with split dosing regimens.

Drug Screening

Infant urine drug screening results reflects drug exposure within a few days prior to delivery, whereas meconium drug screens reflect exposure after 20 weeks of gestation. False negative results can occur with delayed sampling, urine or stool mixed with meconium. Notably, similar to adult UDS screening, most of these screening tests will not pick up fentanyl, other synthetic opioids, tobacco, alcohol, or SSRI/SNRIs.

Recent studies indicate that even intrathecal narcotics administered during labor with regional anesthesia lead to positive maternal and infant drug screens, therefore the hospital administered medications need to be taken into account when positive drug screen results occur. Specifically, 29% of mothers who received fentanyl in regional anesthesia had infants that testing positive on UDS.[10]

Withdrawal symptoms

Infants born to parents with SUD will be monitored for withdrawal symptoms (**Table 11**). The time to onset of withdrawal symptoms will depend on the primary substance used (**Table 12**).

***Table 11**. Symptoms of neonatal abstinence syndrome (NAS)*

Central Nervous System	Gastrointestinal	Autonomic Nervous System
Tremors	Loose stools	Sweating
Irritability	Poor feeding	Fever
High-pitched continuous cry	Emesis	Frequent sneezing
Decreased sleep	Poor weight gain	Frequent yawning
Increased muscle tone		Increased respiratory rate
Hyperactive Moro reflex		Nasal stuffiness, flaring
Myoclonic jerks +/- seizures		Mottling

***Table 12**. Timing of withdrawal symptoms based on primary substance use*

Substance	Onset	Duration
Tobacco	Within 24 hours	5 – 10 days
Heroin	24 – 48 hours	8 – 10 days
Alcohol	24 – 48 hours	
SSRIs	24 – 36 hours	2 – 6 days
Prescription opioids	36 – 72 hours	10 – 30 days
Buprenorphine	36 – 60 hours	Up to 28 days
Methadone	48 – 72 hours	Up to 30 days

Length of Stay

The minimum recommended observation for development of withdrawal symptoms for MOUD is 72 hours but is longer for patients on buprenorphine (4 days) and methadone (5 days). Most parents will be ready for discharge prior to this time, so the Ben Taub MPAT program uses a “Care-by Parent” suite for eligible newborns and parents. This apartment-like suite is located near the NICU, so that parents can continue to care for their

infant while the infant is admitted for observation for neonatal abstinence syndrome (NAS) or neonatal opioid withdrawal syndrome (NOWS).

Treatment of NAS

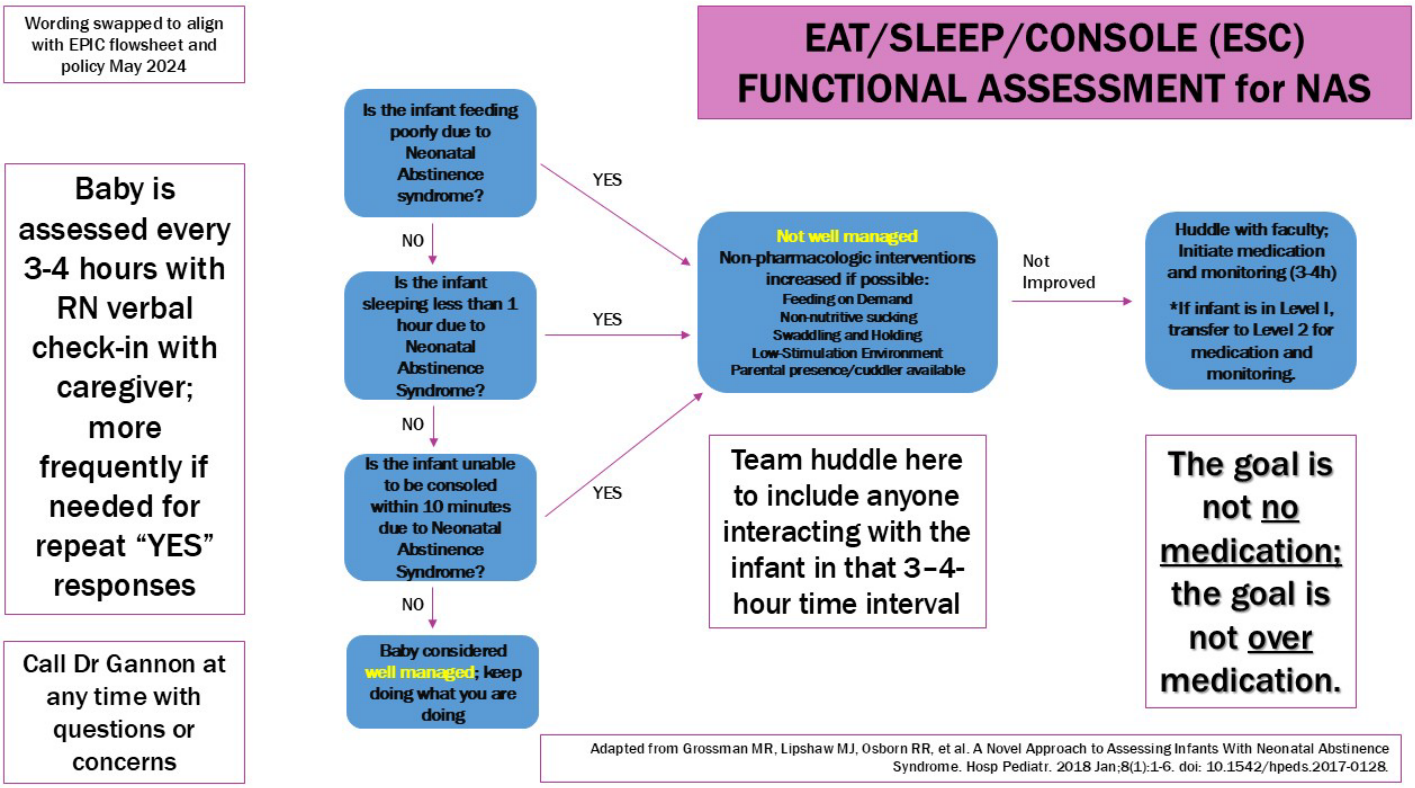
There are two methodologies for monitoring and treating NOWS. The primary method used by the MPAT program is **Eat Sleep Console (ESC)**. Ben Taub's ESC program is illustrated in **Figure 2**. Pharmacologic treatment is a secondary method and may still be needed after non-pharmacologic care has been optimized. The neonatal morphine solution used to treat NOWS should be given as PRN doses initially (up to 3 doses) before scheduled doses are ordered. For polysubstance use that does not include opioids **or** when the maximum dose of neonatal morphine has been reached and the infant is not well managed, Phenobarbital is the first line treatment. Clonidine may be preferred with SSRI exposure.

Data Supporting Eat Sleep Console Program

This method is based on a quality improvement study by Grossman et al. (2018) from Yale New Haven Hospital.[1] This study implemented a program to treat NOWS and evaluated outcomes pre-implementation and post-implementation. The primary outcome evaluated was neonatal length of stay (LOS); secondary outcomes evaluated neonatal narcotic requirements, hospital costs, and breastfeeding rate. Care in this program included a private room and low stimulation environment with dim lights, muted TV, and reduced noise right after delivery. The model also included clustered care, containment or swaddling, and non-nutritive sucking as comfort. Staff engaged parents in continuous care of their infant and encouraged rooming-in on the postpartum unit (MBU). The baby was then transferred to an inpatient room for continued neonatal observation after the parent was cleared for discharge. The parents were told they would be the primary treatment for their infant and needed to be present as much as possible with staff support, and coaching provided to implement the program.

The researchers found a decreased length of stay with the program from 22 days to 6 days. This program was also associated with a decreased use of morphine from 98% to 14%, decreased hospital costs by $34,535 per patient, increased majority breast milk feeding from 20% to 45%, and decreased direct admissions to NICU from 100% to 20%.

Figure 2. *Ben Taub Eat Sleep Console program*



Infant discharge criteria

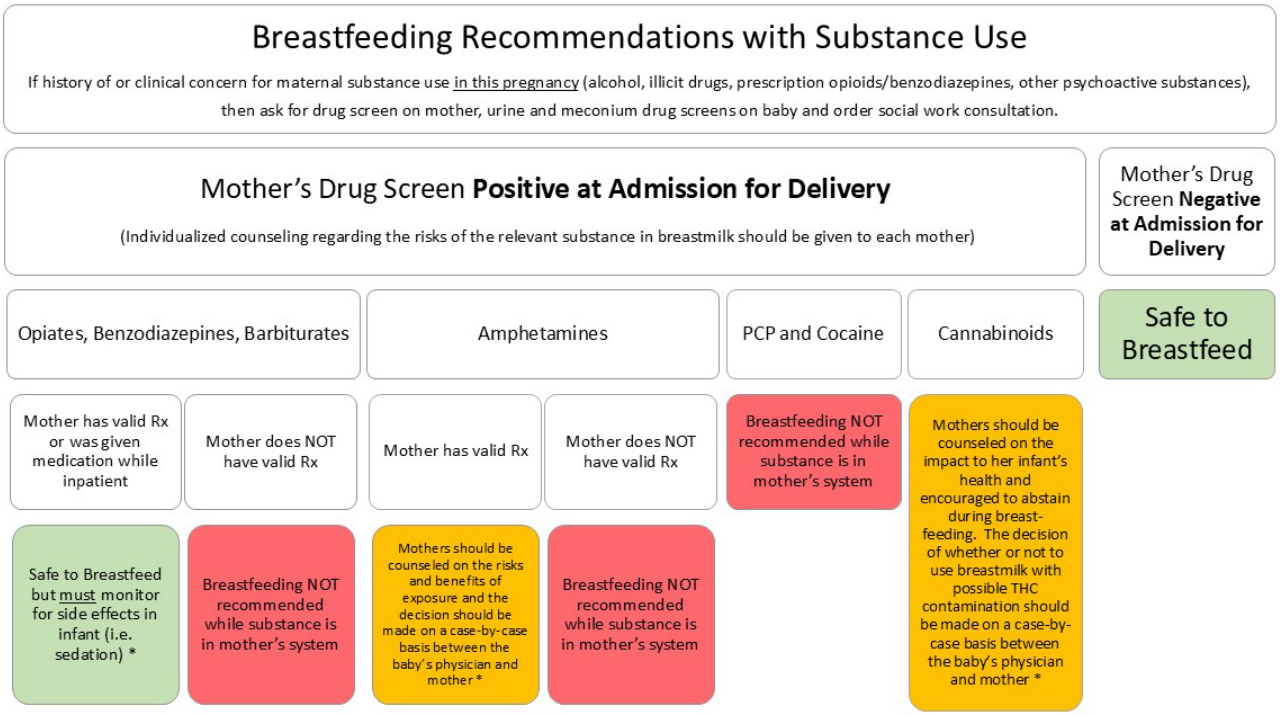
Ben Taub uses the following criteria to determine readiness for discharge:

- ☐ Minimum observation time has passed (3-5 days) without concerns for increasing acute withdrawal or dehydration.
- ☐ No significant clinical signs of withdrawal for 24-48 hours after any medication treatment.
- ☐ Parent education about subacute symptoms that may last weeks to months, safe sleeping, shaken baby syndrome, and who to call for concerns.
- ☐ Warm handoff to primary care provider with visit in 48 hours. Include Hepatitis C and HIV testing/referrals when appropriate.
- ☐ Early Childhood Intervention referral; neurodevelopmental referral for severe cases.
- ☐ Family CARE Portfolio (AKA Plan of Safe Care) is in place, coordination with CPS when involved.

Breastfeeding recommendations

Counseling and recommendations for breastfeeding will depend on substance used as well as use of recent illicit substances. Patients with uncontrolled substance use and no valid prescription for the medications they are taking should be encouraged to formula feed. **Figure 3** illustrates recommendations for breastfeeding based on substance.

Figure 3. *Breastfeeding recommendations based on substance use history*



* Type of medication as well as timing of breastfeeding compared to medication administration should be evaluated to minimize substance exposure if possible

Deal, Gannon, Hair, Tucker 3/2025

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Appendix

Appendix A. Characteristics of common substances involved in SUD

Substance and Derivatives	Intoxication Signs/Symptoms	Withdrawal Signs/Symptoms	Medications to Avoid
Cocaine Intranasal Nasal Smoking Gastrointestinal	Increased HR, BP, and myocardial oxygen demand Increased arousal, alertness, self-confidence, and euphoria	Fatigue, lack of pleasure, anxiety, irritability, sleepiness, and sometimes agitation, extreme suspicion, or paranoia	Beta-blockers (unopposed alpha)
Opioids[1] Heroin Fentanyl Synthetic (ex: oxycodone)	Slurred speech, sedation, pinpoint pupils, relaxation, and euphoria	Autonomic hyperactivity (tachypnea, hyperreflexia, tachycardia, sweating, hypertension, hyperthermia) Lacrimation or rhinorrhea, piloerection ("goose flesh"), myalgia, diarrhea, nausea/vomiting, pupillary dilatation, photophobia, insomnia and yawning.	Nubain, Stadol (precipitates acute withdrawal) Concurrent sedatives (overdose risk)
Benzodiazepines Short acting <12h Intermediate acting (12-24h) Long acting >24h	Sedation, ataxia, respiratory depression[1]	Autonomic instability Tremors, anxiety, perceptual disturbances, dysphoria, psychosis, seizures,	PPIs, sedatives, fluroquinolone antibiotics
Marijuana	Increased HR, BP and RR; conjunctival injection, and nystagmus Dry mouth, increased appetite, ataxia, and slurred speech	Sleeplessness, irritability, anxiety, and depressed mood	
Methamphetamines	Increased HR and BP; metabolic acidosis Diaphoresis, severe agitation, psychosis, delirium, and seizures	Dysphoria, anhedonia, fatigue, increased sleep or insomnia, vivid dreams, agitation, anxiety, drug craving, and increased appetite	Caution with calcium channel blockers in patients with tachycardia

[1]Treat benzodiazepine overdose with **naloxone**

Appendix B. Pharmacokinetics of common illicit substances

	Half-life	Onset	Peak Action	Duration of Action
Cocaine				
Intranasal		<1min	3-5 min	30-60 min
Nasal		1-5min	20-30 min	60-120 min
Smoking		<1min	3-5 min	30-60 min
Gastrointestinal		30-60 min	60-90 min	Unknown
Benzodiazepines				
Short acting <12	1.5-3 hr		0.7-2.5 hr	
Intermediate acting (12-24)	3-24 hr		0.5-6 hr	
Long acting >24	5-50 hr		0.5-4 hr	
Marijuana				
Inhaled		15-30 min		4 hours
Ingested		30 – 180 min		12 hours
Methamphetamines				
Smoking or injection		<1 min		20 hours
Intranasal		5min		
Oral		20 min		

Appendix C. DSM-5 Criteria for Opioid Use Disorder

1. Opioids are often taken in larger amounts or over a longer period than was intended
2. There is a persistent desire or unsuccessful efforts to cut down or control opioid use
3. A great deal of time is spent in activities necessary to obtain opioids, use the opioid or recover from its effects
4. Craving, or a strong desire or urge to use opioids
5. Recurrent opioid use resulting in a failure to fulfill major role obligations at work, school, or home
6. Continued opioid use despite having persistent or recurrent social or interpersonal problems cause or exacerbated by the effects of opioids
7. Important social, occupations, or recreational activities are given up or reduced because of opioid use
8. Recurrent opioid use in situations in which it is physically hazardous
9. Continued opioid use despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance
10. Tolerance, as defined by either of the following:
    a. A need for markedly increase amounts of opioids to achieve intoxication or desired effect
    b. A marked diminished effect with continued use of the same amount of an opioid
11. Withdrawal, as manifested by either of the following:
    a. The characteristic opioid withdrawal syndrome
    b. Opioids are taken to relieve or avoid withdrawal symptoms

↑

Appendix D. Family CARE Portfolio

https://www.txsafebabies.org/posc/assets/docs/posc_portfolio_nfd.pdf

Substance Use Screening and Biologic Testing in Pregnant People and Their Newborns at Texas Children's Hospital Pavilion for Women

October 2025 (Replaces October 2023)

Author: **Dr. Christina Davidson** and PFW Urine Toxicology Workgroup
Editor: Dr. Stacy Strehlow, Dr. Hayden Latham, Dr. Sarah Detlefs

This guideline has been updated to include gender inclusive language

Highlights

- All pregnant patients should have universal **verbal** screening using the DAST tool on admission or during a WAC visit.
- Universal urine drug screening is **NOT** recommended and should only be performed with the patient's permission for specific indications.
- Consult Social Work if the birthing parent admits to use of illicit substances during the pregnancy and/or for positive urine toxicology results confirmed on mass spectrometry and/or positive meconium testing results

Purpose of guideline

To standardize substance use screening and targeted biologic testing for all pregnant people during an obstetric admission using best practices, while eliminating racial and ethnic disparities. The guideline also provides recommendations to avoid stigmatizing language and appropriate alternatives (Table 1). For details on diagnosis and management of substance use disorder (SUD), refer to the Baylor College of Medicine Substance Use Disorder in Pregnancy Perinatal Guideline.

Table 1. Terminology of Substance Use and Addiction: Stigmatizing and Preferred Language[11]

Stigmatizing Language	Preferred Language
Substance abuse	Substance use or misuse, substance use disorder
Abuser, addict, alcoholic	Person with a substance use disorder
Smoker	Person with cannabis or tobacco or nicotine use disorder
Addicted baby	Neonate with neonatal abstinence syndrome or with in utero exposure to [named substance]
Clean or sober	Abstinent, in remission, toxicology "negative" for [substance]
Dirty	Using [substance], toxicology "positive" for [substance]
Drug of choice, habit	Substance of use
Getting or being high	Intoxicated, under the influence of [substance]
Shooting up	Intravenous drug use, injection drug use
Replacement or substitution treatment for opioid use disorder, opioid replacement, medication-assisted treatment	Medications for opioid use disorder, medications for addiction treatment
Relapse	Return to use, symptom recurrence

Definitions: screening vs testing[1]

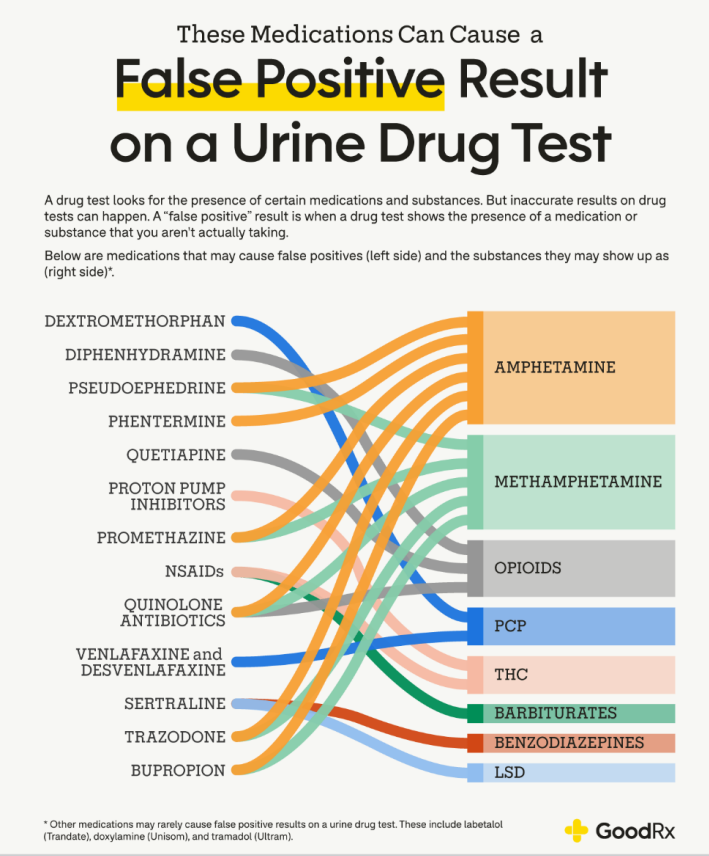
- **Screening:** Screening is used on a population level to determine who is at high risk for a disease. Ideally, it should take place only when interventions are available to prevent or treat the disease state. Given that substance use in pregnancy is common, that the consequences of substance misuse are substantial, and that treatment interventions are available, screening pregnant people for drug and alcohol use is warranted. **In this document, we refer to screening as a universally administered questionnaire designed to ascertain who is at high risk for having a substance use disorder in pregnancy.**

- **Testing:** In this document, biologic testing of urine or meconium is discussed as a test and not as a screening technique. A biologic test may be useful only in selected clinical scenarios in which the results would guide medical management. **Universal biologic testing to *screen* pregnant people is not recommended. The "urine drug test (UDS)/"drugs of abuse screen" ("LABTOXDS" in Epic) offered at TCH for adults and infants is appropriate for *screening* only. Positive results should be confirmed by sending the sample for confirmatory *testing* by tandem mass spectrometry to rule out a false positive finding. This confirmatory testing is a send-out test and takes 3-5 days to receive results.**

Current Recommendations

The current guidance from the American Society of Addiction Medicine (ASAM), American College of Obstetricians and Gynecologists (ACOG) and the Society for Maternal Fetal Medicine (SMFM) includes universal screening of all pregnant individuals with a validated screening tool. Individuals who screen positive should be offered evidence-based treatment and intervention as necessary. Universal biologic testing, however, is not currently recommended given the shortcomings associated with biologic tests. Biologic drug testing results can be associated with false positive results requiring confirmatory testing as well as false negative results or positive results stemming from iatrogenic administration of medications (Figure 1). Use of biologic testing is further limited by the half-life of the substances, with the ability to detect some substances for only a short period of time in the small subset of substances that are tested. **If biologic testing is planned, it should only be performed with the patient's consent and if the outcome of the result is pertinent to the medical management of the patient given the ramifications of positive testing depending on local legislature.[1,2] Despite these recommendations, inequitable screening without informed consent is a common practice.[3]**

Figure 1. Medication Causes of False Positive Urine Drug Screening



https://www.goodrx.com/drugs/side-effects/these-medications-can-cause-a-false-positive-on-drug-tests

Racial Disparities

All pregnant individuals are at risk for substance use disorders,[4] yet racial and ethnic disparities in screening have been demonstrated.[5-7] Non-Hispanic Black individuals are disproportionately more likely to undergo urine toxicology screening than their counterparts, making up one-third of those screened despite only

encompassing 16% of the population.[7] Black and Hispanic individuals are also almost five times more likely to undergo toxicology testing for an indication outside of reported drug use.[6] Despite the recommendations for universal screening, young, less educated, non-Hispanic Black, publicly insured individuals receiving adequate prenatal care are more likely to be screened for substance use than their counterparts.[5] In those who have been identified as having substance use in pregnancy, Black individuals are more likely than White or Hispanic individuals to have referrals placed for Child Protective Services (CPS).[8] Strategies to reduce inequities in screening are pertinent to reduce health care disparities.[9]

Historical and clinical factors associated with positive urine toxicology on labor and delivery[10]

In a clinical cohort study of all people admitted to a labor and delivery unit at an ethnically and racially diverse safety net hospital over a 5-year period (2010–2014), all patients underwent historical and clinical risk assessment and people perceived to be at increased risk of illicit drug use and who consented to testing had urine toxicology performed. A detailed chart review on all people with a positive test during this 5-year period was conducted and compared to all people with a negative test in 2014 (83 people who tested positive for illicit drugs [9.8% of all people tested] were compared to the 179 people who tested negative in 2014). The authors identified the following associations:

- Historical and demographic factors associated with a positive test included:
    - **Historical drug use was the factor most strongly associated with a positive test.**
    - Single relationship status
    - Lack of employment
    - Lack of high school education
    - Nulliparity
    - History of a prior sexually transmitted or blood-borne infection
    - No prenatal care (defined as 0 prenatal visits; scant prenatal care was defined as ≤5 prenatal visits)
    - Unintended outborn delivery
    - Child out of custody or history of CPS case
    - Concurrent tobacco or alcohol use

- Clinical risk factors:
    - Maternal medical complications, such as placental abruption and history of stillbirth, **were not** associated with a positive test
    - Obstetrical complications, like preterm labor, were associated with a **negative** test

Universal Verbal Screening

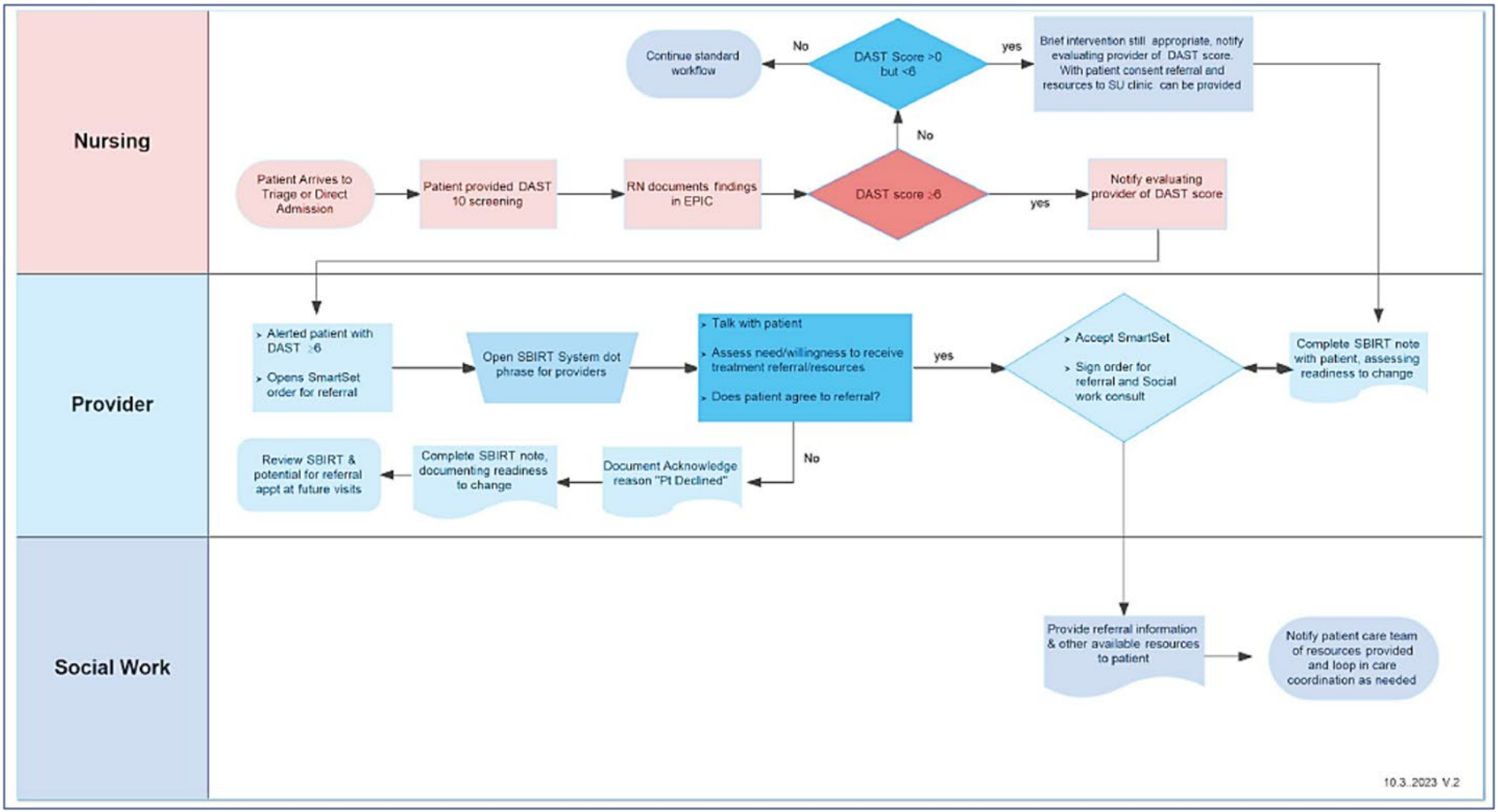
- ☐ The screening tool utilized at PFW in the Women's Assessment Center (WAC) is the Drug Addiction Screening Tool (DAST).
- ☐ DAST should be performed for all patients who present to WAC or as a direct admission.
    - ✓ The WAC nurse will administer a paper screening tool at intake to assess for substance use/misuse and enter the results in Epic.
    - ✓ The WAC nurse will inform the provider of the results of screening.

Follow up of Positive Verbal Screening (Figure 2)

- ☐ If a patient has a DAST score ≥6, they are at risk for complications from substance use and the provider should do a brief intervention and referral to treatment (SBIRT = screening, brief intervention, referral to treatment).

- ☐ If a patient has a DAST score <6 but screens positive to substance use or misuse during the pregnancy, it is still appropriate for the provider to do a brief intervention and consider referral to treatment.

Figure 2. *Management recommendations for nurses and providers based on DAST results*



Urine Toxicology

Obstetric Patients

Indications for ordering urine toxicology

- ☐ Altered mental status, including loss of consciousness, evidence of intoxication, slurred speech, not otherwise explained
- ☐ Recent physical evidence of injection use (e.g. “track marks”)
- ☐ Unexplained soft tissue infections or endocarditis
- ☐ As part of the treatment of a patient receiving medication assisted therapy (MAT) and/or enrolled in a substance use treatment program during pregnancy, to evaluate for any continued separate use of opioids or other substances
- ☐ A patient identified as having used illicit drugs or inappropriately used prescription medications at any point in the pregnancy
- ☐ No prenatal care, defined as patients with zero (0) prenatal care visits.
    - ✓ Prenatal care received at non-TCH sites, including those outside of the United States, should be counted as prenatal care, even if documentation is not available for review
    - ✓ This does not include birthing patients who endorse inability to receive prenatal care due to recent immigration or barriers to access.

Urine collection and Epic ordering for pregnant parent

- ☐ Obtain verbal consent from patient to send urine drug screen (UDS).
    - ✓ If patient declines, UDS is not ordered and the pediatricians are notified by the provider that the patient met criteria for testing but did not consent. This should also be documented in the medical record.
    - ✓ If patient is unable to be consented due to incapacitation that could be related to substance misuse, UDS should be sent and reason documented in the medical record.
    - ✓ Patients who have a UDS and test positive should be informed of the results by a managing provider and informed that social work will be consulted. They should be informed that this is only a presumptive positive and that confirmatory testing will be performed.
- ☐ Ensure documentation of the following in the medical record (smartphrase .PFWUDS):
    - ✓ Patient provided verbal consent for urine toxicology
    - ✓ If applicable, illicit substance used and most recent date of use
    - ✓ Medications patient is currently taking (prescribed or over the counter) that could result in a false positive (Figure 1)
    - ✓ Reason for the UDS
    - ✓ Avoid use of stigmatizing language (Table 1)
- ☐ Collect urine sample prior to administration of medications that may result in a false positive (Figure 1)
- ☐ Avoid testing birthing parent after delivery due to risk of positive substances from medications administered during the L&D process (e.g. IV narcotics for pain, ephedrine after epidural, benzodiazepines in the operating room). Exceptions may include patients who deliver rapidly after admission and urine specimen was unable to be collected prior to delivery.
- ☐ Order LABTOXDS in Epic. This order has been added to order sets for WAC, L&D, antepartum, and scheduled Cesareans and will require you to select the indication for ordering.

If a patient is going to be tested, this should be done immediately upon admission to a labor and delivery setting and not after they have been treated with any medication that could cause a positive test result. If the pediatrics team requests testing of a birthing parent because the baby is showing signs of withdrawal, it is preferable to test the baby; the birthing parent may test positive because of pain medication received at delivery or postpartum.[1]

Follow up of positive UDS

- ☐ Because of the high risk of false positives, birthing parents who test positive should have “confirmatory testing” via mass-spectrometry.

- ✓ If there is a presumptive positive on any of the classes of drugs that are tested on the screen, then order the LABMISC and place a comment in the notes to send the specimen to ARUP: test code 92186-Urine Drug screen with confirmation (this is a specific tandem mass spectrometry test). Order test as soon as possible since the urine specimen will only be kept in the lab for 24 hours; after that, it is discarded
- ✓ The confirmatory urine drug test(s) is a send-out test that takes 3-5 days to result

☐ Consult Social Work if the birthing parent admits to use of illicit substances during the pregnancy and/or for positive urine toxicology results confirmed on mass spectrometry (see Box 4 for additional details)

Newborn Patients (Urine and/or Meconium)

Indications for ordering urine and/or meconium toxicology on newborn

☐ Newborn exhibits symptoms consistent with intoxication or withdrawal
☐ Birthing parent met criteria for testing (see below) and/or tested positive at delivery admission or at a recent hospital or clinic visit.

Urine and/or meconium collection and Epic ordering for newborn

☐ Ensure documentation of the following in the medical record (can use smartphrase ".NEOUDS"):
- ✓ Birthing parent informed of plan to send urine and/or meconium toxicology on newborn and reason for testing
- ✓ Medications birthing parent is currently taking (prescribed or over the counter) and/or was administered during the admission that could result in a false positive (Figure 1). Common medications administered during labor and delivery include:
  - ✓ Ephedrine
  - ✓ Phenylephrine
  - ✓ Neuraxial analgesia/anesthesia (epidural, spinal, combined spinal-epidural [CSE])
  - ✓ IV narcotics (fentanyl)
  - ✓ Benzodiazepines
- ✓ Reason for the urine and/or meconium toxicology
- ✓ Avoid use of stigmatizing language (Table 1)

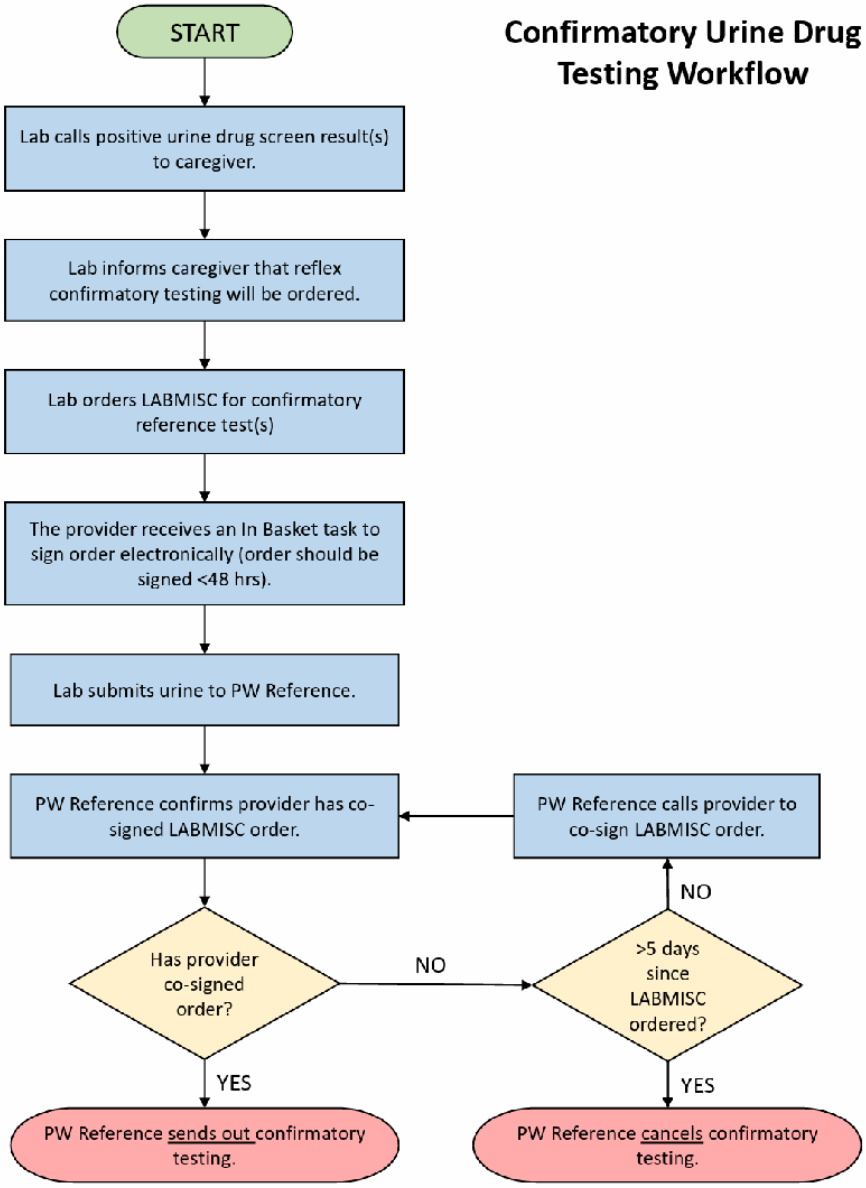
☐ Order LABTOXDS for urine (this is a screening test)
☐ Order LABMEC for meconium
- ✓ Test: Drugs of Abuse Screen, Meconium (3004583 LABMEC)
- ✓ Synonyms: 3004583 ARUP LABMEC

Infant UDS results reflect drug exposure within a few days prior to delivery, whereas meconium reflects exposure after 20 weeks of gestation. Recent studies indicate that even intrathecal narcotics administered during labor with regional anesthesia lead to positive maternal and infant drug screens; therefore the hospital-administered medications need to be taken into account.

Follow up of positive urine toxicology test

☐ Because of the high risk of false positives, newborns who test positive should have confirmatory testing via mass-spectrometry.
☐ If there is a presumptive positive on any of the classes of drugs that are tested on the screen, then order the LABMISC and place a comment in the notes to send the specimen to ARUP: test code 92186-Urine Drug screen with confirmation (this is a specific mass spectrometry test). Refer to Figure 3.
- ✓ Order the test as soon as possible since the urine specimen is discarded after 24 hours.
- ✓ The mass spectrometry confirmatory test is a send-out laboratory test that takes 3-5 days to result.

Figure 3. Workflow to Confirm UDS Results



Social Work Consults and CPS Reporting for Positive Urine Toxicology or Admitted Use During Pregnancy

Consult Social Work if the birthing parent admits to use of illicit substances during the pregnancy and/or for positive urine toxicology results confirmed on mass spectrometry and/or positive meconium testing results.

Before consulting Social Work, the medical provider should complete the following:

- ☐ Confirmatory testing has resulted as positive or has been requested (i.e. urine or meconium)
- ☐ **Inpatient**: Review mother's MAR and home medications to determine if medications taken at home and/or given during the admission or delivery could have caused the results
- ☐ **Outpatient**: Review mother's home medications to determine if there is a valid prescription and/or over the counter medication that could have caused the results

- ☐ **Verbal admission of drug use**: If yes, are there children in the home?

Once a Social Work consult is received, the social worker will complete the following:

- ☐ Speak with the provider to confirm that the review of the mother's record has been completed and/or confirmatory tests have been received or requested.
- ☐ Complete/update a psychosocial assessment.
- ☐ Discuss their findings and identified risk/safety concerns with the provider to develop a plan of care and next steps.
- ☐ Discuss concerns and resources with the patient and continue to provide support.
- ☐ Inform patient of requirement to report to child welfare (CPS).
- ☐ Provide Family CARE Portfolio ("plan of safe care") and other resources to help the birthing parent prepare for a child welfare visit.
- ☐ Report risk/safety concerns to CPS via Statewide Intake, per TCH policy.*

Reasons Social Workers would submit a report to CPS include, but are not limited to*

- ☐ Pregnant parent admits to use of illicit substances and/or misuse of prescription medications during the pregnancy and is the primary caregiver of minor children.
- ☐ Confirmed positive drug test results for mother and/or newborn and home and hospital medications have been ruled out as a contributing factor.
- ☐ Presence of a non-patient primary caregiver of the newborn in the hospital setting with concerns of active drug use and/or intoxication (e.g. confusion, slurred speech, unsteady gait).

report will be made during pregnancy if there are minor children in the home

Appendix

Epic Smartphrases

Smart phrase for birthing parent (.PFWUDS):

Based on current practice guidelines, a urine drug screen is recommended for the following reason:

- ☐ Altered mental status
- ☐ Physical evidence of injection use
- ☐ Unexplained soft tissue infections or endocarditis
- ☐ Patient is in a substance use disorder (SUD) treatment program and/or receiving medication assisted therapy for SUD
- ☐ Use of illicit drugs or misuse of prescription medications during the pregnancy
    - o If this is selected, document substance(s) used and date of last use
- ☐ No prenatal care
- ☐ Other

The patient's prescription and over the counter medications were reviewed, and include the following medication(s) that may result in a false positive UDS (select all that apply):

- ☐ Diphenhydramine (Benadryl)
- ☐ Doxylamine (Unisom)
- ☐ Promethazine (Phenergan)
- ☐ Dextromethorphan (Robitussin)
- ☐ Pseudoephedrine (Sudafed)
- ☐ Labetalol
- ☐ Sertraline (Zoloft)
- ☐ Bupropion (Wellbutrin)
- ☐ Proton pump inhibitors
- ☐ Prescription opiates
- ☐ NSAIDs
- ☐ Other

The patient was informed of the recommendation for urine drug screen and the reason for testing as well as the potential implications and

- ☐ Verbally consents to urine drug screen. The patient was informed that the newborn will be tested as well for substance exposure.
- ☐ Verbally declines urine drug screen. The patient was informed that the newborn will be tested for substance exposure.
- ☐ Is unable to provide consent at this time.

Smart phrase for newborn (.NEOUDS):

Based on current practice guidelines, a urine drug screen and/or meconium of the newborn is recommended for the following reason:

- ☐ Newborn exhibiting symptoms consistent with intoxication or withdrawal

- ☐ Birthing parent met criteria for testing:
    - o Altered mental status
    - o Physical evidence of injection use
    - o Unexplained soft tissue infections or endocarditis
    - o Patient is in a substance use disorder (SUD) treatment program and/or receiving medication assisted therapy for SUD
    - o Use of illicit drugs or misuse of prescription medications during the pregnancy
    - o No prenatal care
    - o Other

- ☐ Birthing parent has positive urine drug test on admission or from recent hospital/clinic visit

The birthing patient's prescriptions, over the counter medications, and medications administered since admission were reviewed, and include the following medication(s) that may result in a false positive UDS (select all that apply):

- ☐ IV narcotic during labor (e.g. fentanyl)
- ☐ Phenylephrine
- ☐ Benzodiazepines
- ☐ Epidural, spinal, or combined spinal-epidural (CSE)
- ☐ General anesthesia
- ☐ Diphenhydramine (Benadryl)
- ☐ Doxylamine (Unisom)
- ☐ Promethazine (Phenergan)
- ☐ Dextromethorphan (Robitussin)
- ☐ Pseudoephedrine (Sudafed)
- ☐ Labetalol
- ☐ Sertraline (Zoloft)
- ☐ Bupropion (Wellbutrin)
- ☐ Proton pump inhibitors
- ☐ Prescription opiates
- ☐ NSAIDs
- ☐ Other

The birthing parent was informed of the plan to send urine and/or meconium toxicology on the newborn and the reason for testing as well as the potential implications.

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Antepartum Management of Obstetric and Fetal Conditions

Antepartum Surveillance Guidelines

[October 2025 (replaces Sepember 2024)]

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Editor: Dr. Manisha Gandhi

Guideline is updated to reflect a change in antenatal testing recommendations for FGR.

Background

Antenatal fetal surveillance is performed to reduce the risk of stillbirth. It has been suggested that when determining the conditions for which antenatal fetal testing should be performed, one should consider the risk of false-negative antenatal fetal surveillance test (defined as incidence of stillbirth occurring within one week of normal test):

- NST: 1.9/1000
- BPP: 0.8/1000
- Modified BPP: 0.8/1000
- CST: 0.3/1000

Additionally, based on expert consensus, ACOG felt that antenatal fetal surveillance could be considered for conditions that would result in at least twice the increased risk of stillbirth as compared to the risk if the condition were not present. ACOG provides guidance on and suggests surveillance for conditions for which stillbirth is reported to occur more frequently than 0.8 per 1,000 (the false-negative rate of a BPP or modified BPP) and which are associated with a RR or odds ratio for stillbirth of more than 2.0 compared with pregnancies without the condition.[1]

Based on ACOG Committee Opinion 828, Indications for Outpatient Antenatal Fetal Surveillance, the following guidelines (Table 2) have been adapted by the BCM OB/Gyn Perinatal Guidelines Committee for antenatal fetal surveillance. In cases where ACOG has recommended once or twice weekly testing or recommends individualization, we have provided specific recommendations. Some indications have been removed and can be individualized based on provider assessment. Initiation of testing at an earlier gestational age, alteration of the frequency of testing from these guidelines, or the addition of such tests as umbilical artery Doppler should be undertaken in consultation with a Maternal-Fetal Medicine specialist. Delivery recommendations have been adapted from ACOG Committee Opinion 831, Medically Indicated Late Preterm and Early Term Deliveries, with some modifications.[2]

We also agree with the following statement from ACOG, “As with all testing and interventions, shared decision making between the pregnant individual and the clinician is critically important when considering or offering antenatal fetal surveillance for individuals with pregnancies at high risk for stillbirth or with multiple comorbidities that increase the risk of stillbirth. It is important to emphasize that the guidance offered in this Committee Opinion should be construed only as suggestions; this guidance should not be construed as mandates or as all encompassing. Ultimately, individualization about if and when to offer antenatal fetal surveillance is advised.”

Equivalent tests

- Modified BPP (NST+AFI/DVP) = 8 point BPP = 10 point BPP

- For testing before 32 weeks, an 8 point BPP can be used
- Reactive NST: 15x15 accel ≥ 32w0d = 10x10 accel <32w0d

Weekly = every 7 days,
Twice weekly = Mon/Thur, Tue/Fri, or Wed/Sat (holidays may lead to earlier testing)

Management of Decreased Fetal Movement in Triage

For a pregnant individual reporting decreased fetal movement after viability, one-time antenatal fetal surveillance at the time the decreased movement is reported may be considered. Unless decreased fetal movement reoccurs, antenatal fetal surveillance for a single episode does not need to be repeated if the initial results are reassuring and there is no other indication for antenatal fetal surveillance.[1] **The BCM Ob/Gyn Perinatal Guidelines Committee makes the following recommendations regarding evaluation of decreased fetal movement in triage (Women's Assessment Center [WAC] at PFW and OB Intake [OBI] at Ben Taub Hospital**):

Gestational age <24 0/7 weeks
Assess fetal heart tones with Doppler → are they within normal limits for gestational age?

- Yes → Reassure patient, no further testing
- No → Ultrasound to determine gestational age

NST can be considered but should be individualized between 23 0/7 and 24 0/7 with shared decision making.

Gestational age 24 0/7 weeks or greater
Perform modified BPP → is NST reactive and Deepest Vertical Pocket (DVP) >2 cm?

- Yes → Reassure patient, no further testing
- No → Perform 10 Point BPP and manage based on BPP score or consider delivery based on gestational age

Table 2. Antepartum Surveillance Guidelines

Indication	GA to initiate testing	Frequency	Delivery Time
MATERNAL CONDITIONS			
Diabetes			
- A1 well-controlled on diet/exercise[2,3]	None	None	39 0/7 – 40 6/7
- A2DM well-controlled (no fetal growth abnormalities, no fluid abnormalities, minimal medication titration) [2,3]	32 weeks	Once weekly	39 0/7-39 6/7
- A2DM poorly-controlled (with associated risk factors – fetal growth concerns, fluid abnormalities, frequent medication titration)[2,3]	32 weeks	Twice weekly (2nd test NST only)	36 0/7-38 6/7 (individualized to situation)
-Type 1 or 2 diabetes[2]	32 weeks	Twice weekly (2nd test NST only)	Well controlled: 39 0/7 – 39 6/7. Vascular complications, poor glucose control, or prior stillbirth: 36 0/7 – 38 6/7
Hypertension[2]			
-Well controlled without meds, AGA fetus	No testing recommended		38 0/7-39 6/7
-Well controlled with meds, AGA fetus	32 weeks	Once weekly	37 0/7-39 6/7
-On meds poorly controlled (requiring frequent medication increase or other comorbidities)	At diagnosis ≥ 28 weeks	Twice weekly (2nd test NST only)	36 0/7- 37 6/7
-Gestational HTN and preeclampsia without severe features	At diagnosis ≥ 28 weeks	Twice weekly (2nd test NST only)	37 0/7
-Pre-Eclampsia with severe features	Inpatient admission recommended		34 0/7 weeks or earlier based on maternal or fetal status
Other			
IVF	36 weeks[4]	Once weekly	At or after 39 0/7
Antiphospholipid antibody syndrome (supported by laboratory and clinical data)	32 weeks[4]	Twice weekly	37 0/7-39 6/7
Cyanotic heart disease	32 weeks	Once weekly	38 0/7-38 6/7
Hemoglobinopathies other than Hb SS disease (SC disease, Sickle-Beta Thalassemia)	32 weeks	Once weekly	39 0/7 if no associated risk factors
Uncomplicated sickle cell disease	32 weeks[5]	Once weekly	39 0/7 if no associated risk factors
Complicated sickle cell disease (maternal hypertension, vaso-occlusive crisis, placental insufficiency, fetal growth restriction)	At diagnosis ≥ 28 weeks	Twice weekly	Individualized based on risk factors
Thyroid disorder, poorly controlled	32 weeks	Once weekly	39 0/7

Indication	GA to initiate testing	Frequency	Delivery Time
Alloimmunization without suspected anemia	32 weeks[6]	Once weekly	37 0/7 – 38 6/7[6]
Alloimmunization with suspected anemia (ie: undergoing serial intrauterine transfusions)	At diagnosis ≥ 28 weeks	Once weekly	Individualized to situation
Renal disease with Cr>1.4 g/dL	32 weeks[1]	Once weekly	38 0/7-39 0/7
Uncomplicated SLE (no flares)	32 weeks[1]	Once weekly	39w0d
Complicated SLE (active lupus nephritis, recent lupus flare, antiphospholipid antibodies with prior fetal loss, anti-RO/SSA or anti-La/SSB antibodies, thrombosis, fetal growth restriction, other comorbidities)	At diagnosis ≥ 28 weeks	Twice weekly	37 0/7-38 6/7
Age 40 or older at EDD	37 weeks	Once weekly	39 0/7-39 6/7
Obesity -Pre-pregnancy BMI 35 - 39.9 kg/m^2 -Pre-pregnancy BMI ≥ 40 kg/m^2	 37 weeks[1] 34 weeks[1]	Once weekly	individualized to situation (can await spontaneous labor)
Intrahepatic Cholestasis of Pregnancy [3] -Total serum bile acid level ≥10 but <40 µmol/L -Total serum bile acid level ≥40 but <100 µmol/L -Total serum bile acid levels ≥100 µmol/L[2] -Severe pruritus, hx stillbirth <36 weeks 2/2 ICP, or worsening hepatic function[a]	At diagnosis ≥ 28 weeks	 Once weekly Once weekly Once weekly Twice weekly	 38 0/7-39 0/7 37 0/7 36 0/7 34 0/7 – 36 0/7
FETAL CONDITIONS			
Fetal Anomaly			
Gastroschisis	28 weeks	Twice weekly	37 0/7[7]
Hydrops	At diagnosis ≥ 28 weeks	Twice weekly	Individualized to situation
FGR (EFW or AC<10%) in a singleton[8,9]			
-Uncomplicated FGR (EFW or AC<10% but >3rd percentile, normal amniotic fluid, no concurrent conditions) -Uncomplicated FGR, EFW <3rd percentile	At diagnosis ≥ 24-28 weeks[b]	Once weekly Once weekly	38 0/7-39 0/7 37 0/7 or at diagnosis if diagnosed later

[3] Deliveries before 39 weeks gestation are associated with an increased risk of admission to the NICU for respiratory complication and other neonatal morbidities; however, maternal anxiety with a history of stillbirth should be considered and may warrant an early term delivery (37 0/7-38 6/7) in women who are educated regarding, and accept, the associated neonatal risks.

Indication	GA to initiate testing	Frequency	Delivery Time
-FGR with additional risk factors (e.g., oligohydramnios, maternal co-morbidities, concerns for worsening FGR)	At diagnosis ≥ 24-28 weeks [4]	Twice weekly	34 0/7-37 6/7
FGR with elevated UA PI (decreased end diastolic flow without absent end diastolic flow)	At diagnosis ≥ 24-28 weeks[b]	**Once** weekly	37 0/7
FGR with absent end diastolic flow *MFM consultation recommended	At diagnosis ≥ 24-28 weeks[b] Consider inpatient admission at time of initial diagnosis for potential steroid administration and short term observation.	Twice weekly	33 0/7-34 0/7
FGR with reversed end-diastolic flow *MFM consultation recommended	Inpatient admission recommended		30 0/7 – 32 0/7
Multiple gestation			
-uncomplicated monochorionic/diamniotic twins[4]	32 weeks	Once weekly	36 0/7 -36 6/7
-monochorionic/diamniotic twins with isolated fetal growth restriction	At diagnosis ≥ 24-28 weeks[b]	Once weekly Twice weekly if concern for worsening FGR or abnormal UA Doppler PI	32 0/7-34 6/7[2]
- uncomplicated dichorionic/diamniotic twins	36 weeks[4]	Once weekly	38 0/7-38 6/7[2]
-dichorionic/diamniotic twins with fetal growth restriction or ≥20% discordance	At diagnosis ≥ 24-28 weeks[b]	Once weekly Twice weekly if concern for worsening FGR or abnormal UA Doppler	-36 0/7-37 6/7 -32 0/7 – 36 0/7 if complicated by other risk factors (eg preeclampsia) or abnormal Doppler studies (recommend considering delivery timing based on singleton recs for AEDF and REDF)
-triplets or higher-order multiples	32 weeks	Once weekly unless with FGR	35 0/7-36 0/7 but should be individualized[2]
OBSTETRIC CONDITIONS			
Abnormal Serum Markers			
PAPP-A ≤ 5% (0.4 MoMs)	36 weeks[4]	Once weekly	At or after 39 0/7

[4] Refer to the Fetal Growth Restriction Perinatal Guideline for recommendations on antenatal testing initiation in pregnancies 24-28 weeks gestation. This should be individualized based on clinical risk factors and shared decision making with the patient. MFM Consult is recommended.

