Obstetrics
Obstetrics – Second/Third Trimester Assessment

(Effective February 2007)
(4 – 8%)

Placenta and umbilical cord
Anatomy/physiology

Fetal–Placental–Uterine Circulation

- Deoxygenated blood pumped by the fetal heart → ductus arteriosus into the descending aorta → hypogastric arteries → umbilical arteries
- 40% of the fetal cardiac output is directed through the umbilical circulation.

- Oxygenated maternal blood → placenta to spiral arteries (branches of uterine Artery)
- Thin layer separates the fetal blood from the maternal blood.
  - Capillary wall, trophoblastic basement membrane, and a thin rim of cytoplasm of the syncytiotrophoblast.

Fetal placenta

- Anchored to the maternal placenta by the cytotrophoblastic shell and anchoring villi.
- Provides large area for exchange across the placental membrane between fetal and maternal circulation.

Maternal placental

- Affected by conditions that decrease uterine blood flow
  - Severe hypotension, renal disease, or placental infarction
- Defects can cause intrauterine fetal growth retardation. (restriction)
Placental Membrane
• consists of fetal tissues, separating the maternal and fetal blood.
• often called a barrier
  – few compounds, endogenous and exogenous, to cross the placental membranes in detectable amounts.

Cordal Attachments
• usually near the center of the placenta

Abnormal attachments
• battledore placenta
  – insertion of the umbilical cord at the margin of the placenta
• velamentous placenta
  – membranous insertion of the cord.

Abnormal attachments
• > 2% of battledore and velamentous placenta associated with significant fetal hemorrhage
• Mainly due to Vasa Previa

Placenta as Endocrine Gland
• functional endocrine units of the placenta - chorionic villi
• outer layer (syncytiotrophoblast) produces protein hormones:
  – human chorionic gonadotropin (hCG)
  – human placental lactogen (hPL)
  – estrogen and progesterone.
• most progesterone is produced by the syncytiotrophoblast After the seventh week of gestation
  – no contribution from the fetus

Normal Placenta
• fetal surface
  – echogenic chorionic plate courses along placental tissue found at the junction with the amniotic fluid.
• basal plate or maternal portion
  – lies at the junction of the myometrium and the substance of the placenta
- during the first part of pregnancy
  - relatively homogenous pebble-gray appearance with smooth borders.
- Enlarged placenta associated with
  - Rh sensitization
  - diabetes of pregnancy
  - congenital anomalies
- Braxton-Hicks contractions

**Placental Position**
- placenta migration?
  - placenta actually does not move
  - appears changed because of enlargement of the uterus
- succenturiate placenta
  - additional placental lobes are joined to the main placenta by blood vessels.

**Doppler Evaluation**
- spiral arteries produces a low-resistance
- uterine arteries are variable depending on the gestational age and location of the placenta
- resistive index and pulsatility index have been used
- maternal uteroplacental circulation compromise associated with a
  - intrauterine growth restriction
  - Preeclampsia
  - placental abruption.

**Placenta Abnormalities**
- function of the placenta can adversely affect pregnancy outcome
  - placental separation
  - cord accidents
  - Trauma
  - viral
  - parasitic infections, can
- barrier between the mother and fetus
- protects fetus from immune rejection

- Placentomegaly - enlarged placenta weighing more than 600 g
- placenta thickness measuring more than 5 cm.
- primary causes for placentomegaly
  - Maternal diabetes
  - Rh incompatibility

- previa
  - 1 out of every 200 implants over or near to the internal os of the cervix.
  - Complete - internal os is completely covered
    - 20% of patients with previa.
  - A partial previa only partially covers the internal os
• marginal does not cover the os
  – but its edge comes to the margin of the os

• low-lying is implanted in the lower uterine segment
  – its edge does not reach the internal os.

• placenta previa - high risk because of the threat of life-threatening hemorrhage.
  • As the lower uterine segment develops, placental attachment uterine wall may be disrupted, resulting in bleeding.
  • cervix softens and dilate
    – may disrupt the attachment of a placenta located over or near the cervical os.

Earlier in gestation
• about 5% of second trimester pregnancies involve complete previa
• partial previas seen in 45% of second trimester pregnancies

Term
• 90% of complete resolving by term – migrates
• 95% of partial resolving

Factors associated with previa
• advanced maternal age
• Multiparity
• prior Cesarean section
• uterine surgery.

Sonography of lower uterine segment
• cautious of misinterpreting placenta position due to overdistended bladder
  – empty bladder and reexamine
  – The transperineal
• misleading uterine contractions
  – reexamine in 20 minutes.
• fetal head to
• mother’s sacrum < 1.5 cm
Placental Accreta
- abnormal adherence of part or all of the placenta with partial or complete absence of the decidua basalis.
- Chorionic villi grow into myometrium, placental villi anchored to muscle fibers rather than to the intervening decidual cells.
- risk ↑ with placenta previa

Placental Increta
- further extension of the placenta through the myometrium.

