1/9/2019

# 1 Placenta, Cord and Amniotic Fluid

### 2 Placenta

- Maternal Surface:
  - Basilar plate
  - Irregular (lobulated)
  - Divided into cotyledons
    - each cotyledon divided into lobules
- Fetal Surface:
  - Chorionic plate
  - $\circ$  Smooth
  - Covered by amniotic membrane
  - Area of Cord insertion
    - $\cdot$  where amniotic membrane joins cord insertion
    - $\boldsymbol{\cdot}$  point of branching of 1 umb. vein and 2 umb. Art.

# 3 Placental Functions:

- Maintenance of pregnancy:
  - $\circ$  Endocrine
    - ·HCG, Estrogen, Progesterone production
- Fetal support:
  - Maintains of homeostasis
  - Metabolism & nutrient transfer
    - · Glycogen, cholesterol and fatty acid synthesis
    - · Electrolytes, glucose, vits. Water transport
  - Gas and waste exchange
    - oxygen, carbon monoxide, carbon dioxide exchange
    - ·Urea, uric acid & bilirubin disposal

## 4 Size and proportion of placenta

- 16-20 cm x 5cm, 450-550 gms
- Early pregnancy-
  - ${\scriptstyle \circ}$  50-70% of uterine volume
- Later pregnancy-
  - uterus grows faster than placenta
  - ° 25-30%
- Maximum dimension during pregnancy-
  - ${\scriptstyle \circ}$  5cm in thickness
  - ∘ up to 20 weeks is <2cm

## 5 Placenta Number

- Singleton-
  - One placenta
- Twins-
  - Monozygotic:
    - Monochorionic/monoamniotic
      - One placenta
    - Monochorionic/diamniotic
      - One placenta

- Dichorionic/Diamniotic
  - Two placentas; may be fused

Dizygotic

Dichorionic/diamniotic

### 6 Placental Membranes

- Three layers
  - ${}^{\circ}$  Chorionic plate
    - $\cdot$  Closest to the fetus
  - Intervillous space
    - Where nutrient exchange occurs
  - Decidua basalis
    - Layer against uterus

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- Blood supply provided by the ovarian and uterine arteries
- Uterine Arteries: main branches of the internal iliac arteries
- Uterine Arteries: Ascend through the lateral wall and anastomose with the ovarian arteries

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### 10 Placental Location

- Can be located anywhere on the uterus
  - Anterior
  - Posterior
  - Fundal
  - Right or left lateral
  - Lower uterine segment
- Combinations

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#### <sup>11</sup> Conditions of the placenta: Previa

- Placenta Previa:
  - Occurs 1/200 pts. at delivery
  - Due to implantation of placenta
  - Will over call in 2nd Trimester >1/200

### 12 Types of Placenta Previa:

- Low lying-
  - $\circ$  low implantation
  - ${\scriptstyle \circ}$  lower segment within 2cm of cervical os
- Partial or Marginal-
  - ${\scriptstyle \circ}$  internal cervical os is partially covered but not attached on all sides
- Total-
  - complete previa entire cervical os covered

13 Placenta Previa

- Based on the relationship to the cervix
- Central or symmetric complete previa has the placenta centered over the internal os
- •

### 14 🔲 Placenta Previa

- Asymmetric complete previa has most of the placenta implanted on one side of the cervical os
- Marginal previa ends at the margin of the cervix without coverage

### 15 Scanning Tips for Placenta Previa

- Maternal bladder must be properly filled (transabdominal exam)
- Obtain partial or full void images
- Contractions may look like placenta
- Before 20 weeks the placenta may appear low but moves as uterus grows
- Vaginal
- Labial

### 16 False positive diagnosis

- Bladder over-distention
  - $\circ$  over filling can alter the shape of lower uterine segment
  - If cervix is bigger than 5cm have patient partial void
  - · Always take partial/complete void pictures

### 17 D Placenta Location and Bladder Fullness

### 18 False positive diagnosis

- Myometrial contractions:
  - If myometrium >1.5cm=contraction
  - · Check to see placenta site
  - If transient contraction will resolve with time
  - When seen in 2nd and 3rd trimesters not always perceived by patient