Indication	GA to initiate testing	Frequency	Delivery Time
2nd trimester Inhibin A ≥ 2.0MoM	36 weeks[4]	Once weekly	At or after 39 0/7
History of other adverse pregnancy outcomes			
Previous SGA requiring preterm delivery **in *immediately preceding pregnancy***	32 weeks[4]	Once weekly	At or after 39 0/7
Previous preeclampsia requiring preterm delivery **in *immediately preceding pregnancy***	32 weeks[4]	Once weekly	After 39 0/7
Previous 3rd trimester stillbirth	32 weeks or 1 week prior to previous stillbirth	Once weekly	Individualized but no earlier than 37 0/7 [5]
PLACENTAL CONDITIONS			
Single umbilical artery	36 weeks[4]	Once weekly	At or after 39 0/7
Velamentous cord insertion	36 weeks[4]	Once weekly	At or after 39 0/7
Chronic placental abruption	At diagnosis ≥ 28 weeks	Once weekly	At or after 39 0/7
Vasa Previa	Recommend inpatient admission at 30-32 weeks		34 0/7 – 37 0/7 (no later than 35-36 weeks based on local data)[2]
Isolated oligohydramnios (DVP<2 cm) - stop testing if resolved after 2 visits	≥ 28 weeks at diagnosis	Twice weekly	36 0/7-37 6/7[2]
Idiopathic moderate to severe polyhydramnios (AFI ≥30 cm or DVP ≥12 cm) - stop testing if resolved after 2 visits	32 weeks[4]	Once weekly	39 0/7
Late term in a well-dated pregnancy (Pregnancies WITH a sonographic exam confirming or revising the EDD before 22 0/7 weeks)	41 weeks[4]	Twice weekly	41 0/7 - 42 0/7
Late term in a suboptimally dated pregnancy (Pregnancies WITHOUT a sonographic exam confirming or revising the EDD before 22 0/7 weeks)	39-40 weeks[10]	Twice weekly	41 0/7[10]

[5] Deliveries before 39 weeks gestation are associated with an increased risk of admission to the NICU for respiratory complication and other neonatal morbidities; however, maternal anxiety with a history of stillbirth should be considered and may warrant an early term delivery (37 0/7-38 6/7) in women who are educated regarding, and accept, the associated neonatal risks.

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Risk-Based Cervical Length Screening and use of Progesterone in the Prevention of Preterm Birth

[December 2023]
Author: Dr. Martha Rac
Editor: Dr. Stacy Strehlow

Definitions and Legend

- TAS = Transabdominal sonography
- TVS = Transvaginal sonography
- TA = Transabdominal
- TV = Transvaginal
- CL = cervical length
- PPROM – preterm premature rupture of membranes
- PTL – preterm labor
- PTB - preterm birth
- sPTB – spotaneous preterm birth, PTB due to PPROM or PTL <37 weeks (up to 36w6d)
- Short cervix – TV CL $\leq$ 2.5cm
- Unsuccessful TV cerclage – sPTB between 14-28 weeks despite history- or ultrasound-indicated TV cerclage
- History-indicated cerclage (also known as prophylactic cerclage) – cerclage placed for a history of one or more second-trimester pregnancy losses related to painless cervical dilation and in the absence of labor or abruptio placentae or for a history of exam-indicated cerclage
- Exam-indicated cerclage – cerclage placed for painless cervical dilation (defined as $\geq$1cm dilation) in the second trimester
- Ultrasound-indicated cerclage – cerclage placed for a short cervix $\leq$2.5cm identified on TV ultrasound and no dilation detected on digital exam.

Questions we need to answer from best available evidence

1. Do we give vaginal progesterone to everyone with a prior spontaneous PTB or just those identified to have a short cervix?
2. Do we perform cervical length screening only in those with a prior spontaneous PTB <34 weeks or <37 weeks?
3. To whom do we offer ultrasound-indicated cerclage?
4. Do we offer 17OHP for women with a prior SPTB?

Do we give vaginal progesterone to everyone with a prior spontaneous PTB or just those identified to have a short cervix?

***Table 1**. Review of best available evidence for vaginal progesterone*

Study	Study type	Population	Intervention	Primary Outcome	Results
DeFonseca et al. 2007	DB, PC RCT, "opt in" 8 centers (London and Chile)	1. Singletons and twins between 20-25 weeks 2. TV CL ≤ 15mm 3. 15% with ≥1 sPTB 4. ~10% twins	200mg micronized Progesterone vs placebo	sPTB <34 weeks	1. N=250 2. Vag Prog ↓sPTB <34 wks (19.2% vs 34.4%, RR 0.56, CI 0.36-0.86) 3. No sig reduction in neonatal morbidity
Hassan et al. 2011	DB, PC, RCT 44 centers, 10 countries	1. Singleton 2. 19w0d-23w6d 3. TV CL 10-20mm 4. No signs of PTL	90mg vaginal progesterone gel (Crinone 8%) vs placebo	sPTB <33 weeks	1. N=458 2. Vag Prog ↓sPTB <33 wks (8.9% vs 16.1%, RR 0.55, CI 0.33-0.92, p=0.02) 3. ↓sPTB, 28, 35 weeks 4. ↓RDS, any neo morbidity and BW<1500gm
Normal et al. 2016 OPPTIMUM study	DB, PC, RCT 65 UK NHS centers, 1 Swedish hospital	1. Singleton 2. Prior PTB 3. ± short cervix 4. +FFN with other risk factor	Vag P vs placebo	1. Fetal death or birth <34 weeks 2. Composite neonatal 3. Standardized cognitive score at 2 yo	Vag P did not reduce PTB<34w, neonatal outcomes or long-term benefit or harm on children at 2 yo.
EPPICC group et al 2021	Meta-analysis of IPD from 31 RCTs 9 trials of vag P vs placebo	1. Singletons, multifetal gestations 2. Prior PTB ± short cervix	Vag P vs placebo or standard care	sPTB <37w, <34w, <28w	1. ↓PTB <34w by 22% 2. But no apparent benefit in women with prior PTB and CL>30mm
Conde-Agudelo et al. 9/2022	Meta-analysis and systematic review, RCTs 10 studies, n=2958 7 small studies, only 1 low risk of bias 3 large studies, all low risk of bias	1. Singletons 2. Prior sPTB	Vag P vs placebo	PTB <37w and <34w	↓PTB <37w and <34w When restricted to studies with "low risk of bias", Vag P did not reduce PBT <37w or <34w
Nelson et al. 10/2022	Prospective obs trial "Before and after design"	1. Singletons 2. Prior sPTB	Vag P vs placebo 3:1 match with historical controls	PTB <35 weeks	Vag P did not reduce PTB <35 weeks (PTB occurred in 24% Vag P group vs 16% of historical cohort)
Conde-Agudelo and Romero 12/2022	Research Letter Post-hoc subgroup analysis	1. Singletons 2. Prior sPTB 3. CL >25mm	Vag P vs placebo	PTB <37w and <34w	Vag P did not reduce PTB <37w or <34w in women with prior sPTB and CL>25mm

- Insufficient evidence exists to recommend vaginal progesterone as a primary prophylaxis in women with a prior PTB.
- BCM OB/Gyn Perinatal Guidelines Committee recognizes the uncertainty this poses to patients who have experienced a successful pregnancy outcome while on 17OHP even though evidence does not support continued use due to lack of benefit. In this situation, vaginal progesterone as primary prophylaxis can be discussed using a shared decision-making process but lack of evidence for efficacy as primary prophylaxis should be discussed and clearly documented.

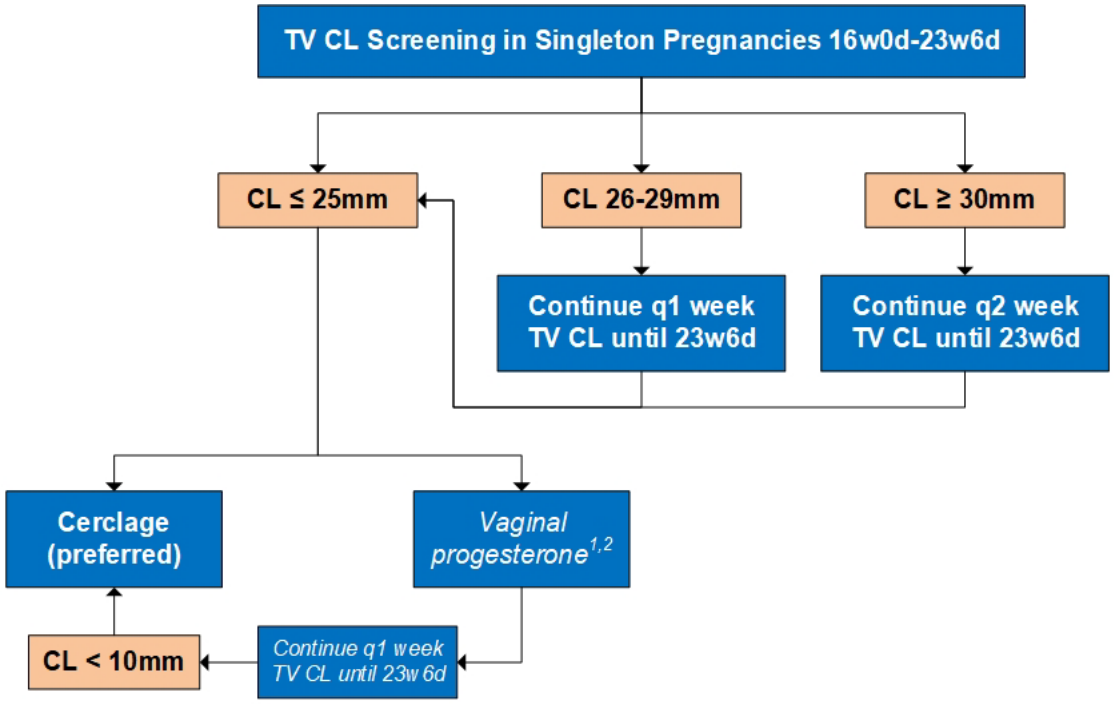
How do we identify women with a short cervix?

- In women with a singleton IUP and prior sPTB *<37 weeks*, we recommend serial transvaginal cervical length screening between 16-23w6d.
    - Ultrasound- or exam-indicated cerclage may be placed up to 23w6d, however the ultimate decision to place or withhold cerclage placement will depend upon the clinical circumstances of each individual patient (e.g. presence or absence of regular contractions, prolapsing membranes)
- BCM OB/Gyn Perinatal Guidelines Committee does *not* recommend universal TV CL screening
- BCM OB/Gyn Perinatal Guidelines Committee recommends transabdominal subjective assessment of the cervix between 16-23w6d on all women, regardless of PTB history, undergoing anatomic survey. If there is a suspicion of a short cervix on TA assessment or the cervix is not visualized, then TV assessment and measurement of the CL should be performed**. A short cervix is defined as a TV CL ≤2.5cm.**

To whom do we offer ultrasound-indicated cerclage vs vaginal progesterone?

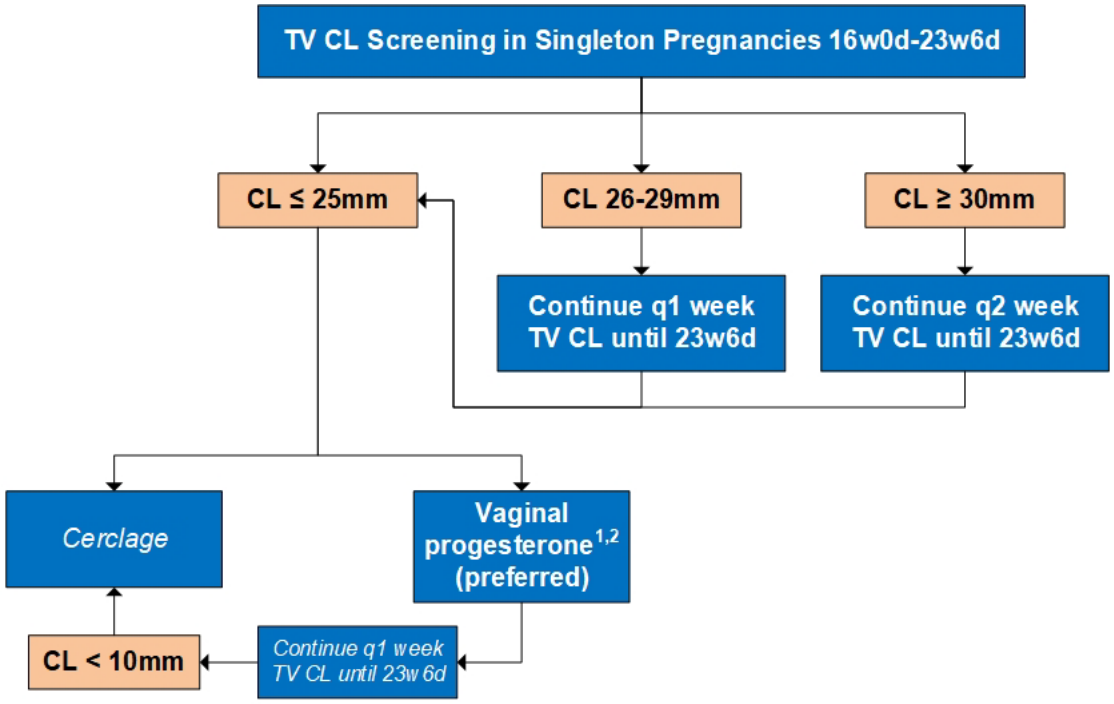
- BCM OB/Gyn Perinatal Guidelines Committee recommends that women with a singleton IUP and prior spontaneous PTB <34 weeks who are identified to have a TV CL ≤2.5cm be offered a TV cerclage as first-line intervention based on the best available evidence.
- In women who decline a TV cerclage placement, vaginal progesterone may provide some benefit based on indirect data and is a reasonable second-line option given safety profile.
- **BCM OB/Gyn Perinatal Guidelines Committee recommends that women with a singleton IUP and prior sPTB between 34w0d – 36w6d who are identified to have a TV CL ≤2.5cm be offered vaginal progesterone as first-line intervention based on the best available evidence.**
- Women who receive vaginal progesterone for a short cervix, regardless of PTB history, should continue weekly CL screening until 23w6d to identify progressive cervical shortening. If a TV CL <10 mm is identified before 24 weeks, a cerclage should be considered as vaginal progesterone does not appear to be effective at or below this cervical length ~~(see slides 16, 17)~~.
- **These recommendations are meant to be a guideline to clinical decision-making. BCM OB/Gyn Perinatal Guidelines Committee acknowledges that our understanding of PTB is evolving and therefore clinical situations will exist that may not fit into either gestational age epoch as described. In these cases, a unique treatment plan is encouraged after individualization of care and shared decision-making regarding cerclage vs vaginal progesterone.** Direct communication with the patient's physician is advised to maintain consistency in care.

Figure 1. *Screening for Singleton Pregnancies with Prior sPTB < 34 weeks*



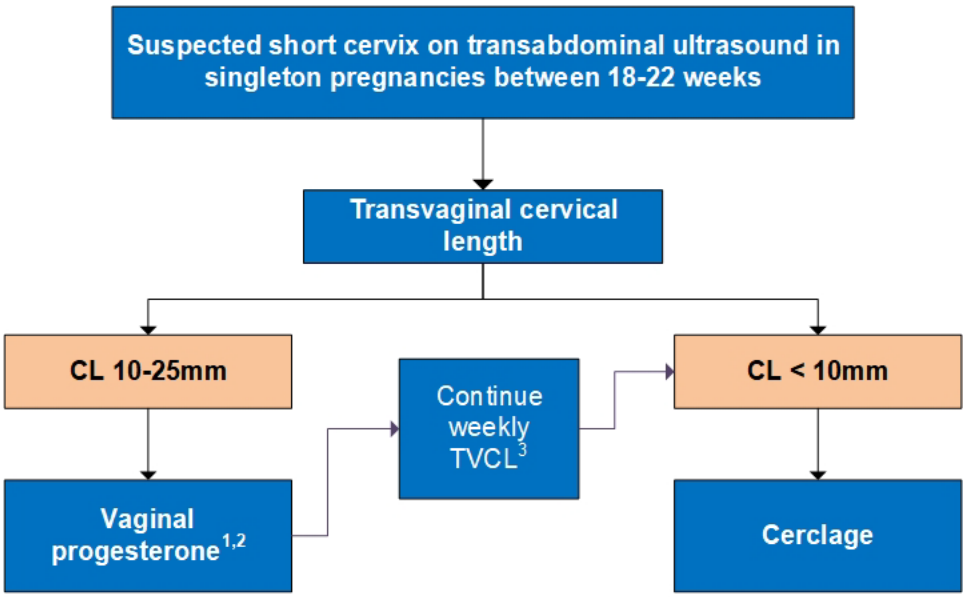
[1]Crinone 8% vaginal gel (90mg) or 200mg micronized progesterone nightly until 36 weeks
[2]Consider cervical exam to rule out cervical dilatation

Figure 2. *Singletons with prior sPTB between 34w0d-36w6d*



[1]Crinone 8% vaginal gel (90mg) or 200mg micronized progesterone nightly until 36 weeks
[2]Consider cervical exam to rule out cervical dilatation

Figure 3. *Singletons with NO Prior Spontaneous PTB < 37 weeks (Asymptomatic)*



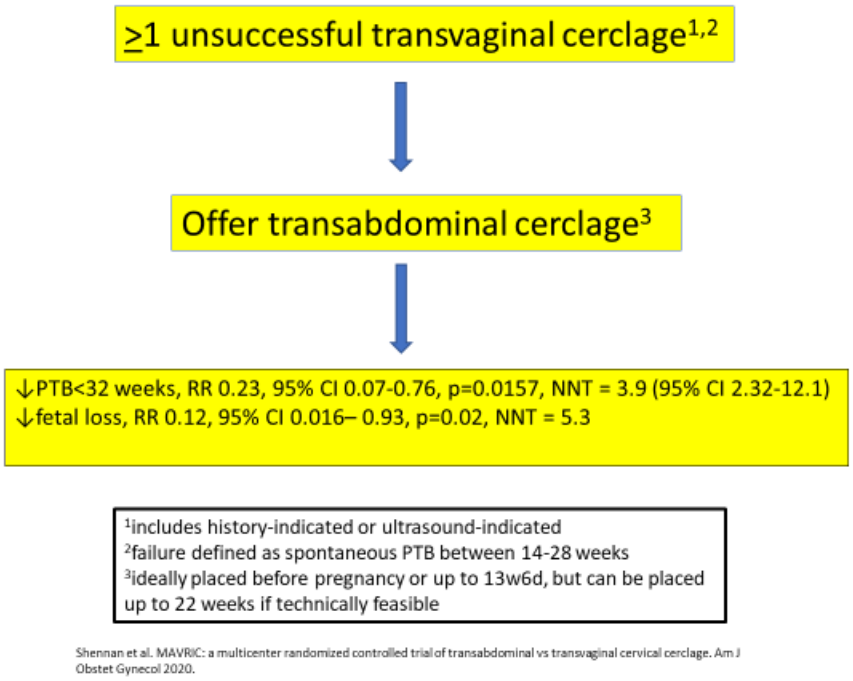
[1]Crinone 8% (90mg) vaginal gel or 200mg micronized progesterone qHS until 36 weeks
[2]Consider cervical exam to rule out cervical dilatation
[3]Continue weekly CL until 23w6d to identify progressive shortening < 10mm for which a cerclage would be indicated

Should we offer 17OHP to women with a prior spontaneous PTB for primary prophylaxis?

- BCM OB/Gyn Perinatal Guidelines Committee recommends that 17OHP not be offered to women with a prior spontaneous PTB.

Who should be offered a transabdominal cerclage?

- Women with a ≥1 unsuccessful history- or ultrasound-indicated TV cerclage should be considered for a transabdominal cerclage.
- Placement of a TA cerclage should be performed before conception but can be placed up to 21w6d, if technically feasible.
- Women with a history of an unsuccessful exam-indicated cerclage should be offered a history-indicated cerclage in their subsequent pregnancy.



Shennan et al. MAVRIC: a multicenter randomized controlled trial of transabdominal vs transvaginal cervical cerclage. Am J Obstet Gynecol 2020.

Additional Notes

- A bimanual exam to check for cervical dilation should be considered in the setting of a short cervix.
- In patients who start vaginal progesterone but then require a cerclage for progressive cervical shortening, it is reasonable to continue vaginal progesterone based on limited evidence.
- Continued cervical length screening is not indicated after cerclage placement.
- In the setting of an exam-indicated cerclage, the perioperative addition of Indomethacin and Cefazolin may prolong latency period. The regimen is as follows:
    - Cefazolin (weight-based dosing: 1 gm if <100kg, 2 gm if ≥100kg): first dose preoperatively and then every 8 hours for 2 doses postoperatively for a total of 3 doses
    - Those with a PCN allergy should receive Clindamycin 600mg instead
    - Indomethacin 50mg PO immediately postoperatively, and then every 8 hours for 2 additional doses for a total of 3 doses
    - If cervical insufficiency is suspected based on a prior pregnancy loss of a multiple gestation, a history-indicated cerclage can be offered after shared decision-making.

Appendix

Table s1. Cerclage Checklist

Indications for Cerclage	[] History-indicated - History of one or more second-trimester pregnancy losses related to painless cervical dilation and in the absence of labor or abruptio placentae - History of exam-indicated cerclage [] Exam-indicated - Painless cervical dilation in the second trimester [] Ultrasound-indicated - Current singleton pregnancy, prior spontaneous preterm birth at less than 34 weeks of gestation, and short cervical length (less than 25 mm) before 24 weeks of gestation - Cervical length less than 10 mm without a history of prior preterm birth, without evidence of cervical dilation [] Transabdominal cerclage - Unsuccessful transvaginal cerclage, defined as singleton delivery before 28 0/7 weeks of gestation from sPTB after placement of history- or ultrasound-indicated cerclage - Anatomic factors that preclude placement of transvaginal cerclage, such as extensively amputated cervix, trachelectomy, recurrent LEEP procedures or a congenitally extremely short cervix
Contraindications for cerclage	Intrauterine infection Active preterm labor PPROM Fetal demise Active bleeding
Scheduling Considerations	[] Schedule ideally between 13-14 weeks for history-indicated cerclage but pending patient presentation for care [] Schedule pending diagnosis for ultrasound- or exam-indicated cerclage - If between 22 and 24 weeks, counsel patient on periviability implications - Ultrasound-indicated cerclages ideally should be placed within 72 hours of diagnosis and referral for US-indicated cerclage should be made to the PFW MFM RN coordinators to be scheduled in the PFW OR or scheduled in the BT OR. - Exam-indicated cerclages ideally should be placed within 24 hours of diagnosis if the patient is beyond 14 weeks; a period of observation to eliminate preterm labor as the cause is reasonable
Pre-Operative Evaluation	[] Pelvic examination including sterile speculum examination and digital examination [] Aneuploidy screening or diagnostic testing, if desired [] T&S, CBC [] Evaluation for infection - Work-up based on symptoms - Evaluation for intraamniotic infection, including amniocentesis if clinically indicated (can consider with exam-indicated cerclage) [] Ultrasound as appropriate [] Anesthesia consultation [] History and physical [] Surgical consent (Risks include bleeding, infection, damage to surrounding structures, rupture of membranes, failure of the cerclage leading to pre-viable, peri-viable or preterm delivery with the potential for adverse outcomes in the current and any future pregnancy, cervical trauma in the setting of labor) [] Discuss planned observation after procedure [] Post-procedural plan for any prophylactic antibiotics and tocolytics [] Length of stay determination after procedure and whether tocometry monitoring is necessary [] Fetal heart rate documented prior to cerclage (day of surgery)
Intraoperative	[] Counseling of patient on intra-operative findings and/or complications [] Discussion if intra-operative findings warrant tocolysis and prophylactic antibiotics
Postoperative	[] Assessment of fetal heart tones after procedure [] Anesthetic considerations (if discharging day of surgery) - Ambulation - Urination - Alert anesthesia of any concerns postoperatively [] Provide patient education – what to expect [] Review activity level with patient [] Discuss use of progesterone if patient was using prior to cerclage placement [] Postoperative analgesia [] Follow-up scheduled within 2 weeks with primary Obstetrician

	[] Employment absence documentation as needed [] No further routine cervical length assessment recommended

Checklist references:

1. Society for Maternal-Fetal Medicine (SMFM); Mateus Nino J, Combs CA, Davidson C; SMFM Patient Safety and Quality Committee. Electronic address: smfm@smfm.org. Society for Maternal-Fetal Medicine Special Statement: Checklists for transabdominal cerclage. Am J Obstet Gynecol. 2023 Oct;229(4):B2-B6.
2. Cate J, Bauer S. Cerclage Checklist. Duke University

Fetal Growth Restriction in Singleton Pregnancies

[April 2025 (replaces September 2024)]

Author: Dr. Manisha Gandhi, Dr. Wesley Lee, Dr. Joan Mastrobattista
Editor: Dr. Manisha Gandhi, Dr. Sarah Detlefs

August 2025 edit – Figure 2 has been updated with no content changes but to make the recommendations more clear and concise.

Highlights

- The term “fetal growth restriction” (FGR) is preferable to IUGR or SGA when referring to a fetus with an EFW or AC below the 10th percentile threshold according to the Hadlock *in-utero* weight standard.[1]
- The FGR diagnosis is based on sonographic fetal biometry when the EFW or AC < 10th percentile, particularly in the presence of oligohydramnios and Doppler flow abnormalities. The index of suspicion for FGR is increased in the presence of specific maternal and/or fetal risk factors.
- The distinction between fetuses that are constitutionally small from those who are truly growth restricted has potential clinical ramifications because the latter are at increased risk for adverse outcomes. At BCM, the recommended interval between interval growth scans is 3 weeks for growth-restricted fetuses.
- Umbilical artery Doppler velocimetry should be monitored in growth-restricted fetuses because it is associated with fewer perinatal deaths and fewer inductions of labor and cesarean deliveries.
- Pregnant people with FGR can be admitted to the hospital when fetal testing more often than 3 times per week is considered necessary.
- Consider delivery of growth restricted fetuses when the risk of fetal morbidity or death exceeds that of neonatal adverse outcomes.

FGR Definition

There is no consensus for the terminology used to classify fetuses and newborns who have failed to achieve normal weight. ACOG recommends that the term fetal growth restriction (FGR) should be applied to fetuses whose estimated fetal weight (EFW) OR abdominal circumference is below the 10th percentile for gestational age.[2,3] The term "small-for-gestational age" (SGA) should be used in the postnatal period to describe neonates whose actual birth weight is below the 10th percentile for gestational age. The term "IUGR" is nonspecific since it can be used to describe limited growth of the fetus, the placenta or both.

Fetuses diagnosed with FGR before 32 weeks gestation have **early-onset** growth restriction (20-30%). Those diagnosed after 32 weeks have **late-onset** growth restriction (70-80%).[3] Early onset growth restriction tends to be more severe and is more often associated with hypertensive disorders of pregnancy.

- Maternal medical conditions
  - Pregestational diabetes mellitus
  - Renal insufficiency
  - Autoimmune disease (eg, systemic lupus erythematosus)
  - Cyanotic cardiac disease
  - Pregnancy-related hypertensive diseases of pregnancy (eg, chronic hypertension, gestational hypertension, or preeclampsia)
  - Antiphospholipid antibody syndrome
- Substance use and abuse (eg, tobacco, alcohol, cocaine, or narcotics)
- Multiple gestation
- Teratogen exposure (eg, cyclophosphamide, valproic acid, or antithrombotic drugs)
- Infectious diseases (eg, malaria, cytomegalovirus, rubella, toxoplasmosis, or syphilis)
- Genetic and structural disorders (eg, trisomy 13, trisomy 18, congenital heart disease, or gastroschisis)
- Placental disorders and umbilical cord abnormalities

Figure 4. Risk factors for growth restriction

Risk Factors

Several maternal and fetal risk factors have been reported as potential causes for fetal growth restriction – some of them are summarized by the 2013 ACOG Practice Bulletin as seen in **Figure 1**.[2]

Differential Diagnosis

The differential diagnosis for growth restriction includes incorrect pregnancy dating, constitutional smallness, and uteroplacental insufficiency, aneuploidy or other genetic syndrome, or fetal infection (i.e. cytomegalovirus).

The distinction between fetuses that are constitutionally small ("normal small fetuses") and fulfilling their growth potential from those who are truly growth restricted has important clinical value because the latter are at much higher risk for adverse outcomes.[4,5] This distinction can often be made by serial scans for EFW on the basis of at least two independent sets of fetal biometry.

Diagnostic Criteria

FGR is diagnosed by estimated fetal weight (EFW) AND/OR abdominal circumference (AC) < 10th percentile, particularly in the presence of oligohydramnios or Doppler abnormalities of the fetal circulation. Accurate dating criteria should be established - ideally from using a first trimester crown-rump length. * [6,7] BCM OB/Gyn Perinatal Guidelines recommends the use of Hadlock to calculate EFW. # [1,8]

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* ACOG considers first-trimester ultrasonography to be the most accurate method to establish or confirm gestational age. Pregnancies without a sonographic examination confirming or revising the estimated due date before 22 0/7 weeks of gestation should be considered sub-optimally dated. The AIUM, ACOG, and SMFM have developed joint guidelines for estimating estimated delivery date (EDD) based on the last menstrual period and an early dating US examination that is ideally performed ≤ 13 6/7 weeks.

EFW is calculated from four fetal size parameters measurements beginning in the second trimester (≥14 weeks). These size parameters include biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur diaphysis length (FDL). This specific prediction model has been reported to estimate weight to within 10 to 15%, random error (1 SD = 7.3%), depending on the quality of the measurements. Next, the ultrasound results are compared to normal percentile ranges according to an intrauterine weight standard that was established by Hadlock and colleagues.

A “normal small fetus” typically demonstrates adequate interval growth despite an EFW below the 10th percentile. In contrast, a growth-restricted fetus (i.e. EFW or AC < 10th percentile) may exhibit decreased growth velocities between scans.

Work up

The following evaluation is recommended for fetal growth restriction[3]

- Confirm accurate due date
- Detailed obstetrical ultrasound (76811)
- Aneuploidy screening with NIPT and/or diagnostic testing for:
  - Early-onset FGR
  - Sonographic abnormalities
  - Polyhydramnios
- PCR CMV on amniotic fluid if patient has amniocentesis
- Serial Growth ultrasounds every 3-4 weeks.[2]
- Antenatal surveillance

Antenatal Surveillance

Antenatal surveillance and Doppler assessment of the fetal circulation is an important adjunct for assessing the likelihood of adverse outcomes with FGR. Early onset FGR is more likely associated with vascular abnormalities of the maternal-fetal placental circulation.[9] Ultrasound findings include abnormal Doppler waveforms that suggest high vascular impedance of the uterine and umbilical arteries. Clinical management revolves around a 40 to 70 percent risk of associated pre-eclampsia and potential problems of prematurity. Late onset FGR is more likely to involve placental villous diffusion and perfusion defects that cause cerebral or umbilical artery Doppler abnormalities. Antenatal surveillance for late FGR revolves around identifying fetuses at risk for stillbirth. **Please see Figure 2 for antenatal surveillance recommendations.**

Clinical management, based on Doppler evaluation of the umbilical artery in fetuses with FGR, is associated with fewer perinatal deaths, inductions of labor, and cesarean deliveries.[10] **BCM OB/Gyn Perinatal Guidelines recommend using a free umbilical cord loop with a minimal angle of insonation**. Measurement of umbilical artery pulsatility index (PI) should be documented. Pulsatility Index utilizes peak systolic velocity (PSV), end-diastolic velocity (EDV), and mean of frequency shift over the cardiac cycle. ISUOG recommends PI rather than S/D ratio or resistance index (RI) be used as it has a linear relationship with vascular resistance (rather than parabolic for the other two indices).[11] .

SMFM does not currently recommend Doppler assessment of other maternal or fetal vascular territories including uterine arteries, middle cerebral artery, ductus venosus, *[12,13] umbilical vein #[14-16] or aortic isthmus to guide clinical management in FGR.[3,17,18] They also recommend against routine use of the cerebroplacental ratio (CPR). € [19] **BCM OB/Gyn Perinatal Guidelines recommends against the regular use of CPR and Doppler parameters other than Umbilical artery studies pending additional evidence to support their use.[17]**

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* The ductus venosus waveform reflects pressure-volume changes in the heart; when the a-wave is either absent or reversed, fetal survival of greater than 1 week is unlikely.

Umbilical vein pulsations are also an ominous pattern. The evaluation of umbilical vein pulsations is best performed in an intra-abdominal portion of the umbilical vein. This approach is more reliable than insonating a free loop of cord because pulsations from the umbilical artery can sometimes be transmitted to the umbilical vein.

€ A cerebroplacental ratio (CPR) represents the ratio of the pulsatility indices (PI) from MCA and UA Doppler waveforms. This ratio reflects the degree of fetal cerebrovascular dilatation resulting from hypoxia and increased placental vascular impedance that leads to decreased UA diastolic flow.

FGR diagnosed prior to 28 weeks gestation

SMFM recommends initiation of antenatal testing for growth restricted fetuses at viability.[3] However, this requires a careful risks/benefits discussion with Maternal Fetal Medicine and, often, Neonatology. Baschat et al states, "**Fetal surveillance should be initiated when the decision to intervene for fetal status has been made, and a BPP can be utilized for this purpose as early as at 24 weeks' gestation"**.[14] The risks of preventing a stillbirth must be weighed against the risks of increased intervention, possible need for classical cesarean delivery with its associated morbidity, and possibility of a neonatal death due to prematurity. Some patients may elect to forego testing prior to 28 weeks given the increased risks as described. **The BCM OB/Gyn perinatal guidelines committee supports patient autonomy on whether to perform antenatal surveillance for FGR prior to 28 weeks following careful counseling. All patients with a diagnosis of fetal growth restriction between 24 and 28 weeks gestation should have counseling with an MFM physician either in the ultrasound unit or in clinic.**

Hospital Admission

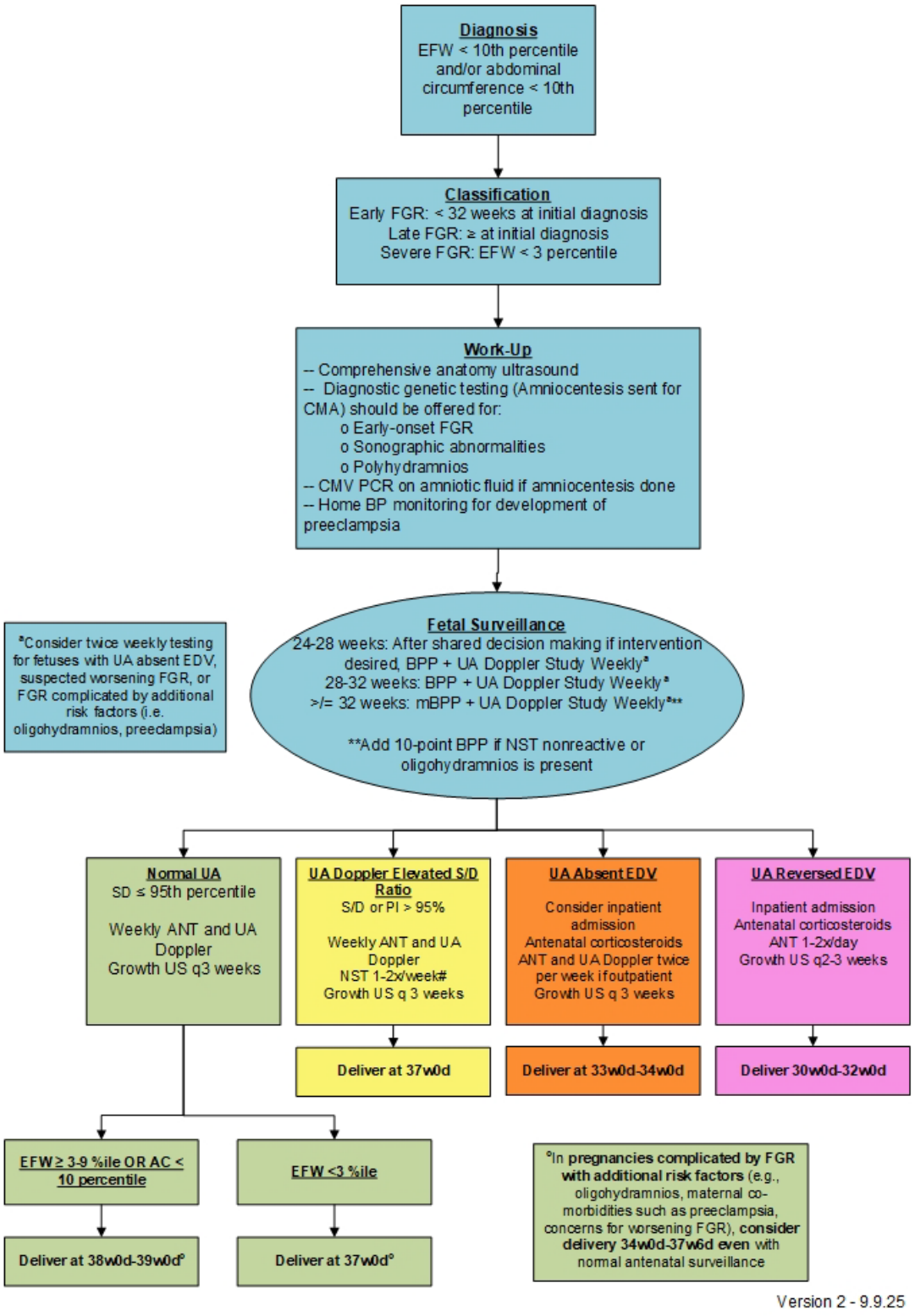
No adequately powered randomized trials are available to guide the decision for hospital admission of a patient with FGR. However, a SMFM Clinical Guideline proposes that this "may be offered once fetal testing more often than 3 times per week is deemed necessary".[3,17]

Delivery Timing

Please refer to Figure 2 for delivery timing recommendations.

Management Algorithms

Figure 5. Management Algorithm for FGR



Adapted from SMFM Clinical Consult Series #52[3] with BCM OB/Gyn Perinatal Guidelines modifications. This figure has been updated with recommendations for fetal surveillance between 24-28 weeks and use of the PI rather than S\D ratio, and delivery recommendations if AC < 3rd percentile.

Outpatient Diagnosis and Evaluation

Fetal Growth Restriction (FGR) (EFW or AC < 10th Percentile)

revised 4/22/2025

Early FGR
< 32 weeks gestation

↓

Detailed scan (CPT 76811)
Genetic counseling

→

Late FGR
≥ 32 weeks gestation

↓

Fetal biometry q 3 weeks
and serial antenatal testing

Antenatal Testing

Umbilical artery Doppler velocimetry with either modified BPP (AF + NST) ≥ 32 wks or 8-point BPP (for GA 24 0/7 - 31 6/7 wks)

Timing

Once per week if GA ≥ 28 weeks
Individualize antenatal testing < 28 weeks

If 8-point BPP Non-Reassuring, Consider 3 Options:

1. Add NST for 10-point BPP, or
2. Repeat BPP in 1 day, or
3. Admit for inpatient evaluation

Consider 2x Weekly Antenatal Testing

- Oligohydramnios
- Absent UA end diastolic velocity
- Suspected worsening FGR

General Recommendations

Establish firm dating criteria

Evaluate maternal and fetal risk factors

Use Hadlock EFW (BPD, HC, AC, FDL)

Interpret EFW using population standards

Home blood pressure monitoring

Early FGR

Offer amniocentesis

- Include chromosomal microarray for FGR with any malformation and/or hydramnios (any GA) OR unexplained etiology
- Recommend PCR testing (CMV) for unexplained FGR who agree to amniocentesis

No screening for toxoplasmosis, rubella, or herpes for isolated FGR with no risk factors.

Comment: Oligohydramnios = AFI ≤ 5 cm or maximum vertical AF pocket ≤ 2 x 2 cm; Umbilical artery (UA) vascular resistance is estimated from systolic to diastolic velocity (SD) ratio or pulsatility index (PI) = (S-D)/mean velocity; Abnormal UA Doppler velocimetry = UA S/D ratio or PI > 95th percentile for gestational age; Twice weekly antenatal testing: Visit 1 = mBPP + UA Doppler, Visit 2 = NST only, add repeat UA Doppler if Visit 1 Doppler abnormal.

Adapted from Society for Maternal-Fetal Medicine Consult Series #52: Diagnosis and Management of Fetal Growth Restriction, 2020

revised 3-21-2021

Evaluation and Delivery Timing - Fetal Growth Restriction (EFW or AC < 10th percentile)

Abnormal Doppler Findings

1. Absent End Diastolic Velocity (AEDV) → UA Doppler 2-3 times/week
   Consider hospitalization
2. Reversed End Diastolic Velocity (REDV) → Hospitalization
   Antenatal corticosteroids
   NST surveillance 1x to 2x day
   Neonatology consultation
   Magnesium sulfate if indicated
   Delivery based on clinical evaluation

Delivery Timing

FGR (EFW between 3rd -10th %ile) *Normal UA Doppler findings*	→ Deliver at 38 0/7 to 39 0/7 wks
FGR + UA Doppler with elevated PI > 95th%ile (No AEDV or REDV); Or with severe FGR (I.e. EFW < 3rd%)	→ Deliver at 37 0/7 wks
FGR + AEDV	→ Deliver at 33 0/7 - 34 0/7 wks (Cesarean)
FGR + REDV	→ Deliver at 30 0/7 - 32 0/7 wks (Cesarean)

Comments

Antenatal corticosteroids if delivery is anticipated before 33 6/7 weeks of gestation or for pregnancies between 34 0/7 - 36 6/7 weeks of gestation in women without contraindications at risk of preterm delivery within 7 days and who have not received a prior course of antenatal corticosteroids

Magnesium sulfate for fetal and neonatal neuroprotection for women with pregnancies that are less than 32 weeks of gestation in whom delivery is likely.

FGR by AC alone: An AC < 3rd %ile with EFW >3rd %ile does not qualify for severe FGR. Delivery for FGR based on AC alone with normal testing and no other risk factors is recommended at 38w0d-39w0d.

ACOG Committee Opinion No. 818: Medically indicated late-preterm and early-term deliveries. Obstet Gynecol. 2021. PMID: 33481529
Adapted from Society for Maternal-Fetal Medicine Consult Series #52: Diagnosis and Management of Fetal Growth Restriction, 2020

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Monochorionic Twin Pregnancies

[April 2025 (replaces April 2016)]

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Editor: Dr. Hayden Latham

Highlights

- Twin-twin transfusion syndrome (TTTS) occurs in 8-10% of MCDA twin pregnancies. Ultrasound screening should occur every 2 weeks starting at 16 weeks. Patients with findings concerning for TTTS should be referred to the TCH Fetal Center for evaluation.
- **BCM OB/Gyn Perinatal Guidelines Committee recommends using the following definition for selective FGR (sFGR): A condition in which one fetus has EFW < 10th centile or AC < 10th centile.**
- Fetal weight discordance ≥ 25th centile without growth restriction also is associated with adverse perinatal outcomes and warrants closer surveillance.
- Twin Anemia Polycythemia Sequence (TAPS) more often occurs following laser photocoagulation of the placenta for TTTS. TAPS is diagnosed when the Middle Cerebral Artery (MCA)-Peak Systolic Velocity (PSV) is >1.5 Multiples of the Median (MoM) in the anemic fetus and <1 MoM in the polycythemic fetus or delta MCA-PSV >0.5 MoM. Fetal Center referral is recommended if MCA-PSV> 1.7 MoM and <0.8 MoM in the anemic and polycythemic fetuses, respectively, or delta MCA-PSV is >1.

Background

The general prevalence of twin-twin transfusion syndrome (TTTS) is 1-3 per 10,000 births.[1] Approximately 8-10% of monochorionic, diamniotic (MCDA) twin pregnancies are complicated by TTTS.[2,3] The prenatal diagnosis, management, and treatment of TTTS have been previously described.[4-6] This guideline is based on recommendations from the Society for Maternal-Fetal Medicine[6] and on expertise within our own Baylor OBGYN Department.

General Principles

Optimal prenatal assessment of MC twins begins with a precise diagnosis of placental chorionicity. Identification of well-dated MC twins is best accomplished during the 11-14 week scan when direct binding between two thin amniotic membranes can usually be visualized (i.e. "t-sign").[7,8] The management goals for TTTS can differ:

15-28 weeks: early detection and/or treatment of serious complications mainly amenable to fetal therapy [TTTS, twin anemia polycythemia sequence (TAPS) and selective fetal growth restriction (sFGR).

29-36 weeks: early detection of complications mainly (not exclusively) amenable to early delivery and/or elective surgery that includes: 1) late onset TTTS; 2) late sFGR; and 3) TAPS.

Surveillance and Management of TTTS

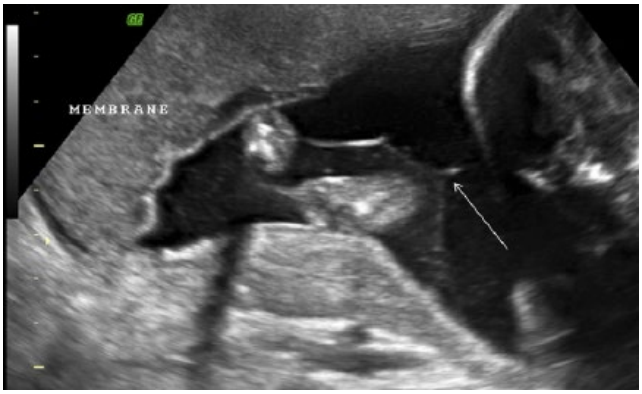
SMFM recommends ultrasound surveillance at 2-week intervals starting from 16-weeks until delivery to identify early occurring TTTS that may develop days following a normal scan. The basic pathophysiology is caused by abnormal placental vascular connections between fetuses. Placental blood flow imbalances lead to volume depletion in the donor twin (oliguria and decreased amniotic fluid) and volume overload in the recipient twin (polyuria and hydramnios).

Sonographic Findings Associated with TTTS[9]

First Trimester Findings:
- Crown-rump length discordance
- Nuchal translucency > 95th percentile or discordance > 20% between twins
- Reversal or absence of ductus venosus A-wave

Second Trimester Findings:
- Abdominal circumference discordance
- Membrane folding
- Velamentous placental cord insertion (donor twin)
- Placental echogenicity (donor portion hyperechoic)
- 20% EFW discordance

Some TTTS predictors have included ductus venosus Doppler, nuchal translucency, membrane folding, and abdominal circumference discordance although the sensitivity of these signs is not extremely high.[5,10,11]

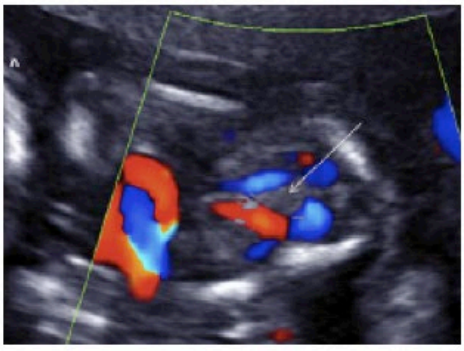


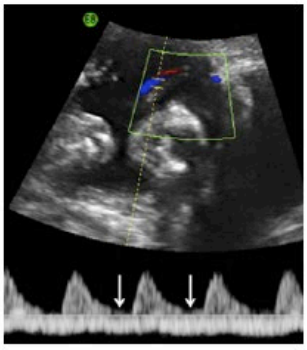
Membrane Folding Example

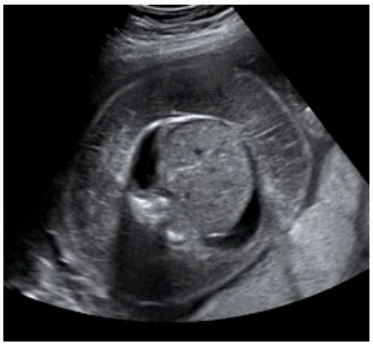
TTTS Staging

The Quintero classification system[8] is the most widely used for establishing fetal prognosis for TTTS on the basis of severity and provides a standardized method to compare outcomes using different therapeutic approaches.

Stage	Ultrasound Parameter	Categorical Criteria
I	MVP of amniotic fluid	MVP < 2 cm in donor sac; MVP > 8 cm in recipient
II	Fetal bladder	Non-visualized fetal bladder in donor twin over 60 minutes of observation
III	Doppler waveforms umbilical artery/vein, ductus venosus	Absent or reversed umbilical artery diastolic flow Reversed ductus venosus a-wave flow Pulsatile umbilical vein flow
IV	Fetal hydrops	Hydrops in one or both twins
V	Absent fetal cardiac activity	Fetal demise in one or both twins


Stage II


Stage III

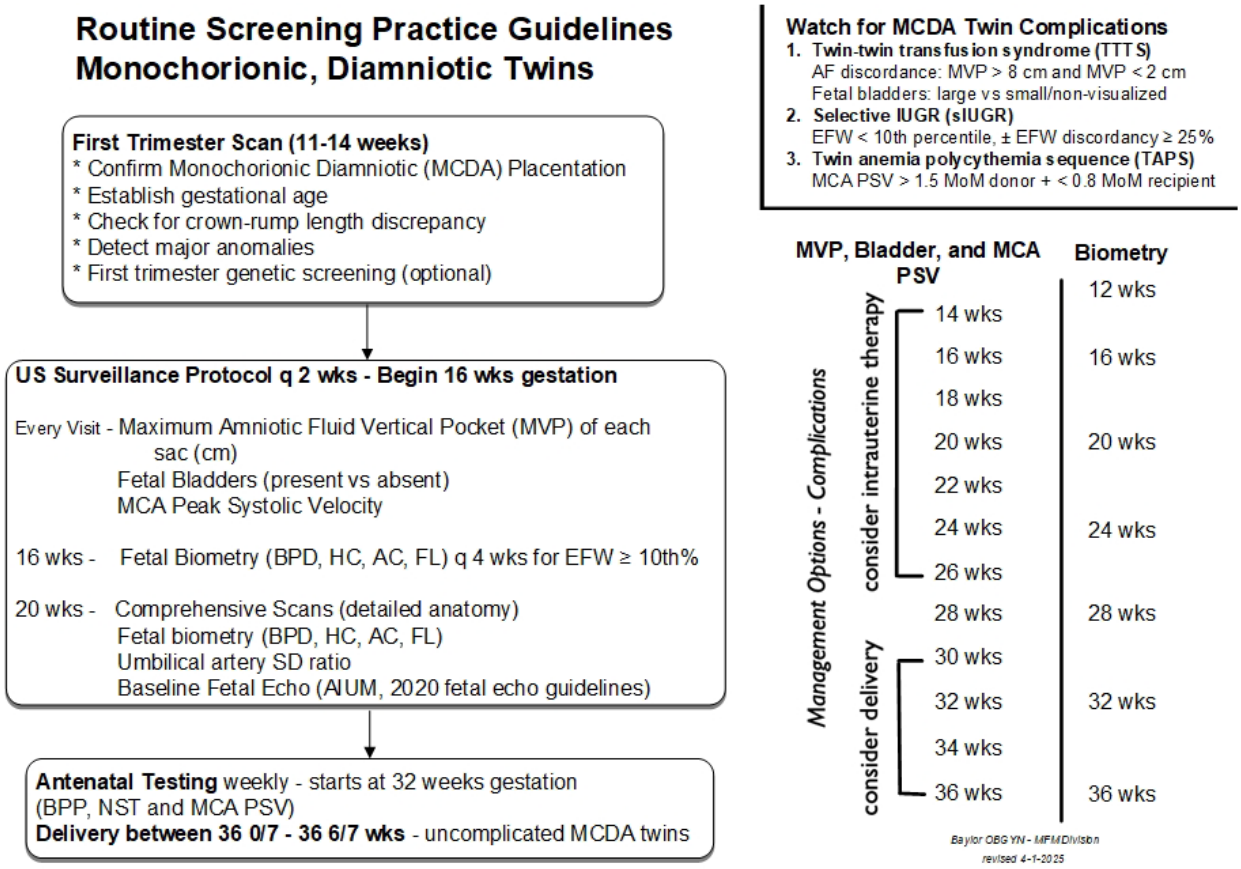

Stage IV

Ultrasound monitoring

Pregnancies not yet diagnosed with TTTS

Two different types of ultrasound scans are commonly used to monitor MCDA pregnancies for the potential development of TTTS. See Figure 1 for management algorithm for TTTS Screening

Figure 6. MCDA Screening Guidelines



Pregnancies affected by TTTS s/p laser ablation

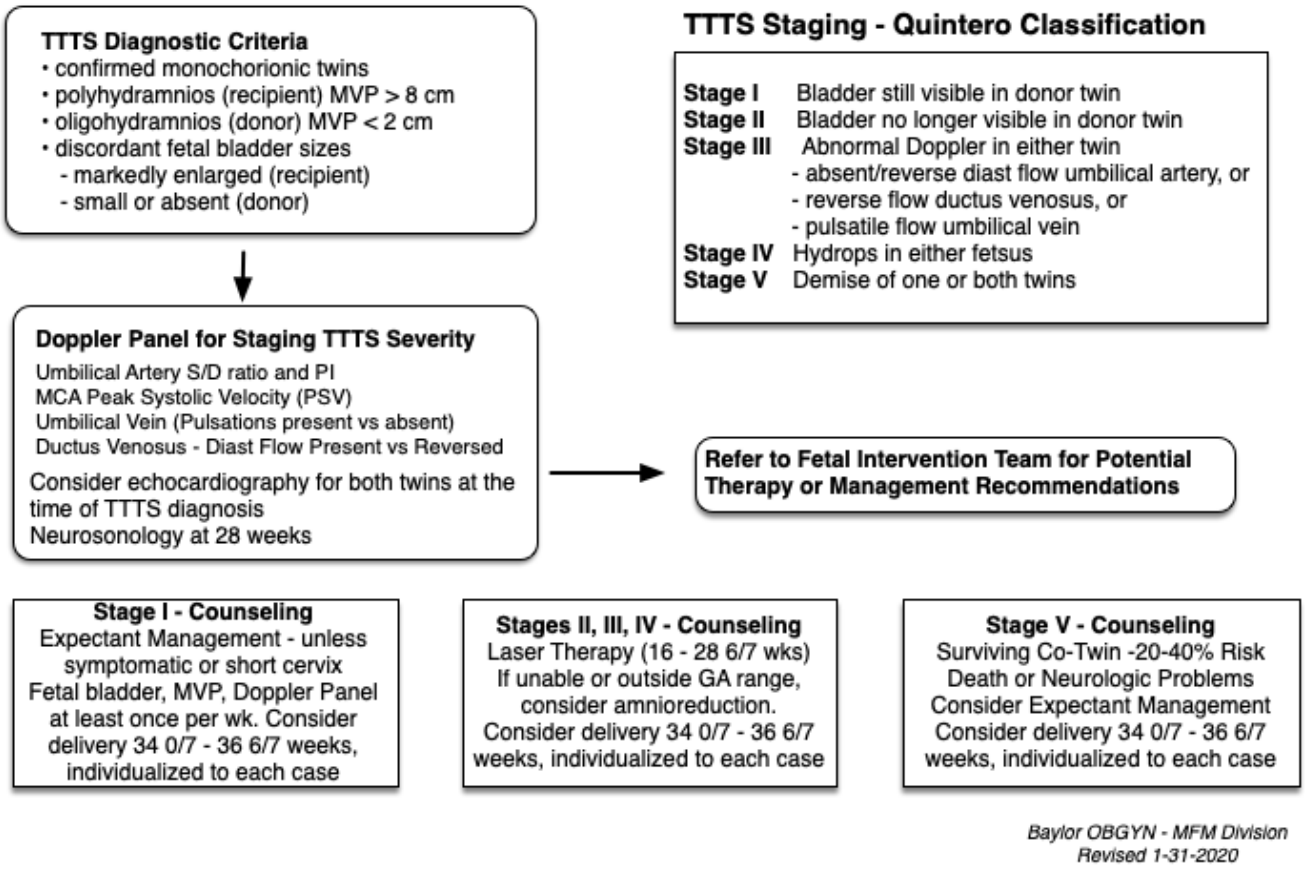
Postoperative follow-up scans should include **weekly** scans for 6 weeks postop before resuming at 2-week intervals provided there are no other concerns.

