

# ULTRASOUND OF THE PLACENTA

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## Disclosure Statement

• Today's faculty: *Cameron Manbeian* does not have any relevant financial relationships with commercial interests or affiliations to disclose.

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## NORMAL PLACENTA

- Uniform moderate echogenicity.
- On its surface abutting the amniotic fluid is the chorionic plate.
- On its attachment to the uterine wall the combined basilar-myometrial layer is a hypoechoic band.
- Placental thickness is usually between 2-4 cm in the 2<sup>nd</sup>/3<sup>rd</sup> trimesters and evaluated subjectively.

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NORMAL PLACENTA



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NORMAL PLACENTA

- Vascular organ with 2 blood supplies.
- From the fetus 2 umbilical arteries arise from the hypogastric arteries carrying blood to the placenta and one umbilical vein carries blood back to the left portal vein of the fetus.
- From the mother, uterine arteries carry blood through the myometrium into the placenta.

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NORMAL PLACENTA

- In the placenta the 2 circulations intertwine to exchange nutrients for wastes and oxygenated blood for deoxygenated blood but do not mix.
- Normal maternal venous channels are hypoechoic and are called venous lakes or intervillous connections.

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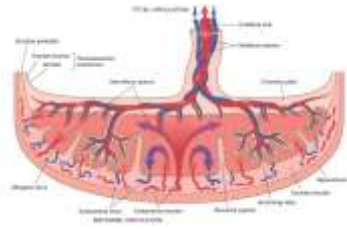
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### PLACENTAL ANATOMY



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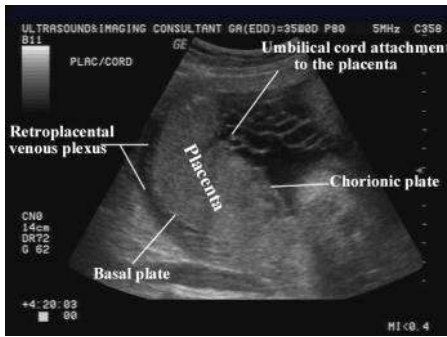
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### MARGINAL SINUS OF THE PLACENTA

- Venous drainage point back into the maternal uterine veins and should not be mistaken for placental separation



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SUCCENTURIATE PLACENTA

- 5-6% of all pregnancies.
- Additional placental tissue separate from the main body, usually smaller
- Connected by intramembranous blood vessels, cord originates from main body of placenta




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SUCCENTURIATE PLACENTA

- Risks: rupture of vessels connecting placental tissue, vasa previa and retention of accessory lobe resulting in post-partum hemorrhage
- Scan entire uterus before assigning placental location and identify cord insertion site




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Bilobed Placenta

- Placenta with 2 even-sized lobes connected by a thin bridge of placental tissue
- Cord often inserts centrally on thinned area, velamentous cord insertion




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### MIMICS

- Mimics of succenturiate lobe are uterine contractions and placenta wrapped around the lateral wall anteriorly or posteriorly.

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### CIRCUMVALLATE PLACENTA

- Chorionic plate smaller than the basal plate with rolled placental edges
- Risk of abruption and hemorrhage, though usually an excellent prognosis
- Often path diagnosis



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### CIRCUMVALLATE PLACENTA

- Look at attachment points of membranes!
- CP membranes only attach on placenta
- Synechia attach to the uterine wall
- Amniotic bands attach to the fetus (very thin)



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### PLACENTAL CORD INSERTION

- The umbilical cord usually inserts in the central portion of the placenta.
- Marginal cord insertion- placental cord insertion within 2 cm of the placental edge. Not associated with growth impairment or preterm delivery.
- However marginal cord <5mm from the placental edge may progress to a velamentous cord insertion.

