437 Team: Obstetrics and Gynecology

Intrauterine Growth Restriction

Objectives:

- Define macrosomia and fetal growth restriction.
- Describe the etiologies of abnormal growth.
- List methods of detection for fetal growth abnormalities.
- Describe the management of fate growth abnormalities.
- Listed the associated morbidities and mortalities of fetal growth abnormalities.

References:

- Kaplan USMLE step 2 CK - Obstetrics and Gynecology
- Online Meded videos
- Team 435

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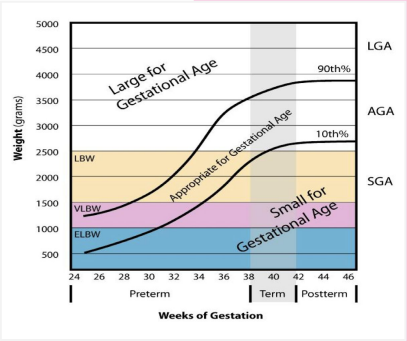
Color index: Important | Notes | Meded | Video-Case

Editing file link

Intrauterine Growth Restriction (IUGR)

- **Common definition of IUGR:** is a fetus with estimated fetal weight (EFW) <5−10th percentile for gestational age. This assumes the fetus is not growing to its genetic potential.
- **Birth Weight definition of IUGR:** is <2,500 grams (5 lb, 8 oz). Clearly, neonatal morbidity and mortality are affected by lowering birth weight. However, **70% of these fetuses are constitutionally small.**



- **Significance:** is to identify infants who are at risk of implications "morbidity and mortality". Alteration of fetal growth may have "short-term" and "long-term" implications.
  - **Short-term:** Lack of adequate reserve to continue intrauterine or even undergo the stress of labor.
  - **Long-term:** Cardiovascular disease, insulin resistance, and Obesity.
- **Dating:** Accurate early pregnancy dating is essential for making the diagnosis. An early sonogram (<20 weeks) is most accurate if conception date is unknown. **Don't change gestational age based on a late sonogram.**

Types of Intrauterine Growth Restrictions	
Early –Onset "symmetric" Growth Restriction (<32 w)	**Late-Onset "Asymmetric"** Growth Restriction (>32 w)
Growth secondary to **hyperplasia**, irreversible. Associated maternal factors: Infection, Smoking, multiple pregnancies, chronic maternal The commonest infection associated with IUGR is cytomegalovirus (CMV). Mother may have complained of flu-like illness. Fetus has sonographic findings compatible with CMV (e.g. microcephaly and cerebral calcification). **The principle differential diagnosis is:** 1. **Chromosomal** abnormality or some other genetic problem. 2. **Congenital** infection. 3. **Uteroplacental** dysfunction.	Growth secondary to **hypertrophy**, reversible. More amenable to the restoration of fetal size with adequate nutrition. Most likely cause is uteroplacental insufficiency, often associated with the development of pre-eclampsia.

Types of Intrauterine Growth Restrictions	
Symmetrical IUGR	**Asymmetrical IUGR**
• Head and abdomen both small • Etiology: Fetal (**decreased growth potential)**, i.e., aneuploidy, early intrauterine infection, gross anatomic anomaly. • All ultrasound parameters (HC, BPD, AC, FL) **are smaller than expected.** • Workup: detailed sonogram, karyotype, and screen for fetal infections. • Antepartum tests are usually **normal**.	• Head normal; abdomen small • Etiology: Maternal + Placental **(decreased placental perfusion)** due to **chronic maternal diseases** (hypertension, diabetes, SLE, cardiovascular disease) or **abnormal placentation** (abruption and infarction). • Amniotic fluid index is often decreased, especially if uteroplacental insufficiency is severe. • **Monitoring** is with serial sonograms, non-stress test, AFI, biophysical profile, and umbilical artery Dopplers

Fetal Causes "Symmetric"

- Aneuploidy (e.g., T21, T18, T13).
- Infection (e.g., TORCH).
- Structural anomalies (e.g., congenital heart disease, neural tube defects, ventral wall defects).

Placental Causes "Asymmetric"

- primary placental disease (chorioangioma, mosaicism)
- Infarction.
- Abruption.
- Win-twin transfusion syndrome (TTTS).
- Velamentous cord insertion.

