Looking Beyond the Fetus – Placenta, Cord & Maternal Parts

Dale Broome, M.D.
Department of Radiology
Beaver Medical Group and
Redlands Community Hospital

Learning Objective

• Recommend MRI when indicated for further evaluation of placenta and cord
• Assess for clinically important variants and pathology that can result in risk to the fetus and mother, including consideration of maternal age

Topics to Discussed

• Placental anomalies
• Placenta previa and accreta
• Placental hematomas and masses
• Umbilical cord anomalies
• Intrauterine membranes
• Uterine contractions vs. leiomyoma

Unknown 1

What is the most likely cause for this appearance to the placenta at 18 weeks EGA?

Unknown 2

What does this short linear membrane represent?

Unknown 3

27 yo with 2 prior C-sections –
Unknown 4
21 wk EGA with vaginal spotting

Case 5 - Single IUP 23 weeks,
Prior D&C.

The Normal Placenta

- **Development** - decidual basalis and chorionic frondosum
- **First US visualization** - at 8-10 weeks.
- **Size** - 15-20 cm diameter at term.
- **Thickness** in mm ≈ gestational age in weeks.
- **Echogenicity** - > than myometrium
- **Retroplacental complex** - hypoechoic myometrium and basilar veins – 8-10 mm.
- **Cord insertion** – usually central.

Thickened Placenta

- **Thickness** > 3 cm. before 20 wks, > 4 cm before 40 wks.
- **Differential Diagnosis:**
  - Uteroplacental insufficiency
  - Maternal diabetes
  - Congenital neoplasms
  - Sacrococcygeal teratoma
  - Chromosomal abnormalities
  - Confined placental mosaicism
  - Fetal Hydrops
  - Maternal anemia
  - Intrauterine infection
  - Hydatidiform mole
  - Placental hemorrhage
  - Beckwith-Wiedemann
Abnormally Thin Placenta

- **Thickness** –
  - < 1 cm 14-20 wk.
  - < 1.5 cm 20-28 wk.
  - < 2 cm after 28 wk.
- **Differential Diagnosis**
  - Polyhydramnios
  - IUGR
  - Chromosomal abnormalities
  - Intrauterine infections
  - Placenta membranacea

Placenta Membranacea

Placenta < 1 cm thick wrapping around almost entire uterine wall

Placenta membranacea

- **Incidence** - 1:3300 pregnancies
- **US** - Thin placenta covers the most, if not all the surface of the uterine cavity.
- **Etiology** - Failure of the entire chorionic laeve to atrophy.
- **Complications** - recurrent 2nd and 3rd trimester bleeding, SAB, preterm labor.

Unknown 2 - Circumvallate Placenta

- **Incidence** - 2% of pregnancies
- **US** - a folded ring of chorion along the placental edge. Most are partial circumvallate.
- **Complications** primarily with complete circumvallate placentas - increased risk of PTL, threatened Ab, marginal hemorrhage, and IUGR.

Succenturiate Lobe

- **Incidence** - 3-6% of pregnancies
- **US** - an accessory cotyledon of placenta resulting from focal failure of chorion laeve to atrophy.
- **Complications** - postpartum hemorrhage, infection and vasa previa.
Succenturiate Lobe with Velamentous Cord Insertion

Placenta Previa

- **Etiology** - probably due to low implantation and trophotropism.
- **Associations** - multiparity, advanced maternal age, prior C-section or uterine surgery.
- **Incidence** - 0.5-1.0% of term pregnancies

Partial placenta previa

Placenta Previa - Clinical Manifestations

- **Painless 3rd trimester bleeding**, although 30% present in 2nd trimester.
- **Other complications** - <5% fetal mortality, preterm labor, IUGR, fetal hemorrhage.

Complete previa

Complete previa

Placenta Previa - US Technique

- **Delayed images** - if uterine contraction suspected.
- **Post void imaging** - essential if transabdominal scan suggests a previa.
- **Transperineal US** – useful when cervix not well seen on transabdominal post void scan. Problems – limited visualization, rectal air.
- **Endovaginal US** - can be performed safely with minimal to no risk. Should be performed gently without significant manipulation of the cervix. More consistent complete evaluation of the cervix.

Low Lying
Marginal Previa
Partial Previa

False Positive US Diagnosis of Placenta Previas

- False positive rate for 2nd trimester US – 80-95%. Almost all will resolve by 34 wks.
  - Tailpale P. Obstet Gynecol. 1997;89:364
- **Etiology**
  - Lower uterine segment contraction
  - Overdistended bladder
False Positive Placenta Previa – Overdistended Bladder

How Low Can You Get?
The Low Lying Placenta
• Different authors use different criteria
  – Within 2 cm of internal os – most common
  – Within 3 cm of internal os
  – Within 2 cm of lateral edge of cervix – my preference
• Confirm with TV sonography near term.
  • Significance
    – Intrapartum bleeding may necessitate c-section. Bhide A. BUOG. 2003;110:860
    – Increased incidence of postpartum hemorrhage Ogueh O. Int J Gynecol Obstet 2003;83:11.