Placental Percreta
- penetration of the uterine serosa.
- the placental vessels can extend within the urinary bladder wall.

Imaging
- for the absence of hypoechoic subplacenta venous channels
- Look for normal myometrium beneath the placenta.

Succenturiate Placenta
- presence of one or more accessory lobes connected to the body of the placenta by blood vessels.
- tendency to develop infarcts and necrosis
- be retained in utero after delivery.

Circumvallate Placenta
- the attachment of the placental membranes is to the fetal surface of the placenta rather than the placental margin.
- placental villi around border of placenta are not covered by the chorionic plate.
- associated with
  - premature rupture of the membranes, premature labor, hemorrhage, and placental abruption.
Circummarginate Placenta

- diagnosed when the placental margin is not deformed
- 20% of placentas
- Complication - Prematurity

Placental Hemorrhage

- locations of hemorrhage include
  - Retroplacental
  - subchorionic, subchorial
  - intraplacental sites.

- seen in first trimester is more likely to resolve spontaneously than in the third trimester.
- echogenicity of hemorrhage depends on its age
  - acute medium-level echogenic to isoechoic
  - subacute and chronic becomes more hypoechoic

Placental Abruption

- Grade 0
  - Late 1st trimester-early 2nd trimester
  - Uniform moderate echogenicity
  - Smooth chorionic plate without indentations
- Grade 1
  - Mid 2nd trimester –early 3rd trimester (~18-29 wks)
  - Subtle indentations of chorionic plate
  - Small, diffuse calcifications (hyperechoic) randomly dispersed in placenta
- Grade 2
  - Late 3rd trimester (~30 wks to delivery)
  - Larger indentations along chorionic plate
  - Larger calcifications in a “dot-dash” configuration along the basilar plate
- Grade 3
  - 39 wks – post dates
  - Complete indentations of chorionic plate through to the basilar plate creating “cotyledons” (portions of placenta separated by the indentations)
  - More irregular calcifications with significant shadowing
  - May signify placental dysmaturity which can cause IUGR
  - Associated with smoking, chronic hypertension, SLE, diabetes

Placental grading
Placental grading

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Placenta and umbilical cord Doppler

- Quantitative Doppler flow
  - measurements include blood flow and velocity
- Qualitative measurements
  - look at the characteristics of the waveform that indirectly approximate flow and resistance to flow.
• Qualitative measurements
  – systolic to diastolic ratio (S/D ratio)
  – resistance index (RI)
  – pulsatility index.

Calculations
• The S/D ratio measures peak systole to end-diastolic blood flow.
• The RI is calculated as systole minus diastole divided by systole.
• The pulsatility takes the difference between peak-systole and end-diastole and divides this by the mean of the maximum frequency over the whole cardiac cycle.

doppler
• fetuses with asymmetric IUGR
  – vascular resistance increases in the aorta and umbilical artery
  – decreases in the fetal middle cerebral artery
• reinforces the head-sparing theory
• Increased vascular resistance reflected by increased S/D ratio or pulsatility index.

Normal artery
• umbilical artery Doppler waveform representing a normal systolic to diastolic ratio

Some resistance
• increased vascular resistance
  – less diastolic flow
• (S/D) ratio is 3.8
• S/D ratio of more than 3.0 after 30 weeks of gestation abnormal, according to some authors

High resistance
• absent end-diastolic velocity (AEDV) has been associated with adverse perinatal outcome.
Severe disease

- most severe Doppler finding, has been associated with adverse fetal outcomes.
- complete reversal of end-diastolic velocity.

Umbilical Cord Insertion Abnormalities/Position

Prolapse
- occurs when the cord lies below the presenting part.
  - Abnormal fetal presentation occurs in nearly half of the prolapse cord cases.
- risk is incurred if the membranes rupture early.

Umbilical Cord Insertion Abnormalities/Position

- 1/3 of cord prolapse problems are produced during obstetric procedures
  - Artificial rupture of membranes
  - Disengaging the head
  - Flexion of an extended head
  - Version and extraction

Vasa previa
- the presence of umbilical cord vessels crossing the internal os of the cervix.
- high mortality 60% to 70% for vaginal delivery
- Risk factors
  - velamentous insertion of the cord, succenturiate lobe of the placenta, low-lying placenta with marginal insertion of the cord near the internal os.