Maternal Causes "Asymmetric"

- Hypertension (e.g., chronic, preeclampsia).
- Small vessel disease (e.g., SLE, long-standing type 1 diabetes).
- Malnutrition.
- Tobacco, alcohol, street drugs.
- Infections (viral, protozoal)

Risks on fetus:

1. **Intrapartum:** fetal heart rate abnormalities, C-sec. , Low Apgar scores, Cord blood acidemia.
2. **Neonatal:** Polycythemia, Hyperbilirubinemia, Hypoglycemia, Hypothermia, Apneic episodes.
3. **Long term:** Largely dependent on the etiology of the IUGR and the gestational age at delivery, increased risk of cardiovascular disorders, insulin resistant, obesity.

Diagnosis

- The **key screening tool** for fetal growth disorders in low-risk women is the assessment of **uterine size** by **fundal height measurement and clinical palpation of estimated fetal weight**. "Not accurate".
- **Ultrasonography** is **the gold standard to assess fetal weight** (by the growth parameters).
  - Biparietal diameter (BPD) "alone assess fetal size".
  - Head circumference (HC).
  - Femur length (FL).
  - Abdominal circumference(AC).
  - All together are an estimate of fetal weight.
  - Biparietal diameter (BPD) "assess fetal size". BPD + head circumference (HC), abdominal circumference (AC), and femur length (FL) are an estimate of fetal weight.
- **Umbilical artery Doppler velocimetry** Abnormal umbilical Doppler (absent or reversed end diastolic flow) can help predict fetuses at increased risk of poor fetal outcome.
- **Uterine artery systolic /diastolic (S/D):** evaluate the fetal-placental circulation, as placental resistance increases the diastolic flow decreases, therefore, there is an increase in S/D ratio.
  - **Absent / reversed end-diastolic flow predicts worse prenatal outcomes** and it's usually an indicator for delivery.
- **Middle cerebral artery (MCA Doppler):** It reflects fetal adaptation this is because the fetus always tries to spare the brain circulation. when there is a decrease in placental perfusion, there is an increase in MCA flow.

Management

An important part of preventive medicine is to anticipate the risk for women with a prior infant with IUGR, and to consider interventions before a woman plans her next pregnancy. Improving nutrition and stopping smoking are two approaches that should improve fetal growth.

Antepartum care

The goal is to expedite delivery before compromise and after lung maturation; This requires regular fetal monitoring with a twice-weekly non stress test (NST) and biophysical profile.

Fetal monitoring:

- Monitoring the growth-restricted fetus involves serial fetal measurement
- **Abdominal circumference - Amniotic fluid index - Cardiotocography - Doppler ultrasound**
- Fetuses with absent end-diastolic flow are **hypoxaemic**, these changes may appear up to 5 weeks before demise
- Reversed end-diastolic flow is suggestive of preterminal compromise; the fetus may die within 1-2 days if not delivered.

Fetal monitoring -> normal. DO **Ultrasonography** ->

A. **Normal** growth, **no clinical intervention**.
B. **Abnormal** strongly suggests IUGR -> **delivery** is indicated at gestational ages of 34 weeks. assess Pulmonary maturity by amniocentesis, but If severe oligohydramnios -> delivery should be strongly considered without assessment of lung maturity. These fetuses are at great risk of asphyxia, and the stress associated with IUGR usually accelerates fetal pulmonary maturity.
C. **Ambiguous** (equivocal for IUGR -> bed rest (w/ kick counting), fetal surveillance, and serial U/S measurements at 3-weekly intervals are indicated to avoid preterm delivery.

Amniotic Fluid Index:

Fetal urine production is significantly lower in the SGA fetus than in the AGA fetus. Decreased renal perfusion results in oligohydramnios.

Biophysical Profile:

1. Breathing
2. Tone
3. Movement
4. Amniotic fluid volume
5. Cardiotocography
   * Requires about 40 mins observation of fetal breathing movements. (Takes time not for every fetus only suspected IUGR)
   * A persistently abnormal biophysical score is associated with the absence of end-diastolic flow.

Labor and after birth

- The goal is to expedite delivery before compromise and after lung maturation.
- The timing of delivery should be based on the results of the antenatal testing, fetal growth pattern, dopplers, and gestational age.

IUGR per se is not a contraindication to induction of **labor**, but there should be a low threshold to perform a cesarean delivery because of the poor capacity of the IUGR fetus to tolerate asphyxia.