Placenta Accreta
• Etiology - uncertain.
  – Defective decidua formation which allows the placenta to remain attached to uterine wall during parturition.
• Incidence - 1:2500
• Complications - painful intra- and post-partum hemorrhage, uterine rupture, uterine inversion, adjacent organ invasion (most commonly bladder).
• Mortality - 10% maternal, 25% infant.

Placenta Accreta
• Associated Conditions
  – Placenta previa (75%), previous C-section
  – grand multiparity, previous D&C, myomectomy, treated Asherman’s syndrome.
• Risk of placenta accreta
  – Previa and unscarred 5%
  – Previa and 1 prior C-section 24%
  – Previa and 2 C-sections 48%
  – Previa and 4 C-sections 67%

Normal Placenta
Accreta 78%
Increta 17%
Percreta 5%
Depth of myometrial invasion can progress during the course of pregnancy.
Ultrasound of Abnormal Placenta

- **Placenta accreta/increta**
  - Thinning (≤ 2 mm) or loss of the retroplacental hypoechoic myometrial zone (>80% sensitive, but nonspecific).
  - Increased number of subplacental and intraplacental vascular spaces (Swiss cheese appearance).  

50 yo 2 prior C-sections – Placenta Increta
Multifocal Thinning of Hypoechoic Myometrium

Ultrasound of Abnormal Placenta

- **Placenta percreta**
  - Thinning, irregularity or disruption of the linear hyperechoic uterine serosa/bladder wall complex.
  - Focal exophytic mass similar to placental echogenicity extending beyond uterine serosa.

Unknown 3 - 27 yo 2 prior C-sections – Placenta Percreta
Disrupted hyperechoic uterine serosa-bladder wall complex

- Bladder nodule
- Radiating placental vessel
Placenta Increta – Color Doppler

- Multiple intraplacental and subplacental hypoechoic vascular spaces.
- Prominent placental vessels radiating from the basal plate of placenta through the myometrium or extending into adjacent organs, most commonly bladder.

MRI of Placenta Accreta

- When should MRI be considered?
  - Previous myomectomy, posterior placenta previa.
  - False positives – significant problem with MRI.
- MR Signs on Fat Sat T2WI:
  - Thinning or discontinuity of the normal hypointense myometrial wall.
  - Focal areas of high T2 signal extending from placenta into myometrium or adjacent organ (bladder, most commonly)
  - Levine D. Radiology 1997;205:773

Periplacental Hematomas

- Clinical
  - Vaginal bleeding or may be asymptomatic.
  - Timing - most occur before 20 wks.
- Etiology
  - Venous bleeding - marginal venous sinus
- Associations - cigarette smoking / decidual necrosis.
- Incidence - 5-18% of threatened Ab’s
- Complications/Prognosis - Vast majority have no complications. When >60cc, may result in SAB.
Marginal (Subchorionic) Hematoma

- Located along the margin of placenta and extend beyond margin of the placenta.
- Rarely separate from placenta

Retroplacental Hematomas / Abruptio Placenta

- Incidence - Clinically - 1% of all pregnancies.
- Etiology - premature placental detachment due to arterial bleeding of the spiral arteries in the decidua basalis.
- Associated conditions:
  - Hypertension
  - Advanced maternal age
  - Multiparity
  - Uterine distension - twins, poly
  - Vascular disease - DM, SLE

Abruptio Placenta

- 15-30% of all cases of third trimester bleeding.
- Timing - usually occurs after 26 wks. 50% occur before labor onset.
- 80% are external abruptions - bleeds out through cervix. Better prognosis. Fewer complications
- 20% are concealed abruption - hematoma confined to uterine cavity. May be detected with US. Worse prognosis.
- Complications - PTL, fetal distress, fetal death (20-60%), maternal shock, DIC, maternal death (1%)

US of Placental Abruption – 28 wks

- US has only 15% sensitivity.
- Avascular on Color Doppler.
- Acute hematomas - echogenic. Can mimic a contraction or thick placenta.
- Chronic hematomas - become hypoechoic in 1-2 weeks. Can mimic a fibroid.