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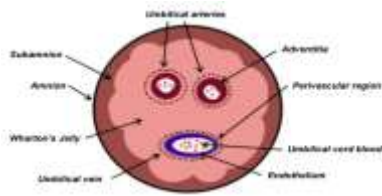
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### UMBILICAL CORD



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### Velamentous Cord Insertion

- Umbilical cord inserts on the chorioamniotic membrane rather than on the placenta. This results in a segment of the umbilical vessels running between the amnion and chorion unprotected by Wharton Jelly present in the cord.
- Prevalence is 1% in singleton pregnancies and about **15%** in monochorionic twin gestations.
- Risk of Vasa Previa, IUGR, and abnormal intrapartum fetal heart rate pattern.

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### Velamentous Cord Insertion



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### PLACENTAL SIZE

- Thickness in its mid portion and should be between 2-4 cm. Placenta position should be considered as anterior placentas are 0.7cm thinner than posterior or fundal placentas.
- Placenta gets thicker throughout pregnancy with thickness in mm usually corresponding to gestational age in weeks.
- Placental thinning has been described in systemic vascular and hematologic diseases that result in microinfarctions, IUGR and preeclampsia.
- Thick placentas >4cm are seen in fetal hydrops, antepartum infections (TORCH), maternal diabetes, and maternal anemia.
- Thickening can be simulated by a contraction or fibroids.

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### PLACENTAL LOCATION

- Placental location is determined by the main placental body position. It can be anterior or posterior, fundal, or left or right lateral.
- **Low-lying placenta** is when the placental edge is located in the lower uterine segment within 2cm or less of the internal cervical os. With persistent low lying placenta, **evaluate placental cord insertion.**
- **Placenta previa** is used when the placental edge covers the internal cervical os.

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### TRANSVAGINAL ULTRASOUND

- If the internal cervical os and placental margin is not seen with transabdominal ultrasound perform transvaginal or transperineal US.
- Accurate measurement of the distance between the lower edge of the placenta and the internal os can be achieved with transvaginal ultrasound.
- If there is an open cervix with bulging amniotic sac at or below the external os transvaginal US is contraindicated. It is also not usually performed after ruptured membranes due to risk of chorioamnionitis.

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LOW LYING PLACENTA

- Distance between the internal cervical os and the placental edge is **1-20** mm.
- The closer the placental edge is to the internal cervical os the higher the risk for antepartum hemorrhage.
- **Look at placental cord insertion and look for accessory placenta.**

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LOW LYING PLACENTA

- US can be repeated in the 3<sup>rd</sup> trimester to re-evaluate after normal placental migration.
- TransAbdominal US okay if can show placental tip >4cm from the Internal Os. Otherwise, Transvaginal US is **essential** to diagnosis!
- Full maternal bladder can make a normal placenta appear low and can falsely elongate the cervix.

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PLACENTAL LOCATION

Placental Edge Distance from Os	Indication for Cesarean Delivery (CD)
>20 mm	Not indicated
11-20 mm	Lower likelihood of bleeding and lower need for CD
≤10 mm	Higher likelihood of bleeding and higher need for CD
Overlap of os by any distance	CD indicated

The placenta migrates about 1 mm per week therefore, the likelihood of a placenta previa diagnosis decreases with gestational age

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### PLACENTA PREVIA

- **Placenta covers or partially covers the internal cervical os.**
- Avoid terms partial or marginal previa. (Normal, LLP, PP)
- Most PP seen <20 weeks resolve by 34 weeks.
- 0.5% incidence of placenta previa at term.

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### PLACENTA PREVIA

- Risk factors: prior C-sections, prior previa, advanced age and smoking
- In the presence of prior C-section there is a high likelihood of an invasive placenta.
- Associated with placental abruption and preterm labor.

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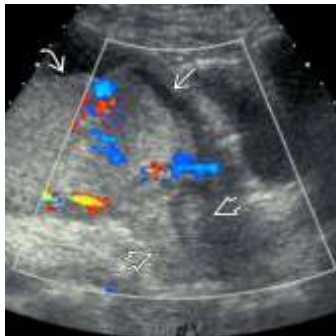
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PLACENTA  
PREVIA WITH  
PLACENTAL  
ABRUPTION




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PLACENTA PREVIA

- Measure cervical length.
- Cervix may be distended with blood.
- Check IO for distension/funneling.
- Patients with **cervical length <30mm** have a higher rate of bleeding, preterm birth, and cesarean hysterectomy due to placenta accreta.