- ☐ Amniotic fluid assessment (maximum vertical pocket or MVP)
- ☐ Estimated fetal weights and abdominal circumference measurements
- ☐ Fetal bladder (present or absent)
- ☐ Middle cerebral artery peak systolic velocity (MCA-PSV).
- ☐ Umbilical artery Doppler should be evaluated after viability (at gestational age when delivery would be considered) in cases of sFGR
- ☐ Evaluation of possible complications related to surgery (chorioamniotic membrane separation, incidental septostomy).

Management of TTTS

Refer to Figure 2 for management of TTTS.

***Figure 7**. MCDA TTTS Management*



Delivery timing for pregnancies complicated by TTTS

In uncomplicated postoperative TTTS patients without evidence of sFGR, delivery at 36 weeks is reasonable as early elective delivery has not been shown to be protective against adverse neonatal outcomes in this group.[12] Furthermore, early delivery is associated with more complications related to prematurity. Delivery timing for cases complicated by sFGR and/or surgical complications should be individualized.

Management for other MCDA twin complications

In addition to TTTS, monochorionic twins are also at risk for developing selective fetal growth restriction (sFGR) and twin anemia polycythemia sequence (TAPS).[13]

Selective Fetal Growth Restriction (sFGR)

Diagnosis

MCDA twins are at risk for discordant twin growth that is more likely to be associated with either velamentous placental cord insertion or unequal placental sharing.[14] **BCM OB/Gyn perinatal guidelines committee recommends defining selective FGR (sFGR, formerly sIUGR) as a condition in which one fetus has EFW <10th centile or AC <10th centile.[15] Fetal weight discordance ≥ 25th centile without growth restriction is also associated with adverse perinatal outcomes. See management for growth discordance ≥ 25% centile (without growth restriction) for recommended management.**

In cases of early sFGR, the presence of inter-fetal anastomoses causes the smaller twin to receive well-oxygenated blood from its co-twin as a “rescue transfusion” phenomenon. The number and type of vascular anastomoses has led to three main well-defined clinical patterns as reported from Denmark.[16] About 5% of

sFGR cases occur later during the third trimester. Late sFGR has placental angioarchitecture that is distinct from early sFGR.[17] The following table summarizes this sFGR classification.[5]

Table 3. Type of sIUGR in MC twins according to the characteristics of umbilical artery Doppler in the small twin, and main clinical and placental features of each type [67]

Type	Clinical features	Placental features
Type I: normal Doppler (positive diastolic flow)	– Benign course with smaller degree of weight discordance – Very low risk of IUFD and co-twin brain damage – IUGR evolves well (normally >34 weeks' GA)	– Unequally shared placenta – High anastomotic diameter which largely compensates for placental territory imbalance – No or small AA anastomosis
Type II: absent/reverse end-diastolic flow (constantly)	– High risk of deterioration and IUFD of IUGR twin (predictable by Doppler evolution in most cases) – Very low risk of intrauterine brain injury of normal co-twin – Mean GA at delivery (due to deterioration of IUGR) 29 weeks	– Very unequally shared placenta – Smaller anastomotic diameter, which compensates for severe placental territory imbalance, but for a shorter time – No or small AA anastomosis
Type III Intermittent absent/reverse end-diastolic flow	– Low risk of hypoxic deterioration of IUGR twin which commonly survives until 32 weeks' GA and beyond – 10–15% risk of unexpected IUFD of IUGR twin (non-predictable) – 10–15% risk of brain injury in normal co-twin	– Very unequally shared placenta – A large AA anastomosis which largely compensates for unequal sharing and allows long in utero survival of IUGR twin, but carries high risk of acute feto-fetal transfusion accidents

Standardized protocol of expectant management of sFGR according to type:

The following protocol has been suggested for management of sFGR in monochorionic twins (based on expert opinion) in our institution:

Type I:

- ☐ Fetal Doppler (umbilical artery, and middle cerebral artery) and amniotic fluid levels checked once weekly
- ☐ Fetal growth assessment every 3 weeks (using Hadlock in-utero weight formula[3])
- ☐ Fetal echocardiography at initial presentation and again if there is evidence of worsening fetal Doppler changes or as otherwise suggested by the Pediatric Cardiology specialist.

Type II and III:

- ☐ Refer to Fetal Intervention
- ☐ Fetal Doppler (umbilical artery, ductus venosus and middle cerebral artery) and amniotic fluid levels checked twice weekly (to identify candidates who may benefit from fetal intervention)
- ☐ Fetal growth assessment every 3 weeks
- ☐ Fetal echocardiography at initial presentation and again if there is evidence of worsening fetal Doppler changes or as otherwise suggested by the Pediatric Cardiology specialist.
- ☐ Neonatology consultation at 23-24 weeks gestation to discuss the chances of survival of both twins in the view of estimated fetal weights
- ☐ Consultation with the Fetal Center is recommended

Presence of ominous signs of fetal deterioration (**persistent** absence/reversal of "a" waves in ductus venosus, fetal hydrops, or significant echocardiographic findings such as impaired cardiac function) are reasons to discuss the option of fetal intervention (laser photocoagulation if feasible or out of the state options). After fetal viability, delivery would be considered (fetal intervention after viability would be considered in the form of laser photocoagulation if feasible in selected cases with expected very low chances of survival of the FGR fetus).

Criteria for hospital admission

Patients with type II or III sFGR should be offered admission to the hospital between 26-28 weeks' gestation (26 weeks' gestation if there is evidence of reversed diastolic flow in umbilical artery or persistent abnormal blood flow pattern in the ductus venosus).

During admission:

- ☐ Administer course of antenatal corticosteroids for fetal lung maturation

- ☐ Neonatology consultation
- ☐ BPP twice weekly
- ☐ NST every 12 hours (frequency can be increased if initial tracings are non-reassuring)
- ☐ Magnesium sulfate for neuroprotection (before 32 weeks) and rescue course of antenatal corticosteroids (if 1-2 weeks have passed since the previous steroid dose) in case of imminent delivery

Management for growth discordance ≥ 25%centile (without growth restriction)

If there is evidence of is ≥ 25% discordance, the BCM OB/Gyn Perinatal Guidelines Committee recommends performing an umbilical artery Doppler study at the time of the growth scan. If the Doppler study is normal, recommend repeating the Doppler study at the next scheduled ultrasound (next q2 week TTTS check or next antenatal testing appointment). If the Doppler study is abnormal (PI > 95th centile), recommend initiation of weekly antenatal testing with Doppler studies.

Delivery timing:

Timing of delivery depends on fetal status

Table 1. Delivery timing by sFGR type

sFGR Type	**Delivery timing**
Elective delivery, reassuring fetal wellbeing	
Type I	34w0d-36w0d
Type II	32w0d
Type III	32w0d-34w0d *34 weeks if fetal status stable (NST/BPP remains reassuring)*
Emergency Delivery indications	
BPP ≤ 4/10	At diagnosis
Category 3 fetal heart tracing	At diagnosis
Sinusoidal pattern	At diagnosis
Moderate variability with accelerations and any of the following: • Recurrent late decelerations • Recurrent variable decelerations (FHR <80 bpm, more than 3/10 minutes) • Fetal bradycardia or recurrent prolonged decelerations	If recurrent and not responding to a trial of in utero resuscitation (IV fluid bolus and left lateral decubitus positioning)

Twin Anemia Polycythemia Sequence (TAPS)

The incidence of spontaneous TAPS in MCDA twins is approximately 5%. Following laser surgery for TTTS, this incidence can be as high as 13%. TAPS results from chronic transfusion across smaller arteriovenous anastomoses.

Diagnosis

SMFM recommends routine evaluation of MCA-PSV during ultrasound surveillance for TTTS and recommends that diagnosis of TAPS should be based on either the classical TAPS criteria (MCA-PSV>1.5 MoM in anemic fetus and and <1 MoM in the polycythemic fetus) or delta MCA-PSV >0.5 MoM.[9,18,19]

However, utilizing these criteria may be associated with increased number of referrals to fetal centers due to either false positive, transient MCA-PSV discordance or early cases of TAPS. Accordingly, the SMFM recommends fetal center referral for cases with stage II TAPS and above (MCA-PSV >1.7 MoM in the anemia fetus and <0.8 in the polycythemic fetus) as they are potential surgical candidates.

Management

The BCM Fetal Intervention team recommends referral to the Fetal Center for cases with stage II TAPS using the classical criteria or significant discordance of MCA-PSV (defined as delta MCA-PSV>1) and above. For cases of suspected or early-stage TAPS (defined as MCA-PSV >1.5 MoM but < 1.7 MoM in the anemic twin and <1 MoM but > 0.8 MoM in the polycythemic twin or delta MCA-PSV 0.5 - 1.0 MoM), we recommend evaluation of MCA-PSV, umbilical artery and Ductus venosus Doppler and at least weekly surveillance). Referral to a fetal center is recommended in early-stage TAPS if findings persist on repeat evaluation.

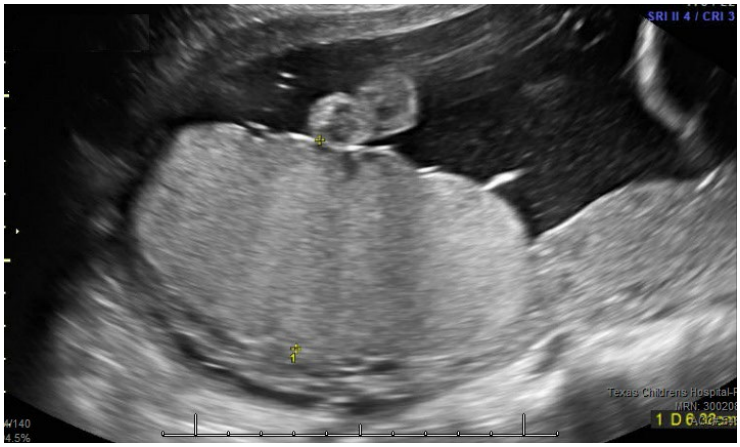
Stages of TAPS

	MCA-PSV in donor (MoM)	MCA-PSV in recipient (MoM)
Stage I	>1.5	< 1
Stage II	>1.7	<0.8
Stage III	Evidence of fetal cardiac compromise	
Stage IV	Hydrops	
Stage V	Single or dual fetal demise	

Associated ultrasound criteria in cases of TAPS

- There are fetal liver and placental changes suggestive of TAPS

The placenta of the anemic fetus appears thick and hyperechogenic, while the placenta of the polycythemic fetus appears thin and translucent . The liver of the polycythemic fetus has a "starry sky" appearance.



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Prenatal Assessment of Chromosomal Abnormalities

[August 2025 (replaces January 2021)]

Author: Dr. April Adams, Dr. Mona Makrameh, **Dr. Christian Parobek**

Highlights

- cfDNA (NIPT) is the preferred screen for fetal aneuploidy.
- Serum screening (i.e. QUAD or integrated screen) may be used if cfDNA is unavailable.
- Mid-trimester maternal-serum AFP screening for body-wall malformations (15-22 weeks) is optional as long as the patient receives a mid-trimester anatomy ultrasound.
- Diagnostic testing (i.e. amniocentesis or CVS) for aneuploidy and chromosomal copy-number variants should be offered to all pregnant patients.
- Obstetric providers should understand risks of aneuploidy and other chromosomal abnormalities, and be able to counsel regarding the benefits, risks and limitations of available diagnostic and screening methods.

Epidemiology of chromosomal abnormalities

Chromosome abnormalities are common, occurring in 1 in 150 live births[1,2]. include autosomal aneuploidies, sex-chromosome aneuploidies and pathogenic copy-number variants (CNVs). While the incidence of autosomal aneuploidy increases with maternal age, these can affect pregnancies at any age and are not related to race or ethnicity.[2] In contrast, sex-chromosome aneuploidies such as Turner syndrome (monosomy X) are generally not associated with maternal age. Finally, CNVs occur in approximately 0.4% of pregnancies and are also unrelated to maternal age.[2] **For patients under age 35, the risk of a pregnancy affected by a disease-causing CNV is higher than the risk of chromosomal aneuploidy (i.e. trisomies 13, 18, and 21).[2-4]**

Screening for chromosomal aneuploidies

Assessment for chromosomal aneuploidy should be offered to every pregnant individual. While the risk of autosomal aneuploidy increases with age, all pregnancies are at risk. Patients may opt for screening, diagnostic testing, or no testing at all. Figure 1 provides information regarding differences in screening and diagnostic testing. Available aneuploidy screening methods include cell-free DNA based screening (cfDNA, also known as non-invasive prenatal testingalso known as non-invasive prenatal testing, or NIPT) and serum screening (including the Quad marker screen and integrated screens). **BCM OB/Gyn Perinatal Guidelines Committee recommends using cell-free DNA (cfDNA) screening as the preferred screening method** due to its superior sensitivity and specificity for detecting common aneuploidies such as trisom[5,OBJ] Professional societies recommend cfDNA screening as an option for all pregnan[2,5,62,6,7,OBJ] cfDNA screening can be collected as early as 9-10 weeks (depending on the laboratory).
Serum screening, including the Quad screen or integrated screen, can be utilized in cases where cfDNA is not covered by the patient's insurance or if the patient declines cfDNA screening for other reasons. While serum screening is less accurate than cfDNA, it still provides useful risk assessment for chromosomal abnormalities.

cfDNA screening for microdeletion/duplication syndromes, rare autosomal trisomies and single gene disorders is *not* currently recommended for routine use by ACOG.[2] In contrast, the American College of Medical Genetics (ACMG) recommends 22q11.2 deletion screening in the context of shared decision making.[7] **The BCM OB/Gyn Perinatal Guidelines currently recommends against offering cell-free DNA aneuploidy screening with microdeletion screening, and that this should be reserved for special situations after genetic counseling**.

Mid-trimester maternal-serum AFP screening

Mid-trimester maternal-serum alpha-fetoprotein (MSAFP) screening is used to detect body-wall anomalies such as neural-tube and ventral-wall defects. However, recent studies indicate that high quality anatomical ultrasounds performed in the first and early second trimesters have a higher sensitivity and specificity for detecting these anomalies compared to MSAFP screening.[8,9] Moreover, MSAFP has both low sensitivity and low specificity for body wall defects.[10-12]Per ACOG guidance and **BCM OB/Gyn Perinatal Guidelines Committee considers MSAFP screening optional** if the patient is undergoing a high-resolution anatomic survey at 20-24 weeks gestation.[2] If MSAFP screening is pursued, an elevation of ≥2.5 multiples of the median (MoM) should prompt referral for a comprehensive anatomy ultrasound and, in the absence of other findings, a third-trimester growth ultrasound.

Diagnostic testing for chromosomal abnormalities

The American College of Obstetricians and Gynecologists (ACOG) recommends that diagnostic testing for chromosomal abnormalities be offered to all pregnant individuals, regardless of age or *a priori* risk.[2] Diagnostic testing is the only method to accurately and comprehensively evaluate for chromosomal abnormalities, including aneuploidy as well as over 100 sub-chromosomal copy-number conditions. Diagnostic testing requires either chorionic villus sampling (CVS; 10-13 weeks gestation) or amniocentesis (15+ weeks gestation). These procedures enable advanced testing with a chromosomal microarray, with or without a karyotype.[4,13]. While insurance coverage for these procedures may be limited to specific indications such as advanced maternal age or the presence of fetal anomalies, it is appropriate to offer diagnostic testing for chromosomal conditions to all pregnant patients. While testing for single-gene disorders with exome or genome sequencing is not recommended for structurally normal fetuses with low *a priori* risk, these tests available for information-seeking families. The risks associated with CVS and amniocentesis are low. The procedure-related risk of pregnancy loss after amniocentesis is approximately 0.1% to 0.3%, and 0.2% to 0.5% after CVS. **Amniocentesis is appropriate and safe in the late-second and third trimesters**, as the risk of preterm birth or other pregnancy complication is low.[14] In general, the risks of diagnostic testing are minimal compared to the significant benefits of obtaining early and accurate genetic information.[3,4,14,15] Offering diagnostic screening to all pregnant patients ensures that they have the opportunity to make informed decisions based on comprehensive genetic information.

Pretest counseling

All prenatal care providers should be comfortable providing basic genetic counseling and arranging for standard genetic testing. Table 1 summarizes key points in pre-test counseling for pregnancies with a known or presumed structurally normal fetus. If a patient opts for diagnostic genetic testing, they should be referred to genetic counseling for coordination. Every patient has the right to pursue or decline prenatal genetic screening and diagnostic testing, and a patient's decision should be documented. Table 2 provides a sample script when discussing genetic screening options.

Table 1. Pretest counseling for chromosomal screening and testing.

Critical information to discuss
• Review family history, medical history, medications, and exposures. • Age-related aneuploidy risk and the 1:250 age-independent copy-number variant risk. • A diagnostic test is most accurate and comprehensive, screening for over 100 additional chromosomal conditions. • All screening tests have a risk of false positives and false negatives. • cfDNA is the preferred screening test if the patients declines diagnostic testing. • Avoid irreversible pregnancy decisions based on a screening test result alone. • An abnormal screen warrants a detailed anatomy scan, genetic counseling, and diagnostic testing.
Additional topics to discuss
• Screening tests may identify maternal health problems (e.g. malignancy or mosaic Turner). • Screening tests are most sensitive for Down syndrome and less accurate for other aneuploidies. Most screens do not detect CNVs. • Use of cfDNA as follow-up for a positive serum screening is an option, but there is a residual risk of adverse outcome.

At minimum, providers should discuss the patient's history, review the age-related aneuploidy risk, discuss the limitations of aneuploidy screening to detect aneuploidy, sub-chromosomal (i.e. copy-number) variants, and single-gene disorders. Patients should be aware that screening tests are limited and that false positives and false negatives are a possibility. Patients should be aware that pregnancy termination is not recommended on the basis of a screening test result alone, and that an abnormal screen warrants detailed ultrasound, genetic counseling, and diagnostic testing.

In addition, providers can consider discussing with patients that both screening and diagnostic options have the potential for secondary findings with maternal health implications. These may include malignancy, mosaic Turner syndrome, and 22q11.2 deletion syndrome.

Table 2. Sample script for genetic testing options.

Some babies are born with genetic conditions that can affect their health. This is possible even if nobody else in the family has a genetic problem or birth defect. While some of these conditions, like Down Syndrome, are easy to recognize at birth, many others are not obvious and only cause problems later in childhood. Recognizing a genetic change early gives parents and doctors the chance to begin early treatment, which can help children perform their best in school and in some cases even save their life. *There are two types of genetic testing to help identify potential genetic conditions in pregnancy. Some families choose to begin with a screening test, which is more convenient but less accurate. This test uses a blood sample to estimate the risk for a few chromosomal conditions such as Down syndrome. Screening tests can be helpful but are not definitive—they can miss conditions and can produce false positives or false negatives. Any positive screening result should be confirmed with a more accurate follow-up test.*

Some families instead choose to begin with a diagnostic test, which is more comprehensive and more accurate. This test uses a small sample of the placenta or the fluid around the baby to check for over 100 genetic conditions. This test is quick, safe, and performed in the office. Typically, we have results for families in about two weeks. Do you want more information about either of these tests?

Formal genetic counseling

Genetic counseling services[16] are available at both Texas Children's Hospital and Ben Taub General Hospital. There are several circumstances in which a referral for dedicated genetic counseling should be considered. These include:

- An abnormal screening or diagnostic test result
- A fetal structural anomaly detected on ultrasound
- A family history of a known or suspected genetic disorder
- The patient is a known carrier of a genetic condition
- The pregnancy has a teratogenic exposure
- Consanguinity (parents are first-cousins or closer)
- Recurrent pregnancy loss
- History of stillbirth or fetal/neonatal loss with structural anomalies
- Patient request for additional information regarding testing options
- Patient desires expanded carrier screening
- Patient desires diagnostic testing
- Discordant fetal sex on screening and ultrasound

Table 3. Genetic Counseling Referral Process at Each Baylor Hospital

Hospital	Genetic Counseling Referral Process
Ben Taub Hospital	1. Place Order: REFERRAL TO OB/PRENATAL GENETIC COUNSELING 2. Send Message: to Wanda Dosal and Adriana Del Rio, attach patient chart
Pavilion for Women	1. Place Order: REFERRAL TO MATERNAL FETAL MEDICINE SERVICES 2. After indicating that patient is pregnant, select "Genetic Counseling"

Limitations of cfDNA screening

While cfDNA is considered a high-quality screening test, it does have false positive and false negative results, as well as the possibility of a "no call" result. Some of the many causes for false positive and false negative cfDNA results are detailed in **Table 4**.

The success of cfDNA screening is dependent on adequate fetal (i.e. placental) free DNA in the maternal circulation, called the fetal fraction. The fetal fraction is a function of several factors. Advancing gestational age and multiple pregnancy increases the fetal fraction, while mosaicism, trisomy 13, trisomy 18, triploidy, artificial reproductive technology, parity, maternal age, low molecular-weight heparin, active autoimmune disease and obesity lower the fetal fraction and increase the chance of a test failure.[17-20]

No-call result due to a low fetal fraction are associated risk for an increased risk of adverse outcomes including growth restriction, aneuploidy, preeclampsia, and preterm birth.[17,21] **Therefore, increased vigilance for these outcomes and consideration for a third-trimester growth ultrasound in cases of no-call results**.

Table 4. Potential causes for false positive or false negative cfDNA results

False Positive Results	False Negative Results
Leiomyoma Maternal Cancer Maternal 45,X or 47,XXX Confined placental mosaicism Fetal or maternal copy-number variants Death of a twin *in utero* (vanishing twin)[30,31] Organ or bone marrow transplant from male donor Medical condition/treatment affecting cfDNA quality Intrahepatic cholestasis of pregnancy Autoimmune disease B12 deficiency	Maternal obesity Low fetal fraction Multiple gestation Confined placental mosaicism Rare fetal aneuploidies (e.g. triploidy) Medical condition/treatment affecting cfDNA quality

Appendix

Table S1. Differences between Available cfDNA Screening Tests (as of 9/15/2025)

Lab	Trisomy 13, 18, 21	Sex-chr aneuploidy	22q11.2 micro-deletion	Other micro-deletions	Additionally validated for	Rh antigen	Other RBC Antigens	Twins	Zygosity	Triplets	Donor & Surrogate Pregnancies	Fetal Fraction Enrichment[a]
BillionToOne (Unity)	Yes	Yes	Opt in	--	--	Opt in	Big C, Little C, Duffy, E, Kell	Yes	Yes	--	Yes	--
LabCorp (MaterniT21)[b]	Yes	Opt in	Opt in	Opt in	T16, T22	--	--	Yes	--	Yes	Yes	--
Myriad (Prequel)	Yes	Opt in	Opt in	Opt in	All autosomal aneuploidies	--	--	Yes	--	--	Yes	Yes
Natera[c] (Panorama)	Yes	Yes	Opt in	Opt in	Triploidy, Vanishing twin	Opt in	--	Yes	Yes	--	--	--
Quest (Qnatal)	Yes	Yes	Opt in	Opt in	--	--	--	Yes	--	--	Yes	--

[a]Fetal fraction enrichment may be useful at earlier gestation or in cases of no-calls due to low fetal fraction.
[b]MaterniT GENOME is not suitable for multiple gestation.
[c]This lab utilizes SNP-based (rather than counting-based) method / analysis, offering unique advantages and drawbacks.

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Previous Cesarean Delivery

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Summary of Recommendations

- **One prior low transverse CD** (documented or suspected based on OB history) and no contraindication to TOLAC
  - Patients should be counseled about VBAC using the VBAC calculator and offered TOLAC antenatally
  - Use of oxytocin for induction and augmentation of labor can be offered, when indicated, regardless of history of prior vaginal delivery.
  - Membrane sweeping can be offered starting at 38 weeks or the visit prior to scheduled induction of labor (whichever is first) to promote spontaneous labor and reduce the need for induction of labor.[3,4]

- **Two prior low transverse CDs** (documented or suspected based on obstetric history) in which **no more than 1 was for a recurring indication** (i.e. failed induction of labor, arrest of active phase, arrest of descent)
  - Patients should be counseled about VBAC using the VBAC calculator and offered TOLAC antenatally
  - Use of oxytocin for augmentation of labor may be offered, when indicated and at the discretion of the provider, regardless of history of prior vaginal delivery.
  - Induction of labor is not recommended due to the associated higher rate of uterine rupture and therefore should not be offered. For patients with 2 prior CDs AND a prior vaginal delivery, however, induction of labor may be considered with shared decision making.
  - Membrane sweeping may be offered starting at 38 weeks, or the visit prior to scheduled induction of labor (whichever is first), to promote spontaneous labor and reduce the need for induction of labor.[3,4]
  - In the absence of spontaneous labor, ERCD should be scheduled. It is reasonable to delay ERCD up to 41 weeks for those people still desiring TOLAC and not yet in spontaneous labor.

- **Two prior low transverse CDs from recurring indications** (i.e., failed induction of labor, arrest of active phase, arrest of descent)
  - Patients should **not be offered** TOLAC antenatally due to their low likelihood of a successful VBAC.
  - Management may be individualized for people who present in advanced labor or preterm labor.
  - If delivery appears imminent and/or it is felt that TOLAC may be associated with fewer risks than urgent/emergent repeat CD, TOLAC may be considered after weighing the risks and benefits as well as the likelihood of successful VBAC.

- **Three or more prior CDs**
  - Patients should **not be offered** TOLAC antenatally due to the limited data regarding risks.
  - Management may be individualized for people who present in advanced labor or preterm labor. If delivery appears imminent and/or it is felt that TOLAC may be associated with fewer risks than urgent/emergent repeat CD, TOLAC may be considered after weighing the risks and benefits as well as the likelihood of successful VBAC.

- **Labor management**
  - Labor progress, maternal symptoms, and fetal status should be assessed and documented in each intrapartum progress note. Labor should only be allowed to continue if all the following criteria are met:
    - The FHR has moderate variability and/or accelerations – **AND-**
    - There are no more than 2 variable decelerations exceeding 60 seconds in duration and decreasing greater than 60 bpm from the baseline or to less than 60 bpm (regardless of baseline) within the previous 30 minutes. **-AND-**
    - The patient has made documented cervical change over the past 2 hours in active phase and with adequate contractions OR the latent phase is <18 hours.
    - There are no clinical signs of uterine rupture (e.g., pain, loss of fetal station, sudden fetal heart rate changes)
  - Arrest of active phase labor with adequate contractions for 2 hours in a person with one or more prior cesareans is an indication for repeat cesarean delivery.
    - Waiting for 4 hours may be considered with shared decision making and documentation of patient counseling.

- **Amnioinfusion should not be utilized in people undergoing TOLAC**. Rather, significant variable decelerations and fetal bradycardia should be interpreted as possible signs of uterine rupture.

- For people planning to deliver at Ben Taub Hospital, antenatal mode of delivery counseling may be performed in any Harris Health clinic or Federally Qualified Health Center by an OB/Gyn physician.
  - Reasonable attempts to obtain the operative reports should be made PRIOR to the consult visit so that they can be reviewed and discussed with the patient at the time of consult.

- At Ben Taub Hospital, the OB service should always be consulted by the Certified Nurse Midwife (CNM) and Family Medicine (FM) services for any patients they admit that desire TOLAC.
  - CNM and FM patients who desire TOLAC can be managed intrapartum by their respective service if the following criteria are met:
    i. The person has had a prior vaginal delivery (either before her CD or a successful VBAC) **–AND-**
    ii. The person has had no more than 1 prior CD **–AND-**
    iii. If induction of labor is required, the person has a favorable cervix (i.e., does not require cervical ripening) **-OR-**
    iv. The person has no prior vaginal deliveries and only 1 prior CD for a nonrecurring indication (i.e., malpresentation, abnormal fetal heart rate), and she presents in active labor (cervix dilated 6 cm or more)
  - An OB consult should be requested for all FM and CNM patients admitted to L&D for TOLAC. The PGY 4 OB resident will be the involved resident and should discuss the patient with the L&D attending.

Introduction

In a 2010 consensus conference, the National Institutes of Health (NIH) examined the safety and outcome of trial of labor after cesarean delivery (TOLAC) and vaginal birth after previous cesarean delivery (VBAC) and factors associated with decreasing rates. The NIH panel recognized that TOLAC was a reasonable option for many people with a prior cesarean delivery (CD) and called on organizations to facilitate access to TOLAC.[7] Some of the changes included offering TOLAC to people with a twin gestation, people with one previous cesarean delivery with an unknown type of uterine incision, and people with 2 previous low-transverse cesarean incisions, even without a prior vaginal delivery.[1,8] ACOG still maintains that a TOLAC should be undertaken at facilities capable of emergency deliveries because the risks of TOLAC, in particular, uterine rupture, may be unpredictable.[1]

Candidates for TOLAC

Candidacy for TOLAC is largely based on the number of prior Cesarean deliveries and whether the patient has any contraindications.

Prior surgical history

- *1 prior Cesarean:* most people with one previous cesarean delivery (CD) with a low transverse uterine incision are candidates for and should be counseled about VBAC and offered TOLAC[1,8]
- *2 prior Cesareans:* based on data from 2 large studies[9,10], ACOG states that it is reasonable to consider people with 2 previous low transverse CDs to be candidates for TOLAC. The chance of achieving VBAC appears to be similar for people with 1 or more than 1 CD.[1,8]
- *3 or more prior Cesareans:* data regarding the risk for people undergoing TOLAC with more than 2 previous CDs are limited[1,11], so it should not be routinely offered at Ben Taub Hospital or the Pavilion for Women

Contraindications

TOLAC is not recommended in patients at high risk for complications, which includes those with[1]:

- Previous classical or T-shaped incision or extensive trans-fundal uterine surgery (i.e. extensive myomectomy).
- Previous uterine rupture or uterine window
- Medical or obstetric complication that precludes vaginal delivery

Risks and Benefits of TOLAC/VBAC and ERCD

Both elective repeat cesarean delivery (ERCD) and (TOLAC) are associated with maternal and neonatal risk.[1] Most maternal morbidity that occurs during TOLAC occurs when repeat CD becomes necessary. Thus, when compared to ERCD, VBAC is associated with fewer complications, and a failed TOLAC is associated with more complications. Consequently, risk for maternal morbidity is integrally related to a person's probability of achieving VBAC.[1] Uterine rupture associated with TOLAC results in the most significant increase in the likelihood of additional maternal and neonatal morbidity.[1] Although serious maternal morbidity increases with increasing number of prior CDs, outcomes are good in most people undergoing these procedures. This risk is attributable to the risks associated with placenta accreta spectrum and/or the need for hysterectomy. There does not appear to be an absolute threshold number of CD beyond which patients should be unequivocally counseled to forgo future pregnancies.[12]

Risk of uterine rupture

The risk of uterine rupture in spontaneous labor is 0.4%.[1,13] This is in comparison to 0.9% for augmented labor, 1.1% for labor induced with oxytocin alone, and 0.9% for labor induced with mechanical dilation with or without oxytocin. In patients with multiple prior CDs, studies regarding the risk of uterine rupture compared to those with one prior CD are mixed, with some studies suggesting the risk was similar[9] and some concluding the risk was higher.[10] Risks factors for uterine rupture in this population included induction of labor and oxytocin augmentation. Conversely, a prior vaginal delivery and/or VBAC was protective.

There is an increased risk with use of prostaglandins (i.e., misoprostol) for third trimester cervical ripening or induction in patients with prior CD or major uterine surgery, therefore it should not be used.[1]

No clear threshold for rupture associated with dose of oxytocin, so an upper limit for oxytocin dosing with TOLAC has not been established.[1]

When uterine rupture occurs, it carries with it an associated 6.2% risk (95% CI, 1.8-10.6) of hypoxic-ischemic encephalopathy (HIE) (8).

Comparisons of risk by mode of delivery

TOLAC vs. ERCD

Compared to ERCD, TOLAC is associated with an increased risk of uterine rupture, uterine dehiscence, transfusion, and endometritis. These risks are encountered primarily in people with a failed TOLAC.[1,12]

Failed TOLAC vs. successful VBAC

Compared to successful VBAC, failed TOLAC is associated with an increased risk of uterine rupture, uterine dehiscence, hysterectomy, transfusion, and endometritis.[1,13]

Maternal morbidity associated with multiple repeat CDs without labor

With increasing number of CDs, there is an increased risk of:[12]

- Placenta accreta
- Hysterectomy
- Transfusion of ≥4 units PRBCs
- Cystotomy
- Bowel injury
- Ureteral injury

- Placenta previa
- Ileus
- Post-operative ventilation
- ICU admission
- Endometritis
- Prolonged operative time

Figure 8. Maternal risk based on number of prior Cesarean deliveries

Risk	1st CD	2nd CD	3rd CD	4th CD	5th CD	≥6 CD
Placenta accreta	0.24	0.31	0.57	2.13	2.33	6.74
Hysterectomy	0.65	0.42	0.90	2.41	3.49	8.99
≥4 units PBRCs	1.05	0.48	0.77	1.59	2.33	10.11
Cystotomy	0.13	0.09	0.28	1.17	1.94	4.49
Bowel injury	0.11	0.06	0.13	0.34	0	1.12
Ureteral injury	0.03	0.01	0.02	0.07	0.39	1.12
Placenta previa	6.42	1.33	1.14	2.27	2.33	3.37
Ileus	0.66	0.45	0.68	0.90	1.55	3.37
Post-op vent	1.0	0.21	0.24	0.69	0.78	1.12
ICU admission	1.85	0.57	0.54	1.58	1.94	5.62
Endometritis	5.98	2.56	2.81	2.96	1.55	6.74
Accreta when previa present	**3.3**	**11**	**40**	**61**	**67**	**67**

Data are presented as %.

Benefits of TOLAC vs. ERCD

Successful VBAC avoids major abdominal surgery and results in lower rates of hemorrhage, thromboembolism, and infection as well as a shorter recovery period. Additionally, it may avoid potential future maternal consequences of multiple CDs.[1,13]

Mode of Delivery Counseling

People with prior CD(s) should be counseled **early** in pregnancy to allow time to consider their options.[1] Reasonable attempts should be made to obtain medical record(s) of the previous uterine incision(s). Intended family size and risk of additional CDs should be considered in counseling. Counseling should be individualized for the patient and should include a discussion on the risks and benefits of TOLAC/VBAC, failed TOLAC, ERCD, and multiple repeat CDs. It should also include a discussion regarding factors associated with an increased or decreased likelihood for successful VBAC and uterine rupture.

Factors associated with DECREASED likelihood for successful VBAC

- First prenatal visit
  - Increased maternal age
  - Maternal obesity
  - Short inter-delivery interval (less than 19 months)
  - Recurrent indication for initial CD (i.e., arrest of active phase, arrest of descent)
- Throughout pregnancy[1,14]
  - Need for induction of labor
  - Birth weight > 4000 grams
  - > 40 weeks gestational age
  - Preeclampsia
  - Maternal obesity

Factors associated with INCREASED likelihood for successful VBAC

- First prenatal visit
  - A prior history of vaginal delivery, either before or after a prior CD[5,7 *]
- Throughout pregnancy[1,14]
  - Spontaneous labor

* The chance of VBAC is 63% with no prior vaginal delivery, 83% with prior vaginal delivery before CD, and 94% with prior VBAC.

Counseling should be done during pregnancy and should include use of a VBAC calculator and the counseling as well as management plan should be documented in the medical record.[1]

- Pavilion for Women: mode of delivery counseling should be performed in clinic for all people who are candidates for TOLAC. An electronic or paper consent form (PFW TOLAC Consent Form) for people with prior CD(s) should be reviewed and signed. The paper form should be scanned into the medical record. A progress note can also be entered. Examples of documentation can be found in the Appendix, Epic Smart Phrases for MOD counseling.
- Ben Taub: mode of delivery counseling should be performed in clinic for all people who are candidates for TOLAC and documented using Epic smart phrases antenatally. Examples of documentation can be found in the Appendix, Epic Smart Phrases for MOD counseling.

Those patients desiring a TOLAC should be counseled again at the time of admission for delivery.

In those people who still desire a TOLAC after counseling, a progress note from a the PGY4 at Ben Taub and the covering resident and/or attending at PFW should be entered into the medical record that the risks and benefits have been reviewed and the patient still desires an attempt to achieve a vaginal delivery. The attending physician responsible for coverage of the patient (at PFW) or Labor and Delivery (at Ben Taub) should be notified and approve the TOLAC.

VBAC Calculator

A VBAC calculator may be used to provide more specific information about the chance of VBAC.[1] The Maternal-Fetal Medicine Units Network derived and published an accurate model (available at https://mfmunetwork.bsc.gwu.edu/web/mfmunetwork/vaginal-birth-after-cesarean-calculator), which does not include race or ethnicity, for the estimation of the probability of VBAC, both for early pregnancy[2] and at the delivery admission.[5] The authors conclude that the removal of race and ethnicity from the model should serve to reinforce the importance of continually rethinking past approaches to care and striving to achieve equity, without which there would be no person-centeredness or quality. In that regard, it is important to note that there continue to be disparities in the cesarean delivery rate among individuals who are in labor, with those who identify as Black or Hispanic having higher rates than those who identify as non-Hispanic White, and it is of crucial importance to target the social determinants that underlie those differences and eliminate the disparity and related morbidity that result from to it.[2] For example, personalized counseling that accounts for social circumstances such as transportation, support systems, distance from the hospital, time off from work, and arranging childcare may more accurately represent a woman's decision and ability to undergo a trial of labor.[6]

Labor management

Induction of labor

Previous studies have compared induction of labor in people undergoing TOLAC to spontaneous labor, however the clinically relevant comparison is induction to expectant management.[1] **Induction of labor for maternal or fetal indications remains an option for people undergoing TOLAC**.[1,8]

- *Compared to expectant management,* the VBAC rate has been shown to be higher among people with a singleton gestation and 1 prior CD undergoing induction of labor at 39-40 weeks as compared to expectant management.[15,16] In one study, the risk of uterine rupture was also higher with induction at 39 weeks vs expectant management (1.4% vs 0.5%, P=.006, respectively); there was no difference in neonatal outcomes.[15]

- *In people with 1 prior CD*, most studies indicate there is no increased risk of uterine rupture with induction of labor if the person has had a prior vaginal delivery. While a vaginal delivery is significantly more likely when labor induction is initiated with a favorable cervix vs an unfavorable cervix, regardless of prior obstetric history, a uterine rupture is no more likely to occur when labor is induced with an unfavorable cervix as compared to a favorable cervix.[17]

- *In people with 2 prior CDs*, one study showed that labor induction outcomes were similar regardless of whether a person had 1 or 2 prior CDs. People in this study with 2 prior CDs undergoing induction of labor were significantly more likely to have had a prior VBAC. After 2 CDs, undergoing induction of labor carried similar maternal and neonatal risks as having ERCD.[18]

Labor Management

No data suggests that intrauterine pressure catheters (IUPCs) or fetal scalp electrodes are superior to external forms of monitoring, and there is evidence that the use of IUPCs does not assist in the diagnosis of uterine rupture.[1,19,20] Therefore, IUPC use should be reserved for routine obstetric indications.

Amnioinfusion should not be utilized in people undergoing TOLAC. Rather, significant variable decelerations and fetal bradycardia should be interpreted as possible signs of uterine rupture.

These patients have labor patterns similar to those who have not had a prior CD.[1] In a person with no prior vaginal deliveries, her labor pattern will mirror a nulliparous person; people with a prior CD and a prior vaginal delivery have labor patterns that follow the same trend as multiparous people.[21,22] People who undergo induction of labor after CD may have a longer latent labor phase.[21,23] *

- Oxytocin augmentation may be used and should be managed as per the respective hospital policy (refer to BCM OB/Gyn Perinatal Guideline on "The Use of Oxytocin at Ben Taub Hospital and Pavilion for Women").
- Once adequate uterine activity has been achieved, **lack of progress in active labor after 2 hours should result in delivery by repeat cesarean.** The study that assessed a labor-management protocol that mandated at least 4 hours of oxytocin augmentation before CD for active-phase labor arrest excluded people with a previous CD[24]; therefore, the safety of this approach in people undergoing TOLAC has not been established. Awaiting 4 hours may be considered with shared decision making and patient counseling.

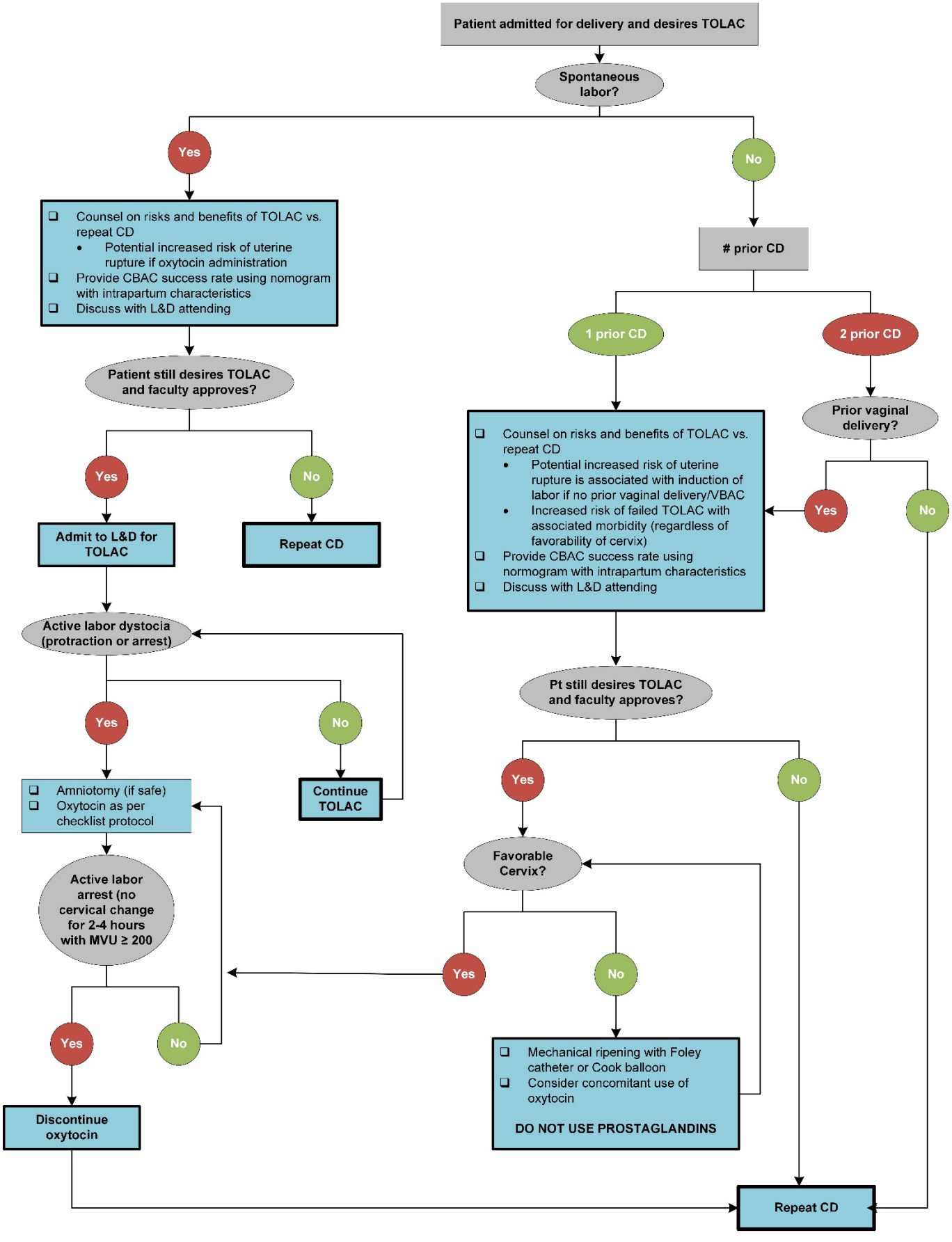
Predictors and signs of uterine rupture

The most common sign associated with uterine rupture is fetal heart rate abnormality, which has been associated with up to 70% of cases of uterine rupture.[1,7,25,26,OBJ][1,7,25,26,OBJ] Review of uterine rupture cases at Ben Taub Hospital has noted an association between the sudden onset of deep/prolonged variable decelerations, not precipitated by recent membrane rupture or rapid dilation/descent, and a final diagnosis of uterine rupture. **Significant variable decelerations and fetal bradycardia should be interpreted as possible signs of uterine rupture rather than routine labor progress and amnioinfusion should not be used.**

Additional signs include loss of fetal station and severe abdominal pain. Onset of severe abdominal pain despite spinal or epidural anesthesia should be interpreted as possible uterine rupture rather than inadequate neuraxial blockade.

* One study showed no difference, as compared to spontaneous labor, once 7 cm dilation was reached.[23] Another study reported that labor duration for TOLAC vs nulliparous people from 4-10 cm was 1.5 (4.6) hours longer (p<.001).[21]

Figure 9. Management Algorithm for TOLAC



Appendix

Epic Smart Phrases for MOD counseling

For people with 1 prior CD (smart phrase: CMDMOD1)

The patient has a history of 1 prior CD for **(indication).** The prior operative report **is/is not available for review** and documents a low transverse uterine incision. I had an extensive discussion with the patient regarding the risks and benefits of TOLAC/VBAC, elective repeat CD, and failed TOLAC.

I counseled her that the benefits of a successful VBAC include avoidance of major abdominal surgery, lower rates of hemorrhage, thromboembolism, and infection, and a shorter recovery period. Additionally, it may avoid potential future maternal consequences of multiple CDs. I explained that uterine rupture associated with TOLAC results in the most significant increase in the likelihood of maternal and neonatal morbidity. I explained to her the risk of uterine rupture of ~1%: as low as 0.4% in the setting of spontaneous labor and as high as 1.1% with induction/augmentation after 1 previous CD. We discussed the risks of scheduled repeat CD, including, but not limited to, operative injury, blood transfusion, hysterectomy. I also reviewed the risks of multiple repeat CDs, including, but not limited to, increased risk of operative injury, blood transfusion, placenta accreta spectrum disorder, and hysterectomy. We discussed the risks of TOLAC, including, but not limited to, uterine rupture, blood transfusion, hysterectomy, maternal/fetal/neonatal death. She understands that a uterine rupture would warrant emergent CD with increased risk for operative morbidity and risk of fetal death or HIE. We discussed that the worst outcome for the maternal/fetal pair is when a repeat CD is indicated during a TOLAC (failed TOLAC).

I further counseled @NAME@ that the likelihood of successful VBAC is ~60-80%. I explained that the likelihood is higher if the prior CD was for a non-recurring indication, such as fetal malpresentation or NRFHR, and that the likelihood is lower if the prior CD was for a recurring indication - labor dystocia (i.e., failed IOL, arrest of active phase, arrest of descent). I further explained that factors present at the time of admission for delivery may increase or decrease the likelihood of success and that spontaneous labor increases the likelihood of success while IOL decreases it. I counseled that timing of delivery would depend on mode of delivery desired and any other maternal or fetal indications. In the absence of maternal or fetal indications warranting delivery at a specific gestational age, a planned repeat CD would generally be scheduled at 39 weeks; if desiring TOLAC and spontaneous labor has not occurred by 41 weeks, we would recommend either scheduled CD or IOL for late-term.

After this discussion, she reported that she would like **TOLAC/elective repeat CD.** She understands that she may change her decision at any time and that factors that develop as her pregnancy progresses may alter her likelihood of success. She understands that she will be counseled again at the time of admission for delivery.

For people with 2 prior CDs (smart phrase: CMDMOD2)

The patient has a history of 2 prior CDs. The first was for **(indication)** and the second was for **(indication).** The prior operative reports **are/are not available for review** and document a low transverse uterine incision in both. I had an extensive discussion with the patient regarding the risks and benefits of TOLAC/VBAC, elective repeat CD, and failed TOLAC.

I counseled her that the benefits of a successful VBAC include avoidance of major abdominal surgery, lower rates of hemorrhage, thromboembolism, and infection, and a shorter recovery period. Additionally, it may avoid potential future maternal consequences of multiple CDs. I explained that uterine rupture associated with TOLAC results in the most significant increase in the likelihood of maternal and neonatal morbidity. I explained to her the risk of uterine rupture of 0.9-1.8% and that some studies have found it to be identical to people with only 1 prior CD. We discussed the risks of scheduled repeat CD, including, but not limited to, operative injury, blood transfusion, hysterectomy. I also reviewed the risks of multiple repeat CDs, including,

but not limited to, increased risk of operative injury, blood transfusion, placenta accreta spectrum disorder, and hysterectomy. We discussed the risks of TOLAC, including, but not limited to, uterine rupture, blood transfusion, hysterectomy, maternal/fetal/neonatal death. In people with multiple prior CDs, there is an increased risk of hysterectomy and blood transfusion. She understands that a uterine rupture would warrant emergent CD with increased risk for operative morbidity and risk of fetal death or HIE. We discussed that the worst outcome for the maternal/fetal pair is when a repeat CD is indicated during a TOLAC (failed TOLAC).

I further counseled @NAME@ that the likelihood of successful VBAC is ~60-80%. I explained that the likelihood is higher if the prior CDs were for a non-recurring indication, such as fetal malpresentation and/or NRFHR, and that the likelihood is lower if the prior CDs were for a recurring indication - labor dystocia (i.e., failed IOL, arrest of active phase, arrest of descent). She understands that the risk of uterine rupture is increased with induction and augmentation of labor and that induction of labor may not be offered, especially in the absence of a prior vaginal delivery. I explained that we can offer membrane sweeping, beginning at 38 weeks, to promote spontaneous labor. She understands that a repeat CD, no later than 41 weeks, may be recommended in the absence of spontaneous labor.

After this discussion, she reported that she would like **TOLAC/elective repeat CD.** She understands that she may change her decision at any time and that factors that develop as her pregnancy progresses may alter her likelihood of success. She understands that she will be counseled again at the time of admission for delivery.

