Fetal Growth Restriction in Singleton Pregnancies

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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 1. 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

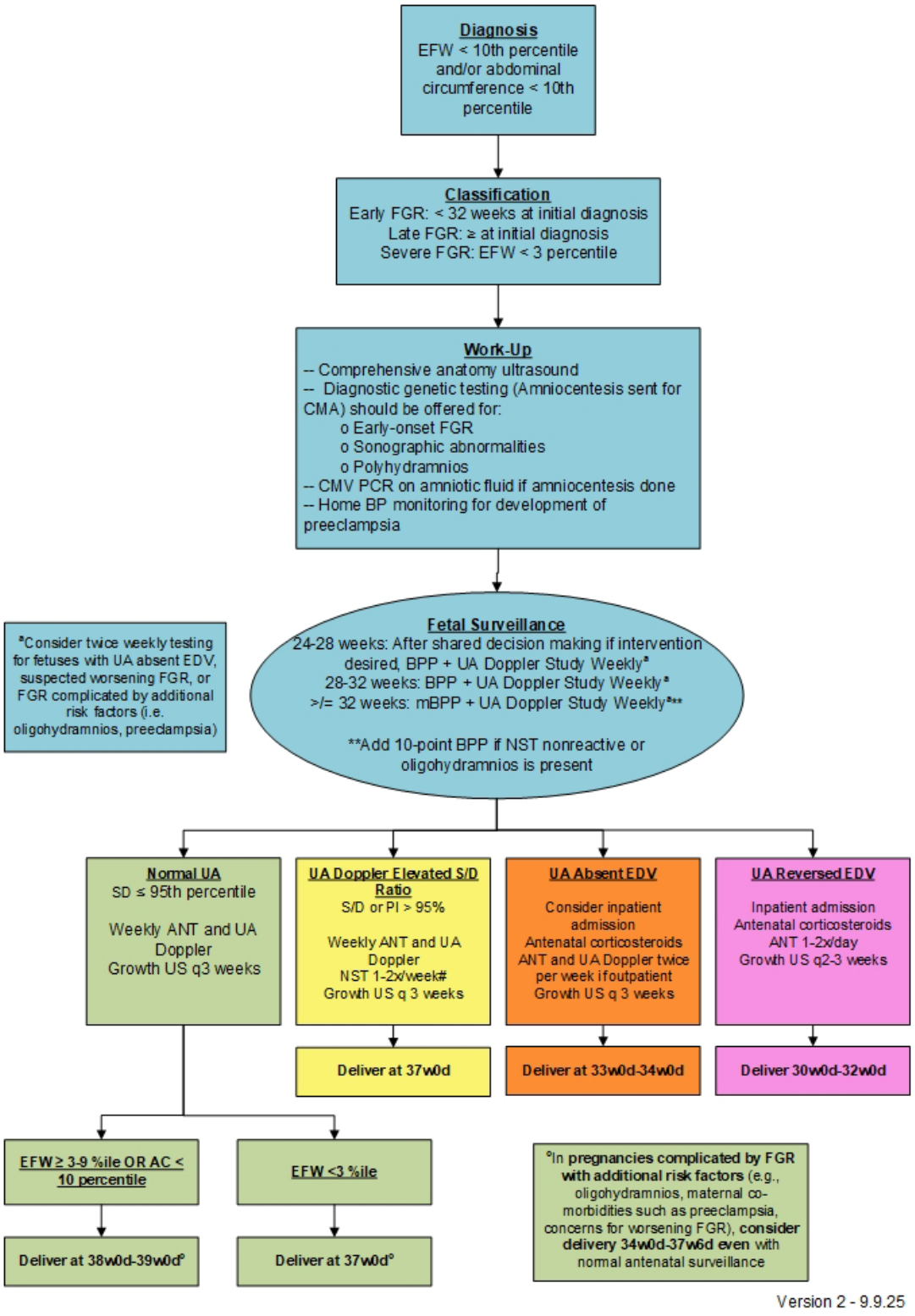
No adequately powered randomized trials are available to guide the decision for hospital admission of a patient with FGR. However, a SMFM Clinical Guideline proposes that this "may be offered once fetal testing more often than 3 times per week is deemed necessary".[3,17]

Delivery Timing

Please refer to Figure 2 for delivery timing recommendations.

Management Algorithms

Figure 2. 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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