Unknown 4 - 21 wk EGA with vaginal spotting – Preplacental Hematoma

- Located along the margin of placenta and extend beyond margin of the placenta.
- Rarely separate from placenta

Preplacental Hematomas

- Clinical - may produce vaginal bleeding, SAB, preterm labor, and fetal demise by compressing umbilical cord.
- Location:
  - Subchorial - beneath the chorionic plate. Breus Mole - massive subchorial hematoma.
  - Subamniotic - between the amnion and chorion.
- US - the two types are indistinguishable. Mass which bulges from the inner placental surface into the amniotic cavity.
Focal Placental Masses

- Placental Infarcts
- True Placental Neoplasms -
  - Chorioangiomas
  - Trophoblastic Disease
  - Metastases
  - Teratoma

Placental Infarct

- General - seen in up to 25% of placentas at path. Large ones are associated with maternal vascular disease.
- US - most are isoechoic with the placenta and not distinctly seen. When large may appear more sonolucent with a hyperechoic rim.

Placental Choriangioma

- Incidence - 1% of placentas at path. 1:3500 by US. Most common solid placental mass.
- Clinical - can elevate MSAFP
- Complications - polyhydramnios (1/3), preterm labor, fetal hydrops, IUGR, and fetal demise.
- US - solid, hypo- to hyperechoic, single or multiple, and usually bulge the amniotic surface. Frequently near the cord insertion. Arterial and venous doppler flow.

Placental Choriocarcinoma

- Incidence - 1% of placentas at path. 1:3500 by US. Most common solid placental mass.
- Clinical - can elevate MSAFP
- Complications - polyhydramnios (1/3), preterm labor, fetal hydrops, IUGR, and fetal demise.
- US - solid, hypo- to hyperechoic, single or multiple, and usually bulge the amniotic surface. Frequently near the cord insertion. Arterial and venous doppler flow.

Gestational Trophoblastic Disease

- Complete or classic hydatidiform mole
- Partial hydatidiform mole
- Co-existing mole and fetus
- Invasive hydatidorm mole
- Choriocarcinoma

Classic or Complete Mole

- Incidence – 1:1200-2000 pregnancies
- Clinical – vaginal bleeding, enlarged uterus (S>D), absent FHT’s, PIH, hyperemesis, anemia.
- BHCG levels – begin to rise in late 1st trimester. Usually > 100,000 in 2nd trimester.
- Genetics – 90% are 46XX, paternal chromosomes from fertilization of empty oocyte.
**Classic Mole – 14 weeks**

Sonography of Classic Mole

- **2nd trimester** – “snowstorm” appearance, echogenic intrauterine tissue with multiple small cystic spaces.
- **Theca lutein cysts** – in up to 50%, multi-septated cysts, usually bilaterally.
- **1st trimester** – variable
  - 56% had classic appearance
  - Fluid collection with complex mass
  - Simple empty gestational sac
  - Heterogeneous thick endometrium
  - Echogenic fluid-fluid levels.
  

**Bilateral Theca Lutein Cyst in Classic Molar Pregnancy**

- Can persist weeks after removal of the mole
- Multi-septated cysts, frequently bilateral

**DDX of Molar Pregnancy**

Hydropic Degeneration of Placenta

- Failed pregnancy / missed abortion
- Low BHCG levels

**Co-existing Mole and IUP**

- Dizygotic twin pregnancy with one classic mole.
- Higher incidence of persistent trophoblastic disease
- Normal fetus with normal placenta – better delineated in 2nd trimester
Partial Hydatidiform Mole

- 70-90% Triploidy (69, XXX most cases). Localized molar degeneration with embryonic/fetal tissue present.
- Clinical (compared to complete mole)
  - usually less symptomatic
  - less severe elevation of bHCG
  - lower incidence of persistent GTD after D&C

Partial Mole with malformed embryo with no heart beat

Partial Hydatidiform Mole

- US – enlarged placenta with localized areas of multicystic avascular spaces interspersed in areas of more normal appearing placenta.
- Embryo/fetus may be seen but is typically malformed with IUGR or embryonic/fetal demise.
- DDX - can mimic missed or incomplete AB and placental hydropic degeneration.

Comparison of Complete and Partial Hydatidiform Moles

- Features CHM PHM
- Karyotype 46,XX (90%) 69,XXX (70%)
- bHCG 10-200 MoM 10-60 MoM
- Persistent GTD 14-29% 1-11%
- Vag bleeding 84-97% 15-25%
- Theca lutein cysts 15-25% 9%
- Hyperemesis 8-26% 5%
- Preeclampsia 12-27% 10-40%
- Uterine enlargement 28-51% < 1%


Invasive Mole

- Incidence - 12-15% of Gestational Trophoblastic Tumors
- Pathology:
  - local invasion of the myometrium
  - preservation of villous pattern
  - hemorrhagic necrosis in myometrium and parametrium
Invasive Mole
- **Diagnosis** - delayed bleeding, plateau or rising bHCG, failure of uterus to regress in size after D&C.
- **US** - changes similar to molar pregnancy, but extending into myometrium, uterine wall.
- **Recurrent Mole** - rising bHCG after normalization after D&C.
- **Persistent Mole** - failure of normalization of bHCG after D&C.