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Periviability

[October 2025 (Replaces December 2023)]

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This guideline has been updated to include recommendations for consideration of antenatal corticosteroids at 21 5/7 weeks when parents desire a trial of resuscitation.

Highlights

- A trial of resuscitation can be considered as early as 22 weeks 0 days. This requires MFM and Neonatology counseling to align with patient desires.
- Recommendations for use of antenatal corticosteroids, tocolysis, magnesium sulfate, latency antibiotics for preterm pre-labor rupture of membranes (PPROM), Group B Streptococcus prophylaxis, fetal monitoring and Cesarean delivery for fetal indications are provided for PFW and Ben Taub Hospital.

Overview

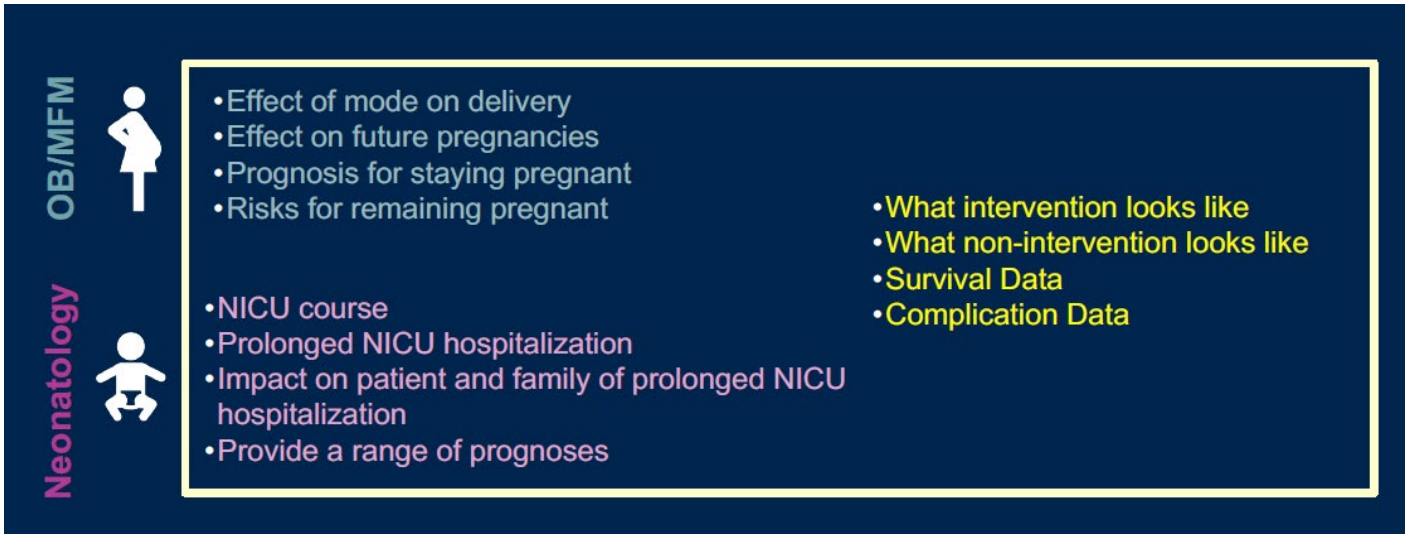
Recommendations for periviability management should address when to offer resuscitation or other interventions versus comfort care, with decisions guided by gestational age and available resources. The American College of Obstetricians and Gynecologists (ACOG) provides guidance on the use of antenatal corticosteroids, tocolysis, magnesium sulfate, latency antibiotics for preterm pre-labor rupture of membranes (PPROM), Group B Streptococcus prophylaxis, and cesarean delivery for fetal indications.[1] Additional considerations include the timing of fetal surveillance—such as initiation of non-stress testing—and best practices for periviability counseling. Effective management requires coordinated, multidisciplinary discussions among Obstetrics, Maternal-Fetal Medicine, and Neonatology**. This guideline offers an overview of key considerations for periviability management and highlights institution-specific recommendations at Texas Children's Hospital and Ben Taub Hospital.**

Definitions

Trial of Resuscitation: This applies to infants born between 22 0/7 and 23w6d. The "TOR" consists of intubation, ventilation, and surfactant. Chest compressions/epinephrine in the delivery room are not routinely pursued or offered.
Neonates born at 24 weeks and beyond will have a resuscitation that may consist of intubation, ventilation, surfactant, and chest compressions/epinephrine.

Joint MFM/OB and Neonatology Counseling Recommendations

Figure 1. Recommendations for joint OB/MFM and Neonatology Counseling



Considerations at **Texas Children's Hospital Pavilion for Women**

Texas Children's hospital and the Newborn Center base neonatology practice based on gestational age and individual clinical considerations, such as parental desires and additional comorbidities.

Table 2. Recommended interventions based on gestational age in periviable gestations

Gestational Age (weeks)	Approach to Resuscitation
< 22w0d	Comfort Care *
22w0d-23w6d	Comfort care and assessment for/trial of resuscitation offered (align with parent desires)*
≥24w0d	Resuscitation recommended*

*Practice guidelines are most appropriate for gestational age infants without significant complications or multiple anomalies. Individual practices and options may vary in the setting of multiple gestations, severe fetal growth restriction or other complications (i.e. Hydrops), and fetal anomalies.

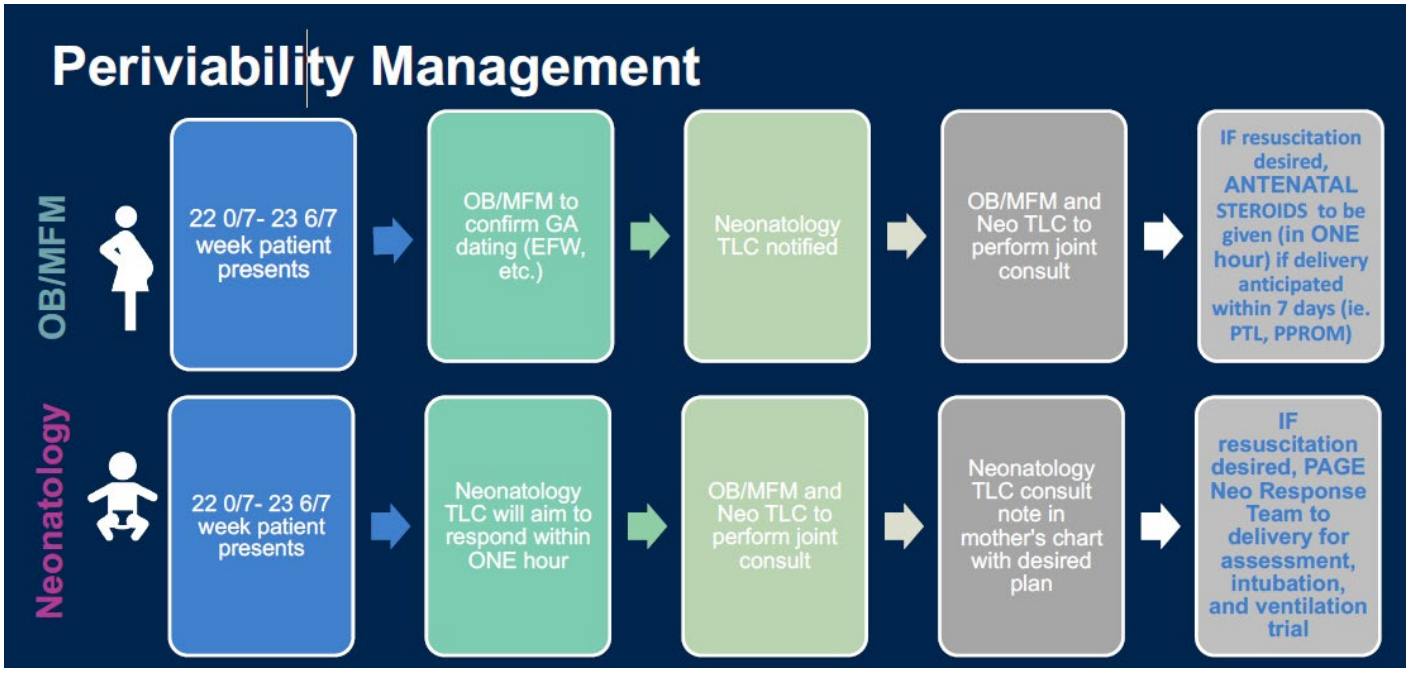
Table 3. Periviability Management Overview at TCH PFW

	Gestational Age			
	< 22 0/7 weeks	**22 0/7-22 6/7**	**23 0/7-23 6/7**	**≥ 24 0/7**
Antenatal Steroids	Not recommended*	*Recommend at 21 5/7 if TOR desired	Recommend if TOR desired	Recommended
Tocolysis to allow ACS administration	Not recommended*	*Recommend at 21 5/7 if TOR desired	Recommend if TOR desired	Recommended
Magnesium for neuroprotection	Not recommended*	Recommend if TOR desired	Recommend if TOR desired	Recommended
Cesarean Delivery	Not recommended	Not recommended for fetal indications	Consider for routine obstetric indications if TOR desired	Recommended for routine indications
Latency Antibiotics (PPROM)	Consider if delivery is not imminent	Consider if delivery is not imminent	Consider if delivery is not imminent	Recommended
Intrapartum Antibiotics for GBS	Not Recommended	Recommend if TOR desired	Recommend if TOR desired	Recommended
Fetal Monitoring (non-stress test or continuous fetal monitoring when indicated)	Not Recommended	Not Recommended	Consider if TOR desired	Recommended
Resuscitation or Comfort Care	Comfort care only	Comfort care and TOR offered; align with parental desires	Comfort care and TOR offered; align with parental desires	Resuscitation recommended unless other circumstances

TOR, trial of resuscitation

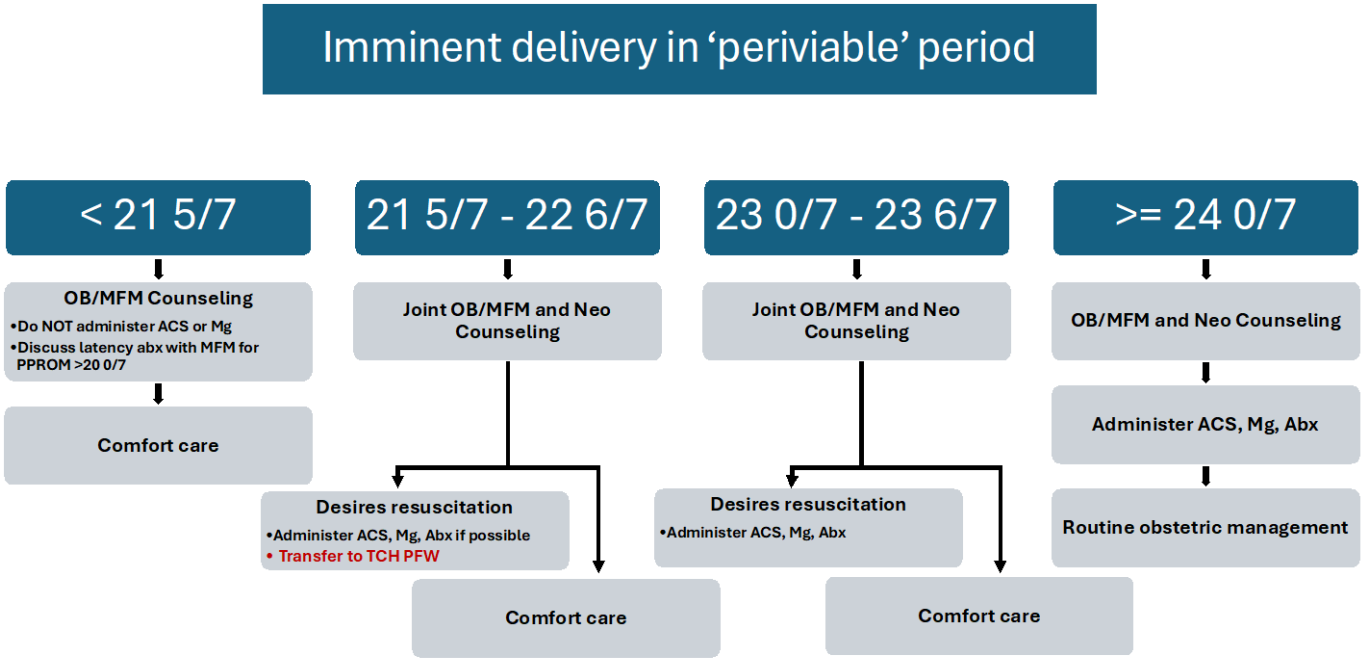
Subspecialist Workflow for Teams Caring for Pregnant Patients at Risk for Periviable Delivery 22w0d-23w6d

Figure 2. *Clinical workflow of periviability based on subspecialty*



Considerations at **Ben Taub Hospital**

Figure 3. Resuscitation Recommendations based on gestational age at BTH



***ACS**: antenatal corticosteroids; **Mg:** Magnesium sulfate; **Abx**: latency antibiotics or GBS prophylaxis*

**Practice guidelines are for most Appropriate for Gestational Age (AGA) infants without significant complications or multiple anomalies. Individual practices and options may vary in setting of multiple gestation, severe IUGR, fetal malformations/disorders, fetal hydrops, etc.*

Table 4. Periviability Management Overview at BTH

	Gestational Age			
	< 22 0/7 weeks	**22 0/7-22 6/7**	**23 0/7-23 6/7**	**≥ 24 0/7**
Antenatal Steroids	Not recommended*	*Recommend at 21 5/7 if TOR desired	Recommend if TOR desired	Recommended
Tocolysis to allow ACS administration	Not recommended*	*Recommend at 21 5/7 if TOR desired	Recommend if TOR desired	Recommended
Magnesium for neuroprotection	Not recommended*	*Recommend if TOR desired	Recommend if TOR desired	Recommended
Cesarean Delivery	Not recommended	Not recommended for fetal indications	Consider for routine obstetric indications if TOR desired	Recommended for routine obstetric indications
Latency Antibiotics (PPROM)	Consider if delivery is not imminent	Consider if delivery is not imminent	Consider if delivery is not imminent	Recommended
Intrapartum Antibiotics for GBS	Not Recommended	Recommend if TOR desired	Recommend if TOR desired	Recommended
Fetal Monitoring (non-stress test or continuous fetal monitoring when indicated)	Not Recommended	Not Recommended	Consider if TOR desired	Recommended
Resuscitation or Comfort Care	Comfort care only	Offer comfort care; **Transfer to TCH if TOR desired**	Offer comfort care; Consider TOR if desired	Resuscitation recommended unless other circumstances

TOR, Trial of Resuscitation

BTH Periviability Checklist Management Based on Gestational Age

Less than 21w5d

- ☐ On admission, OB/MFM to evaluate and confirm GA dating and EFW
  - Ultrasound for EFW should be performed by PGY 2 or higher level clinician
- ☐ Counseling in collaboration with OB/MFM attending
- ☐ Betamethasone and magnesium sulfate for fetal neuroprotection should NOT be administered <21 5/7
- ☐ Discuss need for latency antibiotics with OB/MFM Attending for PPROM (can consider at 20 0/7 if delivery is not imminent)
- ☐ Discuss plan for readmission (if applicable); if would desire trial of resuscitation <23w0d, consider admission to PFW
  - MFM should document a complete consultation so this can be included in the H&P done at PFW
  - Referral should be made for MFM Transfer of Care referral and put the indication as “previable PPROM, admit to PFW at ___ wks” – the online referral is best **https://www.texaschildrens.org/health-professionals/refer-patient/maternal-fetal-medicine**

- PFW will schedule patients in the office before their anticipated admission to do the H&P, orders, and delivery consents for direct admission to WSU. If that's not feasible, they will go to the WAC to then be admitted by one of the inpatient attendings.

21w5d-22w6d

- ☐ On admission, OB/MFM to evaluate and confirm GA dating and EFW
  - Ultrasound for EFW should be performed by PGY 2 or higher level clinician
- ☐ Neonatology to be consulted (ordered and called) **as soon as possible.** Most updated outcome and survival data from PFW/TCH should be utilized during consultation with parents.
- ☐ OB/MFM attending and Neonatology attending to perform collaborative consult together to determine patient goals for care/trial of resuscitation. If attending is not available, next highest fellow/resident should conduct consult.
  - Counseling should include need for transfer to TCH PFW if trial of resuscitation is desired.
- ☐ **If resuscitation is NOT desired**, postnatal assessment/care is managed by primary OB (Neonatology can provide support as needed)
- ☐ **If resuscitation is desired**,
  - Monitoring and mode of delivery counseling with OB/MFM. If MFM is not immediately available for in-person counseling, consult MFM back-up.
  - Antenatal steroids, tocolytics, antibiotics (GBS prophylaxis or latency), and +/- magnesium sulfate should be given at or after 21 5/7 weeks as soon as possible on arrival if delivery is anticipated within 7 days (e.g., preterm labor/advanced cervical dilation, PPROM)
    - Medication administration should not delay transfer out of facility. In the event that the patient transfers from OB Intake to another facility, magnesium sulfate may not be started at time of transfer.
    - **Transfer of care to TCH PFW should be initiated by OB/MFM attending**
      - Document patient stability for transport
      - MFM attending should call PFW MFM attending to discuss case (refer to schedule in QGenda). Plan of care discussions should remain attending to attending.
      - Neonatology fellow/attending should call TCH Neonatology team to discuss case
      - OB/MFM attending (in house attending) should then initiate transfer through Harris Health Transfer Center by calling 713-873-8601; place “ADT20” order in Epic prior to calling transfer center.
      - Once OB/MFM is connected to TCH PFW transfer center, request maternal transport via the TCH Kangaroo Crew (K-Crew will come to Ben Taub to transport patient to TCH PFW)
        - If K-Crew not available, the Transfer Center will coordinate a multi-disciplinary meeting to discuss alternative transport options, including L&D Attending (*39511), MFM Attending (call L&D *39511 to get contact number), Neonatology Attending (call Neo fellow *39210 to get contact number), Transport team members. Note that alternative transport companies may require transport with Obstetric and Neonatal physicians and this may be not possible at all times.

23w0d-23w6d

- ☐ On admission, OB/MFM to evaluate and confirm GA dating and EFW
- ☐ Neonatology to be consulted (ordered and called) **as soon as possible**
- ☐ OB/MFM attending and Neonatology attending to perform collaborative consult together; if attending is not available, next highest fellow/resident should conduct consult. See Figure 1.
  - *Consults that occur prior to 24 0/7 gestational age, should include information on what Trial of Resuscitation will look like at and after 24 0/7 gestational age.*
- ☐ If resuscitation is desired, monitoring and mode of delivery counseling with OB/MFM
- ☐ If resuscitation is desired, antenatal steroids, tocolytics, and magnesium should be given at ≥22 5/7 weeks as soon as possible on arrival if delivery is anticipated within 7 days (ie. PTL/PPROM)
  - Delivery to be performed in OR due to proximity to NICU for stabilization and resuscitation

- If resuscitation is NOT desired postnatal assessment/care is managed by primary OB (Neonatology can provide support as needed)

24w0d

- On admission, OB/MFM to evaluate and confirm GA dating and EFW
- Neonatology to be consulted (ordered and called) **as soon as possible**
- OB/MFM attending and Neonatology attending to perform collaborative consult together; if attending is not available, next highest fellow/resident should conduct consult. See graphic 1.
- Antenatal steroids, tocolytics, magnesium, antibiotics should be given as soon as possible on arrival if delivery is anticipated within 7 days (ie. PTL/PPROM)
- Delivery to be performed in OR due to proximity to NICU for resuscitation (<32 0/7)

Delivery room recommendations

- Neonatology to be PAGED and present at delivery if resuscitation is desired
- Early intubation and ventilation trial; additional resuscitation based on individual circumstances
- Admit to NICU

Appendix

Sample Smartphrases for OB/MFM Counseling at BTH (.cmdperiviableconsult)

22 0/7 - 22 6/7 weeks

I counseled @NAME@ and her partner extensively on the management of a periviable infant, potential clinical scenarios, and the risks, benefits and alternatives to different management strategies. I counseled on the neonatal morbidity and mortality at this GA and that survival may be associated with life-long morbidity. I explained that a trial of resuscitation (TOR) is not offered at Ben Taub prior to 23w0d, however it is offered at TCH PFW as early as 22w0d, so transfer is an option if desired. After counseling, @NAME@ expressed that she would want transfer to TCH PFW for TOR beginning at 22w0d, so we notified the Neo team and returned for joint counseling together regarding management and prognosis of TOR at 22 weeks (see their note for full details). After joint counseling, @NAME@ confirmed her desire for transfer to TCH PFW for trial of resuscitation. She understands that she may deliver prior to transfer or en route and that comfort care would be the management after delivery in that case. I counseled her that prior to transfer, we will administer BMZ for fetal maturity, tocolysis, magnesium sulfate for fetal neuroprotection, and antibiotics for GBS prophylaxis/latency for PPROM.

Regarding mode of delivery, I counseled the couple that cesarean delivery does not improve fetal outcome prior to 23 weeks. For this reason, cesarean delivery prior to 23 weeks would only be considered for maternal benefit, for example, in the setting of uterine rupture and/or hemodynamic compromise from placental abruption. I explained that cesarean delivery would not be offered for malpresentation or FHR abnormalities, so FHR monitoring is not performed prior to 23 wks. I counseled the couple that even at 23w0d - 23w6d, neonatal resuscitation is still considered a trial that the parents can decline, thus FHR monitoring does not have to ensue if they would not want a cesarean delivery for fetal indications prior to 24w0d. I explained that resuscitation is the expectation at or after 24w0d.

Regarding the footling breech presentation, I counseled the couple that vaginal breech delivery is not typically offered/recommended prior to ~32 weeks secondary to the risk of fetal head entrapment, however this may not be as applicable to infants <24 given the very small overall size of the infant. I counseled the couple that, in my experience, breech infants <24 weeks generally deliver rapidly without head entrapment.

23 0/7 - 23 6/7 weeks

I counseled @NAME@ and her partner extensively on the management of a periviable infant, potential clinical scenarios, and the risks, benefits and alternatives to different management strategies. I counseled on the neonatal morbidity and mortality at this GA and that survival may be associated with life-long morbidity. I explained that a trial of resuscitation (TOR) can be offered as early as 23w0d at Ben Taub Hospital if desired. After counseling, @NAME@ expressed that she would want TOR, so we notified the Neo team and returned for joint counseling together regarding management and prognosis of TOR at 23 weeks (see their note for full details). After joint counseling, @NAME@ confirmed her desire for trial of resuscitation. I counseled her that we will administer BMZ for fetal maturity, tocolysis, magnesium sulfate for fetal neuroprotection, and antibiotics for GBS prophylaxis/latency for PPROM.

Regarding mode of delivery, I counseled the couple on the risks and benefits of FHR with cesarean delivery for FHR abnormalities. I explained that the purpose of FHR monitoring is to monitor for signs of fetal distress and intervene if present, which could include emergency cesarean delivery. I counseled them on the likelihood of a classical cesarean delivery at this GA and of the significance that would have on all future pregnancies, including, but not limited to, risk of uterine rupture and plan for pre-labor cesarean delivery in all pregnancies as well as increased morbidity and risk of PAS with multiple repeat cesarean delivery. I further counseled the couple that an emergency cesarean delivery would likely require GETA, so @NAME@ would not be awake when her baby is born and it is possible that her baby may pass away

before she wakes up from surgery. Alternately, if the couple chose not to consider cesarean delivery for fetal indications, we would forgo FHR monitoring and there was potential for stillbirth/intrapartum demise.

I counseled her that management options for threatened periviable birth at this GA includes: 1) BMZ for fetal maturity (and tocolyisis/neuroprotection, as indicated), FHR monitoring, Neo assessment for resuscitation, and cesarean delivery for fetal indications. I explained that there is a high likelihood for classical hysterotomy when cesarean delivery is performed at a periviable gestational and that classical incision mandates repeat cesarean delivery with all future pregnancies due to increased risk of uterine rupture; 2) expectant management with no FHR monitoring, no cesarean delivery, Neo assessment at delivery. I explained that both options are associated with risk of fetal/neonatal demise.

Regarding the footling breech presentation, I counseled the couple that vaginal breech delivery is not typically offered/recommended prior to ~32 weeks secondary to the risk of fetal head entrapment, however this may not be as applicable to infants <24 given the very small overall size of the infant. I counseled the couple that, in my experience, breech infants <24 weeks generally deliver rapidly without head entrapment.

TOLAC

Regarding mode of delivery, I counseled the couple that cesarean delivery does not improve fetal outcome prior to 23 weeks. For this reason, cesarean delivery prior to 23 weeks would only be considered for maternal benefit, for example, in the setting of uterine rupture and/or hemodynamic compromise from placental abruption. I explained that cesarean delivery would not be offered for malpresentation or FHR abnormalities, so FHR monitoring is not performed prior to 23 wks. I also counseled her on the risk of uterine rupture of ~1% after 1 previous cesarean delivery. We discussed potential clinical scenarios in which MOD counseling may be readdressed with her, including, but not limited to, peri-viable latent vs advanced active labor and PTL beyond the periviable GA period. I discussed the possibility of PTL that arrests and that a period of expectant management during PTL may afford pregnancy prolongation, up to weeks, if labor arrests, vs proceeding with repeat cesarean delivery at the first sign of cervical change. If, however, she progresses to advanced PTL, such as 8 cm, where delivery is inevitable, she may be offered cesarean delivery at that time. Based on our discussion, she desires TOLAC, but understands that MOD counseling may be readdressed with her, depending on the clinical picture at the time.

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Antenatal Corticosteroids

October 2025

Authors: Dr. Christina Davidson, Dr. Manisha Gandhi
Editor: Dr. Christina Ackerman-Banks

This guideline is updated to emphasize indications for antenatal corticosteroids in the periviable and late preterm periods.

Highlights

- Antenatal corticosteroid administration depends on risk for delivery in the next 7 days and gestational age.
- A rescue course of steroids could be considered if the patient is undelivered 7 days after the second dose of betamethasone and there remains of risk for preterm birth within the next 7-14 days. Gestational age ≥34w0d is a contraindication to a rescue course of steroids.
- A single course of late preterm steroids can be considered between 34w0d-36w6d if the patient is at risk for delivery within the next 7 days.
- Use of betamethasone for fetal lung maturity in fetuses < 24 weeks should occur in conjunction with maternal fetal medicine and neonatology consultations

Background

Corticosteroid administration before anticipated preterm birth is one of the most important antenatal therapies available to improve newborn outcomes.[1] Antenatal corticosteroid (ACS) therapy leads to improvement in neonatal lung function by enhancing maturational changes in lung architecture and by inducing lung enzymes resulting in biochemical maturation. ACS therapy reduces the incidence of respiratory distress syndrome, intraventricular hemorrhage, necrotizing enterocolitis, sepsis, and neonatal mortality by approximately 50%. A course of ACS consists of 12 mg betamethasone (BMZ) intramuscularly every 24 hours for two doses (preferred regimen) or 6 mg dexamethasone (DMZ) http://www.utdol.com intramuscularly every 12 hours for four doses.[1] **The benefit of ACS administration is greatest at 2–7 days after the initial dose. Treatment with ACS for less than 12-24 hours is still associated with significant reduction in neonatal morbidity and mortality, so a first dose of ACS should be administered even if the ability to give the second dose is unlikely, based on the clinical scenario**.[1-4] No additional benefit has been demonstrated for courses of ACS with dosage intervals shorter than those outlined previously, however, even when delivery appears imminent.[1]

ACOG recommends a single course of corticosteroids for pregnant people between 24 0/7 weeks and 33 6/7 weeks of gestation, including for those with ruptured membranes and multiple gestations, who are at high risk of preterm delivery..[1] A Cochrane meta-analysis reinforces the beneficial effect of this therapy regardless of membrane status and concludes that a single course of antenatal corticosteroids should be considered routine

for all preterm deliveries.[3,5] **This guideline provides recommendations/considerations for administration of a single course of antenatal corticosteroids, including prior to 24 weeks gestation and after 34 weeks gestation as well as indications for a rescue course of steroids.**

When to Consider a Rescue Course of Steroids

Clinical trials investigating repeat doses of ACS have shown an association with higher rates of cerebral palsy[6] and a decrease in birth weight, birth length and head circumference, especially after four courses of ACS.[7] A single repeat course of ACS, however, has been shown to reduce incidence of respiratory distress syndrome, need for surfactant, and composite morbidity..[8] **Rescue course ACS can be provided as early as 7 days from the prior dose, if indicated by the clinical scenario; however, rescue course ACS is not recommended after 34w0d**.[1]

Late Preterm Steroids (ALPS) after 34w0d

ACOG and SMFM now recommend offering a single course of betamethasone for pregnant people between 34 0/7 weeks and 36 6/7 weeks of gestation at risk of preterm birth within 7 days, and who have not received a previous course of antenatal corticosteroids.[1,9] In a double-blind, placebo-controlled, randomized controlled trial, the administration of antenatal late preterm steroids (ALPS) led to a significant decrease in the need for respiratory support. Severe respiratory complications, transient tachypnea of the newborn, surfactant use, and bronchopulmonary dysplasia occurred significantly less frequently in the betamethasone group, while neonatal hypoglycemia was more common in the betamethasone group.[10] ALPS can be considered in people between 34 0/7 to 36 6/7, with preterm labor (cervical >3cm dilated and/or 75% effaced with regular contractions), PPROM, planned late preterm delivery (for example, placenta accreta, placenta previa, vasa previa, preeclampsia, oligohydramnios). People were excluded from ALPS for the following criteria: 1) prior course of antenatal corticosteroids during the pregnancy (before 34 weeks); 2) candidate for stress-dose corticosteroids; 3) twin gestation; 4) known major fetal anomaly; 5) pregestational diabetes; 6) chorioamnionitis; 7) delivery expected within 12 hours due to ruptured membranes with cervical dilation of at least 3 cm, cervical dilation of at least 8cm, or non-reassuring fetal tracing requiring delivery.[10] Tocolysis should not be used to delay delivery to administer ALPS. **Additionally, an indicated preterm delivery (such as preeclampsia with severe features) should not be postponed to administer ALPS**.[1] If late antenatal steroids are administered, the NICU team should be notified due to the risk of neonatal hypoglycemia. Additionally, people should be counseled regarding the known short-term benefits but lack of long-term outcome data in offspring exposed to ALPS.

ACS Considerations for Periviable Gestations

Data from a Eunice Kennedy Shriver NICHD Neonatal Research Network observational cohort revealed a significant reduction in death and neurodevelopmental impairment at 18-22 months for infants who had been exposed to antenatal corticosteroids and born at 23 0/7 through 23 6/7 weeks of gestation (83.4% vs 90.5%), 24 0/7 through 24 6/7 weeks of gestation (68.4% vs 80.3%), and 25 0/7 through 25 6/7 weeks of gestation (52.7% vs 67.9%). .[1] .

A 2021 systematic review and meta-analysis that included 31 retrospective, observational studies of 2,226 infants who were delivered at 22 0/7 weeks to 22 6/7 weeks of gestation found that survival among infants born to pregnant individuals receiving antenatal corticosteroids was twice that of infants born to pregnant individuals not receiving antenatal corticosteroids (39.0% versus 19.5%; P<.01). One multicenter observational cohort that analyzed over 1,000 live births at 22 0/7 weeks to 22 6/7 weeks of gestation found that infants who received antenatal corticosteroids with postnatal life support were more likely to survive than infants who received postnatal life support alone [38.5% versus 17.7% (adjusted risk ratio, 2.11; 95% CI, 1.68–2.65)]. While survival without a major morbidity was improved with antenatal corticosteroids, the absolute rate of survival without major morbidities still remained very low [4.4% versus 1.0% (adjusted risk ratio, 4.35; 95% CI, 1.84–10.28)]. Based on this new literature, ACOG and SMFM revised their recommendation regarding ACS administration at

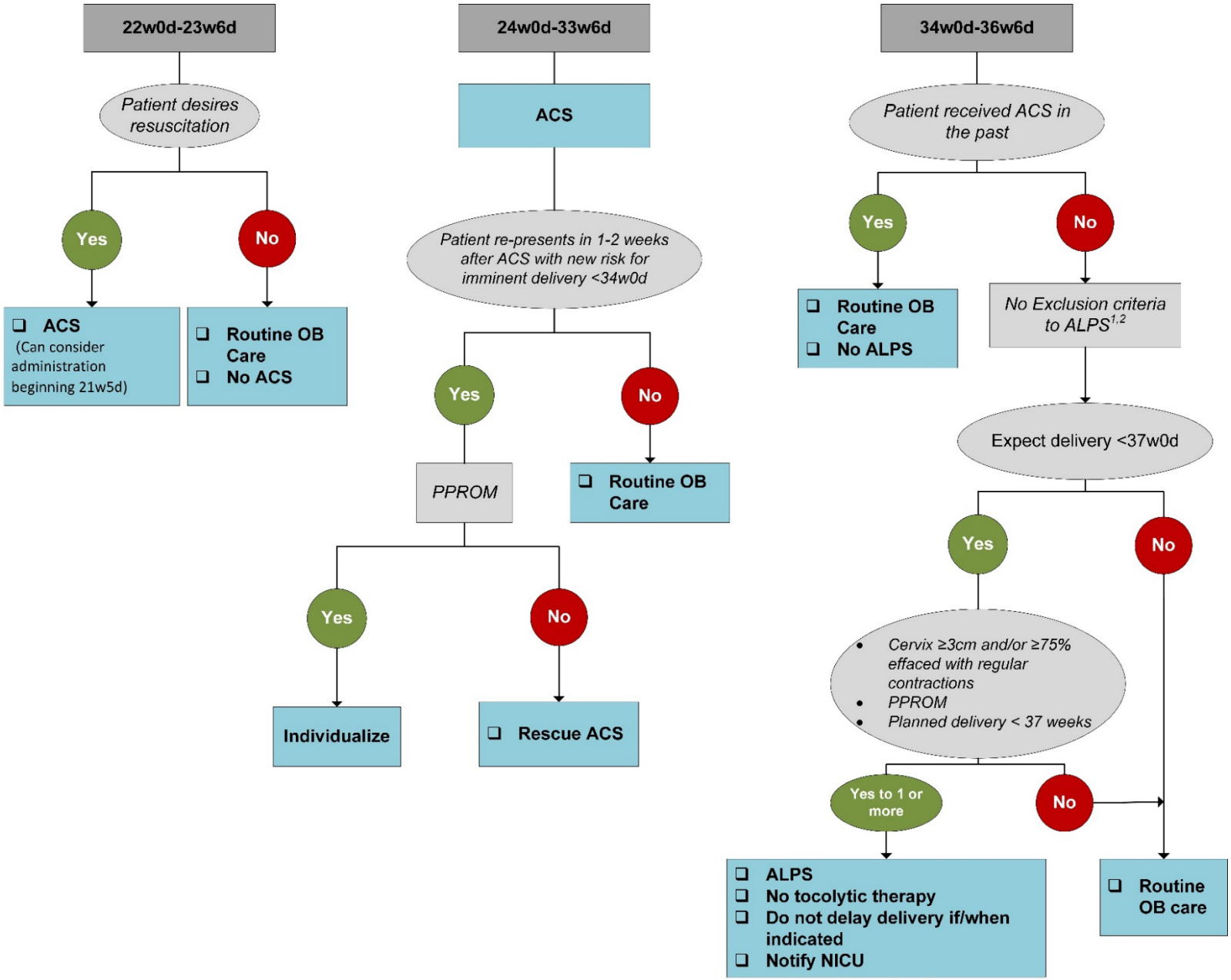
22 weeks of gestation[18]**: Antenatal corticosteroids may be considered starting at 21w5dif neonatal resuscitation is planned at 22 weeks and after appropriate counseling (Figure 1).**

Full recommendations for management of periviable gestations can be found in the Periviability Perinatal Guideline.

General recommendations for ACS administration

Figure 1 highlights recommendations for ACS based on gestational age and clinical considerations.

Figure 1. Antenatal Corticosteroid (ACS) Recommendations for Patients at Risk for PTB within 7 days based on gestational age



[1]ALPS Exclusion Criteria included chorioamnionitis, delivery expected within 12 hours (cervical dilatation ≥8cm, ROM with cervix ≥3cm, non-reassuring fetal status), pregestational diabetes, multiple gestations, and major fetal anomaly).

[2]There should be consideration for the use of antenatal corticosteroids in select populations not included in the original ALPS trial, such as patients with multiple gestations reduced to a singleton gestation on or after 14 0/7 weeks of gestation, patients with fetal anomalies, or those who are expected to deliver in <12 hours.

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Magnesium Sulfate for People at Risk of Preterm Birth for Neuroprotection of the Fetus and Concomitant Tocolysis

[October 2025 (replaces September 2024)]

Author: Dr. Christina Davidson, Dr. Amir Shamshirsaz

This document has been updated to change bolus dose from 6g to 4-6g to account for hospital variation in Magnesium Sulfate policies.

Summary

- Magnesium Sulfate reduces the risk of cerebral palsy in preterm infants prior to 32 weeks gestation
- Tocolysis should only be used short term during antenatal corticosteroid administration
- Magnesium nor Terbutaline should be used as tocolytics for preterm labor

Discussion of Evidence

Approximately one third of cases of cerebral palsy (CP) are associated with early preterm birth. Available evidence suggests that magnesium sulfate given before anticipated early preterm birth reduces the risk of CP in surviving infants. A recent Cochrane review on the use of magnesium sulfate for neuroprotection of the fetus in people at risk for preterm birth included six randomized, placebo-controlled trials involving 6759 babies, and demonstrated a reduction in CP for all six studies who recruited people at less than 34 weeks gestation (RR 0.71; 95% CI 0.71 to 0.89; six trials; 6107 infants) .[1] The number of people needed to be treated to prevent once case of CP among those who survive until age 18-24 months is 46 (95% CI 26-187) in infants exposed to magnesium sulfate in utero before 30 weeks, and 56 (95% CI 34-164) in infants exposed to magnesium sulfate in utero before 32-34 weeks.[2]

Of the 3 large randomized clinical trials designed to evaluate the effect of magnesium sulfate treatment on neurodevelopmental outcomes,[3-5] the only one to show a significant reduction in CP (the "Rouse Regimen") enrolled people at imminent risk for preterm birth between 24 and 31 6/7 weeks of gestation [because of PPROM (87%), advanced preterm labor (10%), or indicated preterm delivery (3%)], randomly assigned them to receive either IV magnesium sulfate or placebo and, in contrast to previous trials, permitted retreatment with magnesium sulfate (up to 34 weeks of gestation).[5]

In people at risk for preterm birth secondary to preterm labor, tocolytic agents are often used to inhibit myometrial contractions. **An evaluation of 19 randomized clinical trials, however, revealed that magnesium sulfate tocolysis did not reduce the frequencies of delivery within 48 hours, 7 days, or early/late preterm birth, and was not associated with improvements in newborn morbidities or mortalities**.[6] Alternatively, beta-mimetics (i.e., terbutaline), calcium channel blockers (i.e., nifedipine), and cyclooxygenase inhibitors (i.e., indomethacin) were not found to be superior when compared with magnesium sulfate treatment.[6] Based on these data:

1. It is appropriate to withhold tocolysis from people presenting in preterm labor as neonatal benefit has not been demonstrated with such treatment.

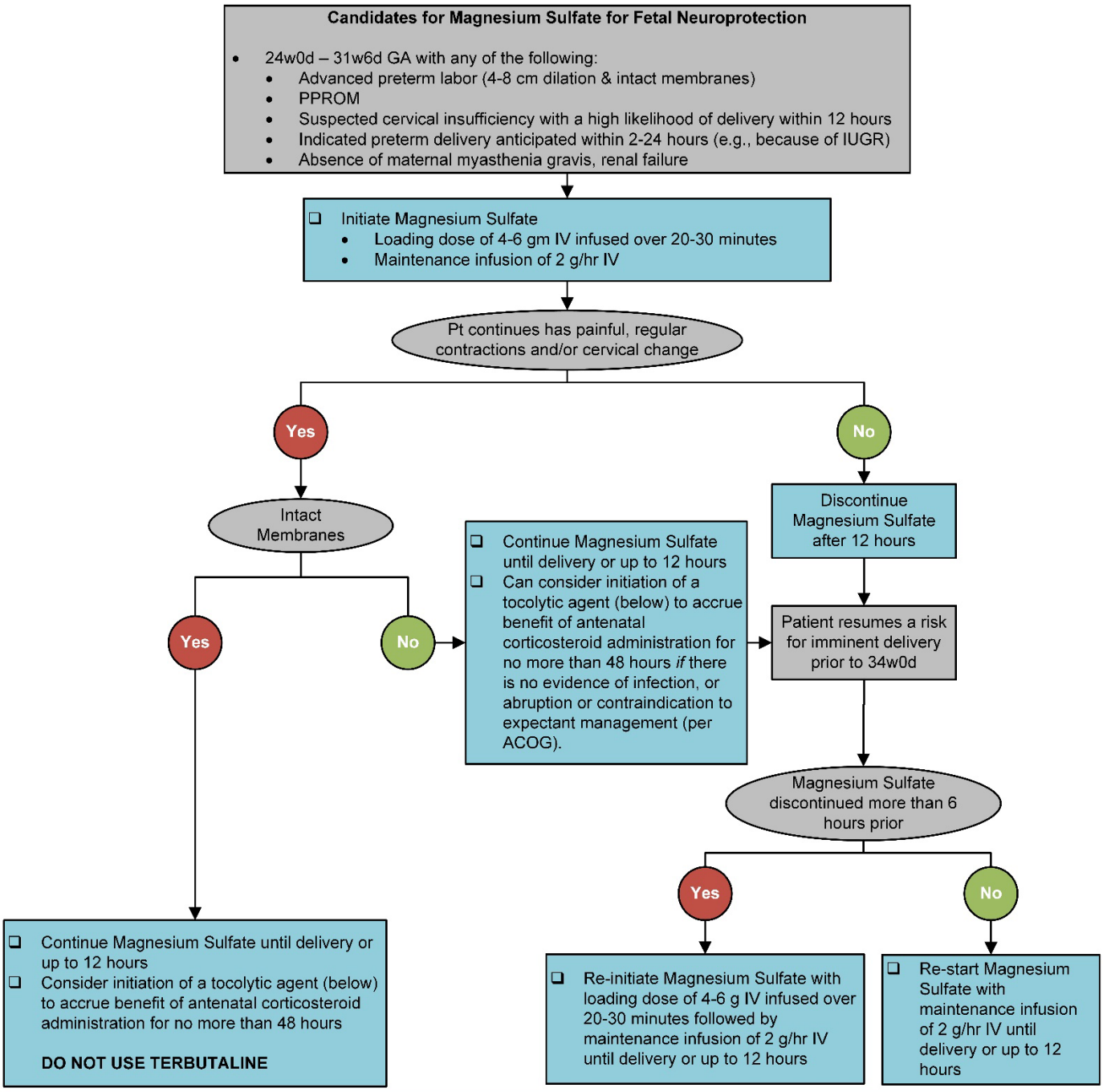
2. **If tocolysis is initiated to achieve time to accrue the benefits of antenatal corticosteroid administration, to facilitate patient transport, or during treatment of reversible causes of preterm labor, the tocolytic agent can be discontinued once these goals have been achieved.**

3. It is appropriate to withhold tocolysis from people with recurrent preterm labor unless used to effect administration of a "rescue course" of antenatal corticosteroids (please refer to BCM Ob/Gyn Perinatal Guideline on "Management of Periviability and the Use of Antenatal Corticosteroids in the Management of Pregnancies at Risk for Preterm Birth") as brief pregnancy prolongation is unlikely to improve neonatal outcomes.

4. **TERBUTALINE SHOULD NOT BE ADMINISTERED ROUTINELY FOR PRETERM LABOR, USED CONTINUOUSLY, USED IN OBSTETRIC TRIAGE AREAS, OR PRESCRIBED ON AN OUTPATIENT BASIS BECAUSE OF THE POTENTIAL FOR SERIOUS MATERNAL HEART PROBLEMS AND DEATH.**

Figure 1 outlines the BCM OB/Gyn Perinatal Guidelines Committee recommendations regarding the use of magnesium sulfate for people at risk of preterm birth for neuroprotection of the fetus and the use of concomitant tocolysis[7].

Figure 1. Use of Magnesium Sulfate for Fetal Neuroprotection and concomitant use of tocolysis[1,6,8]



Recommended Tocolytics

- **Indomethacin**: 25 mg po every 6 hours
  if GA <32w0d, no oligohydramnios, no maternal renal/hepatic impairment
- **Nifedipine Immediate Release**: Initial po dose of 10 mg; repeat dose every 20 min to a max dose of 40 mg po in the first hour, then start 10-20 mg po every 4-6 hours
  if BP >90/50 mm Hg & no maternal cardiac disease or renal impairment

Indications for Terbutaline

- Single dose of 0.25 mg SQ for tocolysis for ECV
- 0.25 mg IV or SQ for management of acute intrapartum fetal distress from suspected uterine tachysystole **or** management of acute intrapartum fetal distress to abolish uterine contractions in preparation for emergent cesarean delivery
- **TERBUTALINE SHOULD NOT BE ADMINISTERED ROUTINELY FOR PRETERM LABOR, USED CONTINUOUSLY, USED IN OBSTETRIC TRIAGE AREAS, OR PRESCRIBED ON AN OUTPATIENT BASIS BECAUSE OF THE POTENTIAL FOR SERIOUS MATERNAL HEART PROBLEMS AND DEATH**

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Placenta Previa and Vasa Previa

[September 2025 (Replaces October 2024)]

Authors: Dr. Hennie Lombaard, Dr. Martha Rac, Dr. Alex Saucedo, Dr. Amir Shamshirsaz
Editor: Dr. Alex Saucedo

This guideline has been separated from the PAS guideline and information added regarding Vasa Previa Type 3.

Summary

Placenta Previa

- Patients diagnosed with placenta previa in the second trimester should have a follow up ultrasound at 32-34 weeks to determine persistence of the previa.
- These patients should be delivered via Cesarean delivery at 36w0d-37w6d weeks gestation, or sooner if labor or clinically significant bleeding occurs.
- Find overview of management in Figure 1.

Vasa Previa

- The placental cord insertion should be visualized at the midtrimester anatomy scan. If the cord insertion is suboptimally visualized, the lower uterine segment should be evaluated transabdominally and/or transvaginally to determine whether a vasa previa exists.
- Patients with vasa previa should be hospitalized 30-34 weeks based on clinical presentation and shared decision making with the patient
- Cesarean Delivery is recommended no later than 35w0d-36w0d. The use of intraoperative ultrasound can be used to identify the location of the fetal vessels to avoid surgical transection at the time of Cesarean delivery.
- Find overview of management in Figure 1.

Placenta Previa

Background

Placenta previa complicates ~0.3-0.5% of pregnancies and risk factors include:[1]

- History of prior cesarean delivery (CD)
- Uterine surgery
- In vitro fertilization (especially with cryopreserved embryos)
- Increasing age
- Multiparity
- Multiple pregnancy
- Smoking
- History of pelvic radiation

Definitions

- **Placenta previa:** a placenta that overlies the internal os of the cervix; all placentas overlying the os (to any degree) are termed previas
- **Low-lying placenta**: a placenta that is near to but not overlying the os[2], diagnosed when the distance between the internal cervical os and the placental edge is 1-20 mm.[3,4]
- **The terms "partial" and "marginal" have been eliminated from the nomenclature**.

Diagnosis

Uterine scarring predisposes to placental implantation in the lower uterine segment (LUS). As pregnancy progresses, >90% of these low-lying placentas identified early in pregnancy will appear to move away from the cervix and out of the LUS. This is thought to be due to the placenta preferentially growing towards a better vascularized fundus, whereas the placenta overlying the less well vascularized cervix may undergo atrophy. In some cases, this atrophy leaves vessels running through the membranes, unsupported by placental tissue or cord (vasa previa). In cases where the atrophy is incomplete, a succenturiate lobe may develop.[1]

The majority of cases of placenta previa are diagnosed during routine sonography in asymptomatic People, usually during the 2nd trimester.[1] Transvaginal ultrasound (TV-US) is superior to transabdominal ultrasound (TA-US) for this indication and therefore, TV-US must be performed to confirm the diagnosis. Once a placenta previa or low-lying placenta has been diagnosed in the midtrimester, follow up ultrasounds should be scheduled for evaluation of placental location and placental cord insertion. If a placenta previa is diagnosed at <24 weeks, up to 88% will resolve by delivery.[5]

Imaging Pearls

When the diagnosis of placenta previa/low lying placenta is made on ultrasound, the ultrasound report should document the following:

- The location of the placenta and the presence of a placenta previa or low-lying placenta. For a low-lying placenta, the distance (in centimeters) from the internal os to the leading edge of the placenta (to include a marginal sinus, if present) should be described.
- A discussion with the person that she has been informed of her diagnosis of placenta previa or low-lying placenta and advised to present to the hospital immediately for vaginal bleeding, that the diagnosis may resolve, and that follow up ultrasounds will be scheduled.
- A recommendation for follow up ultrasound for placental location and placental cord insertion
- In stable patients, follow up ultrasound can be performed at 32 weeks of gestation. If the previa persists, an additional study can be performed at 34-36 weeks of gestation to determine the optimal route and timing of delivery.[2,3]

- If placenta previa or low-lying placenta resolves, the ultrasound report should document the following:
  - The placenta is no longer a previa/low-lying and there is/is not suspicion for vasa previa. **This should include a cine sweep of the lower uterine segment with color Doppler to confirm absence of fetal vasculature.**[6]
  - The findings were conveyed to the patient.
  - No further ultrasounds currently appear indicated.

At 32-34 week follow up scan when placenta previa/low-lying placenta persists:

- The ultrasound report should document the following:
  - Recommendation for cesarean delivery by 36w0d to 37w6d when placenta previa is present.
  - Mode of delivery to be discussed with primary provider when a low-lying placenta is present.
  - The findings were conveyed to the patient and her primary Ob provider.
- Coordination of care: at Ben Taub, the MFM will notify a High-Risk Ob Clinic Resident of the diagnosis and patient information so that delivery arrangements can be made (i.e., resident/faculty to schedule for CD vs. discussion regarding trial of labor).

Management

Acute Bleeding Episode

People who present with bleeding in the 2nd half of pregnancy should have a sonographic examination (preferably by TV approach) for placental location *prior* to any attempt to perform a digital examination. **Digital vaginal examination with a placenta previa may provoke brisk hemorrhage and should not be performed**.[1,7]

In people with a placenta previa who present with an acute bleeding episode or uterine contractions, the following management plan may be employed:

1. Hospitalization
2. Place 2 large-bore IVs
3. CBC ± coags
4. Type and cross for 4 units of PRBCs, in accordance with our hospitals' postpartum hemorrhage risk assessment and stratification tool
5. Administer Rh immune globulin to Rh-negative people; Kleihauer-Betke test should be performed to determine amount of Rh immune globulin necessary.
6. Consider administration of antenatal corticosteroids (ACS) for fetal maturity up to 35 6/7 weeks of gestation
   a. May consider tocolysis up 34 weeks gestation to allow for steroid administration
7. Consider administration of magnesium sulfate for fetal neuroprotection up to 31 6/7 weeks of gestation.
8. Prior to 32 weeks of gestation, moderate to severe bleeding when there is no maternal or fetal compromise may be managed aggressively with blood transfusions rather than resorting to delivery.[1]
9. Discharge home may be considered after 24-48 hours of no further bleeding.[1] Other considerations may include:
   a. Patient has access to a telephone and distance she lives from the hospital.
   b. Patient has a responsible adult and transportation available at all times.
   c. Patient accepts blood product transfusion.
   d. Number of previous hospitalizations for vaginal bleeding.

Antenatal Monitoring and Delivery Planning

See Figure 1 for recommended management.