After birth:

A. **Examine:** to rule out the possibility of congenital anomalies and chronic infections.
B. **Monitor:** **blood glucose levels** because the fetuses do not have adequate hepatic glycogen stores, and hypoglycemia is a common finding.
Furthermore, **hypothermia** is not uncommon in these infants. **Respiratory distress syndrome** is more common in the presence of fetal distress because fetal acidosis reduces surfactant synthesis and release.

Macrosomia

Fetus with estimated fetal weight (EFW) >90–95th percentile for gestational age. Birth weight ≥4,000–4,500 grams

Causes:

- **Maternal:** History of macrosomia pregnancy, increase in pregnancy weight gain, multiparity, prolonged gestation, gestational diabetes, overt diabetes , obesity.
- **Fetal:** Male, beckwith-wiedemann syndrome.

Risk factors:

- Gestational diabetes mellitus.
- Overt diabetes.
- Prolonged gestation.
- Increase in BMI (obesity).
- Increase in pregnancy weight gain.
- Multiparity.
- Male fetus.

Risks on mother and fetus:

- **Maternal:** Postpartum hemorrhage, vaginal or perineal laceration, operative delivery, C-sec, Pelvic floor injury.
- **Fetal:** Shoulder dystocia, clavicular fracture, lower Apgar score, obesity later in life.
- **Neonatal:** NICU (Neonatal intensive care) admission, hypoglycemia, Erb palsy.

Diagnosis:

Fundal height measurement and clinical palpation of estimated fetal weight "however still poor". U/S used to rule it macrosomia out, "associated with a significant error in macrosomia".

Sonogram EFW. Accuracy in estimating birth weight is poor. Errors in prediction of EFW at term are ±400 grams.

Management:

- Elective cesarean (**if EFW >4,500 g in diabetic mother** or **>5,000 g in nondiabetic mother**)

or

- Early induction, but this may result in increased cesarean delivery rate due to failure of induction.

Notes:

- First we look at doppler of placental vessels then we look at doppler of MCA.
- Difference? MCA is a more advanced stage of fetal decompensation.
- We see what's happening at the placental level because if we have uteroplacental insufficiency that means there's resistance at placental level that's affecting blood flow to the fetus(1st stage), then the defensive mechanism is increased flow in mca because the brain is spared (2nd stage).
- MCA doppler: it's an indirect way to assess how much blood is going to the fetus.

- Small for gestational age: a fetus that's below average size of its GA, we don't call it growth retardation it's just that the baby is small. If we don't detect uteroplacental insufficiency or indicators of hypoxia it could just be constitutional.
- Imp: make sure the gestational age is correct. Best time to date a pregnancy is in the 1st trimester.
- Growth retardation is if the baby is <10%ile but that's not absolute, meaning if you have a baby on the 25%ile and you do follow up US and you notice the baby falling of its own curve then that's an indicator of GR.
- E.g: the EFW is on the 25%ile but after 2-3 weeks on follow up the baby is on the 15%ile, so we suspect IUGR.
- Symmetrical IUGR: all the measurements are small (head, abdomen, short femur).
- Asymmetrical IUGR: head is maintaining growth while the rest of the body is not.

Management: depends on the GA

- Once you confirm lung maturity and GR is progressive(baby not doing well) then management is delivery.
- Preterm: give dexamethasone first and continue to follow up the baby, once the baby is compromised(abnormal CTG, doppler or biophysical profile) then deliver. Choosing between c-section or induction of labor depends of OBY history, state of baby, cervical ripening and many other factors.
- Imp: We don't give dexamethasone after 34 weeks.

Teaching case

A 20 year-old G2P1 African-American woman is referred to you from her family physician for an obstetrics consultation. She is **currently 35 0/7** weeks based on a certain LMP with regular 28 day cycles. At her last prenatal visit, **her fundal height measured 30 cm** (It is less than expected ,the abnormality can come from either the size of the fetus or the amount of the fluid). In taking her history about her prior delivery, she tells you that she delivered 3 weeks before her due date, but that her baby was small, weighing 2400 grams(the average weight: 3.2-3.3 kg). She does not report any other pregnancy complications. **She smokes** 2 packs of cigarettes a day and has **gained 8 pounds during this pregnancy.**