### 19 False positive diagnosis

- Placenta Migration:
  - Position of placenta may change later in pregnancy >20 weeks due to differential growth of lower uterine segment
  - Placenta doesn't actually migrate
  - Rescan at @ 36 weeks to check position
  - >32-34 weeks consistent size & position
  - · Late second trimester complete previa will be previa at term in most cases

### 20 False positive diagnosis

- Fibroids
- Placenta abruption with hemorrhage in cervical os
  - can look like marginal previa
- False Negative diagnosis of placenta previa
  - ${}^{\circ}$  fetal head obscures visualization of cervix
  - lateral previa
  - hemorrhage mimics amniotic fluid over cx os

### 21 False positive diagnosis

- Signs of placenta previa:
  - $\circ$  painless 2nd and 3rd trimester vaginal bleeding
- Methods of evaluation of previa:
  - transabdominal U/S
  - transvaginal U/S
  - · can cause bleeding in 3rd trimester!
  - Translabial U/S
    - highlights cervical area very well

## 22 Battledore Placenta or Marginal Insertion

- Eccentric insertion of umbilical cord into placenta
  - Implants into edge of placenta
- 23 D Velamentous Insertion
  - Cord inserts into fetal membranes before entering placenta
  - Increased risk of thrombosis

# 24 Circumvallate Placenta

- Attachment of placental membranes to fetal surface of placenta
  - ${}_{^{\circ}}$  Notice placental villi around the border of the placenta, without evidence of chorionic plate.
- Associated with PROM, premature labor, hemorrhage, and abruption

# 25 Succenturiate Placenta

- One or more accessory lobes
  - · Connected to "main" placenta by blood vessels
- Can develop infarcts
- When not identified during birth may become retained

## 26 🔲 Vasa Previa

- Vascular vessels run through fetal membranes over cervical canal
- Typically have a velamentous cord insertion
- May have a succenturiate lobe
- Sonographically
  - When suspected document Doppler flow over the internal os

### 27 Placental Hemorrhage

- Can occur within or around placenta
- Bleeding FROM the placenta
  - From any cause
- When seen later in pregnancy is more worry some than in first trimester
- Sonographically varies:
  - ${\scriptstyle \circ}$  Size, location, length of time since bleed

## 28 Placenta Abruptio:

- Who is at risk for abruptio?
  - Previous history makes it 5X more likely
  - Drug abuse/smoking
  - Hypertension
  - Abnormal attachment

- · Placenta previa or old scar (C-section usually)
- Trauma

# 29 Placenta Abruptio:

- Signs and symptoms:
  - Maternal
    - · painful uterus with vaginal bleeding
    - $\cdot$ rigid uterus
    - HCT
    - acute renal failure
  - shock
  - Fetal
    - distress/demise
    - ۰IUGR
  - hydrops
  - Anemia
  - Premature labor
  - $\cdot$  normal to preterm labor

# 30 Placenta Abruptio:

- Role of U/S with hemorrhage eval.
  - Features depend on location, size, time since hemorrhage
    - ·Location of bleed-
      - <u>Subchorionic-</u>most common
      - $\boldsymbol{\cdot} \text{Dissection of chorion}$
      - Under chorion but not under placenta
      - · Margin of placenta can be lifted & blood drains out of uterus
      - $\boldsymbol{\cdot} \text{low pressure bleeds}$
      - $\cdot$  associated with cigarette smoking
      - Anechoic subchorionic area

## 31 Placenta Abruptio:

- Location of Bleed cont:
  - <u>Retroplacental</u>
  - high fetal mortality
  - · blood behind placenta lifting it off attachment
    - high pressure bleeds
  - $\boldsymbol{\cdot}$  vaginal bleeding may be absent
  - torn spiral arteries
  - associated with hypertension and vascular disease
  - anechoic area between placenta and uterus
  - may appear as thickened area
  - <u>Preplacental</u>
    - between placenta & fetus
    - $\cdot$  subchorionic but not under placenta
  - $\boldsymbol{\cdot}$  can obstruct blood flow to cord if large

## 32 Placenta Abruptio:

• Diagnostic Clues for Abruptio:

- Hematoma or hemorrhage
- Bulging of Chorionic plate
- Area of thickened placenta due to hemorrhage
- $\circ$  Easier to detect on anterior placenta's
- Best prognosis
  - ·small hematoma, small detachment, subchorionic

## 33 Differential Diagnosis

- Fibroids
- Molar pregnancy
- Succenturiate placenta
- Chorioangioma
- Previa
- Chorio/amniotic separation

#### 34 Placental Lakes:

- Pooling blood commonly found in the placenta's of late pregnancy
  - ${}^{\circ}$  AKA: vascular pooling, intervillous thrombi, venous lakes, subchorionic lakes, maternal lakes
  - $\circ$  Defined collection of intraplacental hemorrhage with maternal and fetal blood

# 35 Placental Lakes:

- Usually of little concern except when:
  - lake > 1.5cm assoc. with increased AFP
  - possible Rh incompatibility
  - when seen <14 weeks assoc. with prior vaginal bleeding
  - when seen <20 weeks associated with increased AFP
- Can be subchorionic or intraplacental

## 36 Chorioangioma:

- Most common tumor placenta
- Benign, rare (1/5000) intraplacental tumors
- Vascular malformation
- Upper limits of size 10cm
- Well circumscribed solid or complex mass U/S
- hyperechoic or hypoechoic
- Placental thickening
- Can be multiple
- Can lead to increased cardiac output (fetal) causes hydrops, IUGR, preterm labor hemorrhage and fetal demise.
- Increased AFP (maternal serum)

## 37 Chorioangiomas

## 38 Placental Irregularities

- Infarction:
  - More common in late pregnancy
  - Intraplacental sonolucency
  - Associated with abruptio, eclampsia, HTN

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- ${\scriptstyle \circ}$  If <30% of placenta involved prob. O.K.
- Placental Cyst:
  - ${\scriptstyle \circ}$  Secondary to obstruction of venous drainage
- Hydropic degeneration =molar pregnancy

# 39 Placental Irregularities

- Placental insufficiency:
  - Seen with-
    - Diabetes, Post Dates pregnancy, HTN
    - ·IUGR, Mult. Infarcts, Abruptio
- Doppler eval. of Placenta
  - Low resistance bed
  - Interrogate function by sampling umbilical vein
  - $\boldsymbol{\cdot}$  increase resistance indicated by end diastolic flow
- 40
- Accreta-chorionic villi grow into myometrim
- <u>Increta-</u>chorionic villi grow through myometrium

   can cause pain, retained products of conception, hemorrhage, and infection
- <u>Percreta</u>-chorionic villi penetrate into uterine serosa
   tissue can extend to bladder or rectum

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41 Accreta
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42 🔲 Increta

43 Percreta

## 44 D Thick Placenta

- Greater than 4 cm may indicate:
- Diffuse
  - Gestational diabetes
  - Non-immune hydrops
  - Congenital anomalies
  - Rh sensitized
  - Fetal or maternal anemia
- Focal
  - Tumor
  - Abruption
  - Hemorrhage

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- 45 D Thin Placenta
  - 2 cm or less
  - May be associated with
    - Preeclampsia
    - Intrauterine growth retardation (IUGR)
    - Juvenile diabetes

46 Placenta Grading:

- Part of overall OB U/S exam:
- Evaluate basal and chorionic plates as well as intraplacental area
  - Grade 0: (10-12 wks and on)
    - Chorionic plate: smooth, straight, well defined
  - Tissue: homogenous
  - · Basal plate: no echo densities
  - Grade 1: (>27 weeks)
  - $\boldsymbol{\cdot}$  Chorionic plate: subtle undulations and irregularities
  - Tissue: Fine texture with random echo densities
  - · Basal Plate: no echo densities

# 47 🔲 Anterior Grade 0 Placenta

# 48 🔲 Grade I Fundal Placenta

# 49 Placenta Grading:

- Grade II: (>32 weeks)
  - $^\circ$  Chorionic plate: Indentations extending into placenta, not to basal plate
  - ${\scriptstyle \circ}$  Tissue: Linear echogenic densities throughout
  - ${}^{\circ}\operatorname{\mathsf{Basal}}$  Plate: Small number of linear echo densities calcifications
- Grade III: (>34 weeks)
  - $^{\circ}$  Chorionic plate: Separation (cotyledons) with Ca, all the way to basal plate, compartmentalization
  - $^\circ$  Tissue: Increased echogenic areas, some shadowing possible, scattered drop-out in central portion of cotyledons
  - ${\scriptstyle \circ}$  Basal Plate: Large Ca, creating shadows