Repeat US for placental localization and placental cord insertion at 32 weeks, as a majority of previas will resolve by this time.[5]

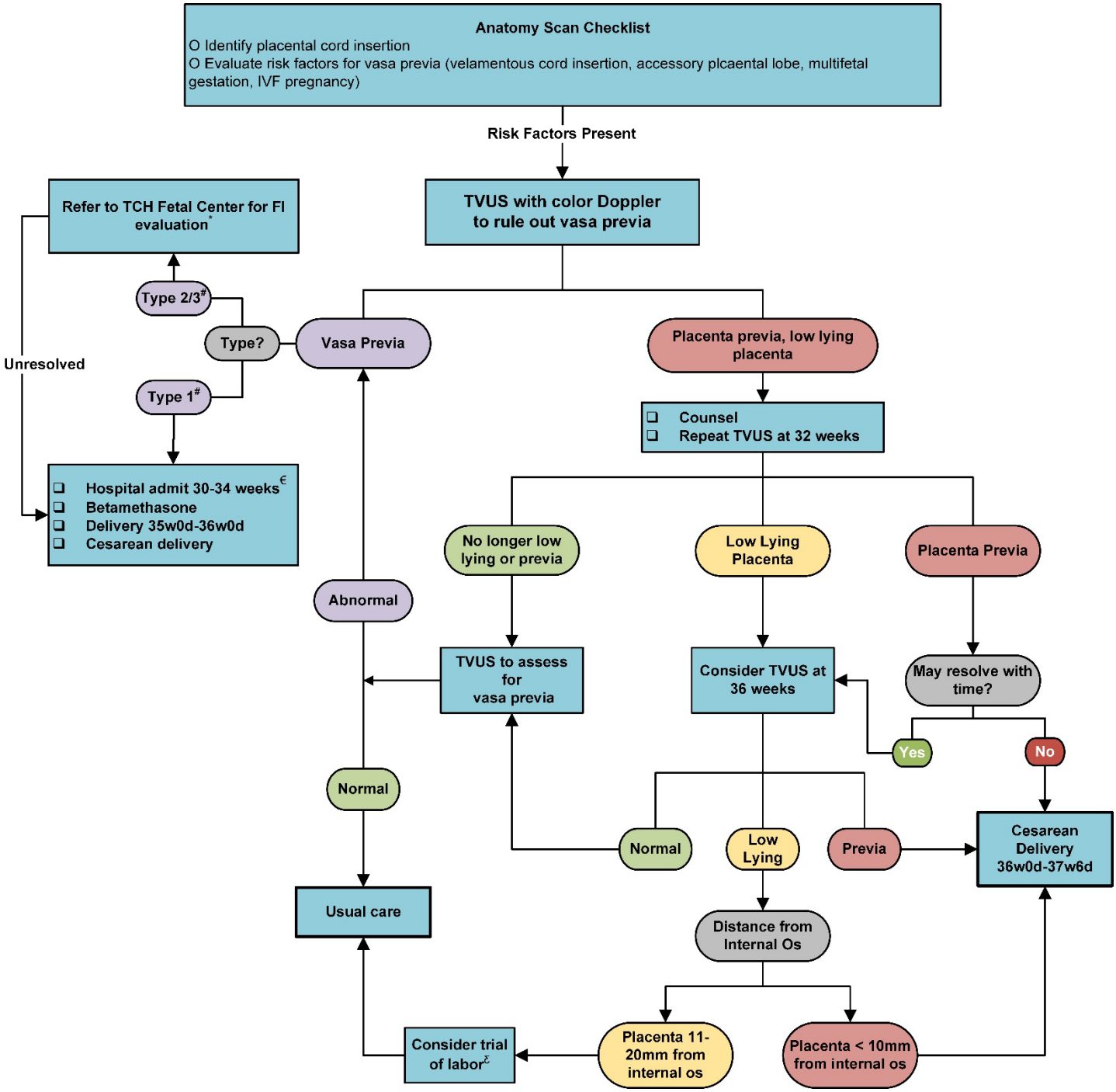
a. In a patient with a placental edge to cervical os distance of >10 mm, vaginal delivery may be considered, and management should be individualized.[8-11 *]
b. Consider repeat TV-US at 34-36 weeks if a low-lying placenta seems likely to resolve and permit vaginal delivery
c. In a patient with prior CD(s) but no sonographic evidence of placenta accreta, **consider placing the patient in the dorsal lithotomy position** should an accreta be diagnosed intraoperatively (as per accreta protocol below).

A placenta previa requires delivery by cesarean.[1] In a stable patient, CD should be performed at 36 0/7 – 37 6/7 weeks.[1,12]

There is an increased risk of postpartum hemorrhage in the setting of previa, even without accreta, often attributable to diffuse bleeding at the placental implantation site in the LUS. In addition to uterotonics, measures such as "oversewing" of the placental bed, intrauterine balloon tamponade, and B-Lynch or other compression sutures may be helpful.[2]

* Three small retrospective studies suggest that people with placenta previa should have a TV-US in the late 3rd trimester and that those with a placenta-internal os distance of less than 2 cm, thus all low-lying placentations, should be delivered by cesarean.[7-9] Another small retrospective study demonstrated that more than two-thirds of people with a placental edge to cervical os distance of >10 mm deliver vaginally without increased risk of hemorrhage. This study has been referenced to demonstrate low-lying placentation as a potentially modifiable obstetric indication for first CD.[10]

Figure 1. Management of vasa previa, placenta previa, low lying placenta



* Some patients may be eligible for ablation of the vasa previa that connects a succenturiate lobe to the main placental mass. The goal of therapy is to permit patients to extend delivery beyond 34 weeks of gestation and for vaginal delivery at term, absent other risk factors.

Type 1 vasa previa velamentous cord insertion and the fetal vessels course unprotected over or within 2 cm of the internal cervical os; Type 2 vasa previa there is a succenturiate lobe or multilobed placenta with unprotected fetal vessels traversing the two lobes of the placenta that cross over the internal cervical os or are within 2 cm of the internal cervical os.

€ Timing of admission should be based on shared decision-making discussion, symptoms (i.e. contractions). In patients who cannot be admitted inpatient can consider cervical length with hospital admission for TVCL < 2.5mm.

£ Studies suggest low lying placenta 11-20mm from internal os are not at increased risk of hemorrhage with a vaginal delivery.

Vasa Previa

Vasa previa is a condition in which fetal vessels run within the fetal membranes and course unprotected over or within 2cm of the internal cervical os. It occurs in approximately 0.46/1000 deliveries. Due to the widespread use of ultrasound and pre-labor cesarean delivery, the perinatal mortality rate is now <10%.[3,4,12,13]

Risk Factors:

- Velamentous cord insertion
- Succenturiate lobe/bilobed placenta
- Low-lying placenta or placenta previa in the second trimester
- In vitro fertilization (incidence of Type I Vasa Previa 1/250)
- Multiple gestation

Definitions

Type I Vasa Previa: there is a velamentous cord insertion and the fetal vessels course unprotected over or within 2 cm of the internal cervical os.

- Can occur after a low-lying placenta or placenta previa resolves.

Type II Vasa Previa: there is a succenturiate lobe or multilobed placenta with unprotected fetal vessels traversing the two lobes of the placenta that cross over the internal cervical os or are within 2 cm of the internal cervical os.

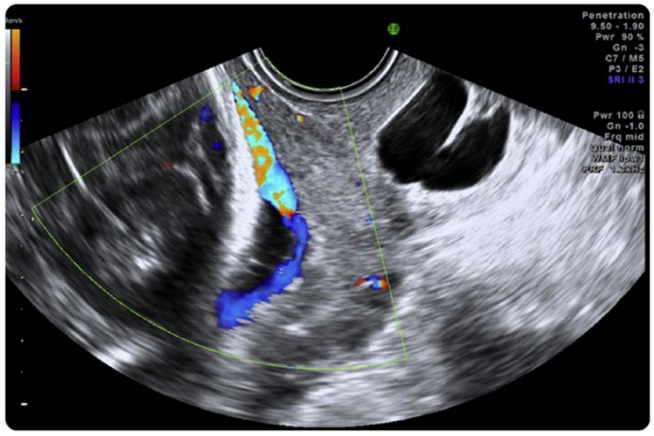
Type III Vasa Previa: there is a normal placental cord insertion into the disk, aberrant fetal vessels run from the placenta to the amniotic membrane, near the internal cervical os, before returning to the placenta.[14]

Diagnosis

Diagnosis of Vasa Previa is routinely made with prenatal ultrasound via evaluation of the lower uterine segment and cervix, supplemented with color and pulsed Doppler imaging. The placental cord insertion site should be documented if technically feasible. Prenatal ultrasound for the detection of vasa previa has high sensitivity at 93% and specificity at 99%. Vasa previa is most commonly diagnosed during routine anatomy survey between 18-26 weeks. If diagnosed during the second trimester, there is a 20% chance of resolution by the third trimester and follow-up imaging is recommended for delivery planning.

When a vasa previa is suspected with transabdominal imaging, a transvaginal ultrasound with color and pulsed Doppler should be performed. Fetal vessels (versus maternal vessels) can be confirmed with pulsed Doppler imaging to document a rate equal to the fetal heart rate.

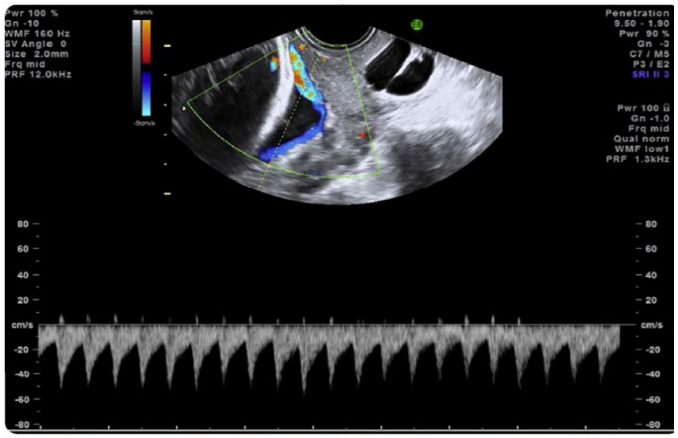
FIGURE 2
Transvaginal ultrasound with color Doppler image of vasa previa



In this image obtained by transvaginal ultrasonography, a fetal blood vessel is seen traversing across the cervical os suggestive of a vasa previa.

SMFM. Diagnosis and management of vasa previa. Am J Obstet Gynecol 2015.

FIGURE 3
Transvaginal ultrasound scan with color Doppler image and pulsed wave Doppler image shows fetal heart rate



Pulsed wave Doppler of the vessel over the cervical os depicts a fetal heart rate, confirming a diagnosis of vasa previa.

SMFM. Diagnosis and management of vasa previa. Am J Obstet Gynecol 2015.

Management

Once the diagnosis of Vasa Previa is confirmed, the goal of management is to balance pregnancy prolongation with avoidance of preterm labor or rupture of membranes that lead to disruption of fetal vessels and bleeding.

See Figure 1 for management guidelines.[1,9]

The decision to hospitalize should be individualized and take into consideration the following factors:

- Presence of symptoms such as preterm contractions and vaginal bleeding
- History of prior spontaneous preterm birth
- How far the patient lives from the hospital and reliability of transportation

In patients who cannot be or decline to be hospitalized, some experts recommend transvaginal cervical length screening and hospitalization for symptoms and/or TVCL less than 25mm as the risk for preterm birth is higher.

ACOG recommends delivery between 34 0/7 – 37 0/7 weeks of gestations. **The BCM Ob/Gyn Perinatal Guidelines Committee recommends delivery no later than 35-36 weeks of gestation** and via a cesarean delivery for persistent vasa previa. Delivery is recommended earlier for signs and symptoms of preterm labor, PPROM or evidence of fetal distress.

The presence of a sinusoidal fetal heart rate pattern with or without vaginal bleeding should prompt concern for fetal anemia due to ruptured fetal vessels and immediate delivery is recommended. The neonatology team should be notified of the potential need for a neonatal transfusion of O-negative blood. In the absence of available type and crossmatched or emergency blood, consider drawing 50-60mL of maternal blood to give to the neonate if routine emergency release will be delayed.

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Placenta Accreta Spectrum (PAS)

[October 2025 (Replaces October 2024)]
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Editor: Dr. Alex Saucedo

This guideline has been separated from the guidelines for placenta previa and vasa previa. Delivery timing has been updated to 32w0d-35w6d for known PAS patients.

Summary

- Patients with placenta previa or low-lying anterior placenta and history of Cesarean delivery or any uterine surgery should be referred to MFM for PAS evaluation at 20 weeks gestation.
- Repeat ultrasound evaluation with transabdominal and transvaginal approach should occur at 28-32 weeks for surgical planning in patients who are at risk for PAS (history of Cesarean/uterine surgery + persistent previa, low-lying placenta).
- Patients at high-risk for PAS should be delivered between 32w0d-35w6d with antenatal administration of corticosteroids. Earlier delivery may be indicated based on clinical presentation and shared decision making with the patient. Delivery past 36w0d is generally not recommended but may be individualized on a case-by-case basis. These patients are ideally scheduled through the BCM PAS team. Ensure the PAS Surgical Planning Checklist is in the Care Coordination Note for scheduled cases.
- Please refer to Figure 2 **for unscheduled/unplanned PAS delivery call-tree and management**. Of importance: (1) Notify PAS#1 on-call, (2) Book OR case for CS, possible TAH/BS, Cystoscopy/Stents, (3) Consult Transfusion Medicine and place 4U pRBC on hold to OR, (4) Consult Neonatology (5) Consult Urology for stent placement (if patient clinical status permits).
- **For unscheduled emergent deliveries**, OR to open both CS and PAS tray set. Place patient in dorsal lithotomy position. Follow the PAS Surgical planning checklist in the care coordination note, perform vertical midline skin incision, perform a classical or trans fundal hysterotomy (do not cut through placenta), deliver neonate and allow for delayed cord clamping as clinically stable. **Do not attempt to remove placenta manually.** If clinical status allows, pack abdomen and await on-call PAS physician. If status deteriorates, call for MTP, pack intestines into upper abdomen, and begin to perform supracervical hysterectomy (or if accessible, clamp uterine artery bilaterally).
- Order routine ERAS post-operative recovery

Background

Placenta accreta spectrum is an overarching term used to describe the clinical condition when part of the placenta, or the entire placenta, implants over a uterine scar and becomes inseparable from the uterine wall.[1] Previously, the terms “placenta accreta,” “abnormally invasive placenta,” and “morbidly adherent placenta” were used to describe the full spectrum of placental disease, however these terms have fallen out of favor, as each may refer to a specific subset of PAS, and the term “Placenta Accreta Spectrum” has now been accepted and endorsed by the International Society for Abnormally Invasive Placenta, FIGO (Federation Internationale Gynecologie et Obstetrique), the American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine. The precise etiology is unknown, but there has been a recent shift away from considering placental trophoblast as a truly invasive placenta disease process (such as a cancer) toward the hypothesis that the placenta accreta spectrum is more of a uterine disease, in which there are defects in the endometrium, junctional zone and/or myometrium, that the placenta mechanically distorts the uterine architecture, and that the etiology of blood loss and morbidity is caused by fibrosis, loss of normal separation

planes, and recruitment and proximity of pelvic vessels in close proximity to the placenta and lower uterine segment.

Definitions

Historically there have been three grades of placenta accreta spectrum disease as defined according to the depth of invasion:[1,2]

1. **Placenta Accreta**: chorionic villi attach directly and firmly to the myometrium, rather than being restricted within the decidua basalis, and with absence of the intervening fibrinoid or "Nitabuch's" layer
2. **Placenta Increta**: chorionic villi extend into the myometrium
3. **Placenta Percreta**: chorionic villi perforate through the myometrium

It is possible to have various depths of invasion ranging from accreta to percreta within a single placental implantation site.

Complications with PAS[1-3]

- Massive obstetric hemorrhage
- Need for hysterectomy
- DIC
- Acute transfusion reactions, TRALI
- Damage to local organs (bowel, bladder, ureters) or neurovascular structures
- ARDS
- Renal failure
- Amniotic fluid embolism
- Re-operation
- Post-op thromboembolism, infection, multisystem organ failure
- Maternal death

Risk Factors

People at greatest risk of placenta accreta are those who have myometrial damage caused by a previous CD (especially multiple prior CD) with a placenta previa or low-lying placenta overlying the uterine scar.[1] Anterior or central placental location has been found to be a significant risk factor in the presence of a previous scar (28.6% vs. 1.9%, P < .001), but not in the absence of a prior scar (2.4% vs. 6.0%, P = .239).[2,4] 90% of cases of PAS will involve an anterior placenta previa, and PAS may occur in the setting of a predominantly posterior placentation or higher implantation, especially in the setting of prior uterine surgery other than cesarean, IVF, or classical hysterotomy.

Table 1. Frequency (%) of placenta accreta according to number of cesarean deliveries and presence/absence of placenta previa[1-3,5]

Cesarean Delivery	Placenta Previa Present	Placenta Previa Absent
First (primary)	3.3	0.03
Second	11-24	0.2
Third	40	0.1
Fourth	61	0.8
Fifth	67	0.8
Sixth or more	67	4.7

Other risk factors for PAS:[1-3,5-10]

- Cesarean scar pregnancy
- In vitro fertilization, with highest risk with cryopreserved embryos
- Any condition resulting in myometrial tissue damage followed by a secondary collagen repair, such as previous myomectomy, classical CD, endometrial defects due to vigorous curettage resulting in Asherman syndrome, submucous leiomyomas, thermal ablation, uterine irradiation/radiation of lower abdomen (for example, radiation of pelvic lymph nodes), and uterine artery embolization
- Prior placenta accreta spectrum disease that was conservatively managed
- Advanced maternal age
- Multiparity
- Hypertensive disorders of pregnancy
- Smoking

Antenatal screening

First line screening is via ultrasound. MRIs may be considered as the second line imaging modality for posterior placentation and suspected lateral involvement.

A high index of suspicion and referral to a specialist for ultrasound imaging should occur for any person in which there is:

1. Suspicion for placenta accreta on ultrasound
2. Placenta previa with abnormal placental appearance
3. Placenta previa with ≥ 1 prior cesarean delivery
4. History of classical cesarean delivery and anterior placentation
5. History of endometrial ablation or pelvic irradiation
6. Inability to adequately evaluate or exclude findings suspicious for placenta accreta in people with risk factors for placenta accreta
7. Any other reason for suspicion for placenta accreta (such as abnormal appearance of the placenta on screening ultrasound)

PAS may be identified on ultrasound in any trimester; however, it is usually based on US findings in the 2nd or 3rd trimester and/or by MRI.[11,12]

Patients at high risk for PAS should have a third trimester ultrasound, at 28-32 weeks, and close to surgery with one of the PAS surgeons present for surgical planning.

Ultrasound Diagnosis for PAS

Image optimization

- In the setting of placenta previa or low-lying placenta, transvaginal ultrasound evaluation is recommended.
- Scan the placenta when the patient has a FULL BLADDER. This is a crucial feature to adequately visualize the uterine-bladder interface and identify any irregularity or bulging of placenta.
- With the abdominal probe in the sagittal/parasagittal plane, tilt the probe so that the handle moves closer to the patient's thighs (nearly parallel) and the transducer end rotates up slightly. This will bring the bladder line into better view and avoid dropouts that occur when the bladder line (interface) is parallel to the transducer.
- Use penetration and adjust the focal point to target the placenta
- Widen the angle of view, to ensure as much of the placenta is visible.

- Ensure the entire placenta is evaluated. Remember, PAS may affect only a portion of the placenta
- Obtain transverse sweeps from low to high (inferior to superior), to look for placental bulging along the parametria
- Transvaginal imaging with and without color Doppler and 3D color Doppler is recommended to evaluate the cervix and for deep invasion for any low-lying placenta, suspected PAS or if the lowermost edge cannot be clearly seen on transabdominal imaging.
- If there is suspicion for lacunae formation versus placental lakes, use of cine sweeps to evaluate turbulence as well as Doppler interrogation and velocimetry can be used to distinguish between the two findings. Placental lakes are more common benign findings in the third trimester and are associated with low velocity (<10cm/s) venous flow, whereas placenta lacunae are abnormal blood collections within the uterus that are highly associated with PAS formation and associated with higher velocity (>15cm/s) venous or arterial flow.[13]

Ultrasound findings

[1,3]In the Special Report of the Society for Maternal-Fetal Medicine Placenta Accreta Spectrum Ultrasound Marker Task Force: Consensus on definition of markers and approach to the ultrasound examination of pregnancies at risk for placenta accreta spectrum,[14] the definition of first trimester PAS markers and the proposed ultrasound approach are presented in Table 2 and Table 3, respectively. Similarly, the definition of second trimester PAS markers and proposed ultrasound approach are presented in Table 4 and Table 5, respectively.

Table 2. *Definitions of PAS markers in the first trimester of pregnancy*

Marker	Definition
Cesarean scar pregnancy	Gestational sac implantation in part or totally within the cesarean scar.
	Gestational sac may have a teardrop or triangular shape.
Low implantation pregnancy	Gestational sac located close to the internal cervical os (up to 8 6/7 weeks of gestation) and/or placental implantation located posterior to a partially filled maternal bladder (up to 13 6/7 weeks of gestation).

Shainker. Special Report of the SMFM: Definition of markers and ultrasound examination in pregnancies at risk of PAS. Am J Obstet Gynecol 2021.

Table 3. *Approach to ultrasound examination in the first trimester of pregnancy.*

Approach to ultrasound examination in the first trimester of pregnancy

- Transvaginal ultrasound is recommended in early pregnancy, and transabdominal ultrasound may be performed when appropriate.
- Detailed evaluation of the uterus in the midsagittal plane to document the gestational sac (up to 8 6/7 weeks of gestation) and/or the placental location (up to 13 6/7 weeks of gestation).
- Documentation should include reference to the position of the sac and/or placenta relative to the bladder, cesarean scar (if present), and internal cervical os.
- Color Doppler imaging using a low-velocity scale, low wall filter and high gain to maximize detection of flow (adjusting as needed for body habitus and other clinical factors).[a]
- Evaluate shape of gestational sac (up to 8 6/7 weeks of gestation).
- Imaging should be performed with a partially filled maternal bladder.
  - The area of interest should be magnified so that it occupies at least half of the ultrasound image with the focal zone at an appropriate depth.

[a] Color Doppler should be limited to the areas of interest and avoid the embryo or fetus whenever possible.

Shainker. Special Report of the SMFM: Definition of markers and ultrasound examination in pregnancies at risk of PAS. Am J Obstet Gynecol 2021.

Tables 4 and 5. *PAS ultrasound markers and ultrasound examination guidelines in the second and third trimesters of pregnancy.*

Definitions of PAS markers in the second and third trimesters of pregnancy

Marker	Definition
Placental lacunae	Irregular, hypoechoic spaces within the placenta containing vascular flow (which can be seen on grayscale and/or color Doppler imaging).
	The following lacunae findings are associated with high risk of PAS: Multiple (often defined as ≥3) • Large size • Irregular borders • High velocity[a] and/or turbulent flow within
Abnormal uteroplacental interface	Loss of the retroplacental hypoechoic zone between the placenta and myometrium.[b]
	This marker is often located along the posterior bladder wall resulting in partial or complete interruption or irregularities of the uterovesical interface.
	Thinning of the retroplacental myometrium (previously described as myometrial thickness of <1 mm).
Abnormal uterine contour (placental bulge)	Placental tissue distorting the uterine contour resulting in a bulge-like appearance.
Exophytic mass	Placental tissue extruding beyond the uterine serosa.
Bridging vessel	Vessel that extends from the placenta across the myometrium and beyond the uterine serosa.

PAS, placenta accreta spectrum.

[a] Some studies suggest a velocity of >15 cm/s as the threshold for high peak systolic velocity; [b] This space represents the uterine decidua and has been described as the "clear zone."

Shainker. Special Report of the SMFM: Definition of markers and ultrasound examination in pregnancies at risk of PAS. Am J Obstet Gynecol 2021.

Approach to ultrasound examination in the second and third trimesters of pregnancy

Marker	Approaches
Lacunae	Detailed evaluation of the entire placenta in orthogonal planes.
	Lacunae should be evaluated using grayscale and color Doppler imaging.
	Doppler assessment should generally be performed with a low-velocity scale, low wall filters, and high gain to maximize detection of flow[a] (adjusting as needed for body habitus and other clinical factors).
Abnormal uteroplacental interface	Evaluation of the uteroplacental interface is optimized by perpendicular orientation of the transducer to the area of interest with minimal transducer pressure.
	Transvaginal ultrasound is recommended in the setting of an anterior, low-lying placenta or placenta previa.
	Imaging should be performed with a partially filled maternal bladder.
	Optimization of gain settings to help differentiate between placental and myometrial tissues.
	The area of interest should be magnified so that it occupies at least half of the ultrasound image with the focal zone at appropriate depth.
	Myometrial measurement should be made perpendicular to the long axis of the uterus and measured at the thinnest site (commonly along the uterine scar).
Abnormal uterine contour (placental bulge)	Placental tissue distorting the uterine contour resulting in a bulge-like appearance (this is best appreciated in a midsagittal plane of the uterus).
Exophytic mass	Placental tissue visualized beyond the uterine serosa.
Bridging vessel	Doppler assessment of vessels extending from the placenta across the myometrium and beyond the uterine serosa.[b]

[a] Some studies suggest a velocity of >15 cm/s as the threshold for high peak systolic velocity; [b] Bridging vessels need to be differentiated from bladder varicosities, which are not placental in origin and do not increase risk of placenta accreta spectrum.

Shainker. Special Report of the SMFM: Definition of markers and ultrasound examination in pregnancies at risk of PAS. Am J Obstet Gynecol 2021.

Ultrasound Documentation, Patient Education and Coordination of Care

Technical performance guidelines for sonographers/physicians and a standard checklist for evaluating patients suspected to have PAS have been developed by an international working group of experts in PAS (Tables 4 and 5). When there is evidence of PAS on ultrasound, we recommend using this checklist or similar, very clear language when reporting (Figure 1). **It is important to note in the ultrasound report whether the bladder is adequately filled**. If the bladder is not sufficiently filled for any reason, the ultrasound may need to be repeated, if possible, to ensure an accurate diagnosis of PAS.

PAS Evaluation AS template

PAS Evaluation
A PAS evaluation was performed via transabdominal and transvaginal approach.
Placental location: anterior / posterior / left lateral / right lateral
Placental relation: far from cervix / low-lying / previa
Placental texture: homogeneous / heterogeneous
Placental lakes: absent / present
Lacunar formation: absent / Grade 1 / Grade 2 / Grade 3
Smallest myometrial thickness: thick normal intervening tissue / thinned > 3 but < 5mm / moderately thinned > 1 but < 3mm / significantly thinned <1mm
Bridging vessels: absent / present
Placental lacunar feeding vessels: absent / present
Uterovesical hypervascularity: absent / present
Subplacental hypervascularity: absent / present
Bladder wall interruption: absent / present
Placental bulge: absent / present
Focal exophytic mass: absent / present

Overall impression: LOW RISK / INCREASED RISK FOCAL / HIGH RISK
Comments:

PAI Score: ___ (3.0 for >2 CD; 3.5 for Grade 3, 1.0 for Grade 2; MT <1mm 1.0, 1-3 0.5, 3-5 0.25; anterior 1.0; bridging 0.5)
Probability of invasion: ____ (>0 5%; >1 10%; >2 19%; >3 33%; >4 51%; >5 69%; >6 83%; >7 91%; >8 96%)
Probability history based: ____ (0 prior CS 3%; 1 prior CS 11%; 2 prior CS 40%; 3 prior CS 61%; 4 prior CS 67%)

Value of each parameter is added together to generate Placenta Accreta Index score

Parameter[a]	Value
≥2 cesarean deliveries	3.0
Lacunae	
Grade 3	3.5
Grade 2	1.0
Sagittal smallest myometrial thickness[b]	
≤1 mm	1.0
<1 but ≥3 mm	0.5
>3 but ≤5 mm	0.25
Anterior placenta previa[c]	1.0
Bridging vessels	0.5

[a] If parameter is not present, then value is 0; [b] Measured in sagittal plane; [c] If any portion of placenta is anterior.

Rac. Placenta Accreta Index. Am J Obstet Gynecol 2014.

Figure 1. MFM Ultrasound Placenta Accreta Spectrum Checklist

MFM Ultrasound Placenta Accreta Spectrum Checklist

A. Patient History/PAS Risk Factors

	Yes	No
Advanced Maternal Age	☐	☐
Previous Cesarean Deliveries (s) and Number ____	☐	☐
Previous Uterine Surgery	☐	☐
Congenital Uterine Anomaly	☐	☐
Assisted Reproductive Technologies	☐	☐
Prior Pregnancy with Suspected Accreta	☐	☐

B. First Trimester Ultrasound Findings (< 13 weeks)

	Yes	No
Low Implantation of Gestational Sac	☐	☐
Placental Lacunae (increased size/number)	☐	☐
Abnormal uteroplacental interface	☐	☐
Lower uterine segment hypervascularity	☐	☐

C. Second and Third Trimester Ultrasound Findings (> 13 weeks)

	Yes	No
Placenta Previa	☐	☐
-- For Previa: Anterior or Posterior or Central		
Loss of retroplacental clear zone	☐	☐
Myometrial thinning	☐	☐
Maternal bladder wall interruption	☐	☐
Placental bulging	☐	☐
Uterovesical hypervascularity	☐	☐
Placental venous lacunae	☐	☐
Bridging vessels across uterine wall	☐	☐

Reminder: PAS Risk for Patients with Placenta Previa*

Number of Prior Cesarean Deliveries	% Risk
0	3%
1	11%
2	40%
3	61%
4	67%

**Citation: Silver RM et al. National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. Maternal morbidity associated with multiple repeat cesarean deliveries. Obstet Gynecol. 2006 Jun;107(6):1226-32.*

Timing of Delivery and Delivery Planning

The timing of delivery in cases of suspected placenta accreta must be individualized, with a goal being to achieve a planned, controlled delivery. Generally, the recommended management of suspected placenta accreta is planned preterm cesarean hysterectomy with the placenta left in situ because removal of the placenta is associated with significant hemorrhagic morbidity.[3] **The results of a decision analysis suggested that combined maternal and neonatal outcomes are optimized in stable patients with ultrasonographic evidence of placenta previa and placenta accreta with delivery at 32w0d-35w6d of gestation without amniocentesis**.[15] Some patients may safely be delivered at 36 weeks; however this decision should be made on a case-by-case basis and only in people with low suspicion for percreta, and with no bleeding or contractions antenatally.

Delay to 36 weeks is not standard practice at Baylor College of Medicine for cases of suspected placenta accreta spectrum in the setting of placenta previa, or in any patient with regular contractions or bleeding, as up to 46% of our own patient cohort presents with clear indications for unscheduled delivery due to bleeding, contractions or both.[16] Further, we have shown that blood loss and need for transfusion is reduced for expected and planned deliveries compared to urgent or unscheduled deliveries.

Preoperative consultation with anesthesiology and notification of the blood bank are indicated before scheduled surgery. Additional surgical services such as gynecologic oncology, urology, interventional radiology, general surgery, and/or vascular surgery may provide additional surgical expertise if needed.[11] A Preoperative Summary Checklist is useful to confirm that needed preparations have been made and to identify the name and contact information for consultants in case they are needed for intraoperative or perioperative assistance.[1]

Management (1, 20-22)

Prenatal Management

- ❑ Any patient with suspected placenta accreta spectrum should be discussed and reviewed by MFM practice and the PAS team for uniformity in diagnosis and management plan.
- ❑ A discussion with the patient and family about the diagnosis of placenta previa or low-lying placenta with concern for placenta accreta spectrum (to what degree of suspicion and what depth is suspected), along with instructions to present to the hospital immediately for vaginal bleeding, loss of fluid or contractions, that a planned preterm delivery with cesarean-hysterectomy is indicated.
- ❑ Complete consents for cesarean hysterectomy at the initial transfer of care visit, and scan into the Media Tab in Epic, as up to 40% of patients may deliver early, most often for contractions or bleeding.
- ❑ Schedule follow up appointments as needed
- ❑ If MRI is requested, the optimal timing for imaging is between 20-32 weeks. After 32 weeks, the likelihood increases for a **false positive** result due to normal changes in the 3rd trimester placenta
- ❑ Evaluate and treat anemia (see Perinatal Guidelines for identification and management of anemia in pregnancy.)
- ❑ Provide the patient with a Placenta Accreta Spectrum medic alert bracelet and at all facilities, provide the patient with the hospital phone number and contact information for where to present and what number to call in case of emergency.
- ❑ The findings and recommendations must be conveyed to the patient and the primary OB provider, especially for patients who live remote from the Texas Medical Center.
- ❑ Identify patients who may require relocation to Houston or earlier than usual admission due to risk factors for emergent delivery (prior preterm birth, bleeding) or due to living remote from the Texas Medical Center.
- ❑ Coordination of care: the MFM will notify the PAS Team of the diagnosis and patient information so that admission and delivery arrangements can be made.

Inpatient Management

1. **Call PAS first on call (Qgenda, PAS team)** if there is a new inpatient diagnosis of PAS or concern about a currently admitted PAS patient.
2. **Utilize the following order sets:**
    a. OBG PW IP Accreta Admission
    b. OBG PW IP Accreta Day of Surgery
3. Ensure that the following information is listed in the patient's Care Coordination Note:

PAS Procedure Planning Checklist (smartphrase .pasplan)

Placental location (Describe): *
Anticipated extent (window, focal, extensive, accreta, increta/percreta): *
Cysto/stents Y/N: *
Femoral artery sheath access Y/N: *
COBRA-OS inserted at start? Y/N: *
Contraception if uterus preserved: *
Research? Y/N (List samples needed): *
Scheduled Delivery Date and GA: *
Scheduled Accreta Surgeon: *
Consents in chart: *

4. Based on logistical factors and the pregnancy history (e.g., previous admissions for episodes of bleeding, lives far from hospital), consider admission to the antepartum service at 32-33 weeks of gestation due to risk of emergency delivery from vaginal bleeding. For all other people, admission should occur no later than 2days prior to planned delivery date.
    a. Prior to 34 weeks of gestation, a single course of betamethasone should be administered for fetal lung maturity.
    b. If admission occurs after 34 weeks of gestation, administration of betamethasone may be considered, and its use should be individualized if no steroid course administered before 34 weeks
    c. Current type and crossmatch of 4 units RBC should be always maintained, in accordance with our hospitals' postpartum hemorrhage risk assessment and stratification tool. Reorder as needed to ensure type and crossmatch are current at all times, to minimize delay in blood release in the event of an emergency.
    d. Two large-bore IVs (18G or bigger) should be placed while on the inpatient service.
5. Contractions in the absence of vaginal bleeding may not necessitate delivery, however the PAS Team should be notified if they occur.
    a. If bleeding with contractions ensue after hours (i.e., nights and/or weekends) and delivery appears indicated but not urgent, consider a single dose of **Indomethacin** 50 mg if the patient is less than 32 weeks gestation. The use of **Nifedipine** for tocolysis should be individualized based on the patient's hemodynamic status.
    b. The back-up faculty should be notified immediately. All back-up faculty (PAS Team, MFM, Gyn Oncology) should be called in to ensure adequate staffing of both the PAS case and Labor and Delivery.
6. A specialist in MFM and/or Gynecologic Oncology is available as needed for all cases.

Intraoperative Management

1. When an intraoperative diagnosis of placenta accreta spectrum is made, all back-up faculty should be notified immediately if after hours. The hospitalist or other attending faculty should be notified

immediately to assist with coordination of additional surgical help if needed. **DO NOT GO THROUGH OR CUT INTO the placenta**.

2. In the operating room:
   a. The patient should be placed in **the dorsal lithotomy position** in low, padded stirrups with an under-buttocks drape to allow for direct evaluation of intraoperative vaginal bleeding, provide access for placement of a vaginal pack or ureteral stents if needed, and allow additional space for an assistant to stand between the patient's legs.
   b. Regional anesthesia should be considered for ureteral stent placement (when indicated) and performance of the cesarean delivery. Once the infant has been delivered and the decision has been made to proceed with hysterectomy, general endotracheal anesthesia should be individualized. In patients who are unstable or with other contraindications, general anesthesia should be considered from the start of the case.
   c. A midline vertical skin incision should be used for optimal visualization and improved access for fundal or posterior uterine wall hysterotomy and for hysterectomy.
   d. The uterine incision should be located such that it **avoids the placenta**. A classical uterine incision, often trans-fundal, may be necessary to avoid the placenta and allow delivery of the infant, however a mid or high transverse hysterotomy above superior edge of placenta might considered on a case-by-case basis. In some cases, a posterior uterine wall incision after exteriorization of the uterus may be desired.
   e. Postoperative recovery may necessitate surgical ICU admission or prolonged observation in Labor and Delivery rooms with ICU capabilities (PFW CCU or Ben Taub LDRs 11 and 12).
   f. At Ben Taub, postoperatively, the patient should be placed back onto the antepartum service for continuity of resident and MFM faculty daily rounding. At PFW, the patient will be transitioned to the appropriate postpartum care unit and team.

PFW Workflows

Figure 2. PFW Notification Workflow for unscheduled or intraoperatively diagnosed PAS cases

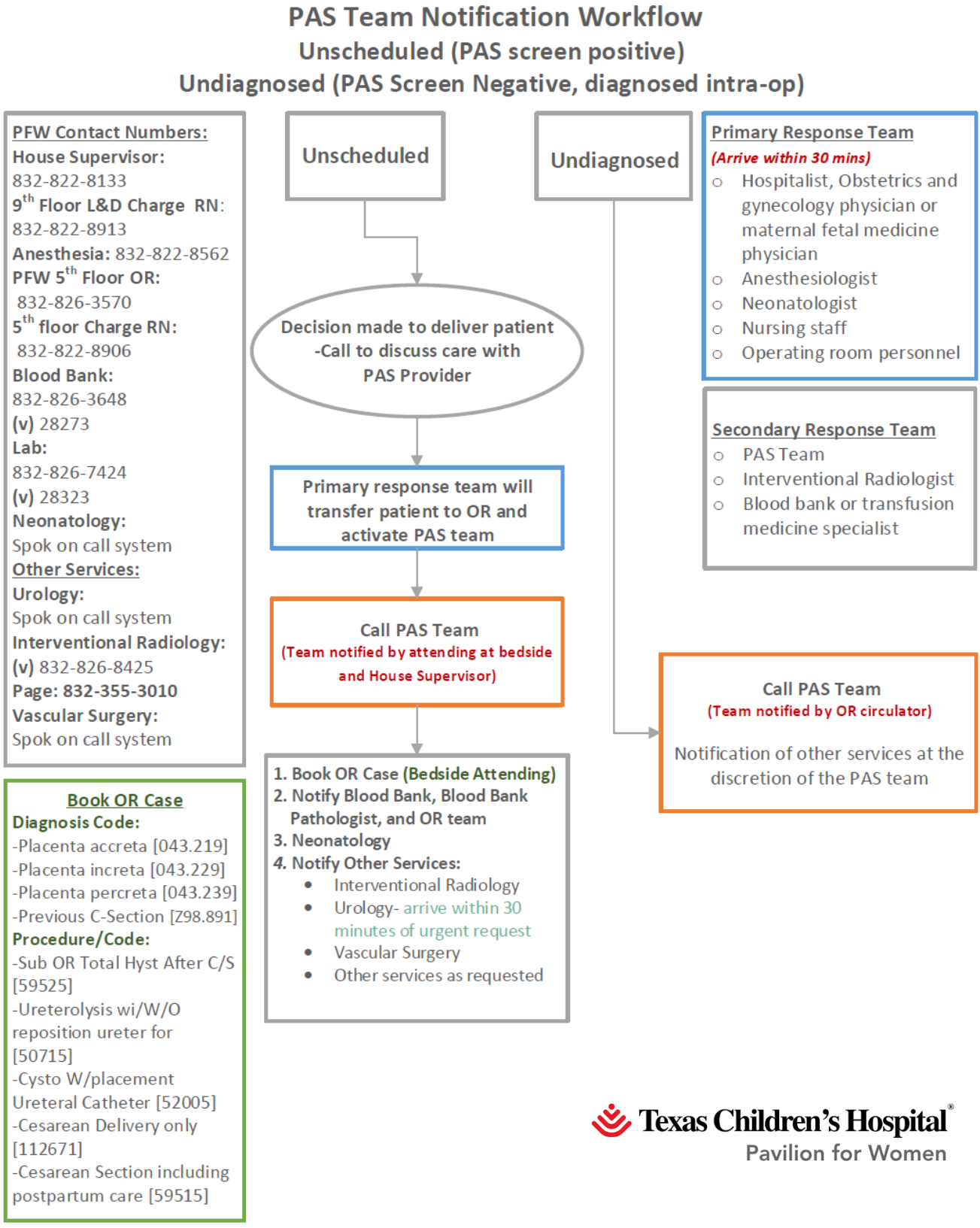
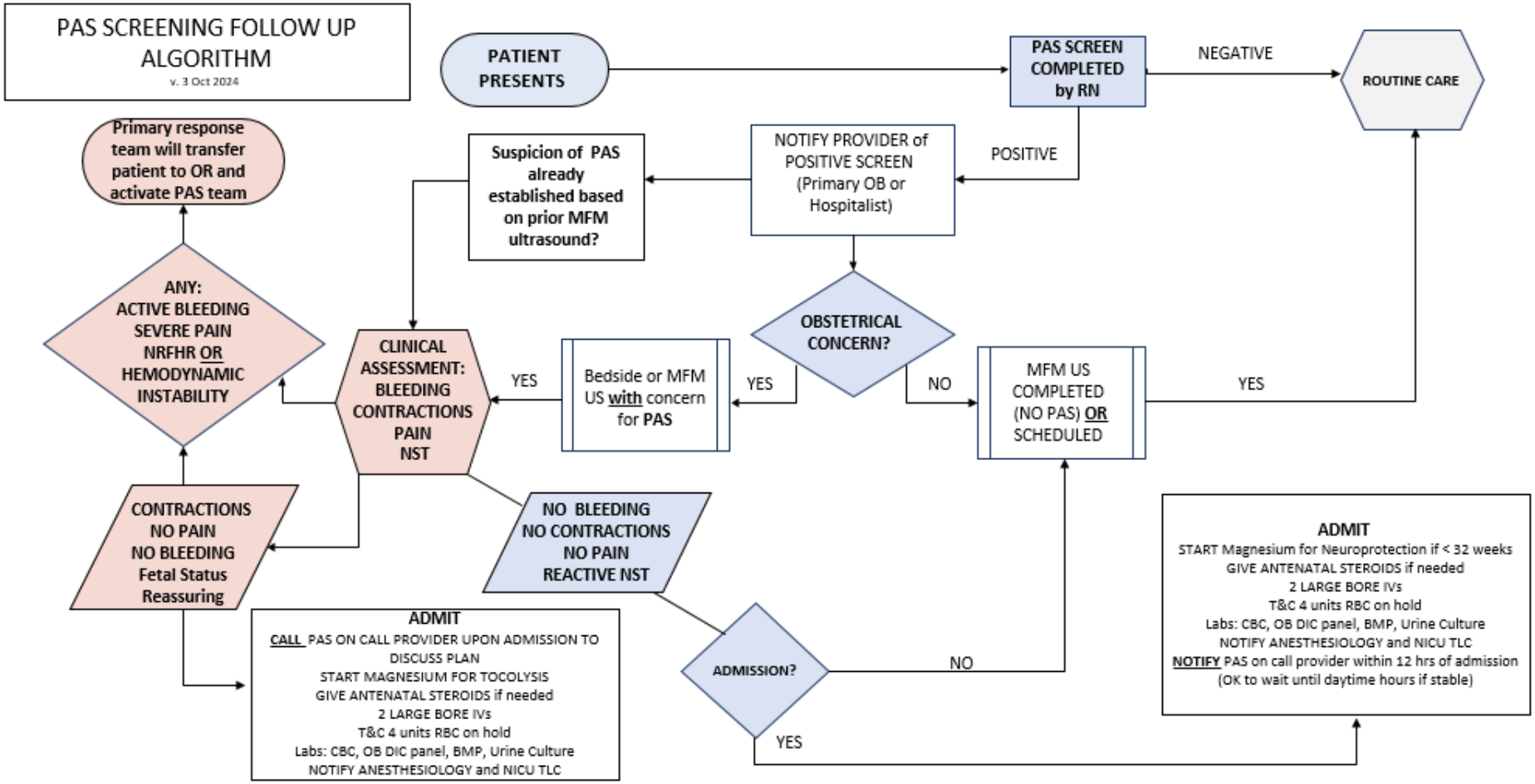


Figure 3. PFW PAS Follow Up Algorithm



Ben Taub Workflows

Contact information

Ben Taub PAS Team		
Name	**Specialty**	**Contact Information**
Amir Shamshirsaz	MFM Critical Care; PAS team Co-Director	ashamshi@bcm.edu
Alex Saucedo	MFM	Alexander.saucedo@bcm.edu
Anthony Costales	Gyn/Onc	Anethony.Costales@bcm.edu
Tracilyn Hall	Gyn/Onc	Tracilyn.Hall@bcm.edu
Claire Hoppenot	Gyn/Onc	Claire.Hoppenot@bcm.edu
Jan Sunde	Gyn/Onc	Jan.Sunde@bcm.edu
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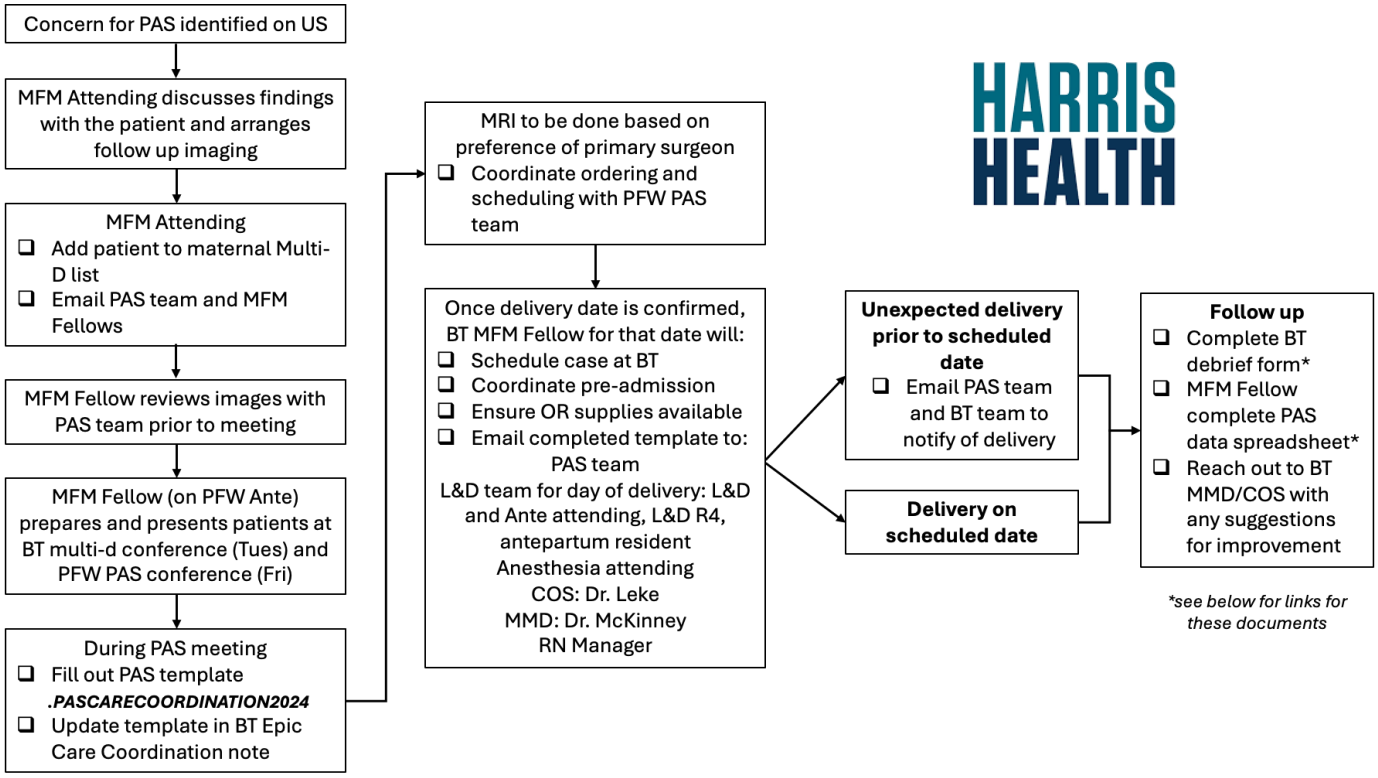
MFM Fellows		mfmfellows@bcm.edu
Christina Reed	Research Director	Christina.Reed@bcm.edu
Yamely Mendez Martinez	Research coordinator	Yamly.MendezMartinez@bcm.edu
Ben Taub Leadership		
April Adams	MFM; Fellowship Director; Director of Ben Taub Multidisciplinary meeting	April.Adams@bcm.edu
Efua Leke	Ob/Gyn; Chief of Obstetrics	Leke@bcm.edu
Jennifer McKinney	MFM; Maternal Medical Director	Jennifer.McKinney@bcm.edu
Chamaine Penright	NP; Ben Taub Multidisciplinary coordinator	Chamaine.Penright@bcm.edu

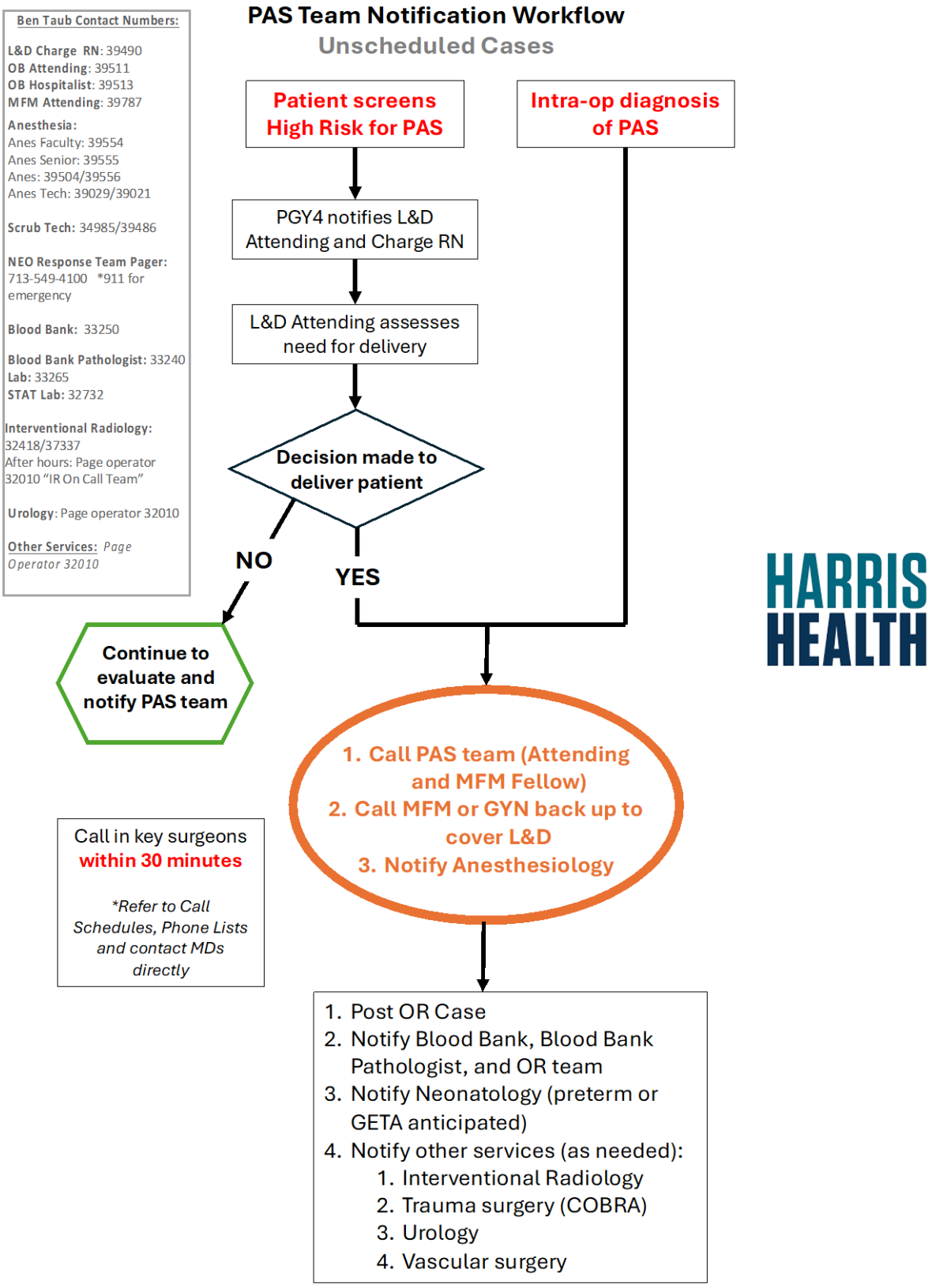
Figure 4. Ben Taub Workflow- Management of Suspected PAS:



BT Debrief Form: please ask Charge RN to coordinate quick huddle after the case to fill out BT OB Debrief form 5.7.2018.docx

PAS data spreadsheet: fill in first sheet for 'Confirmed' PAS, second sheet if 'Suspected' but not confirmed BT PAS Database

Figure 5. Workflow- Unscheduled PAS cases:



Adams, Lundeen, Orozco 2023, updated 10.2024

Care Coordination Note

Template *.PASCARECOORDINATION2024*
Name:
DOB:
HHS MRN:
EDD:
Date when 34 weeks:
PMH:
PSH:
BMI:

PAS Details
Completed imaging:
Upcoming Imaging:
MRI:
Placental location:
Anticipated extent (window, focal, extensive, accreta, increta/percreta):
Impression: PAI:***; Risk ***%

Delivery/Surgical Planning
Planned surgery: ***Cesarean hysterectomy
Delivery Date and EGA at delivery:
Pre-operative admission date and EGA:
Pre-operative BMZ (date, location- inpatient or outpatient):
PAS primary surgeon:
MFM fellow assigned:
Skin incision type:
Uterine incision type:
Cysto/stents:
REBOA/COBRA:

[ ] L&D team notification via email:
- [ ] PAS team
- [ ] L&D team for day of delivery: L&D and Antepartum attending, R4, antepartum resident
- [ ] Anesthesia attending (or Dr. Munnur)
- [ ] Dr. Leke, Dr. McKinney, Sandra Salgar RN

Pre-Op Admission Checklist:

Consults
[ ] Neonatology
[ ] Anesthesia
[ ] Urology for stents, cysto, possible cystotomy repair, possible ureteral repair
[ ] General Surgery for COBRA/REBOA

Paperwork
[ ] Surgical consents (Cesarean delivery, possible hysterectomy, possible bilateral salpingectomy)
[ ] Medicaid hysterectomy consents

Orders
[ ] Type and Screen
[ ] T&C: 4U pRBCs
[ ] Ionized calcium
[ ] BMP
[ ] Fibrinogen
[ ] Coags
[ ] CBC (goal Hb >11 prior to delivery, discuss transfusion prn)

Equipment

Pyxis: in ORs
SS: sterile supply on 2nd floor
Cart: Hysterectomy cart
[ ] Bookwalter retractor part 2 – 005 **SS**
[ ] C-section basin- 229
[ ] C section pack (007) **Main OR**
[ ] Minor lithotomy pack **Pyxis**
[ ] Miscellaneous:
Leggings, ¾ sheet, towels, needle box, foley, chloraprep **Pyxis**
Fluid warmer **OR**
Specimen container **Supply room**
[ ] Ligasure: large and small **Pyxis and Cart**
[ ] 9.75", 13" clip applier **SS**
[ ] GIA reloads **Main OR**
[ ] Fish **Cart**
[ ] 0 Vicryl CT-1 pop-offs 27" **Cart**
[ ] Pennington clamp tray – 001
[ ] Zepplin clamps **Main OR**
[ ] Quikclot **Cart**
[ ] Surgical powder **SS**
[ ] Surgicel **SS**
[ ] Vessel loops (blue and yellow) **Cart**
[ ] Long Bovie tip **Cart**
[ ] 22ga spinal needle **in OR**
[ ] Syringes (10cc, 20cc, 60cc) **in OR**
[ ] ObGyn lap closure set - 006
[ ] ObGyn lap set – 006
[ ] Gyn z-clamps set - 001
[ ] Gyn O'Sullivan retractors - 007
[ ] Stryker OS general new HD camera – 001 **Stryker**
[ ] Stryker OS GU cystoscope set – 001
[ ] Cysto Tubing **Pyxis**
[ ] Goldberg Ureteral Adapter **Pyxis**
[ ] Lighted stents and light cable **Stryker**
[ ] Stents and angle guide wire **Cart, Pyxis**
[ ] COBRA **Main OR or EC**
[ ] Sterile milk **LD Room (blue bowl in OR)**
[ ] Stirrup cart **in OR**
[ ] EEA sizers set – 001 **SS**
[ ] Gyn Z clamps set - 001
[ ] Intra-op US **LD Hallway**

Classification at Delivery

In 2019, FIGO published the FIGO Classification of Placenta Accreta Spectrum Disorders. This classification system uses both clinical findings at the time of delivery and histopathologic findings to determine the final grading of PAS.[17] This system is recommended to standardize nomenclature across multiple centers and to allow more accurate comparison of clinical findings for patient counseling and research. Because clinical findings are used to grade placental invasion, this system works also for centers that offer conservative (uterine sparing) management.