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### VASA PREVIA

- **Umbilical vessels** run through fetal membranes not supported by placental tissue or Wharton jelly and are close to the internal cervical os and below the presenting part of the fetus (1 vessel within 2 cm from the internal cervical os).
- Early diagnosis is critical to survival before rupture of membranes that can cause vessel tearing and severe **fetal bleeding**.
- Risk factors: **velamentous cord insertion, accessory placental lobe**, twin pregnancy, and low lying placenta.

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### VASA PREVIA

- Prevalence is 0.04%.
- Treatment- C-section before rupture of membranes
- Mimics- marginal sinus previa (draining maternal veins) and funic presentation (cord presentation)
- Use **transvaginal US** with color Doppler to exclude vasa previa if transabdominal US is inconclusive.

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### VASA PREVIA

- 2 TYPES
- TYPE 1: Low lying placenta with a velamentous cord insertion
- TYPE 2: Low lying vessels travel between primary and secondary placenta (succenturiate lobe)
- Remember these are unprotected vessels not in the cord traveling over the internal cervical os or within 2 cm of it.

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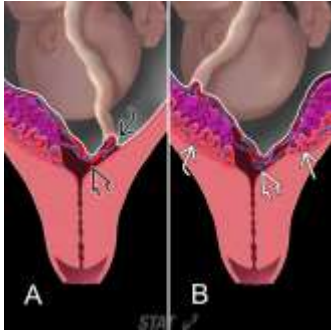
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VASA PREVIA



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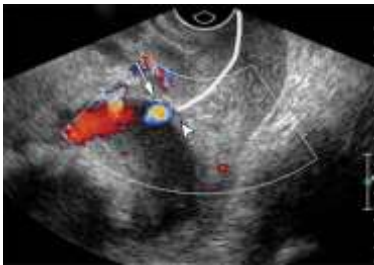
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VASA PREVIA



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Funic (Cord)  
Presentation

- Cord in front of fetus.
- Could prolapse into vagina.
- May require emergent C-section.



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### MARGINAL SINUS PLACENTA PREVIA

- Placental veins at edge of placenta are  $\leq 2$ cm from the internal cervical os.
- These are maternal veins, not fetal
- Do not confuse with vasa previa.
- 10X greater risk of sudden severe hemorrhage!

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### MARGINAL SINUS PLACENTA PREVIA



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### PLACENTA ACCRETA SPECTRUM

- Transvaginal ultrasound will also help to detect Placenta accreta and vasa previa which are **strongly** associated with **placenta previa**.
- Incidence has increased with increasing rate of C-sections, 1/533 pregnancies. In 1970s was 1 in 4027 pregnancies.
- **80-88%** of accreta's have a placenta previa in most large studies!

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PLACENTA ACCRETA SPECTRUM

- Abnormal placental invasion into the uterine wall, leading to failure of placental separation at delivery.
- The most common risk factors are prior **cesarean** delivery and **placenta previa**.
- Other risk factors include prior uterine surgery and assisted reproductive techniques.

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PLACENTA ACCRETA SPECTRUM

- The rising incidence is attributed to the growing rate of cesarean delivery.
- Risk increases with each cesarean delivery in setting of previa (3%, 11%, 40%, 61%, 67%)
- Other risk factors include previous myomectomy, advanced maternal age, and Asherman syndrome.
- Significant risk of maternal/fetal demise!

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PLACENTA ACCRETA SPECTRUM

- Classified according to the depth of placental invasion into the uterine wall and outside the uterus.
  - Placenta **accreta**: placenta is in direct contact with (attaches to) the myometrium (80%).
  - Placenta **increta**: placenta invades into the myometrium (15%).
  - Placenta **percreta**: placenta extends beyond the uterine serosa into surrounding structures (5%).