Recurrent Trophoblastic Disease with Invasive Mole – 6 wks post D&C

Choriocarcinoma
- **Incidence** - 1:4000, 5-8% of GTD
- **Pre-existing conditions**: 50% molar pregnancy, 25% abortion, 22% normal pregnancy, 3% ectopic pregnancy
- **Pathology** - loss of villous pattern; transmural invasion, distant metastases
- **US** - similar to invasive mole with extrauterine involvement - liver, adnexa, etc.

Choriocarcinoma

Placental Cord Insertions

- **Incidence** - 1.0 -1.6% of deliveries
- **Associations** - multiple gestations, uterine enlargement, IUD, uterine anomalies.
- **US** - umbilical cord inserts into the membranes attached to the placenta rather than into the placenta proper.
- **Significance** - cord rupture and hemorrhage during labor and delivery. A small percentage have vasa previa.

Velamentous Cord Insertion
Velamentous Cord Insertion

- Incidence - rare.
- US - velamentous insertion with the intramembranous vessels extending across the cervical os.
- Significance - Perinatal mortality 60-70%.
- DDX - cord prolapse

Vasa Previa

- Incidence - rare.
- US - velamentous insertion with the intramembranous vessels extending across the cervical os.
- Significance - Perinatal mortality 60-70%.
- DDX - cord prolapse

Single Umbilical Artery

- Incidence - 0.2-1.1%
- Associated anomalies – 18-47%.
- Aneuploidy 17%.
- When isolated finding after detailed US, aneuploidy nearly 0%.
- IUGR 15-20% even without fetal anomalies.

Nuchal Cord

- Must wrap >360 degrees around neck
- Antenatal diagnosis rarely associated with perinatal complications

Intrauterine Membranes

- Unfused Amnion
- Chorioamniotic Separation
- Circumvallate Placenta
- Septated Uterus
- Amniotic sheet / Intrauterine synechia
- Amniotic Band Syndrome

Chorioamniotic Separation

- Normal prior to fusion < 16 weeks.
- Etiology after 16 weeks
  - Hemorrhage
  - Rupture or tear of amniotic membrane
    - Twins
    - Polyhydramnios
    - Amniocentesis or trauma
Unfused Amnion – 13 weeks

Can present as a short thick membrane.

Unknown Case 5 - Single IUP 23 weeks and history of prior D&C
Amniotic sheet from Intrauterine synechiae

Intrauterine Synechiae / Amniotic Sheet
- **Etiology** - fibrous intrauterine synechia from prior endometrial instrumentation or infection. Covered by amnion and chorion.
  - Y shaped split at its endometrial margin.
  - Bulbous thickening along its free edge.
  - No attachment to or fixation of fetal parts.

Septated Uterus

IUP in left horn

Septation

Amniotic Band Syndrome
Amniotic Band Syndrome

- Pathogenesis – Exogeneous (amnion disruption with fetal parts adhere to/entangle with sticky chorionic mesoderm. Endogenous – focal developmental error in limb connective tissue formation.
- Associated Anomalies – anencephaly, nonmidline encephaloceles, asymmetric facial clefts, nasal deformities, abdominal wall defects, scoliosis. Limb constriction rings, lymphedema, and amputations.
- US – amniotic bands in direct contact with fetal parts with restricted movement. Amniotic band not always seen.

Focal Uterine Contraction vs. Uterine Fibroid

<table>
<thead>
<tr>
<th>Uterine Contraction</th>
<th>Uterine Fibroid</th>
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<tbody>
<tr>
<td>Isoechoic</td>
<td>Hypoechoic</td>
</tr>
<tr>
<td>Homogeneous</td>
<td>Heterogeneous</td>
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<tr>
<td>No US attenuation</td>
<td>Attenuates US beam</td>
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<tr>
<td>Bulge inner uterine contour only.</td>
<td>Bulges outer uterine contour</td>
</tr>
<tr>
<td>Migratory, evanescent</td>
<td>Fixed</td>
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15 wk IUP with uterine contraction

Uterine Leiomyoma

Summary

- Placental anomalies
- Placenta previa and accreta
- Placental hematomas and masses
- Umbilical cord anomalies
- Intraterine membranes
- Uterine contractions vs. leiomyoma