DOCUMENT the FIGO Grade identified at the time of delivery, based on the following criteria:

Table 4. FIGO clinical classification for the diagnosis of PAS disorders at delivery (35)

GRADE 1	**Abnormally adherent placenta (PLACENTA ADHERENTA OR CRETA)**
Clinical criteria	At vaginal delivery - No separation with synthetic oxytocin and gentle controlled cord traction. - Attempts at manual removal of the placenta results in heavy bleeding from the placenta implantation site requiring mechanical or surgical procedures. If laparotomy is required - Same as above. - Macroscopically, the uterus shows no obvious distension over the placental bed (placental 'bulge'), no placental tissue is seen invading through the surface of the uterus, and there is no or minimal neovascularity.
Histologic criteria	- Microscopic examination of the placental bed samples from hysterectomy specimen shows extended areas of absent decidua between villous tissue and myometrium with placental villi attached directly to the superficial myometrium. - The diagnosis cannot be made on just delivered placental tissue nor on random biopsies of the placental bed.
GRADE 2	**Abnormally invasive placentation (PLACENTA INCRETA)**
Clinical criteria	At laparotomy - Abnormal macroscopic findings over the placental bed: bluish/purple colouring, distension (placental 'bulge'). - Significant amounts of neovascularity (dense tangled bed of vessels or multiple vessels running parallel cranio-caudially in the uterine serosa. - No placental tissue seen to be invading through the surface of the uterus. - Gentle cord traction results in the uterus being pulled inwards without separation of the placenta (the 'dimple' sign).
Histologic criteria	Hysterectomy specimen or partial myometrial resection of the increta area shows placental villi within the muscular fibres and sometimes in the lumen of the deep uterine vasculature.

GRADE 3	**Abnormally invasive placentation (PLACENTA PERCRETA)**
GRADE 3a	**Limited to the uterine serosa**
Clinical criteria	At laparotomy - Abnormal macroscopic findings on uterine surface (as above) and placental tissue seen to be invading through the surface of the uterus (serosa). - No invasion into any other organ, including the posterior wall of the bladder (a clear surgical plane can be identified between the bladder and uterus).
Histologic criteria	Hysterectomy specimen showing villous tissue within or breaching the uterine serosa
GRADE 3b	**With urinary bladder invasion**
Clinical criteria	At laparotomy - Same as 3a. - Placental villi are seen to be invading into the bladder but no other organs. - Clear surgical plane cannot be identified between the bladder and uterus.
Histologic criteria	hysterectomy specimen showing villous tissue breaching the uterine serosa and invading the bladder wall tissue or urothelium.
GRADE 3c	**With invasion of other pelvic tissue/organs**
Clinical criteria	At laparotomy - Same as 3a**.** - Placental villi are seen to be invading into the broad ligament, vaginal wall, pelvic sidewall or any other pelvic organ (+/- invasion of bladder).
Histologic criteria	Hysterectomy specimen showing villous tissue breaching the uterine serosa and invading pelvic tissues/organs.

Postoperative Management (Special Considerations):

1. Patients should be closely monitored in the immediate postoperative period for signs of ongoing hemorrhage or hemorrhagic shock.
2. Alert the attending physician for any signs of hypovolemia and/or if the patient triggers MEWS. Transfusion and reoperation may be required.
3. Those who have had a large transfusion or volume of fluid infused may have significant 3rd spacing and edema, including airway edema. In such cases, intubation may need to be maintained until the patient has had time to diurese and a breathing trial has been performed.
4. Intraperitoneal drain: An intraperitoneal drain (J-P, Blake) may be placed at the surgeon's discretion, most commonly when a complex cystotomy and repair are performed (to monitor for urinary leak), or if there is concern for ongoing intraperitoneal bleeding. If a drain is in place, output should be recorded and monitored, and the drain site inspected during rounds for signs of infection.
   a. In general, removal of the drain will be directed by the PAS or urology teams, depending upon the indication for placement.
   b. If a patient is to be discharged with the drain in place, the patient and their family should be instructed on drain care, output recording, and this teaching documented in the medical record.

5. Postoperative activity and intake: **An extended recovery after surgery (ERAS) approach is recommended following cesarean hysterectomy**. This includes early ambulation (when safe), physical therapy consultation, and a supportive bowel regimen (docusate or peri-colace, scheduled simethicone, milk of magnesia or miralax prn). Patients should be allowed to eat or drink when they feel ready to do so. Avoid carbonation or gas-inducing foods until bowel function has returned. Sugar-free chewing gum and coffee have been shown to reduce the time of return of bowel function and their use is encouraged.
6. Cystotomy and repair (and urinary tract involvement): cystotomy may be performed intentionally when extensive fibrosis is present between the bladder and placenta or incidentally when extensive disease is present. To permit proper healing, the bladder must remain empty and tension-free.
    a. A Foley catheter is to remain in place, usually between 10-14 days, however a longer duration may be necessary. Timing of removal will be determined by the urology or PAS faculty.
    b. Bladder repair and maintenance of a catheter or stent can cause bladder spasm, therefore all patients with bladder repair or stent (without contraindications) should be given the following:
        i. B&O suppository BID prn
        ii. Oxybutynin 5 mg po q8h prn (may be a higher dose, as directed by the urology team)
        iii. Oxybutynin slow release
        iv. Keflex 250mg BID prophylaxis until Foley is removed outpatient

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Labor and Delivery

Induction of Labor and Delivery Timing

[August 2025 (replaces September 2024)]
Author: Dr. Christina Davidson
Editor: Dr. MT Winsten

Highlights

The BCM Ob/Gyn Perinatal Guidelines Committee makes the following recommendations regarding timing of delivery and management of labor and labor induction. These guidelines are not meant to be all-inclusive and there may be other appropriate indications for delivery that are beyond the scope of these guidelines.

1) **There is no role for elective delivery in a woman with a suboptimally dated pregnancy.[1]**

2) For patients who desire planned repeat CD, delivery is advised at 39 weeks of gestation using best clinical estimate of gestational age.[1]

3) Late term (41 0/7- 41 6/7) and post term (≥42 0/7) IOL:

   a) IOL between 41 0/7 and 42 0/7 weeks of gestation should be considered due to increases in stillbirth, neonatal death, and infant death with gestations at >41 0/7 weeks.[2]

   b) Given concern that a full-term or late-term suboptimally dated pregnancy could actually be weeks further along than it is believed to be, late-term delivery is indicated at 41 weeks of gestation when gestational age is uncertain (i.e., suboptimally dated), using the best clinical estimate of gestational age.[1]

4) Table I below can be used to guide the clinical decision making for optimal timing of indicated late-preterm and early-term births.[3] There may be variations in clinical practice dependent on the clinical situation given none of the management recommendations are A recommendations

5) ACOG criteria should be satisfied prior to performing a CD for failed IOL, arrest of active phase, or arrest of descent/2nd stage labor. The criteria for CD should be documented in the medical record (see smart phrase examples).

6) If a CD is performed that does not meet ACOG criteria, shared decision making and counseling on risks of CD should be well documented in the medical record (see smart phrase example).

Introduction

The American College of Obstetricians and Gynecologists (ACOG) and the Society for Maternal-Fetal Medicine (SMFM) have long discouraged nonindicated delivery before 39 weeks of gestation due to the neonatal risks of late-preterm (34 0/7–36 6/7) and early-term (37 0/7–38 6/7) births.[4] There are, however, maternal and fetal indications that warrant delivery prior to 39 weeks of gestation. Although not intended to serve as standard of care, a consensus based on available data and expert opinion determined optimal timing of indicated deliveries in the late-preterm and early-term periods..[5] Table I presents ACOG's modifications of these recommendations for timing of delivery.[4]

Although guidelines for indicated late-preterm and early-term deliveries depend on accurate determination of gestational age[4,5], women with suboptimally dated pregnancies should be managed according to these same guidelines because of the lack of a superior alternative.[1] According to ACOG, pregnancies without an ultrasonographic examination confirming or revising the estimated due date before 22 0/7 weeks of gestation should be considered suboptimally dated. Consistent with the practice for accurately dated pregnancies, the timing of an indicated delivery for a suboptimally dated pregnancy should be based on the best clinical estimate of gestational age.[1]

Regarding mode of delivery, the rapid increase in the rate of cesarean delivery (CD) without evidence of concomitant decreases in maternal and/or neonatal morbidity or mortality raises significant concerns about contemporary CD rates. The primary CD increases the risk of maternal complications in the index pregnancy as well as future gestations. The most common indication for primary cesarean delivery is labor dystocia. ACOG recently published a clinical practice guideline that provides definitions for labor arrest, along with recommendations for management of dystocia in the first and second stages of labor that may help optimize labor management and assist with assessment of indication for cesarean delivery for labor dystocia.[6] This document replaces the ACOG and SMFM Obstetric Care Consensus from March 2014 on the Safe Prevention of the Primary Cesarean Delivery.[2]

Induction of Labor

When delivery is indicated, often an induction of labor (IOL) must be undertaken. The goal of an IOL is to stimulate uterine contractions before the spontaneous onset of labor in order to achieve a vaginal delivery.[7]

If the Bishop score is greater than 8, the probability of vaginal delivery after IOL is similar to that after spontaneous labor.[8] **If the cervix is unfavorable, numerous studies have found that the use of cervical ripening methods lead to lower rates of cesarean delivery (CD) than IOL without cervical ripening**.[2] The Bishop scoring system, which was originally developed in the 1960s, has been simplified to include an assessment of only dilation, station and effacement with a similarly high predictive ability of successful induction. **A simplified Bishop score of greater than 5, in both indicated inductions and spontaneous labor at term and preterm was associated with a probability of a vaginal delivery after IOL similar to spontaneous labor.[9]**

Bishop Score

Score	Dilation (cm)	Effacement	Station	Consistency	Position
0	Closed	0-30	-3 *(-3 to +3 scale)*	Firm	Posterior
1	1-2	40-50	-2	Medium	Midposition
2	3-4	60-70	-1 or 0	Soft	Anterior
3	≥5	≥80	+1, +2	---	---

"Simplified" Bishop Score

- If the Bishop score is >8, theprobability of vaginal delivery after IOL is similar to that after spontaneous labor
- Simplified Bishop score >5 performs similarly to an original Bishop score >8
- Unfavorable cervix → use of cervical ripening methods leads to lower rates of CD than IOL without cervical ripening

Cervical Ripening Safety and Efficacy[7,10-16]

Agent	Dosing/Route	Safety and Efficacy	Side Effects
Misoprostol/Cytotec (PGE1)	-25 mcg PV q 3-6 hours -25-50 mcg PO q 2-4 hours -oxytocin should not be administered <4 hours after last misoprostol dose	-vaginal misoprostol at doses of 50 mcg, compared with other dosages and routes of administration, has the highest probability of achieving vaginal delivery within 24 hours -Higher doses associated with increased incidence tachysystole -contraindicated in TOLAC secondary to uterine rupture	-fever, chills, diarrhea (mostly in high dosing for early abortions, rare with doses used cervical ripening/IOL)
Dinoprostone/Cervidil (PGE2)	-slow-release suppository placed in vaginal fornix -10-mg suppository releases 0.3 mg of dinoprostone every hour -remains in place for up to 12 hours -can be repeated every 12 hours -Patients must remain recumbent for 2 hours after placement -must be removed 30 minutes before starting oxytocin		-nausea, vomiting, diarrhea (less common than with misoprostol) -temperature elevation in up to 50% of patients (similar to misoprostol)

Agent	Dosing/Route	Safety and Efficacy	Side Effects
Oxytocin	-Low- and high-dose IV infusion regimens -Low-dose: 0.5-2 mU/min starting dose, increasing by 1-2 mU/min q 15-40 min -High-dose: 6 mU/min starting dose, increasing by 3-6 mU/min q 15-40 min -No established max dose -Uterine response ↑ from 20-30 weeks & ↑ rapidly at term -t ½ = 1-6 min -Uterus contracts within 3-5 min of starting oxytocin -Steady-state reached in 40 min	-Lower BMI, greater cervical dilation, parity, gestational age = predictors of successful response to oxytocin for induction -in nullips, high-dose is associated with lower CD rate compared with low-dose protocols, with no difference in maternal hemorrhage -IV oxytocin + AROM ranks in top 3 most effect IOL method; IV oxytocin without AROM ranked 15th in effectiveness	-anaphylactic reactions, PPH, cardiac arrhythmias (PVCs), fatal afibrinogenemia, nausea, vomiting, pelvic hematoma, subarachnoid hemorrhage, hypertensive episodes, uterine rupture -antidiuretic effect - prolonged or high-dose IV infusion may lead to water intoxication and hyponatremia -most reported adverse events pertain to uterine tachysystole, secondary to slow onset of action, long time to steady state, unpredictable therapeutic index because of variability in patients' uterine receptivity based on oxytocin receptor status

Agent	Dosing/Route	Safety and Efficacy	Side Effects
Mechanical ripening (Foley catheter and double-balloon [Cook] catheter)	-Foley can be used inpatient and outpatient -Foley: 16-26 gauge with inflation of 30 to 80 mL -Cook: 80 ml in each balloon -Cook removal after 6 hours compared with 12: shorter insertion-to-delivery interval, similar Bishop score change and CD rates, lower rates of maternal intrapartum fever	-outpatient Foley: shorter intervals from admission to delivery, lower rates of CD, no difference in adverse maternal/perinatal outcomes compared to inpatient (low risk patients) -Foley: primary choice for cervical ripening because it costs less and has efficacy similar to double-balloon catheter -Comparison of Cook vs. 60 ml Foley : equally efficacious for inducing labor, no statistical difference in CD between groups -Combination of balloon catheter with oxytocin or misoprostol: shorter induction to delivery time, increased rate of delivery within 24 hours compared to any solo method -Combination of a single-balloon catheter with misoprostol = most effective method for reducing odds for CD and prolonged time to vaginal delivery -Foley + oxytocin has been studied in 1 prior CD	-Both types of catheters have similar efficacy, safety, and patient satisfaction levels - inconsistent results of chorio in the setting of ROM + Foley -no correlation found between use of Foley and subsequent risk of preterm birth

Failed induction of labor[3,17-20]

Failed induction indicates lack of progression into the active phase of labor (i.e., CD in the latent phase for lack of cervical dilation)

Standardized IOL management: **active labor defined as 4 cm/90% or 5 cm**

Amniotomy within 24 hours of starting induction	IUPC after membrane rupture	Titration of oxytocin to achieve >200 MVUs	At least 12 hours of oxytocin after ROM before CD for failed induction	4% nullips and no multips in latent labor after 12 hours

Subsequent studies validated at least 12, 15, or 18 hours of membrane rupture + oxytocin before considering failed IOL; all studies defined active labor as 4/90 or 5 cm

Only 1 study has used 6 cm for defining entry into the active phase

Results were consistent with the other studies that used either a 4- or 5-cm cutoff	Consistent with previous research: 96% of patients who reach 4-cm dilation ultimately reach 6 cm

ACOG: CD for failed IOL can be avoided by recommending that oxytocin be administered for at least 12–18 hours after ROM before deeming the induction to be unsuccessful. Depending on clinical characteristics, patient preference, and discussion of the risks and benefits, the decision to continue past 18 hours may be individualized.

Standardized IOL Protocols[21-23]

- Protocol:
  - Amniotomy within 24 hours of oxytocin induction
  - IUPC after membrane rupture
  - Titration of oxytocin to MVUs 200-300 or cervical change
  - Oxytocin for at least 12 to 18 hours after membrane rupture before diagnosis of failed IOL

- Findings:
  - Rate of failed IOL was significantly lower in the protocol-adherent group vs. protocol-nonadherent group, both among nulliparous (3.8% vs. 9.8% respectively; p=.043) and multiparous women (0% vs. 6%, respectively; p=.0004) women
  - Nulliparous women in the protocol-adherent group spent 3.5 fewer hours in labor than did the women in the nonadherent group.
  - Multiparous women in the protocol-adherent group spent 1.5 fewer hours in labor than did the women in the nonadherent group.
  - The lowest rate of failed induction was observed when *all* elements of the protocol were followed

- A standardized IOL protocol is also associated with reduced CD rate p (25.7% vs 34.2%; P=.02) and neonatal morbidity (2.9% vs 8.9%; P=.001) in Black women undergoing IOL.

- Early amniotomy (defined as artificial rupture of the membranes at < 4 cm) in nulliparous labor induction has been recognized as a safe and efficacious adjunct, with a resultant shortening of the time to delivery by >2 hours as well as increase in the proportion of induced nulliparous women who deliver within 24 hours.

IOL vs. Expectant Management in Nulliparous Patients (ARRIVE Trial)[21]

Recommendations regarding the timing of delivery are founded on balancing maternal and perinatal risks. Delivery before 39 0/7 weeks without a medical indication is associated with worse perinatal outcomes.. For women who are at 41 0/7 weeks or later, delivery has been recommended because of increasing perinatal risks. When gestation is between 39 0/7 and 40 6/7, prior common practice was to avoid an elective IOL because of a lack of evidence of perinatal benefit and concern about a higher frequency of CD and other possible adverse maternal outcomes, particularly among nulliparous women. However, these conclusions were derived largely from observational studies in which IOL was compared with spontaneous labor. Such a comparison, however, provides little insight into clinical management, because spontaneous labor is not a certain alternative to IOL. Most observational studies that have used the clinically relevant comparator of expectant management have not shown a higher risk of adverse outcomes with IOL; instead, some of these studies have shown that IOL resulted in a lower frequency of CD and more favorable perinatal outcomes than expectant management. The ARRIVE trial (A Randomized Trial of Induction Versus Expectant Management) was designed to test the hypothesis that elective IOL at 39 weeks would result in a lower risk of a composite outcome of perinatal death or severe neonatal complications than expectant management among low-risk nulliparous women.

A Randomized Trial of Induction Versus Expectant Management (ARRIVE):

- RCT comparing elective IOL at 39 weeks with expectant management among low-risk nullips
- Inclusion criteria: low-risk NTSV population (low risk = absence of any condition considered to be a maternal or fetal indication for delivery before 40 5/7, dated by LMP c/w US <21 0/7 or by US <14 0/7
- IOL group assigned to undergo IOL at 39 0/7 - 39 4/7, exp management group asked to forego elective delivery before 40 5/7 and to have delivery initiated no later than 42 2/7
- No specific IOL protocol
- 62.7% in the induction group and 64.2 % in the expectant management group with unfavorable simplified Bishop score (< 5) at time of randomization
- Outcomes:
  - No difference in composite outcome of perinatal mortality and severe perinatal morbidity
  - CD rate significantly lower in IOL group (18.6% versus 22.2%, P = < 0.001)
  - IOL group with significantly lower rates of GHTN and preE (9.1% versus 14.1%, P = < 0.001) and need for neonatal respiratory support within first 72 hours of life (3.0% versus 4.2%)
  - No significant differences noted according to race or ethnic group, maternal age, BMI, or modified Bishop score

ACOG: it is reasonable for obstetricians and health-care facilities to offer elective induction of labor to low-risk nulliparous women at 39 weeks gestation.

ACOG definitions of labor and management of labor dystocia[6]

Once active labor is reached (6 cm), either spontaneously or during IOL, various strategies exist to manage abnormal labor progression (dystocia) or labor arrest.

	Latent Labor	Active Labor	2nd stage Labor	Induction of Labor
Definition	Onset of labor to 6 cm	-Begins at 6 cm -Standards of active-phase management and active-phase arrest should not be applied until at least 6 cm	Begins at complete dilation (10 cm), NOT at onset of pushing	
Dystocia (abnormally slow labor progress)	-Prolonged : >16 hours -Labor may take >6 hours to progress from 4-5 cm and > 3 hours to progress from 5-6 cm of dilation	-Labor protraction = labor progress that is slower than normal (<1 cm dilation in 2 hours) -A slow but progressive active phase of labor demonstrating cervical change at least every 4 hours in the setting of reassuring maternal and fetal status should not be an indication for CD	-Prolonged: >3 hours of pushing in nullips, >2 hours of pushing in multips -Arrest: individualized approach; incorporating information regarding progress, clinical factors that may affect the likelihood of vaginal delivery, discussion of risks and benefits of available interventions, and individual patient preference is recommended when time in the second stage is extended beyond the parameters -Arrest can be identified earlier if there is lack of fetal rotation or descent despite adequate contractions, pushing efforts, and time	
Management of Dystocia	Exp management, AROM, oxytocin, d/c home	AROM, oxytocin, IUPC, continuous labor support (i.e., doula)	Immediate pushing at complete dilation, manual rotation	AROM, IUPC
Arrest (criteria for CD)	None	-Labor arrest = cessation of labor progress despite best attempts at augmentation ❑ Cervix ≥ 6 cm ❑ Membranes ruptured ❑ No cervical change after at least 4 hours of adequate uterine activity (>200 MVUs) **OR** at least 6 hours of inadequate uterine activity with oxytocin augmentation	❑ Cervix 10 cm ❑ Membranes ruptured ❑ > 3 hours of pushing in a nulliparous patient or > 2 hours of pushing in a multiparous patient (can be identified earlier if lack of fetal rotation or descent despite adequate contractions, pushing efforts, and time) ❑ Assess for OVD before CD	Failed IOL: ❑ Cervix <6 cm ❑ Membranes ruptured ❑ Oxytocin administered for at least 12-18 hours **after** membrane rupture

Management of IOL through Active and Second Stage Labor[2,6,7]

Checklist for Intrapartum Management

Intrapartum Management

A. Induction of labor (see algorithm)

- ☐ Unfavorable cervix and membranes intact → cervical ripening
  - ☐ Balloon
  - ☐ Balloon + Pitocin
  - ☐ Balloon + misoprostol (do not use in TOLAC)
  - ☐ Cervidil (do not use in TOLAC)
- ☐ Favorable cervix and/or membranes ruptured → Pitocin
- ☐ AROM as soon as safe and feasible
- ☐ Consider IUPC in latent labor to titrate MVUs >200 if unable to increase Pitocin because of contraction frequency

B. Augmentation of labor for labor dystocia (no or inadequate cervical change)

- ☐ Pitocin: initiate at 2 mU/min and increase by 2mU/min every 30 mins
- ☐ AROM
- ☐ IUPC if contracting every 2-4 minutes to titrate MVUs >200

C. Second stage

- ☐ Attempt manual rotation if OP or OT
- ☐ Assess for/offer operative vaginal delivery if at least +2 station for concerning FHR, maternal exhaustion, slow descent, and/or maternal request

***Figure 1**. Induction of Labor Algorithm*

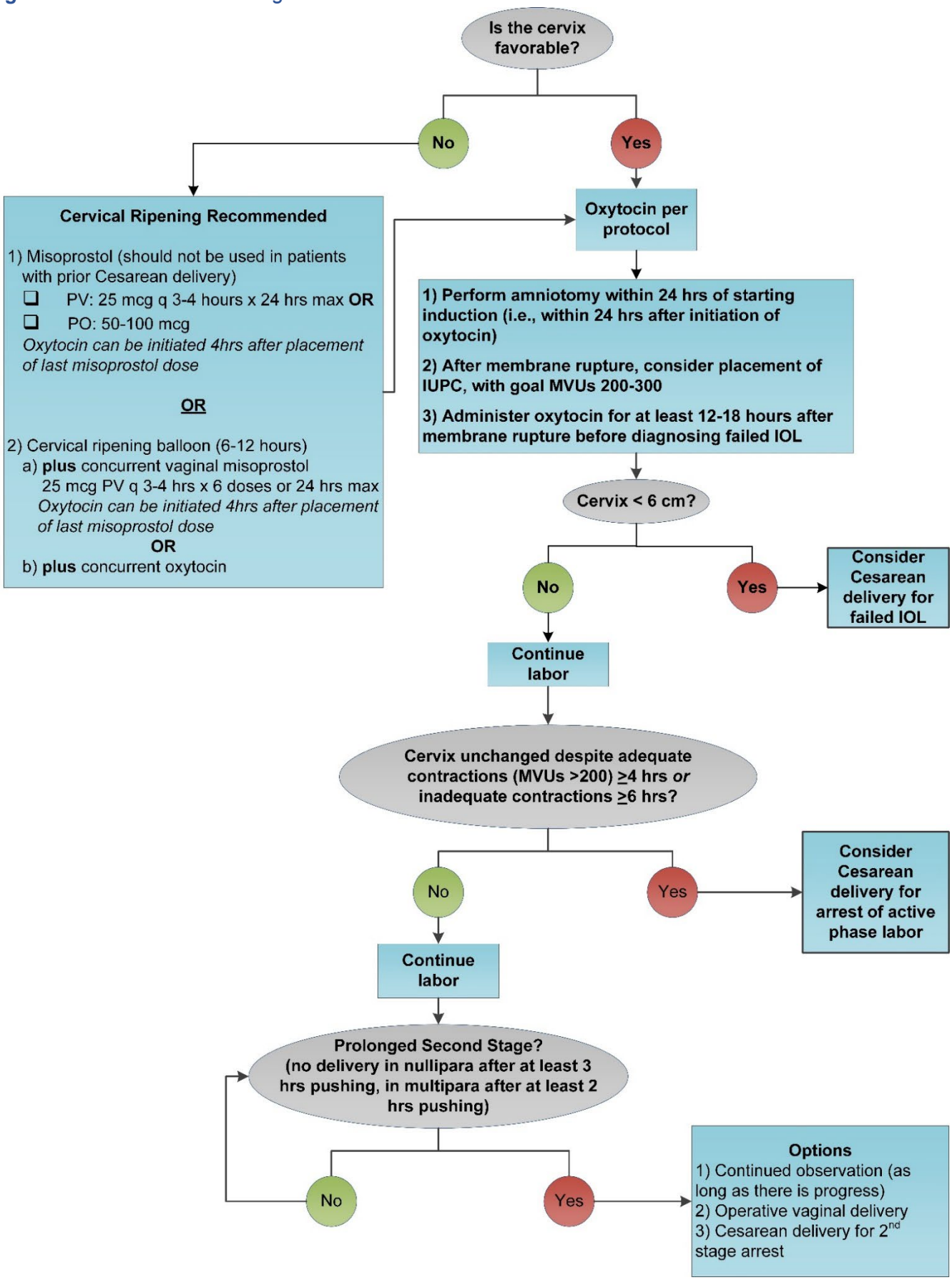

TABLE 2

Spontaneous labor progress stratified by cervical dilation and parity

Cervical dilation, cm	Median elapsed time, h		
	Parity 0 (95th percentile)	Parity 1 (95th percentile)	Parity ≥2 (95th percentile)
3-4	1.8 (8.1)	—	—
4-5	1.3 (6.4)	1.4 (7.3)	1.4 (7.0)
5-6	0.8 (3.2)	0.8 (3.4)	0.8 (3.4)
6-7	0.6 (2.2)	0.5 (1.9)	0.5 (1.8)
7-8	0.5 (1.6)	0.4 (1.3)	0.4 (1.2)
8-9	0.5 (1.4)	0.3 (1.0)	0.3 (0.9)
9-10	0.5 (1.8)	0.3 (0.9)	0.3 (0.8)

Modified from Zhang et al.[20]

ACOG. Safe prevention of primary cesarean delivery. Am J Obstet Gynecol 2014.

Arrest of Labor Diagnostic Criteria

A. Failed Induction (all boxes should be checked):

- ☐ Cervix <6 cm
- ☐ Membranes ruptured
- ☐ Oxytocin administered for at least 12-18 hours **after** membrane rupture

B. Active Phase Arrest (all boxes should be checked):

- ☐ Cervix ≥ 6 cm
- ☐ Membranes ruptured
- ☐ No cervical change after at least 4 hours of adequate uterine activity (>200 MVUs) **OR** at least 6 hours of oxytocin administration with inadequate uterine activity

C. Second Stage Arrest (all boxes should be checked):

- ☐ Cervix 10 cm
- ☐ Membranes ruptured
- ☐ > 3 hours of pushing in a nulliparous patient or > 2 hours of pushing in a multiparous patient (can be identified earlier if lack of fetal rotation or descent despite adequate contractions, pushing efforts, and time

D. Above criteria not met:

- ☐ Through shared-decision making with the patient, the decision was made to move to cesarean even though criteria were not met.
- ☐ Shared-decision making was well documented and it was documented that the patient was counseled on ACOG criteria for cesaran delivery.

Smart phrase examples[6,24]

At Ben Taub: .CMDDYSTOCIA
At PFW: .LABORDYSTOCIA

Failed IOL
@name@ was admitted for IOL for ***. I counseled her on my recommendation for cesarean delivery for failed induction of labor because ALL of the following criteria have been met:

- ☐ Cervix <6 cm
- ☐ Membranes ruptured
- ☐ Oxytocin administered for at least 12-18 hours after membrane rupture

@name@ understands and agrees with the plan.

Arrest of Active Phase Labor
@name@ was admitted in labor. I counseled her on my recommendation for cesarean delivery for arrest of active phase labor because ALL of the following criteria have been met:

- ☐ Cervix ≥ 6 cm
- ☐ Membranes ruptured
- ☐ No cervical change after at least 4 hours of adequate uterine activity (>200 MVUs) OR at least 6 hours of oxytocin administration with inadequate uterine activity

@name@ understands and agrees with the plan.

Arrest of Descent/2nd Stage Labor
@name@ was admitted in labor and progressed to complete dilation. I counseled her on my recommendation for cesarean delivery for arrest of descent/2nd stage labor because ALL of the following criteria have been met:

- ☐ Cervix 10 cm
- ☐ Membranes ruptured
- ☐ > 3 hours of pushing in a nulliparous patient or > 2 hours of pushing in a multiparous patient OR lack of fetal rotation or descent despite adequate contractions, pushing efforts, and time

Cesarean Delivery When ACOG Criteria Not Met
@name@ was admitted in labor and progressed to ***. We reviewed her labor course and I counseled her that she does not meet ACOG-supported criteria for cesarean for labor dystocia at this time. Through shared-decision making with the patient, the decision was made to move to cesarean even though criteria were not met. I further counseled her on the risks of cesarean delivery compared to vaginal delivery, including, but not limited to increased risk of bleeding, infection, and damage to nearby structures. I also counseled her that, given the high repeat cesarean delivery rate, future pregnancies are at increased risk of complications such as placenta previa, placenta accreta spectrum disorder, uterine rupture, and hysterectomy, all of which increase with each subsequent cesarean delivery.

Table 1. ACOG recommendations for the timing of delivery when conditions complicate pregnancy

Table 1. Recommendations for the Timing of Delivery When Conditions Complicate Pregnancy*

Condition	General Timing	Suggested Specific Timing
Placental/Uterine Conditions		
Placenta previa†	Late preterm/early term	36 0/7–37 6/7 weeks of gestation
Suspected accreta, increta, or percreta†	Late preterm	34 0/7–35 6/7 weeks of gestation
Vasa previa	Late preterm/early term	34 0/7–37 0/7 weeks of gestation
Prior classical cesarean delivery	Late preterm/early term	36 0/7–37 0/7 weeks of gestation
Prior myomectomy requiring cesarean delivery‡	Early term (individualize)	37 0/7–38 6/7 weeks of gestation
Previous uterine rupture	Late preterm/early term	36 0/7–37 0/7 weeks of gestation
Fetal Conditions		
Oligohydramnios (isolated or otherwise uncomplicated [deepest vertical pocket less than 2 cm])	Late preterm/early term	36 0/7–37 6/7 weeks of gestation or at diagnosis if diagnosed later
Polyhydramnios (mild, idiopathic)†	Full term (early term birth not routinely recommended)	39 0/7–40 6/7 weeks of gestation
Growth restriction (singleton)		
Otherwise uncomplicated, no concurrent findings, EFW between 3rd and 10th percentile	Early term/full term	38 0/7–39 0/7 weeks of gestation
Otherwise uncomplicated, no concurrent findings, EFW <3rd percentile	Early term	37 0/7 weeks of gestation or at diagnosis if diagnosed later
Abnormal umbilical artery Doppler studies: elevated impedance to flow (eg, S/D ratio, pulsatility index, or resistance index greater than 95th percentile for gestational age) with end-diastolic flow still present	Early term	37 0/7 weeks of gestation or at diagnosis if diagnosed later
Abnormal umbilical artery Doppler studies: absent end-diastolic flow	Preterm/late preterm	33 0/7–34 0/7 weeks of gestation or at diagnosis if diagnosed later§
Abnormal umbilical artery Doppler studies: reversed end-diastolic flow	Preterm	30 0/7–32 0/7 weeks of gestation or at diagnosis if diagnosed later§
Concurrent conditions (oligohydramnios, maternal comorbidity [eg, preeclampsia, chronic hypertension])	Late preterm/early term	34 0/7–37 6/7 weeks of gestation
Multiple gestations—uncomplicated		
Dichorionic-diamniotic twins	Early term	38 0/7–38 6/7 weeks of gestation
Monochorionic-diamniotic twins	Late preterm/early term	34 0/7–37 6/7 weeks of gestation
Monochorionic-monoamniotic twins	Preterm/late preterm	32 0/7–34 0/7 weeks of gestation
Triplet and higher order multiples	Preterm/late preterm	Individualized
Multiple gestations—complicated		
Dichorionic-diamniotic twins with isolated fetal growth restriction	Late preterm/early term	36 0/7–37 6/7 weeks of gestation
Dichorionic-diamniotic twins with concurrent condition	Late preterm	Individualized
Monochorionic-diamniotic twins with isolated fetal growth restriction	Preterm/late preterm	32 0/7–34 6/7 weeks of gestation
Alloimmunization		
At-risk pregnancy not requiring intrauterine transfusion	Early term	37 0/7–38 6/7 weeks of gestation
Requiring intrauterine transfusion	Late preterm or early term	Individualized

Maternal Conditions		
Hypertensive disorders of pregnancy		
Chronic hypertension: isolated, uncomplicated, controlled, not requiring medications	Early term/full term	38 0/7–39 6/7 weeks of gestation[||]
Chronic hypertension: isolated, uncomplicated, controlled on medications	Early term/full term	37 0/7–39 6/7 weeks of gestation[||]
Chronic hypertension: difficult to control (requiring frequent medication adjustments)	Late preterm/early term	36 0/7–37 6/7 weeks of gestation
Gestational hypertension, without severe-range blood pressure	Early term	37 0/7 weeks of gestation or at diagnosis if diagnosed later
Gestational hypertension with severe-range blood pressures	Late preterm	34 0/7 weeks of gestation or at diagnosis if diagnosed later
Preeclampsia without severe features	Early term	37 0/7 weeks of gestation or at diagnosis if diagnosed later
Preeclampsia with severe features, stable maternal and fetal conditions, after fetal viability (includes superimposed)	Late preterm	34 0/7 weeks of gestation or at diagnosis if diagnosed later
Preeclampsia with severe features, unstable or complicated, after fetal viability (includes superimposed and HELLP)	Soon after maternal stabilization	Soon after maternal stabilization
Preeclampsia with severe features, before viability	Soon after maternal stabilization[¶]	Soon after maternal stabilization[¶]
Diabetes		
Pregestational diabetes well-controlled[†]	Full term	39 0/7–39 6/7 weeks of gestation
Pregestational diabetes with vascular complications, poor glucose control, or prior stillbirth	Late preterm/early term	36 0/7–38 6/7 weeks of gestation
Gestational: well controlled on diet and exercise	Full term	39 0/7–40 6/7 weeks of gestation
Gestational: well controlled on medications	Full term	39 0/7–39 6/7 weeks of gestation
Gestational: poorly controlled	Late preterm/early term	Individualized
HIV		
Intact membranes and viral load >1,000 copies/mL	Early-term cesarean delivery	38 0/7 weeks of gestation
Viral load ≤1,000 copies/mL with antiretroviral therapy	Full term (early term birth not indicated)	39 0/7 weeks of gestation or later
Intrahepatic cholestasis of pregnancy: total bile acid levels <100 micromol/L	Late preterm/early term	36 0/7–39 0/7 weeks of gestation or at diagnosis if diagnosed later[#]
Intrahepatic cholestasis of pregnancy: total bile acid levels ≥100 micromol/L	Late preterm	36 0/7 weeks of gestation or at diagnosis if diagnosed later[#]
Obstetric Conditions		
Preterm PROM	Late preterm	34 0/7–36 6/7 weeks of gestation[**]
PROM (37 0/7 weeks of gestation and beyond)	Generally, at diagnosis	Generally, at diagnosis
Previous stillbirth	Full term (early term birth not routinely recommended)	Individualized[††]

Abbreviations: EFW, estimated fetal weight; HELLP, hemolysis, elevated liver enzymes, and low platelet count; PROM, prelabor rupture of membranes (also referred to as premature rupture of membranes); S/D, systolic/diastolic.

*In situations in which there is a wide gestational age range for acceptable delivery thresholds, the lower range is not automatically preferable, and medical decision making for the upper or lower part of a range should depend on individual patient factors and risks and benefits.

[†]Uncomplicated, thus no fetal growth restriction, superimposed preeclampsia, or other complication. If these conditions are present. then the complicating conditions take precedence and earlier delivery may be indicated.

[‡]Prior myomectomy may require earlier delivery similar to prior classical cesarean (36 0/7–37 0/7 weeks of gestation) in situations with more extensive or complicated myomectomy. Data are conflicting regarding specific timing of delivery. Furthermore, timing of delivery may be influenced by the degree and location of the prior uterine surgery, with the possibility of delivering as late as 38 6/7 weeks of gestation for a patient with a less extensive prior surgery. Timing of delivery should be individualized based on prior surgical details available and the clinical situation.

[§]Consultation with maternal-fetal medicine subspecialist is recommended.

[||]Expectant management beyond 39 0/7 weeks of gestation should only be done after careful consideration of the risks and benefits and with appropriate surveillance.

[¶]Management individualized to particulars of maternal-fetal condition and gestational age.

[#]Measurement of serum bile acid levels and liver transaminase is recommended in patients with suspected intrahepatic cholestasis of pregnancy. Delivery before 36 weeks of gestation occasionally may be indicated depending on laboratory and clinical circumstances.

[**]The balance between benefit and risk, from both maternal and neonatal perspectives, should be carefully considered, and patients should be counseled clearly. Although a period of expectant management may be considered for women who request additional time for the onset of spontaneous labor, the potential maternal and neonatal risks associated with prolonged expectant management should be discussed. Care should be individualized through shared decision making, and expectant management should not extend beyond 37 0/7 weeks of gestation. Outside the scenario of unknown GBS status, latency antibiotics are not appropriate in this setting. If expectant management is being considered in a patient with unknown GBS status, an initial GBS culture should be obtained, and an antibiotic regimen active against GBS should be started until results of the GBS culture return. Women with PPROM who are colonized with GBS are at an increased risk of neonatal infection with expectant management. The potential additional neonatal risks associated with prolonged expectant management in the setting of maternal GBS colonization should be discussed and the reasons for discouraging such management reviewed and documented in the medical record. Abbreviations: GBS, group B streptococcus; PPROM, preterm prelabor rupture of membranes.

[††]Deliveries before 39 weeks of gestation are associated with an increased risk of admission to neonatal special care units for respiratory complications and other neonatal morbidities; however, maternal anxiety with a history of stillbirth should be considered and may warrant an early term delivery (37 0/7 weeks to 38 6/7 weeks) in women who are educated regarding, and accept, the associated neonatal risks.

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Breech Presentation in a Singleton Gestation

December 2025 (Replaces May 2019)
Author: Dr. Christina Davidson
Editor: Dr. Alex Vidaeff

Highlights

- Patients with fetus in Breech presentation should be counseled on options including scheduled Cesarean delivery or external cephalic version. Scheduled or planned vaginal breech delivery should not be routinely offered.

Management options

There are several initial options for management of singleton breech fetuses at term. Figure 1 includes a flow diagram for management recommendations. Figure 2 describes management recommendations for a patient who presents in labor with a fetus in breech presentation.

1. External Cephalic Version
2. Cesarean delivery
3. Vaginal breech delivery

External Cephalic Version[3]

External cephalic version (ECV) refers to the attempted conversion of breech to vertex by manual manipulation through the maternal abdomen. It is best performed at term.

The overall success rate of ECV ranges from 35% to 86%, with an average success rate of 58%. Predictors of success include multiparity and an oblique or transverse fetal lie. Nulliparity, advanced dilatation, fetal weight of less than 2,500 gm, anterior placenta, and low station are less likely to be associated with success. Most patients with a successful external cephalic version will give birth vaginally.

Contraindications

Absolute contraindications to ECV are conditions that warrant delivery by cesarean, such as placenta previa or prior classical cesarean delivery. Rupture of membranes is also considered a contraindication to ECV.

Procedure Risks

Fetal heart rate changes during attempted ECVs are not uncommon but usually stabilize when the procedure is discontinued. Serious adverse effects associated with ECV are uncommon, but there have been a few reported cases of placental abruption, uterine rupture, fetomaternal hemorrhage, alloimmunization, and fetal death.

ECV Checklist

Pre Procedure

- ☐ Perform ultrasound to confirm breech presentation
- ☐ Review anatomy ultrasound report or, if unavailable, perform ultrasound to evaluate for any anomalies that would complicate a vaginal delivery
- ☐ Document gestational age
- ☐ Perform non-stress test (NST), which should be reactive to proceed
- ☐ Ensure that no contraindications to ECV are present
- ☐ Obtain written consent
- ☐ Administer Anti-Rh(D) (if indicated)

During Procedure

- ☐ Utilize ultrasound guidance
- ☐ Consider short acting tocolytic (i.e. beta agonist) and/or neuraxial anesthesia which may improve success
- ☐ Evaluate fetal heart tones frequently
- ☐ Have operating room available for emergent Cesarean delivery if indicated

Post Procedure

- ☐ Perform NST
- ☐ Determine delivery plan regardless of success

Cesarean Delivery

Cesarean delivery is the preferred delivery method for a fetus in persistent breech presentation.

Vaginal Breech Delivery

ACOG recommends that the decision regarding the mode of delivery should consider patient wishes and the experience of the health care provider. Planned vaginal delivery of a term singleton breech fetus may be reasonable under hospital-specific protocol guidelines for both eligibility and labor management.[6]

Risks

Before a vaginal breech delivery is planned, parents should be informed that the risk of perinatal mortality or short-term neonatal morbidity may be higher with vaginal breech delivery than if a cesarean delivery is planned,[7,8] and the patient's informed consent should be documented.[9] However, strict adherence to selection criteria can make outcomes associated with a planned vaginal breech very similar to those associated with a planned cesarean delivery.[4,5]

Patient and provider willingness to abandon the vaginal delivery attempt is essential if there is a concern for fetal condition or in case of inadequate progress of labor (oxytocin augmentation is unadvisable).[4,10]

Contraindications

- Footling breech or transverse presentation
- Hyperextension (“stargazing”) of the fetal head
- Oligohydramnios
- Concern for cephalopelvic disproportion
- Fetal anomalies
- Fetal weight < 2500g or > 4000g
- Gestational age < 37 weeks
- Inadequate maternal pelvis by clinical evaluation

Figure 1. Management of Singleton with Breech Presentation at or near term

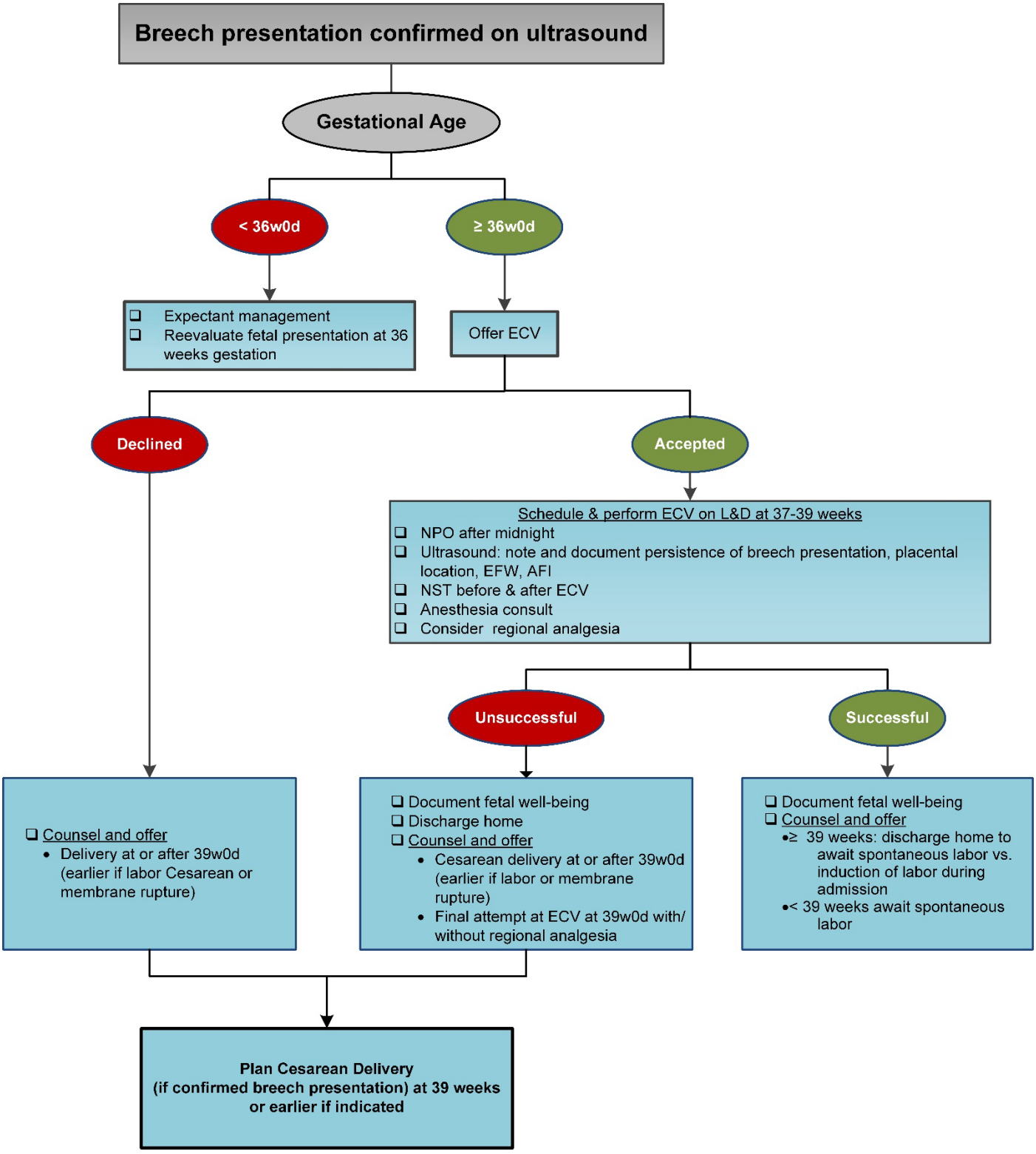
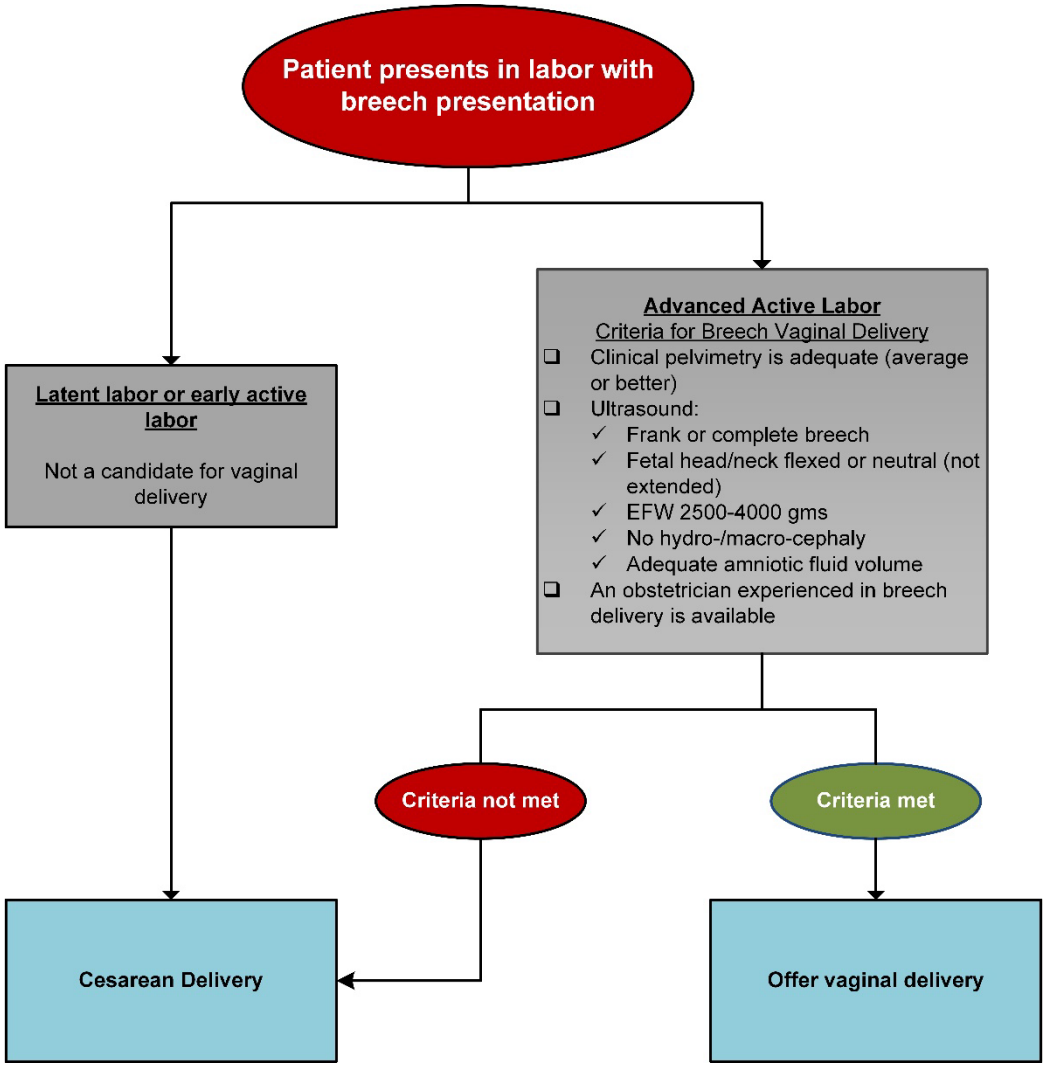


Figure 2. Management of Patient who Presents in Labor with Fetus in Breech Presentation



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Twin Vaginal Delivery Checklist

[June 2022]

Twin Vaginal Delivery Checklist

Planned vaginal delivery of a twin gestation should include every effort to avoid delivering the first twin vaginally followed by urgent or emergent cesarean delivery of the second twin. This checklist should be used for all patients admitted to L&D for planned vaginal delivery of twins.