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### ULTRASOUND FEATURES

- Multiple irregular (bizarre, tornado shaped) placental lacunae- hypoechoic areas (Swiss-cheese appearance)- **most predictive sonographic finding**
  - Normal placental lakes are round with laminar flow
  - Turbulent lacunar blood flow
- Irregular or absent retroplacental clear space (and myometrial thinning <1mm)
- Turbulent high velocity flow deep in the placenta separate from the fetal surface of the placenta

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### ULTRASOUND FEATURES

- Protrusion of the placenta into the bladder or loss of the hyperechoic uterine serosa-bladder interface.
- Increased vascularity at the interface of the bladder with the uterine serosa.
- Increased subplacental vascularity.
- Vessels bridging the placenta to the uterine margin.
- After 15 weeks, US has been shown to be about **80%** sensitive and **80%** specific for the diagnosis of placenta accreta.

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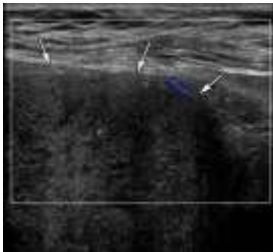
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### LOSS OF RETROPLACENTAL CLEAR SPACE



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PLACENTAL LACUNAE



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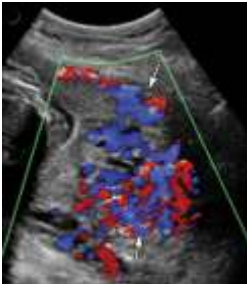
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INCREASED VASCULARITY



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PLACENTAL LAKE

- Often no flow is seen.
- More round than the lacunae seen in placenta accreta.
- Often closer to the fetal surface of the placenta.
- Can change size and shape with time.
- May resolve.



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PERCRETA

Most US features do not reliably predict depth of invasion or type of placenta accreta spectrum



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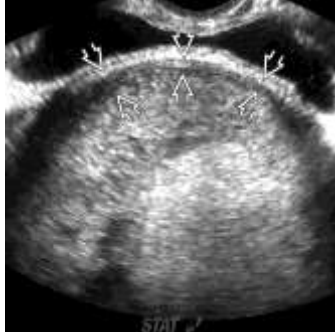
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Normal  
Bladder  
Interface



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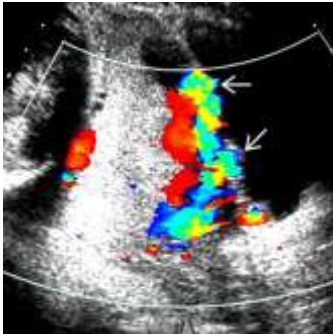
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PLACENTA ACCRETA SPECTRUM

- Problems arise at delivery when the placenta does not completely separate from the uterus and is followed by massive hemorrhage leading to disseminated intravascular coagulopathy and the need for hysterectomy.
- During urgent surgery there is risk of injury to the ureters, bowel, and bladder.
- Further complications such as adult respiratory distress syndrome, acute transfusion reaction, electrolyte imbalance, acute renal failure and death can occur.

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PLACENTA ACCRETA SPECTRUM

- Average blood loss at delivery in a woman with placenta accreta is 3000-5000 mL. 40% require more than 10 units of blood.
- Women at highest risk have a **placenta implanted over a uterine scar** from a prior C-section and women with **placenta previa** and multiple **prior C-sections**.
- US diagnosis allows for planning to minimize maternal and neonatal morbidity.

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### CHORIOAMNIOTIC SEPARATION

- Chorion and amnion fuse in early pregnancy and by 14wks are not distinguishable
- Separation can rarely occur later in pregnancy – focal or extensive
- Extensive cases pose a risk of preterm delivery and development of amniotic bands

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### CHORIOAMNIOTIC SEPARATION

- It is associated with prior interventions- amniocentesis or surgery, but can occur sporadically
- It is seen as a free-floating or adherent membrane surrounding the fetus and can overly the placenta

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### PLACENTAL CYSTS

- True placental cysts or chorionic plate cysts are usually seen along the fetal surface of the placenta typically near the cord insertion. Usually are benign and small. Avascular.
- Very rarely if larger than 4.5 cm they have been reported to be associated with IUGR.