Biometric parameters

- Biparietal diameter
- Head circumference
- Femur length
- Humerus length
- Abdominal circumference
- Fetal weight

Fetal Measurements

second trimester gestational age parameters

- biparietal diameter
- head circumference
- abdominal circumference
- femur length.
Obstetrics – measurements

Head/face

- Biparietal diameter (BPD)
  - measured perpendicular to the fetal skull at the level of the thalamus and septum pellucidum.
  - Intracranial landmarks - falx cerebri, and choroid plexus anteriorly and posteriorly
  - septum pellucidum anteriorly in the midline
  - choroid plexus in the atrium of each lateral ventricle.
- Fetal skull growth
  - 3 mm/week in the second trimester
  - 1.8 mm/week in the third trimester.

Head shape should be ovoid
- Dolichocephalism flattened or compressed
  head Ψ
- Brachycephaly round head Ψ
- Calipers - leading edge to the leading edge
  - outer edge to inner edge

Head Circumference
- Taken at the level of the BPD
- BPD level should be measured with the calipers on the outer border of each side
- Occipital frontal diameter (OFD) - outer border of the occiput to the outer border of the frontal bone.
- Or just draw the circle

Cephalic Index
- Used to confirm appropriate head shape
- Dolichocephaly
- Brachycephaly

Cl = BPD/OFD/100

Trunk

- Abdominal Circumference
  - Measured in a transverse plane at the level of the liver where the umbilical vein branches into the left portal sinus.
  - Left portal vein and the right portal vein form a J shape.
- More affected by growth disturbances than the other basic parameters.

Extremities

- Femur
  - Most widely measured and easily obtainable of all fetal long bones
  - Distal femoral epiphysis seen after 32 weeks
- PTE is identified in gestations greater than 35 weeks.
- Tibia and Fibula
Obstetrics – measurements

**Extremities**

- **Humerus**
  - more difficult to measure than the femur
- **Radius and Ulna**
  - two parallel bones - commonly found by the fetal face
  - The ulna is larger and anatomically medial, and penetrates much deeper into the elbow

**Using Multiple Parameters**

- appropriate only when the fetus is growing normally
- Fetal weight estimation is useful in following IUGR fetuses.
- Averaging the BPD, HC, AC, and FL

**Other age parameters**

- **Orbits**
  - Orbital diameter increases from 13 mm at 12 weeks to 59 mm or greater at term.
- **Cerebellum**
  - the length at the level of the cerebellum, vermis, and fourth ventricle
- **depth of the cisterna magna**
  - 5 mm ± 3 mm, > 10 mm → abnormal.
- **nuchal fold**
  - < than 3 mm.

**Amniotic fluid assessment**

- association between IUGR and decreased amniotic fluid (oligohydramnios)
- Oligohydramnios also associated with
  - fetal renal anomalies
  - rupture of the intrauterine membranes,
  - postdate pregnancy.

**Amniotic fluid index**

- the uterine cavity is divided into four equal quadrants
- largest vertical pocket of amniotic fluid, measured in each quadrant
  - excluding fetal limbs or umbilical cord loops
- sum of the four quadrants
  - Normal 8 to 22 cm
  - decreased < 5 cm
  - increased > 22 cm.

**Fetal Presentation**

- Longitudinal lie
- Transverse lie
- Oblique lie
Fetal Presentation

• **Vertex (cephalic)**
  – fetal head is visualized at level of bladder and lower uterine segment

• **Breech**
  – lower extremities or lower body are found to be in the lower uterine segment

• **Complete breech** when both the hips and lower extremities are found in the lower pelvis
• **Footling breech** (incomplete) hips are extended and one (single footling) or both feet (double footling) are the presenting parts closest to the cervix.
• **Frank breech** - thighs flexed at the hips and the lower legs extended in front of the body and up in front of the head

Transverse

• When a transverse cross-section of the fetal head or body is noted in the sagittal plane, a transverse lie is present

Situs

• the right and left sides of the fetus should be determined
• differentiate sides by identifying anatomic landmarks.

Fetal well-being Biophysical Profile

• **Fetal breathing movement (FBM):**
  – One episode for 30 seconds continuous during a 30-minute observation.

• **Gross body movement:**
  – At least three discrete body/limb movements in 30 minutes, unprovoked; continuous movement for 30 minutes should be counted as one movement.

• **Fetal tone:**
  – Active extension and flexion; at least 1 episode of limbs or trunk.

• **Fetal heart rate (FHR):**
  – Also known as the Non-stress test (NST) at least two episodes of FHR of greater than 15 beats per minute and at least 15 seconds duration in a 20-minute period

• **Amniotic fluid index (AFI):**
  – One pocket of amniotic fluid at least 2 cm in two perpendicular planes; or AFI total fluid measures between 5 and 22 cm.

Biophysical Profile

• To determine the BPP, a value of two points is given to each of the 5 parameters
• Observation done over a 30 minute period
• cardiac nonstress test (NST) is the only one not done by the sonographer
Score values

- A BPP score of 8 to 10 is considered normal.
- A score of 4 to 6 has no immediate significance.
- A score of 0 to 2 indicates either immediate delivery or extending the test to 120 minutes.