On admission to labor and delivery

Obstetrician

- ❑ Patient should be counseled on importance of epidural analgesia for delivery
- ❑ An obstetrician skilled in twin delivery, including possible breech extraction of 2nd twin, should be present or readily availability (within 30 minutes) throughout labor
- ❑ H&P should include the following documentation:
  - ✓ Ultrasound estimated fetal weight (EFW) of both twins, ideally within 2 weeks of admission
  - ✓ Ultrasound assessment of fetal presentation of both twins
  - ✓ Delivery plan that includes mode of delivery of 2nd twin if non-cephalic (breech extraction vs. cesarean birth) that takes into consideration weight discordance of twins

RN

- ❑ Patient should have large bore IV access placed
- ❑ RN should know covering and delivery provider's name(s) and contact information

Anesthesia

- ❑ Patient should be assessed for possible early epidural placement to ensure it is in place and working at complete dilation

At complete dilation

- ❑ Patient should be transferred to the operating room for delivery when she reaches complete dilation and/or no later than +3 station of the 1st twin
- ❑ Delivering provider should be at bedside to initiate transfer to operating room
- ❑ Primary RN should notify Charge RN and anesthesia of plan to move to operating room
- ❑ Patient should be transferred to operating room for delivery with preparation for double set up

Upon arrival to the Operating Room:

- ❑ Transfer via LDR Bed to OR suite and place in Allen stirrups on OR table.

- ❑ Confirm presence of the following in the OR:
  - ✓ Ultrasound is in room and powered on
  - ✓ Indicated anesthesia and neonatal personnel
  - ✓ All uterotonic agents
  - ✓ PPH cart (in hallway)
  - ✓ Vaginal delivery table
  - ✓ Cesarean delivery table
  - ✓ Amnihook for AROM of 2nd twin
  - ✓ Fetal scalp electrode and cables
  - ✓ Oxytocin pump
  - ✓ Forceps (type to be specified by delivering obstetrician)
  - ✓ Vacuum

Twin Vaginal Delivery Checklist

A time-out should be performed and the delivering obstetrician should announce the following:

- ❑ Positive patient identification (PPID)
- ❑ Planned mode of delivery of 1st twin (i.e., spontaneous, forceps, vacuum). If forceps or vacuum planned, they should be in OR
- ❑ Identification of ultrasound operator to assist with presentation of 2nd twin after delivery of 1st twin
- ❑ EFW, weight discordance, and current presentation of twins
- ❑ Contraindications to any uterotonic agents based on the patient's medical history
- ❑ Immediate or post-placental oxytocin after delivery of 2nd twin
- ❑ Plan after delivery of 1st twin:

If 2nd twin is cephalic, consider the following plan:

- ✓ Increase/start oxytocin PRN (increase by 2-4 mU/min or start at 4 mu/min) – **to be administered by RN**
- ✓ Continue patient expulsive forces, when appropriate
- ✓ Avoid AROM until head is engaged
- ✓ Confirm forceps or vacuum if planned are in OR

If 2nd twin is non-cephalic

- ✓ Will vaginal or cesarean delivery be performed?
- ✓ If vaginal delivery, consider the following plan:
  - Have Piper forceps available in the OR
  - Discontinue oxytocin and patient pushing
  - Have terbutaline and/or nitroglycerin in OR for uterine relaxation – **to be administered by Anesthesia**

[1]

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Shoulder Dystocia

[September 2024 (replaces September 2021)]

Authors: Drs. Christina Davidson, Carey Eppes, and Efua Leke
Editor: Dr. Alex Vidaeff

Background

Shoulder dystocia is an obstetric emergency with a reported incidence ranging from 0.2% to 3% of vaginal deliveries and potential to significantly contribute to fetal and maternal morbidity.[1] Shoulder dystocia cannot be accurately predicted or prevented but some risk factors are known. Fetal macrosomia is thought to be the most important risk factor. Fetuses of diabetic mothers have larger shoulders relative to their biparietal diameter, creating potential for impaction. Precipitous labor and assisted deliveries can preclude spontaneous truncal rotation and therefore result in impaction as well.[1]

Although uncommon, both maternal and neonatal morbidity can result from the maneuvers employed to resolve shoulder dystocia. The most common neonatal complications are fractures of the humerus or clavicle, and brachial plexus injuries, which typically resolve without long term sequelae. Some studies have suggested rare events such as asphyxia or HIE are associated with longer time to delivery, although the interval to delivery cannot accurately predict the severity of any resulting injury. Maternal complications primarily include increased risk of postpartum hemorrhage and obstetric soft tissue lacerations including anal sphincter injuries. Hyperflexion during McRoberts maneuvers has been associated with subsequent neuropathy and symphyseal separation. More significant maternal morbidity can also ensue when measures like the Zavanelli maneuver are required for delivery.

Although most cases of shoulder dystocia occur in non-diabetic mothers with normal size fetuses, attempts to identify and appropriately manage at-risk patients should be made. An early study indicated that the presence of fetal macrosomia and maternal diabetes only accurately predicted 55% of shoulder dystocia cases.[2] Patients with increasing birth weight, history of shoulder dystocia and maternal diabetes remain at increased risk of shoulder dystocia, and clinical considerations should be incorporated into their labor management.

Labor patterns have been studied in relation to shoulder dystocia and are not known to be predictive of this outcome. Universal elective cesarean delivery is not recommended for patients with prior shoulder dystocia; however, the events and outcomes of the prior delivery should be taken into consideration in counseling and management.

Management of at-risk patients

Based on the available evidence:

1. Patients should be counseled on the risks of shoulder dystocia and be offered elective cesarean delivery if EFW ≥ 5000g (non-diabetic) and ≥ 4500g (diabetic).
2. People with a history of shoulder dystocia (recurrence risk of about 10%[3]) will be identified at time of admission, marked on the L&D board with an identifier ("SD"), and this information will be relayed to the care teams during all sign-out reports:
3. A pre-delivery briefing between the physician and nursing team will occur in 2nd stage of labor.
4. Two labor and delivery nurses will be assigned at delivery for at-risk patients.

This September 2024 guideline removes the recommendation to counsel patients about shoulder dystocia risk with EFW > 4000g

Shoulder dystocia maneuvers[3-5]

Once shoulder dystocia is diagnosed, the first step is to call for help. Gentle downward traction along with maternal expulsive efforts should be attempted.

An episiotomy may be cut at any time to facilitate completion of the maneuvers.

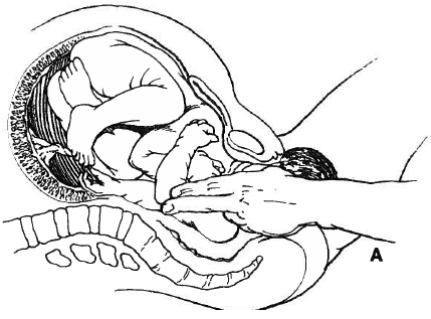
1. McRoberts maneuver and suprapubic pressure:

Exaggerated flexion of the patient's thighs is considered the primary technique to resolve shoulder dystocia.[5] Suprapubic pressure is typically employed as well, with an assistant applying suprapubic pressure directed at a 45 degree angle off of vertical to move the fetal shoulder downwards and laterally.

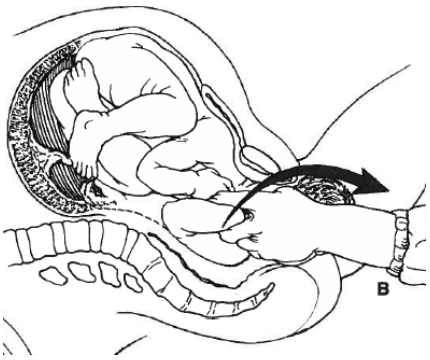
McRoberts's maneuver can also be used prophylactically in patients deemed to be at-risk for shoulder dystocia.

2. Posterior shoulder delivery:

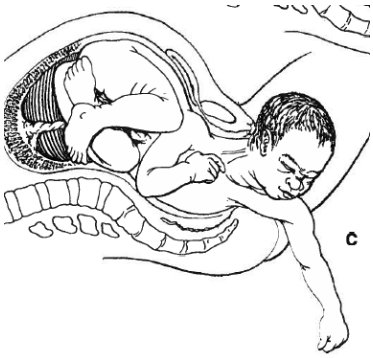
According to a 2011 report, delivery of the posterior shoulder showed the highest overall rate of success in comparison with other maneuvers and is therefore suggested as the next best maneuver if McRoberts and suprapubic pressure fail.[4]



The operator's hand is introduced into the vagina: if the fetal back is toward the right, the right hand is used; if the back of the fetus is toward the left, the left hand is used.



The fingers of the operator follow along the humerus to the antecubital fossa. Pressure is applied in the antecubital fossa.



As the fetal arm flexes, the index finger grasps the forearm of the infant and gently sweeps it across the chest and face of the fetus and out of the vagina.

3. Modification of the posterior shoulder delivery

It involves delivering the posterior shoulder before the posterior arm, using the operator's two middle fingers placed in the posterior axilla and creating outward and downward traction to deliver the posterior shoulder before the arm is then delivered from the pelvis.

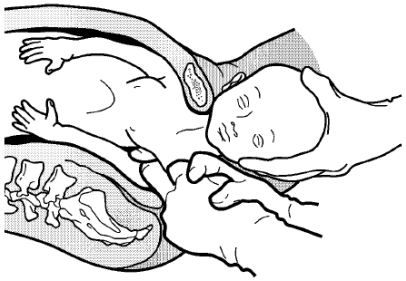
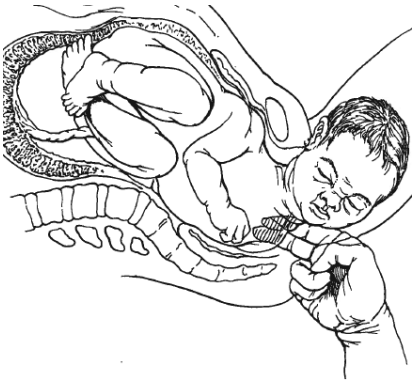


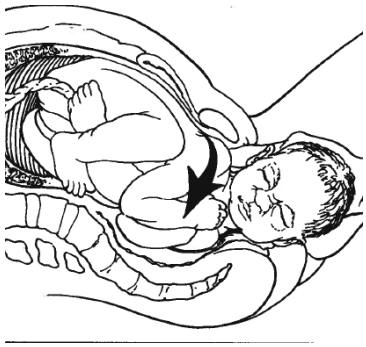
Fig. 1. The head is gently held upward by an assistant. The operator has the 4th and 5th fingers of each hand flexed and pressed against the woman's perineal area. The middle fingers are both placed into the fetus's posterior axilla, one from the fetus's front and the other from the fetus's back. The fingers overlap each other. By using both fingers, traction is used to pull the posterior shoulder downward and outward along the curve of the sacrum.
Menticoglou. Severe Shoulder Dystocia. Obstet Gynecol 2006.



4. Modified Woods maneuver

The operator's hand is placed on the posterior aspect of the posterior shoulder, which is rotated like a screw in a clockwise direction, thus releasing the anterior shoulder.

5. Rubin's Maneuvers



Two maneuvers that involve rocking the anterior shoulder trans- abdominally to disimpact it and manually adducting the most accessible shoulder to reduce the overall transverse diameter.

6. Deliberate fracture of the clavicle

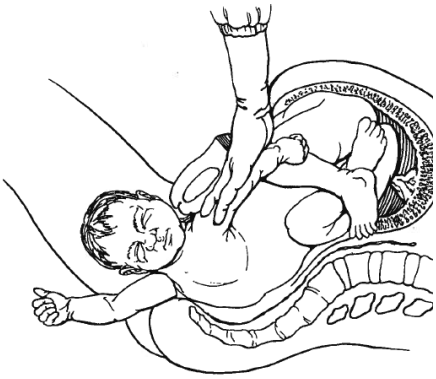
This can be performed to reduce this diameter by placing upward pressure on its midportion in order to avoid subclavian vascular injury.

7. All fours maneuver

This involves placing the patient on her hands and knees to allow rotation of the maternal pelvis with the aim to disimpact the anterior shoulder under the symphysis

8. Abdominal rescue:

Last resort effort in delivery, whereby a low transverse hysterotomy is performed and the fetal shoulder is assisted below the symphysis pubis, followed by vaginal delivery of the infant.



Ben Taub Shoulder Dystocia Protocol

In the event a shoulder dystocia is diagnosed, the below protocol should be initiated and followed until resolution of this obstetrical emergency:

Ben Taub Shoulder Dystocia Protocol

Labor Nurse	First Responder nurse (charge)	Second responder nurse
• Note time the shoulder dystocia is announced • Initiate OB LOCAL Alert system • Place patient in McRoberts • Apply suprapubic pressure and be aware of the correct direction based on instruction from the delivering physician • Relay relevant information to arriving team members (including Neo team) • Obtain cord gases • Close the loop on all communications	• Identify your role • Activate OB Emergency system 37800 “OB emergency room x” • Holds second leg for McRoberts • Close the loop on all communications	• Identify your role • Announce time in 30 second increments • Initiate overhead page • Call Neo • Start time keeping and note taking with checklist • Crowd control and explain to family what is occurring
OB First/second Physician	**OB Attending physician**	**Anesthesia**
• Shoulder dystocia recognized and announced • Ask for time recording to begin and to activate OB emergency system • Close the loop on all communications • Ask patient to be placed in McRoberts position • Ask for and indicate direction for suprapubic pressure • Explain to patient what is occurring • Begin shoulder dystocia maneuvers: • Delivery of posterior arm • Rubins/Woods maneuvers • Gaskin • Episiotomy • Give OB team report • Debrief with patient and family with attending physician	• Repeat maneuvers : ○ Delivery of posterior arm ○ Rubins/Woods maneuvers ○ Gaskin ○ Episiotomy • Consider extreme maneuvers: ○ 4th degree episiotomy ○ ○ Zavenelli ○ Abdominal Rescue • If proceeding to OR: state to team what will be done in the OR • Debrief with patient and family	• Ensure proper IV access • Assess analgesia/anesthesia (may need emergent operative delivery) • Be aware of patients baseline H/H and NPO status

Shoulder dystocia maneuvers table

Maneuver	Order (ex: 1, 6)	Time
McRoberts		
Suprapubic		
Posterior Arm		
Anterior Rubin		
Posterior Rubin		
Woods Screw		
Gaskin		
Episiotomy		
Zavenelli		
Symphysiotomy		
Abdominal Rescue		

Additional Resources

An epic smartphrase has been developed for use at Ben Taub in the event of any shoulder dystocia to create uniformity in the documentation process. This smart phrase should be routinely used in these cases, and can be accessed by culling from an existing user:".deliveryshoulderdystocia."

The AHRQ has a link to a shoulder dystocia checklist that can be accessed: https://www.ahrq.gov/sites/default/files/wysiwyg/professionals/quality-patient-safety/hais/tools/perinatal-care/modules/strategies/labor-delivery-unit/tool_shoulder-dystocia.docx

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Delayed Cord Clamping in Preterm and Term Infants

[July 2024 (replaces May 2019)]

Author: Dr. Kelli Barbour

This guideline covers the separate literature for delayed cord clamping and cord milking in both preterm and term infants, with a suggested combined algorithm and checklist.

Summaries

Delayed Cord Clamping (DCC)

DCC appears to be safe in the preterm infant and appears to decrease the risk of death, improve one-minute Apgar scores, and decrease the number of infants requiring a transfusion. There is an increased risk of hypothermia (but only by 0.12 degrees.) Maternal adverse events are not increased by DCC.

DCC appears to be safe in the term infant and may decrease the risk of iron deficiency. Maternal adverse events are not increased by DCC, but these have not been studied extensively.

Each delivery is unique and the decision for DCC should be made after discussion between the delivering obstetrician, neonatologist, and resuscitation team. We suggest that before each delivery that the obstetrician discusses the patient's history and whether or not DCC should be attempted. The appropriateness of DCC should take maternal, placental, and fetal/neonatal factors into account. An algorithm is suggested below to help identify cases where DCC should not be attempted.

If DCC is agreed upon and performed, the resuscitation team can help monitor the vigorousness of the infant, suggest additional resuscitation maneuvers before the cord is clamped (see below for cord milking), and prompt earlier cord clamping if clinically indicated. Cord gases can be sent on a segment taken after cord clamping.

Cord Milking

Cord milking can be performed in non-vigorous neonates who are born at 35 weeks or greater (strong recommendation). Cord milking is also reasonable to consider for preterm babies 28+0-34+6 week preterm babies who cannot receive DCC (weak recommendation). Cord milking should NOT be performed in GA 27+6 weeks or less (strong recommendation).

Delayed Cord Clamping

Delayed cord clamping (DCC) of preterm infants had been historically practiced until the early to mid 1900s, when the standard or care transitioned to immediate cord clamping (ICC). Immediate cord clamping was done particularly in preterm neonates secondary to concerns of harm from delayed resuscitation, as well as hypothermia for increased exposure and jaundice and/or polycythemia from the additional red blood cell mass. Recently, attention has returned to the possible benefits of delayed cord clamping with much research focused on preterm infants. Delayed cord clamping is typically defined as delay in clamping the cord after birth of the neonate by at least 30-60 seconds.

Delayed cord clamping is thought to be associated with increased autotransfusion from the placenta to the neonate, resulting in increased blood volume and aiding time for physiologic transition (ensuring adequate cardiac output, oxygenation, and arterial blood pressure until respiration is established). Secondary to the increased blood volume, infants are thought to benefit from decreased anemia (and its sequelae), and decreased hypoxia.

Literature Review

Preterm Infants

A systematic review and meta-analysis of delayed cord clamping was published January of 2018 and included the studies up through July 2017, including the results of a large Australian RCT of delayed cord clamping in premature neonates born at less than 30 weeks. (1) This systematic review included RCTs that looked at delayed cord clamping in premature infants where delayed cord clamping was at least 30 seconds. Studies that included cord milking in addition to delayed cord clamping were excluded unless those trials had less than 20% of infants receiving cord milking. The review identified 18 RCTs with a total of 2834 infants. Two studies were ongoing at the time of the meta-analysis. The majority of the infants randomized to DCC had the cord clamped after 60 seconds. Included studies had varying exclusion criteria.

In their study-level meta-analysis, delayed cord clamping reduced the primary outcome of all-cause (hospital) mortality (RR 0.68, 95% CI 0.52-0.90; risk difference -0.03, 95% CI -0.05 - -0.01; for a number needed to benefit of 33, 95% CI 20-100). A similar difference was seen in the analysis of the 3-studies assessment delayed cord clamping in infants born at 28 weeks or less. No differences were seen in mortality by type of delivery, where the infant was held in relation to the introitus/incision, or duration of cord clamping (early was anything less than 30 seconds).

Delayed cord clamping was also associated with reduced incidence of low one-minute APGARs. DCC increased the peak hematocrit by 2.37 percentage points (95% CI 1.94-3.52, p<0.00001). The proportion of infants receiving a blood transfusion was reduced by 10% (95% CI 6-13%, p<0.00001); a similar difference was seen in neonates born at or before 28 weeks. No differences were seen in 5-minute APGARS, need for intubation for resuscitation, admission temperature, mechanical ventilation, intraventricular hemorrhage, brain injury, chronic lung disease, patent ductus arteriosus, necrotizing enterocolitis, late-onset sepsis, or retinopathy of prematurity. The incidence of polycythemia was increased (RR 2.65, 95% CI 1.61-4.37), but there was no impact on the use of partial exchange transfusion for polycythemia. DCC was associated with increased peak bilirubin, but there was no difference in the use of exchange transfusion. In terms of maternal outcomes, there was no difference in the number of women with postpartum hemorrhage or requiring blood transfusion. The study does not report on long-term outcomes.

Of note, the Australian Placental Transfusion Study (APTS), published in December 2017, was the largest RCT included in the meta-analysis, having randomized 1634 premature neonates born at less than 30 weeks gestation to delayed cord clamping. In this study, DCC was done for at least 60 seconds. (2) The primary outcome chosen for this study was a composite of death and major morbidity (severe brain injury, severe retinopathy, necrotizing enterocolitis, late-onset sepsis, chronic lung disease). In this RCT, there were no differences in the composite primary outcome (37.0% for DCC versus 37.2 for early/immediate cord clamping (RR 1.00, 95% CI 0.88-1.13, P= 0.096). In unadjusted univariate analysis, mortality in the DCC group was

decreased (6.4% versus 9.0%, RR 0.69, 95% CI 0.49-0.97). When this outcome was adjusted post-hoc for multiple comparisons, the difference was no longer significant (p=0.39). There was no difference in secondary outcomes. Long-term outcomes were published in a follow up study and showed reduced mortality or neurodevelopmental impairment with DCC (12). When neurodevelopment impairment was assessed alone, the association was not significant, but still suggestive of benefit of DCC.

Umbilical artery pH

In terms of the effect of DCC on umbilical artery pH, the limited studies that have been conducted show either no change or a small decrease in pH (0.03). It is not known how DCC affects umbilical artery pH in non-vigorous infants.

Blood banking

DCC is associated with decreased volume and nucleated cell counts in cord blood donations (sufficient collection in 17% of DCC cases compared to 39% of early CC cases.

Multifetal pregnancy

Some of the studies of DCC have included twin pregnancies. There is still insufficient evidence to recommend or avoid DCC in multiple gestations, especially in monochorionic pregnancies.

FGR

In a sub-analysis of the FGR/SGA preterm infants at Brown University, DCC in these infants was noted to be safe and associated with a higher admission temperature, lower risk of suspected NEC (but not confirmed NEC). (3) Of note, the parent study was not included in the 2017 meta-analysis as more than 20% of cords were milked. The authors reported that the initial hematocrit, peak bilirubin in the first week, and the outcomes of suspected NEC and bronchopulmonary dysplasia were not different between the groups.

Resuscitation during DCC

A 2018 Cochrane review identified 1 study (Katheria 2016) that had looked at the provision of respiratory support before cord clamping. (4) 150 infants were randomized to respiratory support by CPAP or PPV versus no respiratory support. Mortality, need for inotropes, receipt of blood transfusion, peak hematocrit, and development of IVH did not different between the two groups. The quality of evidence was rated as low secondary to lack of precision on multiple outcomes. (5)

A newly designed resuscitation table that can be placed between the maternal legs or along her side has been studied for feasibility in the Netherlands. (6) The investigators found that the table could be used (it was feasible) and that heart rates remained stable and SpO2 increased in infants resuscitated with the table. A similar study with a mobile resuscitation trolley showed that the use of the trolley was feasible and was acceptable to parents; providers voiced concerns about access to the neonate for resuscitation. (4)

Long-*term* outcomes

Long-term data outcomes in preterm infants are lacking.

Unanswered Questions

How generalizable the meta-analysis is to all groups of premature infants is unclear. There is insufficient data for or against DCC in infants with growth restriction and abnormal umbilical blood flow. The effect of DCC on long-term outcomes is also limited.

Term Infants

A systematic review and meta-analysis of delayed cord clamping in term infants was published in 2013 and included the studies up through February 2013. (1) This systematic review included RCTs that looked at

delayed cord clamping in term infants where delayed cord clamping was at least 60 seconds (the exact time comparison groups differed between studies). Breech infants and multifetal gestations were excluded.

The review identified 15 RCTs with a total of 3911 dyads. In their study-level meta-analysis, delayed cord clamping did not reduce the primary outcome of mortality (RR 0.37, 95% CI 0.04-3.41; 2 trials). Mean birth weight was higher in the DCC group (101g difference, 95% CI 45-157g; 12 trials). Need for phototherapy was decreased in the early CC group (RR 0.62, 95% CI 0.41-0.96; 7 trials). Hemoglobin concentrations at 24-48 hours were lower in the early CC group (MD -1.49 g/dL, 95% CI -1.78- 1.21), but did not differ at subsequent assessments. Infants in the early CC group were more likely to be iron deficient at 3-6 months of age (RR 2.65, 95% CI 1.04-6.73; 5 trials). Only one trial reported on longer-term neurodevelopment outcomes and did not show a difference in the Ages and Stages Questionnaire scores.

No studies reported on maternal deaths or severe maternal morbidity. There was no significant difference in severe postpartum hemorrhage (RR 1.04, 95% CI 0.65-1.65; 5 trials) or postpartum hemorrhage (RR 1.17, 95% CI 0.94-1, which can be adapted.44; 5 trials).

RCTs published since February 2013 –

In 73 infants randomized to DCC of >5 minutes versus ICC of <30 seconds, 48-hour hematocrit was higher in DCC infants (57.6% versus 53.1%, p<0.01), as was hemoglobin; peak bilirubin levels did not differ between groups. (2) 11 infants underwent cord milking instead of DCC. (18)

CHD infants

A pilot RCT of 30 singleton neonates with congenital heart defects, designed to test safety and feasibility, randomized infants to ECC (<10 sec) versus DCC (>120 sec). (3) There was no difference in safety measures (polycythemia, peak bilirubin, phototherapy, 5-minute Apgar, pre-operative mortality) or surgical parameters between the two arms, nor in neonatal morbidities. Hematocrits were higher within the first 72 hours for infants in the DCC arm, although this difference was not seen later in the hospitalization. The likelihood of needing a blood transfusion was less in the DCC cohort (7% versus 43%, p=0.02), but not during hospitalization.

LGA infants

Vural et al looked at hematologic parameters in term LGA infants. (4) 51 term LGA infants were randomized in Turkey to ICC (<15 sec) versus DCC (>=60 sec). Apgar scores and cord gas pH did not differ between arms. Neither two-hour hematocrit nor 24-hour bilirubin nor the incidence of polycythemia differed significantly between arms.

Maternal outcomes

De Paco et al looked at the length of the 3rd stage in term vaginal deliveries with DCC. (5) 97 term singleton pregnancies were randomized to ECC (<10c) versus DCC (>2 min). There was no difference in length of second stage, blood indices, or umbilical cord parameters.

Resuscitation during DCC

Katheria et al randomized 60 vaginally-delivered term infants at risk of resuscitation to 1-minute versus 5-minute DCC. (6) Non-vigorous infants in the 1-minute arm had their cords clamped immediately, while non-vigorous infants in the 5-minute arm were placed on the Life-Start Bed. Infants requiring resuscitation at 5 minutes had CONTINUED delayed cord clamping. The primary endpoint was StO2 (cerebral oxygen saturation). 63% of infants in the 1-minute group required resuscitation versus 43% in the 5-minute group (p=0.20). StO2 in the 5-minute group was better than the in the 1-minute arm (mean 82 versus 79, p=0.02). Mean blood pressure was also higher in the 5-minute arm (mean 53 versus 47, p = 0.02).

Long-term outcomes

A few studies have looked at long-term outcomes of infants randomized to DCC. Andersson followed up iron status and neonatal developmental outcomes in 382 infants in Sweden; follow up data was available in 90.8% of participants. (7) Infants had been randomized to ECC (<-10 sec) versus DCC (>-180 seconds). Using the Ages and Stages Questionnaire, scores were 5 points higher in male infants in the DCC arm, but 12 points lower in girls in the same arm. Iron status and hematologic studies did not differ between the arms. At 4 years of age, 263 infants (68.8% of the original cohort) were assessed for neurodevelopment outcomes. (8) No differences were noted in IQ (as measured by WPPSI-II). DCC arm children had higher adjusted mean differences (AMDs) in ASQ in personal-social (2.8; 95%CI, 0.8-4.7) and fine-motor (2.1, 95% CI 0.2-4.0). Fewer children in the DCC arm fell below the cutoff in the ASQ fine motor domain (11.0%vs 3.7%; P = .02) and Movement ABC bicycle trail task (12.9% vs 3.8%; P = .02).. In male children having received DCC had significantly higher AMDs in the WPPSI-III processing-speed quotient (4.2; 95%CI, 0.8-7.6; P = .02). Boys in the DCC arm compared to the ECC arm had higher AMDs in movement ABC bicycle-trail task (0.8; 95%CI, 0.1-1.5; P = .03), and fine-motor (4.7; 95%CI, 1.0-8.4; P = .01) and personal-social (4.9; 95%CI, 1.6-8.3; P = .004) domains of the ASQ.

6-month hematologic indices were investigated by Nesheli et al in Pakistan. (9) They looked at 60 term infants who were delivered vaginally and who had been randomized to ECC (<10 sec) versus DCC (50-60 seconds). Hemoglobin, hematocrit, and transferrin saturation were higher in infants randomized to DCC. MVC and MCH did not differ significantly. No differences were noted in polycythemia, hyperbilirubinemia, tachypnea, or in maternal hemorrhage.

In the follow up of the Mercer study, 44 infants had follow-up at 4 months of age. (10) The DCC cohort infants had higher ferritin levels (96.4 ng/ml versus 65.3, p=0.03) and greater myelin content in the internal capsule and other maturing brain regions. No differences were seen in the Mullen score for neurodevelopment or in hematocrit.

Ashish et al are conducting a long-term follow up study to look at anemia indices and neurodevelopmental scores at 8-24 months. (11)

Unanswered Questions

How generalizable the meta-analysis and RCTs is to all groups of term is up for debate. DCC times have differed significantly between studies. There is insufficient data for or against DCC in infants with growth restriction and abnormal umbilical blood flow. The effect of DCC on long-term outcomes is also limited, mainly arising from one cohort.

2024 Update

A new systematic review and meta-analysis of delayed cord clamping was published December of 2023 and included the studies up through June 2023. The authors assessed outcomes in infants born at <32 weeks and >/=32 weeks. In all infants, DCC was associated with decreased mortality prior to discharge with a number needed to treat of 40. In infants born at less than 32 weeks, DCC was also associated with decreased need for blood transfusion, increased risk of hypothermia (by 0.12 degrees C). These outcomes did not differ in infants born at or after 32 weeks. (19)

Cord milking in a late preterm/term non-vigorous infant

Background

Umbilical cord milking (UCM) provides an additional avenue for possible autotransfusion.

Literature review

In the 2024 systematic review and meta-analysis described above, the authors also looked at umbilical cord milking compared with immediate cord clamping and delayed cord clamping. In this study, there was no clear evidence that cord milking decreased mortality prior to discharge compared to immediate cord clamping, but improvements in hemoglobin and hematocrit were seen. When UCM was compared to DCC, there was also no significant difference in mortality before discharge.

Katheria, et al, performed a cluster randomized controlled trial of umbilical cord milking born between 35-42 weeks' EGA with a primary outcome of NICU admission. In the analysis of 1730 infants for whom the primary outcome was available, UCM did not decrease the risk of NICU admission. UCM, however, was associated with higher hemoglobin, less need for delivery room cardiorespiratory support (OR 0.57, 95% CI 0.33-0.99), lower incidence of moderate or severe HIE (OR 0.48, 95% CI 0. 24-0.98), and less therapeutic hypothermia (OR 0.57, 95% CI 0.33-0.99).

Cord milking should **NOT** be performed in preterm infants born at <28 weeks due to concerns for increased risk of severe IVH (per 2021 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care and 2023 AHA and AAP Focused Update on Neonatal Resuscitation Guidelines).

Katheria et al (Dec 2023) completed a RCT in non-vigorous preterm babies 28-32 weeks GA (n=1019) comparing DCC 60 sec to umbilical cord milking. This trial showed no increase in severe IVH in the cord milking arm compared to the DCC arm (1.4% vs 1.4%). Therefore the 2023 AHA and AAP Focused Update on Neonatal Resuscitation Guidelines considers UCM in the GA range 28-34 to be acceptable when immediate resuscitation is considered necessary and DCC not able to be performed. (22)

GA	**Vigorous Infant**	**Non-Vigorous/ DCC not possible**
≤27 6/7	DCC	Immediate Cord Clamping
28 0/7 -34 6/7	DCC	Cord Milking may be reasonable
≥35 0/7	DCC	Cord Milking

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SOCIETY SUPPORT

In January 2017 (prior to the meta-analysis and the APTS), ACOG recommended a delay in umbilical cord clamping in vigorous term and preterm infants for at least 30-60 sections after birth. Secondary to the small increase in the incidence of jaundice requiring phototherapy in term infants undergoing DCC, ACOG recommends ensuring that mechanisms are in place to monitor/treat neonatal jaundice. The American Association of Pediatricians endorses the 2017 ACOG guidelines. The 2021 Neonatal Resuscitation Program (NRP) also recommends DCC of 30-60 seconds in vigorous preterm infants.

The World Health Organization recommends DCC for at least 60 sections in term and preterm infants who do not require positive pressure ventilation. The Royal College of Obstetricians and Gynecologist recommend DCC of at least 120 seconds in healthy preterm and term infants. The American College of Nurse-Midwives recommends DCC for 2-5 minutes in term and preterm neonates. The 2021 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care guidelines support at least 60 seconds of duration in newborns at 34 weeks or greater and at least 30 seconds in neonates born before 34 weeks.

PROCEDURE

How is DCC performed?

DCC should not delay warming, drying, and stimulating of the neonate. Immediate skin-to-skin contact can be done and the neonate can be cleaned with clean/warm blankets. In a cesarean section, the infant can be held close to the wound. Secretions can be cleared if they are copious or if there is obstruction.

How is UCM performed?

UCM can be performed by consistently and slowly milking the cord 4 times with each swipe performed over 2 seconds. After each swipe, the end of cord is released. This method was used in the MINVI trial (Katheria et al, 2023), as well as the UK trial (Rabe, et al), and Japanese trial (Hosono, et al).

A video demonstrating UCM is available at https://bcmedu-my.sharepoint.com/:v:/g/personal/barbour_bcm_edu/EYyhuv4Q6FNJmnimHZgn0MEBB_rwkhRCrDf_8DFdu6PLeA?nav=eyJyZWZlcnJhbEluZm8iOnsicmVmZXJyYWxBcHAiOiJPbmVEcml2ZUZvckJ1c2luZXNzIiwicmVmZXJyYWxBcHBQbGF0Zm9ybSI6IldlYiIsInJlZmVycmFsTW9kZSI6InZpZXciLCJyZWZlcnJhbFZpZXciOiJNeUZpbGVzTGlua0NvcHkifX0&e=FH8ffN.

If cord banking is planned, this can still be done, but the family should be counseled that inadequate total volume and nucleated cells are likely to be encountered.

What about the 3rd stage of labor?

Active management of the third stage of labor can continue, including the use of oxytocin and other uterotonics.

DCC ALGORITHM

Discussion with Neonatology/Pediatrics to decide if Delayed Cord Clamping should be done

Contraindictions to Delayed Cord Clamping

- **Maternal Contraindications** (hemorrhage, hemodynamic instability)
- **Placental Contraindications** (placental abruption, abnormal placentation, umbilical cord avulsion)
- **Fetal/Neonatal Contraindications** (need for immediate resuscitation, FGR with abnormal cord Doppler evaluation, complicated monochorionic pregnancy)

If NO to all:

Proceed with delayed cord clamping x 30-60 seconds (or greater if vaginal delivery)

If YES to 1: proceed with immediate cord clamping; consider UCM

If infant is born at 35+0 or greater and is non-vigorous, proceed with UCM

DCC checklist

⇒ **Discussion with neonatology regarding plans for DCC**
⇒ Decide on amount of planned DCC time
⇒ Ensure room temperature is set to 75F

⇒ Once the infant is delivered, place infant skin-to-skin on the maternal abdomen (or on the surgical drapes near the surgical incision
⇒ Initiate warming, drying, and stimulating
⇒ Bulb suction of the airway as needed
⇒ Continuous assessment by Neonatology and Obstetrics regarding infant status and need for UCM and/or earlier cord clamping
⇒ Cord clamp at goal DCC time or earlier if clinically indicated; consider UCM.

UCM checklist
⇒ Ensure EGA of 35+0 or greater (can consider from 28+0 – 34+6)
⇒ Discussion with neonatology regarding possibility of UCM

Oxytocin Use in Labor

[September 2021 (reaffirmed September 2024)]
Author: Dr. Christina Davidson

Background

ACOG recognizes both low- and high-dose oxytocin regimens, however, a numeric value for the maximum dose has not been established.[1] Based on pharmacokinetic studies of synthetic oxytocin, a steady state level of oxytocin in plasma is achieved by 40 minutes. Therefore, any dosing regimen that increases the infusion rate significantly faster than 40 minutes will result in additional drug being given before the full effects of the previous dose can be known.[2] In addition, aggressive hydration and increased glucose administration have been shown to shorten labor and reduce the need for oxytocin administration.[3-5]

A checklist-based system was developed for the administration of oxytocin that focused on uterine and fetal response to oxytocin, rather than on any specific dosing regimen.[6] In the absence of uterine tachysystole with fetal heart rate decelerations or signs of fetal intolerance of labor, the authors felt the dose to be virtually irrelevant; thus, the protocol allowed for any of the oxytocin regimens approved by ACOG. The protocol was based on maternal and fetal response to oxytocin rather than infusion rate. Following adoption of this protocol at a tertiary care hospital, the authors found that the maximum oxytocin used to achieve delivery was significantly lower in the checklist managed group. There was no difference in the length of any stage or phase of labor, total time of oxytocin administration, or rate of operative vaginal or abdominal delivery. The cesarean delivery rate declined and newborn outcome was improved.

Therefore, the BCM OB/Gyn Perinatal Guidelines Committee endorses the use of a pre-oxytocin and in-use oxytocin checklist protocol in Labor and Delivery. The Ben Taub and PFW Checklists are listed on the following pages. In addition to this policy, the Harris Health System Perinatal Nursing Policy for Oxytocin Administration for the Induction or Augmentation of Labor states the following:

- A qualified licensed professional shall reevaluate the patient at 20 mU per minute oxytocin rate
- There shall be an attending physician assessment, progress note and order to exceed greater than 40 mU per minute with a maximum dose noted.

Ben Taub Hospital Pre-Oxytocin Checklist

This pre-oxytocin checklist represents a guideline for care, however individual medical care is directed by the physician.

If the following checklist cannot be completed, oxytocin should not be initiated.

- ✓ Physician or midwife order on chart.
- ✓ Current history and physical exam on the chart.
- ✓ Indication for induction/augmentation is documented.
- ✓ Pelvis is documented by physician or midwife to be clinically adequate in women with no prior term vaginal delivery.
- ✓ Estimated fetal weight within past week (clinical or ultrasound) less than 4500-5000 grams in a non-diabetic person or less than 4250-4500 grams in a diabetic person.
- ✓ Gestational age documented.
- ✓ Consent signed (general L&D consent).
- ✓ Physician with cesarean delivery privileges is aware of the induction/augmentation and readily available. (A physician with privileges to perform a cesarean delivery must be on site at all times and available for urgent situations)
- ✓ Status of the cervix is assessed and documented.
- ✓ Presentation is assessed and documented.
- ✓ **Fetal assessment completed and indicates: (ALL criteria should be satisfied)**
  - **A minimum of 30 minutes of fetal monitoring is required prior to starting oxytocin.**
  - **At least 2 accelerations (15 bpm x 15 sec) in 30 minutes are present, OR a biophysical profile of 8/10 is present within the past 4 hours OR moderate variability for at least twenty (20) minutes.**
  - **No late decelerations in the last 30 minutes.**
  - **No more than 2 variable decelerations exceeding 60 seconds and decreasing greater than 60 bpm from baseline within the previous 30 minutes prior to starting oxytocin infusion.**

This document does not apply to a formal Oxytocin challenge test without the intent to induce or augment labor.

Ben Taub Hospital In-Use Oxytocin Checklist

This in-use oxytocin checklist represents a guideline for care, however individual medical care is directed by the physician.

- **Oxytocin should be initiated at no more than 2 mU/min and increased by no more than 2 mU/min every 30 min to avoid uterine tachysystole with FHR abnormalities. Tachysystole is defined as >5 contractions in 10 minutes, averaged over 30 minutes.**
- Checklist will be completed with every oxytocin titration or at a minimum of every 30 minutes, even if there is no change to the oxytocin regimen.
- **Oxytocin should be stopped or decreased if the following checklist criteria are not satisfied:**
    - **If oxytocin is stopped, is not increased, or is decreased, the indication for such action should be documented (for example, sustained Montevideo units >200 mm Hg, fetal heart rate abnormality).**

Fetal Assessment indicates (ALL criteria should be satisfied):

- ✓ At least 1 acceleration of 15 bpm x 15 seconds in 30 minutes or moderate variability for 10 of the previous 30 minutes.
- ✓ No more than 1 late deceleration occurred.
- ✓ No more than 2 variable decelerations exceeding 60 seconds in duration and decreasing greater than 60 bpm from the baseline within the previous 30 minutes.

Uterine Contractions (ALL criteria should be satisfied):

- ✓ No more than 5 uterine contractions in 10 minutes averaged over thirty (30) minutes.
- ✓ No two contractions greater than 120 seconds duration.
- ✓ Uterus palpates soft between contractions.
- ✓ If IUPC is in place, oxytocin should be increased to achieve sustained Montevideo units of at least 200 mm Hg, but must calculate less than 300 mm Hg and the baseline resting tone must be less than 25 mm Hg.
    a. If tachysystole is present but Montevideo units are less than 200 mm Hg, IUPC functionality should be evaluated (i.e., “flush” and “zero” the IUPC, confirm return of amniotic fluid per vagina if amnioinfusion is in process).

If oxytocin is stopped, the pre-oxytocin checklist will be reviewed before oxytocin is reinitiated. An order shall be required to restart the infusion, including the rate at which to restart the infusion.

- If oxytocin has been off for less than 30 minutes, restart at half the rate that was infusing at time of discontinuation If oxytocin has been off for greater than 30 minutes, restart the infusion as per the order.

Oxytocin should be discontinued immediately once a decision is made to proceed with cesarean delivery.

Pavilion for Women Pitocin Checklist

Pitocin Initiation Checklist (ALL criteria must be satisfied to initiate Pitocin)
☐ **1. Minimum of 30 minutes of fetal monitoring prior to start**
~Must include ONE of the following~
☐ **2 or more accelerations (15 bpm x 15 sec) in 30 minutes**
☐ **BPP of 8/10 present within the past 4 hours**
☐ **Moderate variability**
☐ **No late decelerations in the last 30 minutes**
☐ **No more than 2 variable decels > 60 sec in duration & decrease > 60 bpm in past 30 min**
Pitocin In Use Checklist (The "In Use" checklist will be completed every 30 minutes. Pitocin should be decreased or stopped if the following checklist criteria are not satisfied.)
Fetal Assessment indicates ALL of the following:
☐ **At least 1 acceleration of 15 bpmX15 bpm in 30 minutes or adequate variability for 10 of the previous 30 minutes**
☐ **No more than 1 late deceleration in previous 30 minutes**
☐ **No more than 2 variable decels > 60 sec duration & decrease > 60 bpm in past 30 min**
~Must include 1 of the following 2 criteria~
☐ **At least 1 accel of 15 bpm x 15 seconds in 30 minutes**
☐ **Moderate variability for 10 of the previous 30 minutes**
Uterine Contractions
~(must meet ALL criteria)~
☐ **No more than 5 uterine contractions in 10 min, averaged over 30 min**
☐ **No 2 contractions greater than 120 seconds duration**
☐ **Uterus palpates soft between contractions**
☐ **If IUPC, MVU must be NO more than 300 MVUs**
☐ **If IUPC, baseline resting tone must be < 25 mm Hg**
***if oxytocin is stopped the Pitocin Initiation checklist will be reviewed before Pitocin is reinitiated.** Of import ***reduce** Pitocin as first measure. Do not turn Pitocin off completely without notifying provider. Reducing should be the first step, not turning it off **MVU=Montevideo Units**

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In Utero Resuscitation for Category II and Category III FHR Tracings

[September 2024 (replaces September 2021)]

Author: Dr. Christina Davidson
Editor: Dr. Alex Vidaeff

- ✓ Recheck the FHR pattern 15- 20 min after each intervention.
- ✓ THE PRESENCE OF FHR ACCELERATIONS (WHETHER SPONTANEOUS OR ELICITED) OR MODERATE FHR VARIABILITY OR BOTH ARE HIGHLY PREDICTIVE OF NORMAL FETAL ACID-BASE STATUS.

- ☐ Change maternal position
  - Left or right lateral
  - Knee-chest

- ☐ Fluid bolus: 500-1000 ml lactated Ringer's solution IV over 20 min (except in women at risk for pulmonary edema)

- ☐ Decrease or stop infusion of oxytocin

- ☐ If tachysystole is present, consider administration of terbutaline 0.25 mg SQ or IV in patients with no contraindication.

- ☐ If maternal hypotension is present, which may occur in association with an epidural anesthetic, consider ephedrine in a 5 mg bolus (or anesthesia consult)

- ☐ Perform cervical exam:
  - Assess progress of labor
  - Assess for umbilical cord prolapse
  - Place fetal scalp electrode if the FHR tracing is of suboptimal quality
  - Perform digital fetal scalp stimulation to assess for FHR acceleration
    - Vigorously rub the fetal scalp for 15 sec using an examining finger
    - Following stimulation, acceleration in the FHR of at least 15 bpm above baseline, lasting at least 15 sec, is associated with a low prevalence of fetal acidemia
  - Consider vibro-acoustic stimulation as an alternative method of fetal stimulation that does not require vaginal examination
    - Apply a vibro-acoustic stimulator to the abdominal wall for 5 seconds
    - After the stimulus, acceleration in the FHR of at least 15 bpm above baseline, lasting at least 15 sec, is associated with a low prevalence of fetal academia

- ☐ For patients without a history of Cesarean delivery, consider amnioinfusion if recurrent deep, variable decelerations are present: place an IUPC and administer a bolus of 500 ml of warmed normal saline or D5 lactated Ringer's solution over 30 min followed by a continuous infusion at 200 ml/hr

Figure 1. Management of category II fetal heart tracings

FIGURE 1
Algorithm for management of category II fetal heart rate tracings

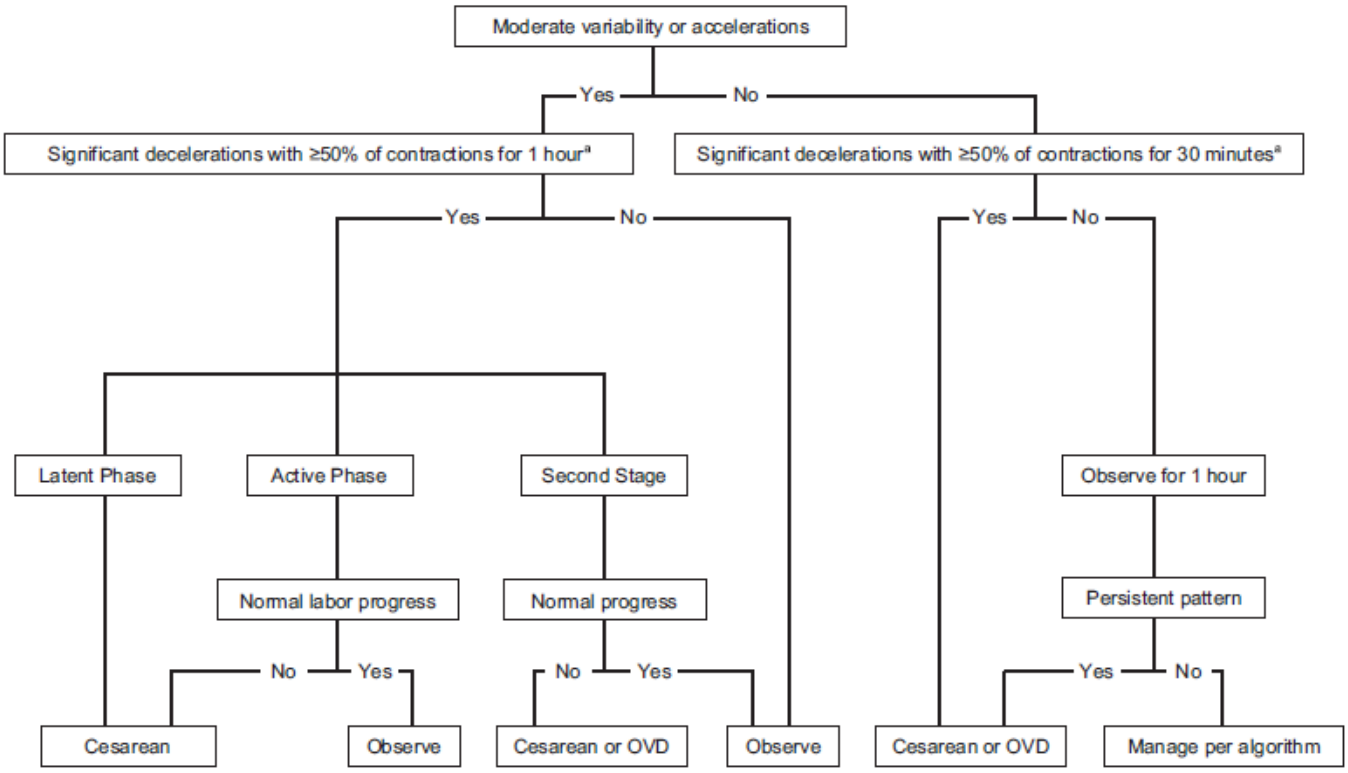

Figure 2. Clarifications for Figure 1 algorithm

TABLE
Management of category II fetal heart rate patterns: clarifications for use in algorithm

1. Variability refers to predominant baseline FHR pattern (marked, moderate, minimal, absent) during a 30-minute evaluation period, as defined by NICHD.
2. Marked variability is considered same as moderate variability for purposes of this algorithm.
3. Significant decelerations are defined as any of the following:
   - Variable decelerations lasting longer than 60 seconds and reaching a nadir more than 60 bpm below baseline.
   - Variable decelerations lasting longer than 60 seconds and reaching a nadir less than 60 bpm regardless of the baseline.
   - Any late decelerations of any depth.
   - Any prolonged deceleration, as defined by the NICHD. Due to the broad heterogeneity inherent in this definition, identification of a prolonged deceleration should prompt discontinuation of the algorithm until the deceleration is resolved.
4. Application of algorithm may be initially delayed for up to 30 minutes while attempts are made to alleviate category II pattern with conservative therapeutic interventions (eg, correction of hypotension, position change, amnioinfusion, tocolysis, reduction or discontinuation of oxytocin).
5. Once a category II FHR pattern is identified, FHR is evaluated and algorithm applied every 30 minutes.
6. Any significant change in FHR parameters should result in reapplication of algorithm.
7. For category II FHR patterns in which algorithm suggests delivery is indicated, such delivery should ideally be initiated within 30 minutes of decision for cesarean.
8. If at any time tracing reverts to category I status, or deteriorates for even a short time to category III status, the algorithm no longer applies. However, algorithm should be reinstituted if category I pattern again reverts to category II.
9. In fetus with extreme prematurity, neither significance of certain FHR patterns of concern in more mature fetus (eg, minimal variability) or ability of such fetuses to tolerate intrapartum events leading to certain types of category II patterns are well defined. This algorithm is not intended as guide to management of fetus with extreme prematurity.
10. Algorithm may be overridden at any time if, after evaluation of patient, physician believes it is in best interest of the fetus to intervene sooner.

FHR, fetal heart rate; *NICHD*, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development.

Clark. Category II FHRT. Am J Obstet Gynecol 2013.

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Obstetrical Use of Misoprostol (Cytotec®)

[August 2022 (replaces September 2021)]

Summary

The BCM OB/Gyn Perinatal Guidelines Committee therefore makes the following recommendations:[1]

1. If misoprostol is used for cervical ripening in the third trimester, 25 mcg intravaginally or 100 mcg orally should be considered; the route of administration should remain consistent throughout the cervical ripening process.
2. Intravaginal 25 mcg doses should be administered every 3-4 hours, with clinical correlation (i.e. taking into account the uterine contraction pattern and maternal-fetal status at the time), up to a maximum of 8-6 total doses, respectively.
3. Oxytocin should not be administered less than 4-6 hours after the last misoprostol dose, with clinical correlation (i.e. taking into account the uterine contraction pattern and maternal-fetal status at the time).
4. Misoprostol should not be used in the third trimester for cervical ripening in those patients with previous transmural hysterotomy (e.g. cesarean section), non-reassuring fetal status or oligohydramnios.
5. For midtrimester induction of labor for fetal demise or for a medically indicated termination of pregnancy, misoprostol 400 mcg vaginally or sublingually every 3 hours for up to 5 doses or a vaginal loading dose of 600-800 mcg followed by 400 mcg vaginally or sublingually every 3 hours is an appropriate option. This regimen may be safely used in people with a prior cesarean delivery, although these people are likely at increased risk for uterine rupture with any termination method employed. Osmotic cervical dilators (e.g. laminaria) do not provide added benefit to induction with prostaglandin analogues.[2]
6. Following midtrimester induction of labor with misoprostol, 10 units of IM oxytocin into the upper thigh should be administered after fetal delivery since it significantly increases placental expulsion rates and decreases short-term postpartum blood loss.
7. For postpartum hemorrhage from uterine atony, misoprostol 400 mcg can be safely used sublingually, orally, or rectally.