Physical Exam: **BP 110/70**; fundal height is 30 cm(the acceptable range 32-38cm). Fetal heart tones are present

- **Obstetrical Ultrasonography Report:**
  - Fetal number: Single
  - Position: Cephalic
  - Placenta: Anterior
  - Amniotic fluid volume: Normal
- **Fetal biometry:**
  - BPD: 82.9 mm = 33.3 ± 3.1 weeks
  - HC: 299.7 mm = 33.2 ± 3.0 weeks
  - AC: 274.0 mm = 31.5 ± 3.0 weeks
  - FL: 58.0 mm = 30.3 ± 3.0 weeks
  - Humerus: 51.2 mm = 29.9 ± 2.8 weeks
  - Estimated fetal weight = 1700 ± 308 grams, **less than the 10th percentile** at 34.9 weeks
  - Fetal Anatomy: Normal
  - Umbilical artery Doppler Flow: S/D ratio = 2.66 (normal)

Questions:

1. How do you interpret the ultrasound?

- Based on the sonographic findings of parameters, "smaller than anticipated" the fetus qualifies for a diagnosis of IUGR. What to do after? Observation and monitoring. Since the doppler and fluid is normal, and deliver when she's 36-37 weeks.

2. What can you tell the patient is the possible etiology of the IUGR?

- Maternal Factors:
  - Medical conditions (hypertension, renal disease, diabetes, vascular/autoimmune disease)
  - Substance use and abuse (tobacco in this patient, alcohol, cocaine)
  - Infections (viral, protozoal)
  - Teratogen exposure
- Fetal Factors:
  - Small constitutional size
  - Genetic & structural abnormalities
  - Multifetal gestation
- Placental Factors:
  - Primary placental disease (chorioangioma, mosaicism)
  - Abnormal placentation (previa, abruption, hematoma)

3. The patient asks you why the fetal growth problem was not detected earlier. What are the methods to screen and diagnose fetal growth disorders?

- Because she's a smoker and that's related to uteroplacental insufficiency that appears late in the pregnancy.
- A review of the pregnant patient's medical and obstetrical history is needed to determine whether she is at risk for abnormal fetal growth. Fetal anatomic survey will also screen for fetal and placental findings.
- **The key screening tool for fetal growth disorders in low risk women is** assessment of uterine size by fundal height measurement. However, fundal height assessment is not accurate as a diagnostic tool. (when we suspect)
- Ultrasonography is the gold standard to assess fetal weight. (to confirm)
- Umbilical artery doppler velocimetry: (absent or reversed end diastolic flow) can help predict fetuses at increased risk of poor fetal outcome.

4. What would you tell the patient are the potential consequences of IUGR?

- Short term risks: fetus may lack adequate reserve to continue existing in the uterus or to undergo the stress of labor.
- Long term risks: cvs disease, insulin resistance, obesity.
- The primary concern regarding IUGR is an increase in perinatal morbidity and mortality. The risk of stillbirth is dependent on gestational age and the primary etiology. In addition, both intrapartum and neonatal complications may increased, depending on the gestational age at delivery.
- **Intrapartum:**
  - Increased risk of fetal heart rate abnormalities
  - Cesarean delivery
  - Low Apgar scores
  - Cord blood acidemia
- **Neonatal:**
  - Polycythemia
  - Hyperbilirubinemia
  - Hypoglycemia
  - Hypothermia
  - Apneic episodes
- **Longterm:**
  - Lifelong increased risk of cardiovascular disorders

5. How would you approach managing this patient?

- Once IUGR is suspected/confirmed, serial sonographic assessments to monitor fetal growth is indicated every few weeks.
- If the pregnancy is remote from term, periodic antenatal fetal testing is indicated (Biophysical profile [BPP], modified BPP, Non-stress test, are all acceptable)
- The timing of delivery should be based on the results of the antenatal testing, fetal growth pattern, dopplers, and gestational age.

Notes:

- Imp to note that she is certain of her LMP.
- In fundal height there's a range, if it's 3 cm above or below the determined GA then we just follow up the patient.
- We check amniotic fluid volume to see if she's leaking fluid to the outside and maybe that's why the fundal height is low.
- The doppler is reassuring, because usually the first thing to be affected is growth, fluid, biophysical, NST and lastly the doppler so here the baby is not severely compromised.