# 50 🔲 Anterior/Left Lateral Grade III Placenta

# 51 Aging of the Placenta:

- Calcifications
- Intravillous lobes
- Thrombosis
- Most pregnancies @ term grade I or II
- 20-30% @ term grade III
- If grade III<34 weeks: possible IUGR, maternal infection, hypermature placenta
- $\bullet$  If grade O @ term: possible diabetes mellitus, Rh incompatibility

# 52 D Lung maturation/placental aging

• Grade III correlates with mature lungs because usually see Grade III>37 weeks which is usually a good time for mature lungs as well

# 53 🔲 Cervix

- Cervix should measure approximately 3 cm
- $\bullet$  Closed cervix has no fluid within and appears ``V'' shape at internal os
- Bulging of membranes through the external os is a poor prognostic sign
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54 🔲 Vaginal Cervix

55 🔲 Labial Sonography

- Image lower uterus and cervix regions
- Place draped transducer over labia minora
- Sagittal plane
- Image internal cervical os and lower placenta

56 **Labial Sonography** 

## 57 D Umbilical Cord

### 58 D Umbilical Cord

- Two arteries, one vein
  - Arteries carry deoxygenated blood
  - Vein carries oxygenated blood
- Blood to fetus
- ∘ via vein
- From fetus
  - via arteries

### 59 **Umbilical Cord**

- Usually arises from mid placenta
- Wharton's Jelly appears as echogenic material around the cord
- Diameter typically between 1-2 cm
- Length approx. 40-60 cm

# 60 **Umbilical Cord**

- Visualizing two arteries on each side of bladder confirms three-vessel cord
- Should use color Doppler imaging (CDI) or power Doppler imaging (PDI)

## 61 Single Umbilical Artery

- Associated with
  - Congenital anomalies
  - IUGR
  - Increased perinatal mortality
  - Increased chromosomal abnml
- About 50% normal preg.
- 0

### 62 Omphalomesenteric Cyst

- Cvstic lesion in cord
  - Persistence and dilation of a segment of the omphalomesenteric duct
- Usually found closer to fetal cord insertion
- Usually not larger than 6cm

### 63 **Umbilical Cord Knots**

- True knots associated with:
  - Long cords
  - Polyhydramnios
  - IUGR
  - Monoamniotic twins
- False Knot

- Larger blood vessels
  - $\boldsymbol{\cdot}$  Fold on themselves

# 64 Knots

• False Knot

True Knot

# 65 🔲 Nuchal Cord

- Occurs in about 24% of deliveries
- Multiple coils around fetal neck
- Complications
  - Decreased fetal breathing and movement
  - Decreased fetal weight
  - FHR decelerations
  - Fetal death
- CDI/PDI mandatory
- 66 Umbilical Cord Doppler

# • Done to determine normal flow in arteries

- Decreased diastolic flow indicates possible fetal hypoxemia
- Obtain Doppler signal at the same location
- Measure the systolic to diastolic ratio (RI)
- Normal ratios
  - 25-39 weeks 4.0 or less
  - 30-34 weeks 3.3 or less
  - $_{\circ}\,35\text{--}40$  weeks 3.0 or less

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# 67 Indications for Umbilical Cord Doppler

- Maternal disease
  - Hypertension
  - Renal
  - Diabetes
  - Malnutrition
  - Autoimmune problems (Rh sensitization)
- IUGR
- Umbilical anomalies
- Previous fetal demise
- Chromosomal anomalies

68 🔲

- Systole
  - Pulsatile Waveform
- Diastolic
  - Steady and continuous waveform

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70

• Increased Resistance

- Decrease Mean Velocity
- Development of a notch in the early diastolic portion of the velocity waveform caused by destructive interaction between outgoing and reflected waves



- Seen throughout pregnancy
- Increased in first and second trimesters
- Decreased in third trimester
- Small reflectors in fluid is vernix
  - Vernix increases at term