Dosing

The optimal dose and timing interval of intravaginal misoprostol, synthetic PGE1 analogue, are unknown. A randomized double-blind trial found that a dose of 50 mcg every 3 hours was associated with a shorter start-to-delivery interval and a higher incidence of vaginal delivery after one dose, but that 25 mcg every 3 hours was effective as well and associated with a lower incidence of tachysystole and cord pH values < 7.16.[3] In comparing the 25 mcg dose given every 3 hours vs. every 6 hours, patients with the 6 hour dosing schedule had longer intervals to delivery, more frequently required oxytocin augmentation and had more failed inductions.[4]

With orally administered misoprostol, the plasma concentration peaks earlier and higher than with vaginal administration, however, the plasma concentrations are detectable for longer after vaginal administration.[5] Giving 100 mcg of misoprostol orally every 4 hours has been shown to be as effective as vaginal administration of 25 mcg every 4 hours, with no differences in maternal or neonatal outcomes.[6]

Nonviable pregnancies

For midtrimester induction of labor in the setting of fetal demise or a medically indicated termination of pregnancy (eg, previable preeclampsia with severe features), high doses of misoprostol have been employed. A dosing regimen of 400 mcg intravaginally every 6 hours has been shown to be effective.[7] When this regimen was compared to 400 mcg orally every 3 hours, the vaginal route was found to be superior.[8] ACOG now recommends either of the following regimens: 1) 400 mcg administered vaginally or sublingually every 3 hours for up to 5 doses. If delivery is not effected after 5 doses, the woman may be allowed to rest for 12 hours before starting the cycle again. The vaginal dosage is superior to sublingual dosage for nulliparous people; or 2) a vaginal loading dose of 600-800 mcg followed by 400 mcg vaginally or sublingually every 3 hours.[2] In a randomized clinical trial of third-stage management after misoprostol second-trimester pregnancy termination, a single intramuscular injection of 10 units of oxytocin was superior in terms of achieving a significant reduction in the need for operative placental removal and postpartum blood loss compared with a single 600 mcg oral dose of misoprostol or a nonpharmacologic approach to the management of the third stage. Interventions to facilitate placental removal if it has not occurred spontaneously by 2 hours after delivery is recommended as the likelihood of spontaneous expulsion after this time is low.[9]

History prior CD

Misoprostol has not been recommended for cervical ripening in patients who have had prior cesarean delivery or major uterine surgery because of the risk of uterine rupture.[10] However, in a review of 101 people with at least one prior cesarean delivery undergoing abortion at 14 - 28 weeks' gestation with misoprostol, there was no case of uterine rupture or hysterectomy. During the study, 6 dosage regimens of misoprostol were used, with the most frequent dose was 400 mcg intravaginally every 6 hours.[11]

Uterotonic

Finally, misoprostol can be used as a uterotonic for postpartum hemorrhage due to uterine atony. The time to onset of misoprosol is longer than other uterotonics, so it should be considered after methergine, hemabate, and pitocin. Recommended dose ranges are 400 mcg - 1000 mcg, and the routes of administration are oral, rectal and buccal. After oral administration, uterine tonus develops, which is not followed by uterine contractions unless repeated doses are given. Studies have shown that doses higher than 400 mcg increase side effects and may not increase effectiveness.[1,5]

Route	Onset of Action	Duration of Action
Oral	8 min	~2 hrs
Sublingual	11 min	~3 hrs
Vaginal	20 min	~4 hrs
Rectal	100 min	~4 hrs

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Miscellaneous Guidelines

Trauma in Pregnancy

[June 2022]
Author: Dr. Christina Davidson
Editor: Dr. Sarah Tounsi

Background

Blunt abdominal trauma is the leading type of traumatic injury in pregnancy, with motor vehicle crashes, falls, and assault being the most common etiologies. Several adverse outcomes can occur in pregnancy, including placental abruption, preterm labor and preterm delivery, uterine rupture, and pelvic fracture. An algorithm for management of trauma in pregnancy should be used at all sites caring for pregnant women (**Figures 1 and Figure 2**). An alignment of policies within each system optimizes appropriate triage, integration of care, management, and monitoring of pregnant trauma patients and their fetuses.[1] Management of penetrating injuries (stabbing, gunshot wound, impaled by object) will depend largely on the entrance location of the wound and the gestational age. Visceral injuries are less likely when the entry site is anterior and below the uterine fundus. Penetrating injuries are more likely to affect the fetus, especially those anterior and below the uterine fundus.[2]

If there is penetrating trauma or major blunt trauma that results in injury of the patient greater than minor bruising, lacerations or contusions (such as gross injury or deformity, concern for head or spinal injury, loss of consciousness, or severe neck or back pain), the patient should be evaluated first in the Emergency Center for trauma survey and clearance; they should not be bedded initially in Ob triage.

- At TCH, the patient should be evaluated first in the West Tower Emergency Center (**Figure 3**, which can be found at http://connect2depts.texaschildrens.org/depts/1/Emergency%20Medicine%20Physicians/SitePages/Physicians.aspx). Following EC evaluation and clearance, the patient can be transferred to WAC for further evaluation and monitoring by the Obstetric team.
- At Ben Taub Hospital, the patient should be evaluated first in the Emergency Center (refer to Ben Taub Hospital Department Guideline No: T-12 on the pregnant trauma patient at https://apps.hchd.local/sites/dcc/Policy/Departmental/Women%20Infants%20and%20Children/T-12%20Pregnant%20Trauma%20Patient-BT.pdf). Following EC evaluation and clearance, the patient can be transferred to OBI for further evaluation and monitoring by the Obstetric team.
- The Obstetric team should evaluate the patient in the EC upon arrival and prior to transfer to WAC or OBI and initiate continuous fetal heart rate monitoring in pregnancies of at least 24 0/7 weeks gestation.
- Patients who suffered minor trauma (minor bruising, lacerations or contusions) will be evaluated and treated exclusively in WAC and OBI.

Figure 1. Evaluation and Management of Trauma in Pregnancy in *Viable* Gestations[1]

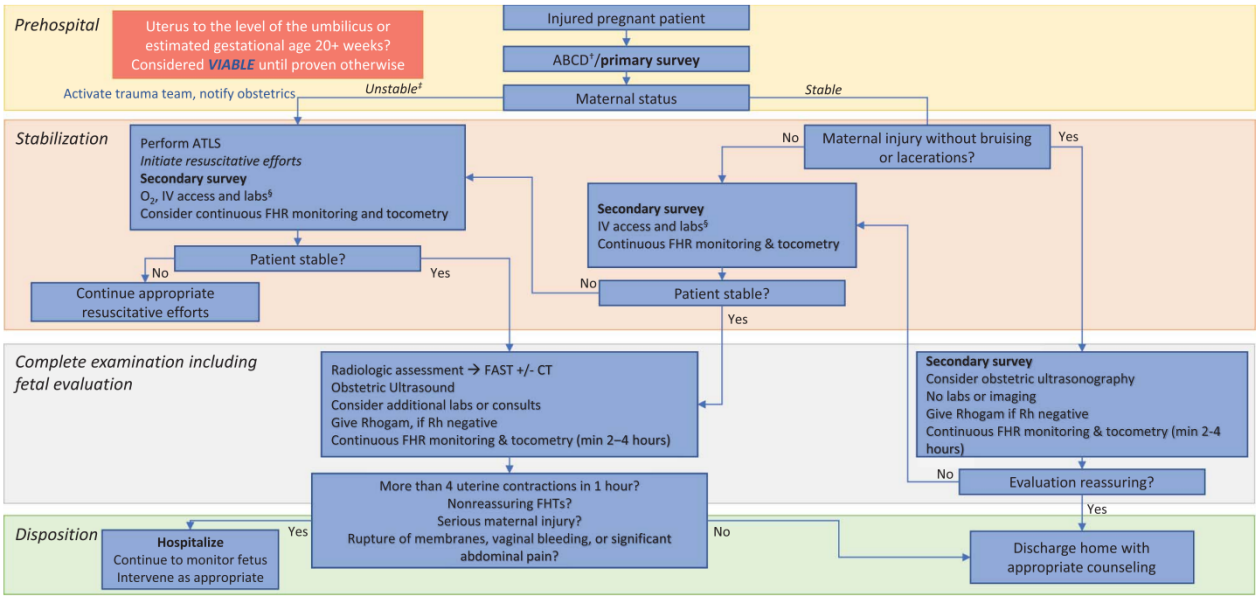


Fig. 1. Evaluation and management of trauma in pregnancy in viable* gestations. *Viable defined as 22–24 weeks of gestation; varies by region. †ABCD: airway, breathing, circulation, displacement (ensure left lateral tilt of patient). ‡Unstable: cardiac arrest, unresponsive, loss of airway or respiratory arrest, blood pressure less than 80/40 or heart rate less than 50 or greater than 140 beats per minute (bpm), viable fetus with fetal heart rate (FHR) less than 110 or greater than 160 bpm. §Laboratory values: if unstable: complete blood count, coagulation profile, fibrinogen, fetal maternal hemorrhage screen, type and screen, creatinine±arterial blood gas; if stable: complete blood count, coagulation profile, fibrinogen, fetal maternal hemorrhage screen, type and screen. ATLS, *Advanced Trauma Life Support*; IV, intravenous; FAST, focused abdominal sonography for trauma; CT, computed tomography; FHT, fetal heart tone.

Greco. Management of Abdominal Trauma in Pregnancy. Obstet Gynecol 2019.

Figure 2. Evaluation and Management of Trauma in Pregnancy in *Non-Viable* Gestations[1]

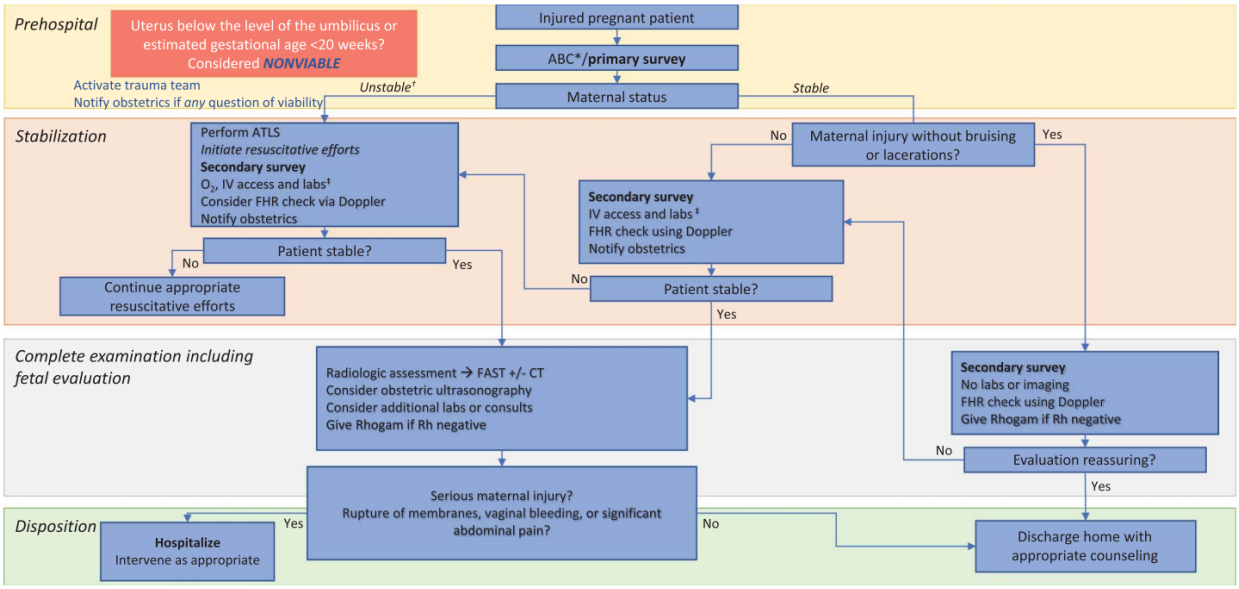
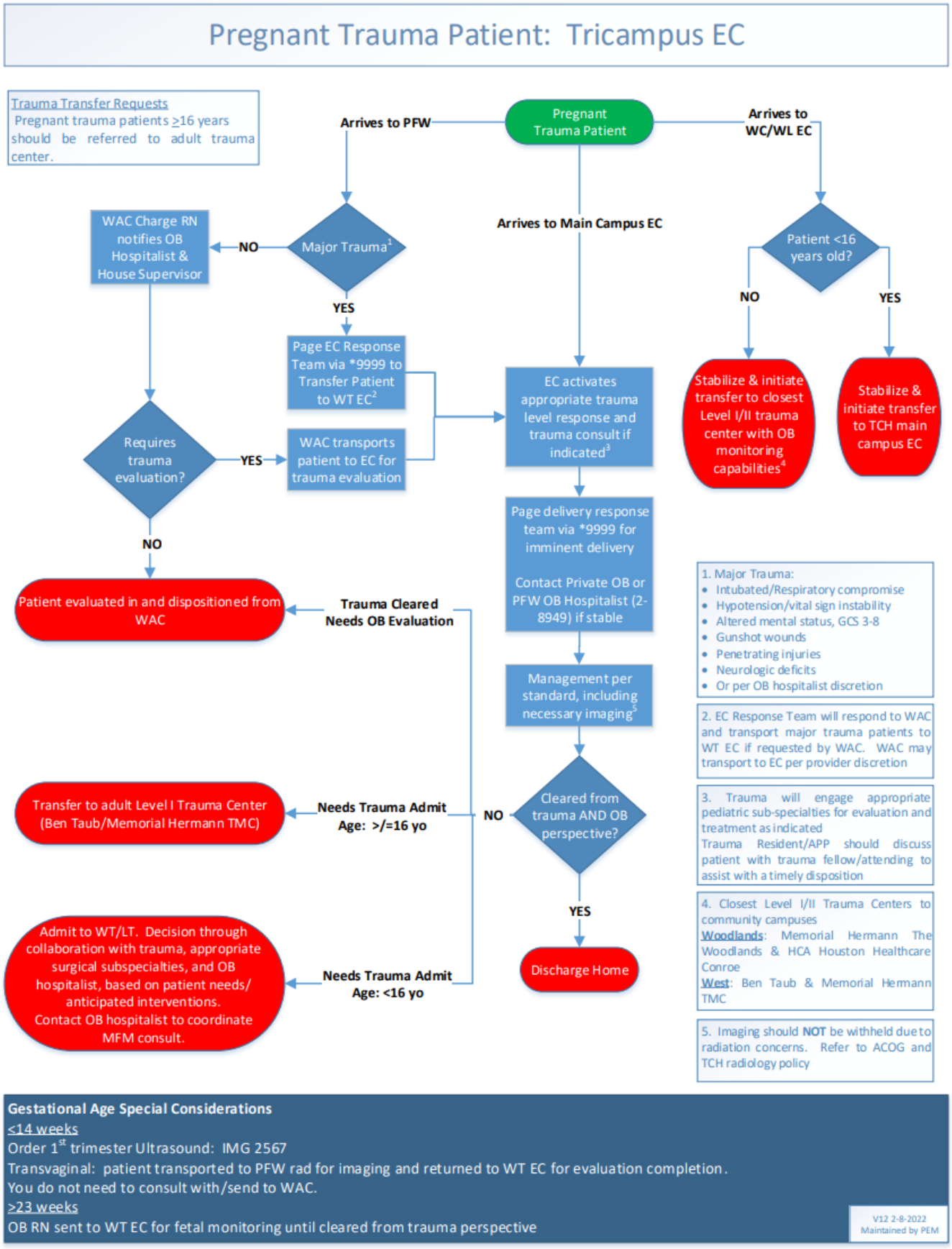


Fig. 2. Evaluation and management of trauma in pregnancy in nonviable gestations. *ABC: airway, breathing, circulation. †Unstable: cardiac arrest, unresponsive, loss of airway or respiratory arrest, blood pressure less than 80/40 or heart rate less than 50 or greater than 140 beats per minute (bpm), viable fetus with fetal heart rate (FHR) less than 110 or greater than 160 bpm. ‡Laboratory values: if unstable: complete blood count, coagulation profile, fibrinogen, fetal maternal hemorrhage screen, type and screen, creatinine±arterial blood gas; if stable: complete blood gas, coagulation profile, fibrinogen, fetal maternal hemorrhage screen, type and screen. ATLS, *Advanced Trauma Life Support*; IV, intravenous; FAST, focused abdominal sonography for trauma; CT, computed tomography.

Greco. Management of Abdominal Trauma in Pregnancy. Obstet Gynecol 2019.

Figure 3. Management of the Pregnant Trauma Patient at Texas Children's Hospital



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Carbon Monoxide Poisoning and Hypothermia

October 2024 [Replaces February 2021]
Author: Dr. Carey Eppes
Editor: Dr. Lexie Hammerquist

This guideline was updated with gender inclusive language

Carbon Monoxide Poisoning

Carbon monoxide (CO), an odorless, colorless gas, which can cause sudden illness and death. It can be produced by gas or oil burning furnaces, portable generators, charcoal grills and any time a fossil fuel is burned.

The below information was obtained from references[1-4] and some information is copied directly from the CDC Website.

For Patients

- **Do** have your heating system, water heater and any other gas, oil, or coal burning appliances serviced by a qualified technician every year.
- **Do** install a battery-operated or battery back-up CO detector in your home. Check or replace the battery when you change the time on your clocks each spring and fall. If the detector sounds leave your home immediately and call 911.
- **Do** seek prompt medical help if you suspect CO poisoning and are feeling dizzy, light-headed, or nauseated.
- **Don't** use a generator, charcoal grill, camp stove, or other gasoline or charcoal-burning device inside your home, basement, or garage or near a window.
- **Don't** run a car or truck inside a garage attached to your house, even if you leave the door open.
- **Don't** burn anything in a stove or fireplace that isn't vented.
- **Don't** heat your house with a gas oven.
- **Don't** use a generator, pressure washer, or any gasoline-powered engine less than 20 feet from any window, door, or vent. Use an extension cord that is **more than 20 feet long** to keep the generator at a safe distance.

For Providers

The signs and symptoms of CO exposure are variable and nonspecific. A tension-type headache is the most common symptom of mild CO poisoning. Other common symptoms of CO poisoning are dizziness, weakness, drowsiness, upset stomach, vomiting, chest pain, and confusion.[3]

Clinical manifestations of severe CO poisoning are a result of impaired oxygen delivery and utilization and respiration at a cellular level, especially in the cardiologic and neurologic systems. Common signs include: tachycardia, tachypnea, hypotension, metabolic acidosis, dysrhythmias, myocardial ischemia or infarction, noncardiogenic pulmonary edema, irritability, impaired memory, cognitive and sensory disturbances, ataxia, altered or loss of consciousness, seizures, coma, and death, although any organ system might be involved.

CO poisoning can be fatal to anyone, but particularly high-risk populations include children, pregnant people and the fetus, persons with sickle cell disease, older adults, and persons with chronic illness (e.g., heart or lung disease)

The effects of CO poisoning on the developing fetus depend greatly on the gestational age of exposure and the dose. As a general rule, fetal injury is more likely when acute maternal CO poisoning is associated with more severe symptoms such as loss of consciousness. An anoxic event during the early gestational ages of embryogenesis or shortly after may be associated with anatomical malformations such as limb abnormalities or microcephaly, specifically in fetuses that survive to viability. At later gestational ages, severe exposures can be associated with the fetal neurological sequelae of anoxia, including but not limited to hypoxic ischemic encephalopathy, hypotonia, and cerebral palsy. Mortality rates for fetuses may be as high as 67% in severe intoxications. Generally, mild maternal exposures presenting with only headaches and nausea are more likely to result in favorable fetal outcomes.

Pregnant people poisoned with CO should be hospitalized and fetal monitoring should be provided. Affinity of CO to hemoglobin is stronger in fetus compared with other age groups. In event of CO poisoning, fetal COHb level will be higher than that of mother, and clearance is 5 times slower. Fetal COHb value returns to normal level 40 hours after COHb level normalizes in mother. Fetal involvement can occur even if maternal CO level is not toxic. Therefore, when compared with other cases of CO poisoning, HBO treatment is initiated at lower maternal CO level in pregnant people, and is more aggressive and longer lasting in order to protect the fetus. No correlation has been determined between fetal death and maternal COHb level. Nonetheless, CO exposure may have teratogenic effects of physical deformity, psychomotor disability, or miscarriage. Despite administration of HBO, in cases of CO poisoning during third trimester, adverse effects on fetal brain have been reported.

Management of Suspected CO Poisoning

1. Assess symptoms and recent patient activities that point to likely CO exposure. Evaluation should also include examination for other conditions, including smoke inhalation, trauma, medical illness, or intoxication. Remove from the source of CO.
2. Administer 100% oxygen until the patient is symptom-free or until a diagnosis of CO poisoning has been ruled out.
3. Perform carboxyhemoglobin (COHgb) testing when CO poisoning is suspected.
    - Venous or arterial blood may be used for testing.
    - A fingertip pulse multiple wavelength spectrophotometer, or pulse CO-oximeter, can be used to measure heart rate, oxygen saturation, and COHgb levels in the field, but any suspicion of CO poisoning should be confirmed with a COHgb level by multiple wavelength spectrophotometer (CO-oximeter).
    - A conventional two-wavelength pulse oximeter is not accurate when COHgb is present.
4. **An elevated COHgb level of 2% or higher for non-smokers and 9% or higher COHgb level for smokers strongly supports a diagnosis of CO poisoning**.

- The COHgb level must be interpreted in light of the patient's exposure history and length of time away from CO exposure, as levels gradually fall once the patient is removed from the exposure.
- In addition, CO can be produced endogenously as a by-product of heme metabolism. Patients with sickle cell disease can have an elevated COHgb level as a result of hemolytic anemia or hemolysis. Additional information about interpretation of COHgb levels can be found within the Clinical Guidance, or call your local Poison Control at (800) 222-1222.

5. Hyperbaric oxygen (HBO) therapy should be considered in consultation with a toxicologist, hyperbaric oxygen facility, or Poison Control Center (800) 222-1222. For additional management considerations, consult a medical toxicologist, Poison Control at (800) 222-1222, or a hyperbaric oxygen facility**. HBO should be considered if there is loss of consciousness, visual impairment, and any clinical findings persisting for more than 3 weeks.**
    - HBO is not advisable for pregnant patients except for CO poisoning. In a case series of 32 pregnant patients, it was observed that HBO treatment under 2.4 ATA pressure for 120 min had no harmful effects on the mother and the fetus. Note that HBO is contraindicated if acute pneumothorax.
6. Be aware that CO exposure may be ongoing for others spending time in or near the same environment as the patient. These individuals should be evaluated and tested as described in this advisory.
7. Healthcare professionals treating people for CO poisoning should notify emergency medical services (EMS), the fire department, or law enforcement to investigate and mitigate the source and advise people when it is safe to return.
8. Advise patients about the CDC's Generator Safety Fact Sheet. There is also risk for CO poisoning with grills, camp stoves, or other gasoline, propane, natural gas, or charcoal-burning devices. Stress that that these devices should never be used inside an enclosed space, home, basement, garage, or camper — or even outside near an open window or window air conditioner.

Hypothermia in Pregnancy[5-8]

What is hypothermia?

- Hypothermia is caused by prolonged exposure to very cold temperatures. When exposed to cold temperatures, your body begins to lose heat faster than it's produced. Lengthy exposures will eventually use up your body's stored energy, which leads to lower body temperature.
- Hypothermia occurs when the core body temperature drops below 95°F (35°C).
- Body temperature that is too low affects the brain, making the victim unable to think clearly or move well. This makes hypothermia especially dangerous, because a person may not know that it's happening and won't be able to do anything about it.
- While hypothermia is most likely at very cold temperatures, it can occur even at cool temperatures (above 40°F) if a person becomes chilled from rain, sweat, or submersion in cold water.

Signs and symptoms of hypothermia

Adults

- Shivering
- Exhaustion or feeling very tired
- Confusion
- Fumbling hands
- Memory loss
- Slurred speech
- Drowsiness
- Very low energy

Babies

- bright red, cold skin
- very low energy

Risks of Hypothermia

Life threatening cardiac arrhythmias or hypotension may result from hypothermia. Patients with cardiac disease, medical complications of pregnancy, or excessive blood loss are at increased risk for complications. Based on post-anesthesia literature in pregnancy, an increase in myocardial work occurs during rewarming.

Swiss Staging System for Hypothermia

Stage	Symptoms	Suspected core temperature
I	Conscious and shivering	89.6 to 95°F (32 to 35°C)
II	Altered mental status, not shivering	82.4 to 89.6°F (28 to 32°C)
III	Unconscious, not shivering, vital signs present	75.2 to 82.4°F (24 to 28°C)
IV	No vital signs	< 75.2°F (< 24°C)

Information from references 13 and 14.

Blood volume is decreased in hypothermic patients because of intense peripheral vasoconstriction and fluid shifts from intravascular to extravascular spaces. Heart rate and cardiac output subsequently fall. Initial hypertension is followed by hypotension with rewarming, and a greater intravascular volume is demanded.

Cardiac arrest is more likely below 20°C [9]. Enzymatic activity is also severely affected at low temperatures, which is especially relevant for appropriate coagulation in the obstetric patient, placing them at increased risk of platelet dysfunction and disseminated intravascular coagulation.

The association between maternal temperature and fetal heart rate is not completely understood; however, it is known that hyperthermia is associated with fetal tachycardia, and hypothermia correspondingly with fetal bradycardia. A case report of accidental maternal hypothermia demonstrated fetal bradycardia that resolved with maternal re-warming.

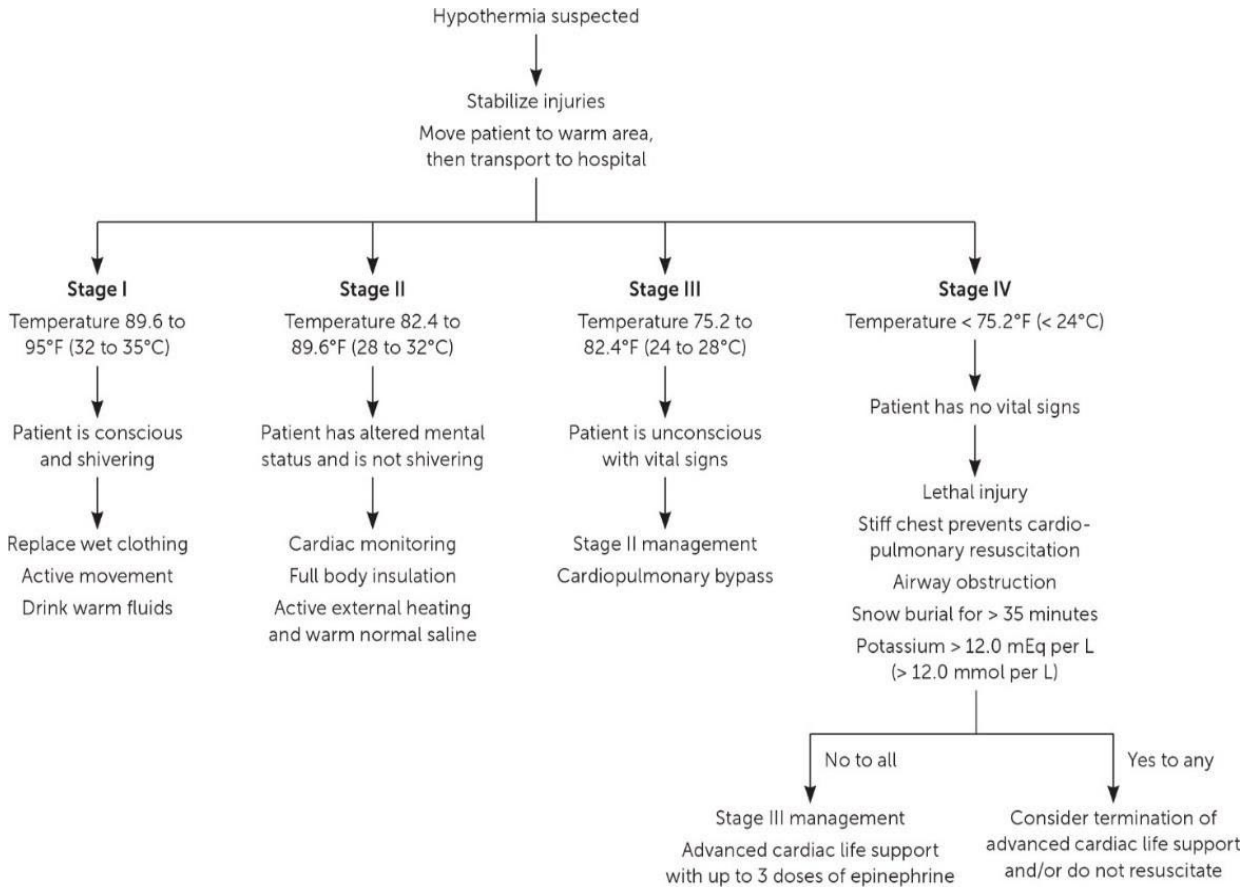
Management of Hypothermia

Initial treatment of hypothermia should be based on symptoms alone, with core temperature used to confirm staging and to aid management decisions. Thermometers capable of reading low temperatures are essential because many standard thermometers do not read below 94°F (34.4°C). The use of rectal thermometers may be inadvisable in the field because exposure can increase heat loss. When accurate measurement of core temperature is not practical, management decisions should be based on the Swiss Staging System.

In anticipation of possible cardiac dysrhythmia, cardiac monitoring should be used for high-risk patients and anti-dysrhythmic agents should be available. In addition, continuous administration of warmed oxygen may be indicated. **Because vasoconstriction also may be associated with hemodynamic instability, blood pressure and heart rate should be monitored every 5-15 minutes until the patient's temperature reaches ~95 degrees F. To avoid profound hypotension in patients who are volume depleted, adequate volume replacement is essential in conjunction with rewarming.**

When fluid resuscitation is warranted, normal saline is preferred over lactated Ringer solution because hypothermic patients cannot effectively metabolize lactate. Fluids should be warmed to 100.4 to 107.6°F (38 to 42°C). Passive heat transfer from warmed crystalloids allows for symmetric internal rewarming. Patients who have cardiac instability (e.g., systolic blood pressure less than 90 mm Hg, ventricular arrhythmias, core temperature less than 82.4°F) or who are in cardiac arrest should be transported to a center capable of providing cardiopulmonary bypass services. Survival without significant neurologic impairment may be possible for extended periods of time because of the decrease in total body metabolic demand and a concomitant decrease in cerebral oxygen requirements. In most circumstances, hypothermic patients should be rewarmed—ideally to a core temperature of 98.6°F— before pronouncing death. However, terminating or avoiding advanced cardiac life support without rewarming is advisable for hypothermic patients with lethal injury, a stiff chest, airway obstruction, snow burial for more than 35 minutes, or serum potassium level greater than 12.0 mEq per L (12.0 mmol per L).

Figure 1. *Management of Hypothermia*



Frostnip and Frostbite

Frostnip is a self-limiting process that presents similarly to frostbite, with hyperesthesia, paresthesia, and pallor. However, there is no tissue loss when the area is warmed, and symptoms resolve within 10 minutes. The extremities and face are most commonly affected. The time between frostnip and frostbite varies depending on the severity of environmental exposure, presence or lack of insulating clothing, and use of medications or recreational drugs. Frostnip should be addressed at the onset of symptoms.

Frostbite is a freezing injury in which initial cooling causes vasoconstriction and localized ischemia. Continued exposure leads to ice crystal formation that causes cellular lysis, electrolyte abnormalities, and microvascular occlusion. Rewarming causes an inflammatory response, which increases the risk of thrombosis and reperfusion injuries. This process is worsened if tissue is allowed to re-freeze.

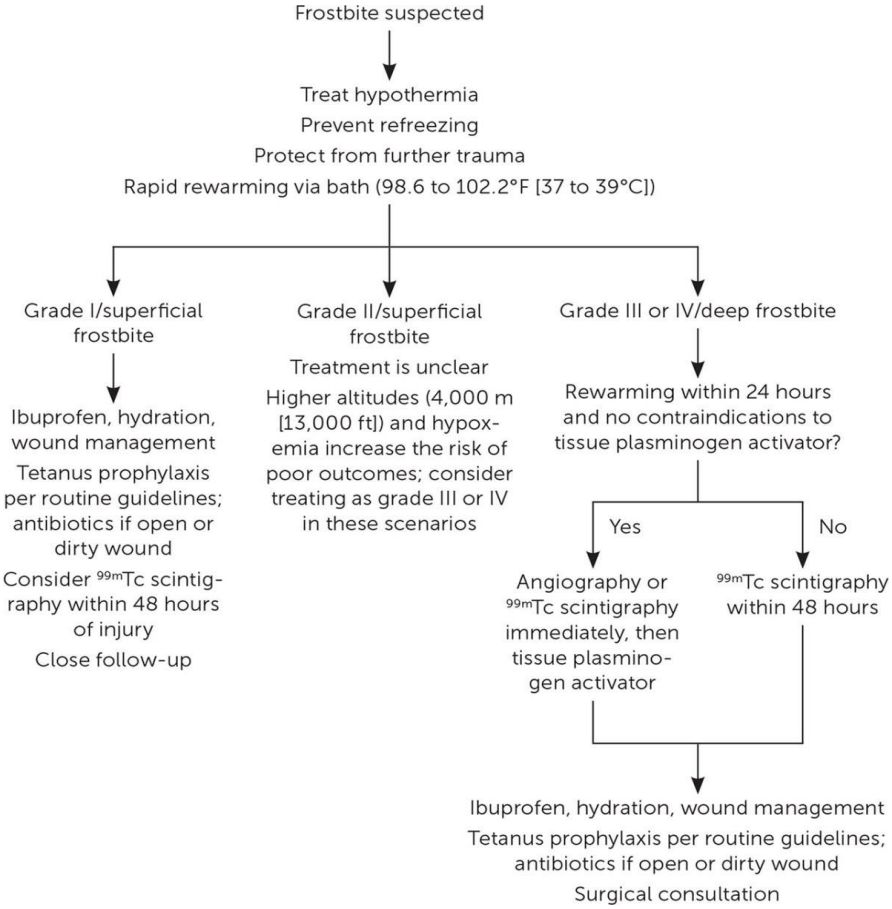
Traditional Frostbite Grading System

Grade	Presentation
First degree (superficial)	Edema, pallor, and erythema; slightly raised plaque; no blisters; absent to minimal tissue loss
Second degree (superficial)	Clear blisters with edema and erythema; absent to minimal tissue loss; blisters develop 6 to 24 hours after rewarming[1]
Third degree (deep)	Hemorrhagic blisters suggest subcutaneous or dermal involvement; black eschar develops over weeks; tissue loss
Fourth degree (deep)	Muscle and/or bone involvement; mummification and gangrene; full-thickness tissue loss; absence of blisters in deep frostbite is a poor prognostic factor[1]

Note: Frostbite severity may take several weeks to completely assess and is difficult to assess before rewarming.

Information from references 1, 16, and 18-20.

Figure 2. Diagnosis and Management of Frostbite



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Breastfeeding Guidelines for Medically Complex Patients

[October 2025]

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This guideline has been developed collaboratively with MFM and neonatology at PFW and Ben Taub Hospital.

Highlights

- Many medications are compatible with breastfeeding and review of available literature is important before counseling a patient who is on any medication
- Readily available evidence-based resources to help guide patient counseling include InfantRisk, E-lactancia, Reprotox, and Lactmed.
- Patients should **never** be told to “pump and dump” or stop breastfeeding based on medication use alone without review of evidence for each individual medication.

How safety of medications in breastfeeding determined

- In general, medications that have a low molecular weight, low protein binding, high lipid solubility, a weak base, have a low volume of distribution, or a high oral bioavailability pass into breastmilk in higher quantities.[1]
- General principals to consider:
    - If something is safe to give to infants by mouth, then even if a small amount is transferred in small amounts through milk, then it should still be safe.
    - Highly protein bound or large molecules do not pass into breastmilk easily.

- If a medication is not bioavailable when taken orally, then it will not be in an active form in the infant if consumed through breastmilk.

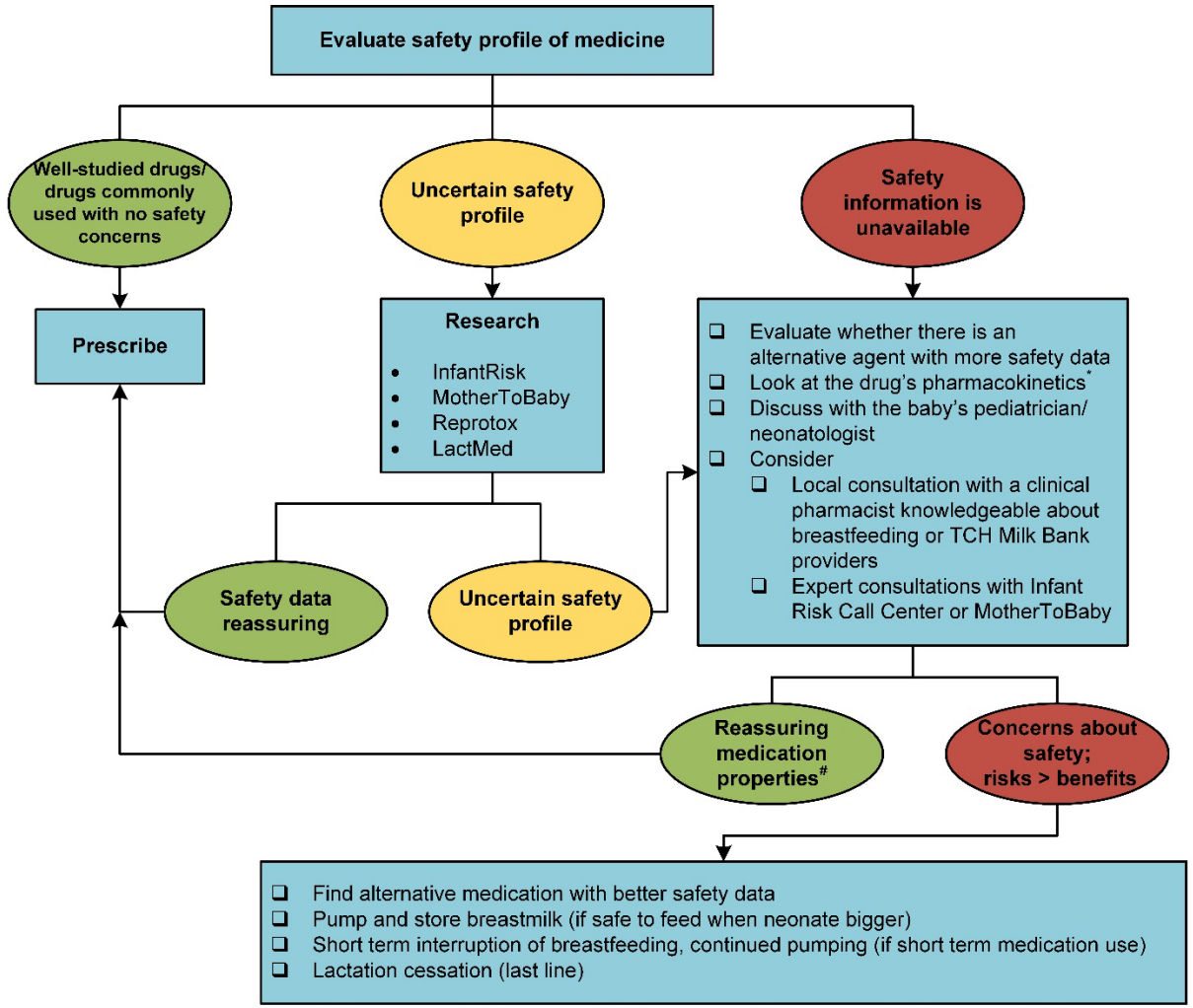
Considerations for Certain Medical Conditions

Breastfeeding is rarely contraindicated based on medical condition. However, in specific conditions where sleep deprivation may affect medical management,

- HIV[2]
  - Evidence-based, patient-centered counseling should be provided to all people living with HIV to support shared decision-making about infant feeding. Counseling should be multi-disciplinary (including obstetric, infectious disease, and pediatric teams) and include information about the importance of achieving and maintaining viral suppression to reduce the chance of lactational transmission to less than 1% but not zero; replacement feeding (formula or donor human breastmilk) eliminates this risk. Counseling should be personalized based on each person's clinical and HIV history. Regardless of infant feeding choice, people who chose to feed their infant breastmilk or formula should be supported in their goals. Engaging Child Protective Services or similar agencies is not an appropriate response to infant feeding choices impacted by HIV. Providers are encouraged to contact the National Perinatal HIV/AIDS Hotline (1-888-448-8765) with HIV-related questions about infant feeding.
- Epilepsy[3]
  - Breastfeeding is often compatible with most anti-seizure medication. While breastfeeding itself does not increase seizure risk, the associated sleep changes and deprivation can increase the risk for seizures.
  - Patients should be encouraged to optimize sleep as much as possible. One option is to prioritize one 4-hour stretch of sleep between feeds overnight with a support person watching and feeding baby during that time.
  - Consider sitting in a low chair or on the floor to breastfeed to reduce the risk of infant falls in the event of a seizure
  - As with all families, parents with epilepsy should be strongly discouraged from co-sleeping.
- Multiple Sclerosis
  - Breastfeeding is protective of MS flares postpartum and is encouraged.
- Cardiomyopathy[4]
  - While breastfeeding is not contraindicated in patients with Cardiomyopathy, certain medications such as Dopamine Antagonists (Bromocriptine) can reduce breastmilk supply. Most other medications utilized in patients with heart failure are safe and compatible with breastfeeding. In this setting the benefits and risks of this medication should be discussed and decision to breastfeed should be individualized based on shared decision making and clinical factors.
- Substance Use Disorder- refer to Substance Use Disorder Perinatal Guideline.
- Patients who desire to breastfeed but encounter challenges or are unable to breastfeed
  - The clinical team staff including lactation specialists, nurses, and physicians from OB/Gyn and Pediatrics teams can help the patient process and determine the best alternative feeding practice for their infant.
  - The patients should be offered supportive services including access to Social Work, Psychology and Psychiatry as this limitation may differ significantly from their postpartum expectations. Breastfeeding challenges have been linked to development of postpartum mood disorders.[5] All care team members should be cognizant and respectful of this association.
- Patients who are critically ill
  - Infant feeding plans should be discussed early in pregnancy, throughout prenatal care, and during the hospital admission process.
  - Patients who are critically ill postpartum may be unable to utilize the breast pump or directly breastfeed for a significant period of time, which may reduce long term success for breastfeeding.
  - For patients who expressed a desire to breastfeed, lactation specialists should be consulted to help provide lactation support. This may include help with assistance with placing the breast

pump or manual expression and milk collection for patients who are mechanically ventilated or unable to do so themselves for whatever reason. Pumping may also decrease the risk of postpartum engorgement and/or mastitis (if frequent expression is continued).

Figure 1. Decision algorithm for using medication in lactating patients based on drug data available



*Favorable Pharmacokinetic characteristics include molecular weight > 800 g/mol or Da, shorter half life, > 90% protein binding, high volume of distribution. This information can be found on UpToDate drug information but do not use UpToDate lactation recommendations.
#Dosing strategies to reduce milk transfer include dose immediately after breastfeeding (helps with drugs with shorter half lives); use the lowest dose for shortest duration necessary

Breastfeeding safety resources

When reviewing a medication's safety profile, please consider referring to multiple sources and check the source for when it was most recently updated.

Infant Risk Center

- Free call center for parents and clinicians (0800-1500 CST): 806-352-2519
- Phone applications
  - MommyMeds for Moms
  - InfantRisk for Healthcare Professionals
- https://infantrisk.com/infantrisk-center-resources

Reprotox

- Has summaries on the effects of medications, chemicals, and biologics on pregnancy, fetal development, fertility, and lactation safety
- Paid subscription, but free for trainees (email reprotox@reprotox.org to obtain free subscription for medical students, residents, and fellows).
- https://reprotox.org/

E-Lactancia.org

- Free resource online in English and **Spanish**
- Available to healthcare workers and patients
- Recommended by the Academy of Breastfeeding Medicine
- https://e-lactancia.org/

LactMed

- Has information on medication levels in breastmilk, how much is passed to the infant, and possible adverse effects for the nursing infant. It also suggests therapeutic alternatives for medications that have poor safety data.
- https://www.ncbi.nlm.nih.gov/sites/books/NBK501922/

University of Rochester Lactation Study Center

- Consultation hotline: 585-275-0088
- https://www.urmc.rochester.edu/childrens-hospital/breastfeeding-lactation-medicine/lactation-study-center

Figure 2. Medication Safety by Drug Class

	Antihypertensives	Cardiac Medications	Diabetes	Anticoagulants	Anti-Rheumatic/ Immunosuppresants	Psychiatric	Analgesic	Antibiotics/ Antivirals
Compatible (L1-L2)	Captopril Enalapril Hydralazine Hydrochlorothiazide Labetalol Metoprolol Nifedipine Propranolol Verapamil	Furosemide Metoprolol Digoxin Spironolactone	Glipizide GlyburideInsulin Metformin	Enoxaparin Heparin Warfarin	Etanercept Hydroxychloroquine Prednisone	Amitriptyline Carbamazepine Fluoxetine Heloperidol Lamotrigine Methylphenidate Olanzapine Nortriptyline Paroxetine Quetiapine Risperidone Sertraline Trazodone Venlafaxine	Acetaminophen Gabapentin Hydrocodone Ibuprofen Ketorolac Oxycodone	Acyclovir Azithromycin Aztreonam Cefazolin Ceftriaxone Cephalexin Clindamycin Gentamicin Hydroxyzine[$] Oseltamavir Metronidazole Nitrofurantoin Pip/Tazo Valacyclovir
Likely Compatible (L3)	Amlodipine Atenolol Candesartan Carvedilol Aprosartan Ibesartan Lisinopril Losartan Traimeterine Valsartan		Exenatide Liraglutide Pioglitazone Semiglutide	Dabigatran Rivaroxaban (**Xarelto**)	Azathioprine Cyclosporine Infliximab Rituximab Sulfasalazine Tacrolimus	Aripiprazole[^] Clozapine* Dextroamphetamine Duloxetine Guanfacine* Haloperidol Lurasidone Lorazepam Mirtazapine	Ketamine Pregabalin	Ciprofloxacin Doxycycline Meropenem Paxlovid Trimethoprim/ Sulfamethoxazole[#] Levaquin
Hazardous (L4-L5)	Chlorthalidone Minoxidil Nadolol Nitroprusside Terazosin	Nitroprusside	Canagliflozin Dulaglutide Empagliflozin	Apixaban (Eliquis)	Cyclophosphamide Leflunomide Methotrexate Mycophenolate	Atomoxetine Lithium* Valproic Acid		

	Cold/Flu/Allergy	Other/MISC
Compatible (L1-L2)	Second generation antihistamines (ex Loratadine, cetirizine) Diphenhydramine*	Buprenorphine Methadone
Likely Compatible (L3)	Pseudoephedrine[$] Guaifenesin	Hydroxyurea*
Hazard (L4-L5)	**Benzonatate (Tessalon Perles)[%]**	Chemotherapeutics

Medication Safety Scale adapted from InfantRisk Center

L1 – Compatible
- Extensive data suggest there is little to no risk to a breastfeeding infant. Possiblity of harm is remote.

L2 – Probably Compatible
- Limited to extensive data suggests there are only limited risks to a breastfeeding infant.

L3 – Presumed Compatible (yellow)
- No or limited data suggest this drug may be compatible in breastfeeding mothers. No studies in humans are available. Use only if the risk is justified.

L4 – Possibly Hazardous
- No data to significant data suggests there may be a possible risk to a breastfeeding infant, but the benefits from use in breastfeeding women may be acceptable despite the risk.

L5 – Hazardous
- No data to significant data suggests that this could be potentially harmful to a breastfeeding infant. Avoid if at all possible.

Unknown
- There is no data or information available.

*When used the infant should be monitored for adverse effects. Lithium has been used during lactation with monitoring of neonatal lithium levels and renal function.
[#]Bactrim is compatible in lactation especially if the infant is > 30 days old. Caution recommended in preterm infants or newborns as there is a theoretic risk of hyperbilirubinemia.
[$]Antihistamines and pseudoephedrine are technically safe but can reduce milk supply so they should be used with caution.
^Aripiprazole is technically safe but can significantly reduce milk supply when used during pregnancy or postpartum, so should be used with caution.
[%]Benzonatate (Tessalon Perles) are voltage gated sodium channel blockers and can be toxic and even fatal if children < 2 y/o ingest them. They look like candy so this risk may be higher than with other medications. **Use in breastfeeding is NOT recommended.**

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Imaging during lactation

Lactating people may require medical imaging for a variety of reasons. **The vast majority of the time, interruption in breastfeeding, "pumping and dumping", is NOT indicated.** See Table 1 for breastfeeding recommendations based on nuclear medicine study.[6]

Table 1. Common Nuclear Medicine Imaging Agents and Recommendations for Breastfeeding

Imaging agent	*Breastfeeding interruption*
Noncontrast radiographs	No
Nonvascular administration of iodinated contrast	No
CT with iodinated intravenous contrast	No
MRI with gadolinium-based intravenous contrast	No
Nuclear medicine imaging	
PET	No
Bone scan	No
Thyroid imaging	
I-131	Cessation for this infant
I-123	Recommendations vary, up to 3 weeks
Technetium-99m pertechnetate	Up to 24 hours, depending on dose
Renal imaging	
Tc-99m DTPA	No[a]
Tc-99m MAG3	No[a]
Tc-99m DMSA	No[a]
Tc-99m glucoheptonate	No[a]
Cardiac imaging	
Tc-99m Sestamibi	No[a]
Tc-99m Tetrofosmin	No[a]
MUGA	
Tc-99m RBCs in vitro	No[a]
Tc-99m RBCs in vivo	Up to 12 hours, depending on dose
VQ scan	
Tc-99m MAA	12 hours
Breast imaging	
Screening or diagnostic mammography	No
Ultrasound	No
MRI with gadolinium-based intravenous contrast	No

[a]The International Atomic Energy Administration recommends withholding breastfeeding for 4 hours or one feeding to account for any external radiation and free Tc99m pertechnetate in the product.

CT, computed tomography; MRI, magnetic resonance imaging; MUGA, multigated acquisition scan; Tc-99m MAA, technetium-99m macroaggregated albumin; PET, positron emission tomography; Tc-99m MAG3, technetium-99m mertiatide; Tc-99m DMSA, technetium-99m succimer; VQ, ventilation-perfusion.

Contact information for lactation support at PFW and Ben Taub

There is breastfeeding support 24/7 at each hospital.

- At PFW the lactation charge nurse is available 24/7 on the Voalte for questions or support.
- At Ben Taub lactation department support is available in-house from 7a to 11p daily at 713-873-9934 and on call support is available 24/7: ask the 3B charge RN to contact the on call lactation consultant. If higher level of support is needed, lactation will contact the lactation medical director, Dr. Stephanie Deal for additional assistance.

Appendix

Approach to conversations about breastfeeding for medically complex patients

These guidelines are not meant to be an exhaustive list but will include recommended resources for up-to-date information regarding medication safety with lactation. They can be used to provide patients with resources to ensure they are making informed choices regarding their breastfeeding goals.

- Breastfeeding is a personal choice, and as clinicians, we serve an important role in providing patients with accurate information about the benefits of breastfeeding and any potential risks associated with their own health.

- The American Academy of Pediatrics (AAP) recommends exclusive breastfeeding for 6 months. This is followed by the addition of complementary foods at 6 months and continued breastfeeding for up to 2 years or beyond as long as mutually desired by the mother and the child. These recommendations are in alignment with the World Health Organization. [7]

- Breastfeeding has been shown to have many health benefits for the infant and mother: [7-11]
    - Infant: lower rates of respiratory infections, severe diarrheal illness, ear infections, childhood obesity, necrotizing enterocolitis, SIDS.
    - Mother: Decreased rates of hypertension, type 2 diabetes, hyperlipidemia, cardiovascular disease, breast cancer, ovarian cancer. Improved return to pre-pregnancy weight and birth spacing.
    - Both: Increased bonding
    - These benefits must be weighed against a mother's medical comorbidities and medications that are required to help treat maternal conditions.
    - Parent's own milk is like medicine for preterm infants, as it reduces prematurity-related complications and improves survival rates.[7] Parents should be strongly encouraged to express milk, even if they don't plan to directly breastfeed long term.
        - Encourage parent to begin expressing milk within six hours of delivery.
        - Drops of milk are administered to infant in the buccal mucosa as oral immune therapy every 3-6 hours. This provides exposure to protective biofactors which can reduce premature related morbidities such as NEC and late onset sepsis.[12,13]
        - Early feedings promote intestinal maturation and healthy microbiome development in premature infants.

- Risks:
    - All medications pass into breastmilk to some extent. There are factors that increase the amount that passes into breastmilk and increase infant exposure.
    - Certain maternal disease states put the infant at increased risk of exposure through lactation. (Ex. cancer with active chemotherapy treatment).

- Alternatives[7]
    - Store breastmilk and feed when infant is older
    - During an infants' hospitalization, pasteurized donor milk may be available to be given with parental assent to infants while their mothers are pumping and working on their milk supply. Infants are not discharged home on donor milk and have to transition to formula prior to discharge.
        - At PFW donor milk is available for purchase prior to discharge. Families may purchase up to 400 mL with a cost of $10/100 mL. Contact lactation services for assistance with donor milk purchase if desired.
        - At Ben Taub donor milk is only available for infants < 1800g.
    - Formula can be used as an alternative for late preterm and term born infants.

- Formula is not introduced into a preterm infant diet (< 1500 grams birthweight) until 34 weeks postmenstrual age (PMA) due to increased risk of necrotizing enterocolitis. Preterm infants receive donor milk until 34 weeks adjusted. Patients with complex medical comorbidities have been found to have lower rates of breastfeeding initiation and breastfeed for shorter durations.[14]. Studies have shown that concerns related to medication safety during lactation can lead to inappropriate interruption and early cessation of breastfeeding.

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