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### PLACENTAL CYST



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EVALUATION OF 2<sup>nd</sup>/3<sup>rd</sup> TRIMESTER BLEEDING

- Potentially serious etiologies include: placenta previa, placenta accreta, placental abruption and vasa previa.
- Light vaginal bleeding or bloody vaginal discharge can occur with preterm labor and cervical incompetence as the cervix dilated and cervical veins bleed.
- In the 2<sup>nd</sup> trimester mild bleeding can result from a small marginal separation at the placental edge that does not expand.

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EVALUATION OF 2<sup>nd</sup>/3<sup>rd</sup> TRIMESTER BLEEDING

- Uncommon causes of bleeding in the 2<sup>nd</sup> or 3<sup>rd</sup> trimester include cervical infection and neoplasm.
- Uterine rupture can occur late in pregnancy in patients who have had prior C-sections/uterine surgery and presents with severe pain and bleeding.

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PLACENTAL ABRUPTION

- Placental abruption is defined as premature placental separation from the implantation site.
- Placental abruption complicates approximately 1% of pregnancies and most frequently occurs between 24 to 26 weeks of gestation.
- Risk factors for abruption include chronic hypertension, trauma, and advanced maternal age.

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PLACENTAL ABRUPTION

- Usually presents with pain and vaginal bleeding.
- US is insensitive for detection of placental abruption, with reported sensitivity as low as 25%.
  - This is because acute and subacute hematomas are frequently isoechoic to placental tissue. US can help determine the extent of abruption by depicting hematomas, which form as a sequela of abruption.

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PLACENTAL ABRUPTION

- Retroplacental hematoma should be suspected at US if the retroplacental hypoechoic zone is thickened to more than 2 cm.
- Location- Marginal, Retroplacental, Preplacental
- Rule out fetal bradycardia!

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RETROPLACENTAL ABRUPTION (CHRONIC)



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Acute hemorrhage



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Marginal Abruption

- Most common type
- US may not show the lifted placental edge.



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### THROMBOTIC COMPLICATIONS

- 2 TYPES
- 1. PLACENTAL INFARCT FROM THROMBOSIS OF THE SPIRAL ARTERIES- TRIANGULAR HYPERECHOIC REGIONS
- 2. ECHOGENIC CYSTIC LESIONS- THROMBOSIS OF THE INTERVILLOUS REGIONS WITH NECROTIC VILLI

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ECHOGENIC CYSTIC LESIONS



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PLACENTAL CHANGES

- Progressive development of calcifications- not observed in all pregnancies.
- Utility of Grannum classification has decreased.
- Early maturation of the placenta increases the risks of adverse fetal outcomes.
- Premature calcifications may be associated with placental vascular insufficiency.



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PLACENTAL CHANGES

Placental grade	Description
Grade 0	- No visible calcification + Absent chorionic plate
Grade 1	- Scattered tiny calcification + Subtle indentations of chorionic plate
Grade 2	- Larger focal and comma like calcifications + Larger indentations of chorionic plate
Grade 3	- Extensive basal calcifications and curvilinear calcifications fully outlining cotyledons + Complete indentations of chorionic plate

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Criteria	Normal Placenta	Violations/Abnormalities
Morphology	Typically lobulated with rounded angles	Rectangular or lobulated Chromosomal placenta Placenta membranacea Thick or thin placenta
Placental thickness	Typically 2-4 cm, increasing with gestational age	
US echogenicity	Homogeneous	Vessel lakes can be seen in normal placenta Calcifications Placental lacunae can be seen by MRA
Location	Variable	Low-lying placenta or placenta previa
Cord origin	Central	Marginal or velamentous cord insertion
Whorled placental surface	Non-whorled (uncommon) Typically seen Subchorionic or extra-uterine Nodule or cyst	Placenta accreta, increta, or percreta
Membranes	Absent	Placental abruption and associated hemorrhage
Movements	Absent	Trichotillaxia and neuroglycopenic necrosis

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