## 72 Production of Amniotic Fluid

- First Trimester
  - Cells lining amnion secrete AF
  - Water diffuses across chorion frondosum
  - Prior to kidney function, passive diffusion from fetus across skin
  - Amnion covering cord also involved
- 12 Weeks
  - Fetal kidneys produce majority of fluid through urination

# 73 🔲 Function of Amniotic Fluid

- Aides symmetrical growth
- Cushions fetus
- Prevents adhesions
- Freedom of movement for fetus
- Aides in lung development
- Maintains constant temperature for fetus
- 98% water, 2% solids

## 74 Resorption of Amniotic Fluid

- Ingested by fetus
  - only small amt. related to urine production in early to mid pregnancy
- At term rate of ingestion = urine production
- Equilibrium must be maintained Production Reabsorption

# 75 🔲 Amniotic Fluid Index

- Fluid determined by measuring fluid pockets
- Measure four pockets free of fetal parts or umbilical cord

## 76 Abnormal Volume of AF

- Polyhydramnios:
  - >2000-3000ml in 3rd Trimester
  - Indicator of possible fetal abnormality
  - LGA with tight abdomen
  - Causes of Polyhydramnios
    - Idiopathic-<50% unknown</li>
    - Maternal causes:
      - Diabetes
      - RH incompatibility

- Pre-eclampsia
- ∘ CHF
- Syphillis or infections

# 77 Polyhydramnios:

- Causes due to fetal abnormality:30%
  - NTD and CNS (45%)-
    - · Anencephaly, meningocele, encephalocele, hydrocephaly, hydranencephaly
  - GI Anomalies-
    - Duodenal atresia
    - Double Bubble sign:
      - fluid filled stomach
      - fluid filled duodenum
      - $^\circ$  fluid not passed to small bowel for absorption. Esophageal atresia, jejunal atresia, diaphragmatic hernia

# 78 Polyhydramnios: Causes due to fetal abnormality cont.

- Multiple gestation
- Grossly malformed fetus
- Circulatory Abnormalities:
  - · Cardiac arrhythmias, coarctation of aorta,
  - $^{\circ}$  fetal hydrops, any compromising congenital defect of the heart.
- Miscellaneous:
  - Teratomas, Pulmonary hypoplasia, Trisomy 18 & 21, Cystic hygroma

# 79 Dolyhydramnios: Sonographic characteristics

- Excessive fluid
- Free floating fetal body
- Placenta appears thin

# 80 Oligohydramnios:

- Volume- <500ml
  - Poor acoustic window
- Causes of oligohydramnios:
  - Premature rupture of membranes
    - or leaking membrane
    - ·increased risk of infection and fetal demise
  - IUGR
    - intrauterine growth restriction

# 81 🔲 Causes of oligohydramnios cont.

- Structural urinary abnormalities:
  - Renal Agenesis (Potters Syndrome)
    - congenital absence of kidneys
    - polycystic kidney disease
  - Renal obstruction-
    - · large fetal bladder that does not empty due to bladder neck or ureteral obstruction
    - ureteral obstruction

# 82 Structural urinary abnormalities

- General guidelines for evaluating renal disease:
  - Differentiate adrenal glands from kidneys when determining size
  - Check texture of kidneys
  - hypoechoic relative to liver
  - ${}_{\circ}$  Renal size should be no more than 1/3 of the total abd. volume

## 83 Other Causes of Oligohydramnios

- Post maturity/Post term pregnancy
- Fetal demise
- Intrauterine infection

# 84 Oligohydramnios

- Severe decrease in amniotic fluid
- Associated with
  - Genitourinary defects
  - Intrauterine growth restriction
  - Premature rupture of membranes (PROM)

# 85 🔲 Conclusion

- Placenta
  - $\circ$  Function
  - ∘ Size
  - $\circ$  Location
  - Grading/maturation
  - ${}^{\circ}\operatorname{Pathologies}$
- Umbilical Cord
  - Masses
  - $\circ$  Dimensions
  - Knots
  - Nuchal cord
  - Single artery
- Cervix
  - Measurements
- Amniotic Fluid
  - Polyhydramnios
  - Oligohydramnios

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