Point-of-Care Ultrasound in the Assessment of the Imminent Delivery

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Disclosures
• No financial disclosures

Introduction
• Emergency department delivery

• Ultrasound
  – Cervical dilation and length (labor)
  – FHR
  – Placental positioning
  – Fetal presentation
  – Estimated gestational age

• Goals
  – Common emergencies
  – Point-of-Care ultrasound assessment
  – Case-based

• General technique
  – Transabdominal ultrasound
  – Transvaginal ultrasound
  – Translabial ultrasound
**Introduction**

- General technique
  - Curvilinear probe
  - Indicator to patient’s head (for most applications)
  - OB setting

**CASE: THE COMBATIVE GRAVID**

**Case: The Combative Gravid**

- 20 yo G1P0 BIBA CC: “I’m having a baby”
- Hx IVDA
- No prenatal care
- “I think I’m 5 months pregnant”
- Gush of bloody fluid several hours ago

**Case: The Combative Gravid**

- History limitations: All of them
  - Limited history and exam
  - Gestational age not really clear
  - Never had confirmation of IUP
  - Never had assessment for complications
  - Refusing speculum exam

**Case: The Combative Gravid**

- What do you want to know?
  - Is she actually in labor?
  - FHR
  - Placental position
  - Fetal presentation
  - Estimated gestational age
Case: The Combative Gravid

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Labor

- True vs False Labor
  - Cervical dilation
  - Cervical length (effacement)
  - Cervical funneling

- Stage of Labor
  - Degree of cervical changes

Labor

- False Labor
  - Irregular contractions
  - No change in intervals
  - No change in intensity
  - No cervical changes

- True Labor
  - Regular contractions
  - Gradually shortening intervals
  - Gradually increasing intensity
  - Cervical changes present

Labor

- Stage of Labor
  - Stage 1
    - Regular contractions → Cervical effacement → Full cervical dilation
    - Active phase at cervical dilation of 3 to 4 cm
      - Dilation at rate of 1.2 cm/hr nulliparous (~5 hours)
      - Dilation at rate 1.5 cm/hr multiparous (~4 hours)
  - Stage 2
    - Full cervical dilation → Delivery of infant
      - Mean 54 minutes nulliparous women
      - Mean 20 minutes multiparous women
    - DO NOT TRANSPORT
  - Stage 3
    - Delivery of infant → Delivery of placenta

Labor

- What does this really mean for me?
  - Assessment of cervix
    - Dilated: definitely in labor
      - Includes funneling
        - Dilation of internal os
      - One of the earliest signs of labor
    - Cervix not dilated, may be in latent phase of stage 1 labor
      - Assess cervical length (effacement)

  - Assessment for cervical dilation
    - Yes
      - Patient is in labor
        - <15 mm
          - Likely in labor
        - 16–29 mm
          - Unclear
        - >30 mm
          - Likely not in labor
    - No
      - Assess cervical length
Labor

• Cervical dilation
  – Digital exam
  – Experience
  – Cooperation
  – Contraindications
    • Placenta previa

Labor

• Cervical dilation by digital exam
  – Patient cooperation
  – Performer confidence
  – Contraindications
    • Vaginal bleeding
    • Rupture of membranes suspected
    • Preterm patients where prolongation of gestation is desired

Labor

• Cervical dilation by ultrasound
  – Yes or no
  – Degree
    • 10 cm = full dilation

Labor

• Cervical dilation by ultrasound
  – Less accurate than transvag or translabial
  – Technical considerations
    • Full bladder very important for visualization
    • Body habitus
    • Fetal positioning

Labor

• Cervical dilation
**Labor**

- Cervical dilation

**Labor**

- Cervical dilation

**Labor**

- Cervical length (effacement)
  - Measure from internal os to external os
  - Normal length 40 – 50 mm
  - Positive correlation between cervical length <30mm and risk for preterm birth between 16 and 28 weeks gestation*
  - Cervical length cutoff < 15 mm high spec, PPV, and LR for true labor²


**Labor**

- Cervical length

**Labor**

- Cervical funneling
  - Dilation of the internal cervical os only
  - One of the earliest signs of labor
  - Can NOT be assessed on digital exam
Labor

• Cervical funneling
  – (58)
  • 79% rate of preterm delivery with funneling > 50%

• Cervical length

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Fetal Heart Rate

• Measure FHR
  – Ultrasound assessment
  • Measure FHR
  • Monitor for decelerations?
Fetal Heart Rate

- FHR indicator of fetal well-being
  - > 20 weeks gestation
  - 120 – 160 bpm normal
  - Bradycardia: FHR < 110
    - Sign of fetal distress
    - Late decelerations
  - Tachycardia: FHR > 160 bpm

Fetal Heart Rate

- Ultrasound assessment
  - M-mode
    - Tracing of heart movement over time
    - Measure peak-to-peak or trough-to-trough
  - Dynamic monitoring?
    - In place of tocometry

Fetal Heart Rate

- Ultrasound assessment

Fetal Heart Rate

- Monitor for decelerations
Fetal Heart Rate

- Fetal SVT
  - Flecainide

Case: The Combative Gravid

- What do you want to know?
  - Is she actually in labor? YES
  - FHR 136
  - Placental position
    - Fetal presentation
    - Estimated gestational age

Placental Position

- Placental abnormalities
  - Placenta previa
  - All the other ones
Placental Position

- Placenta previa
  - Placental tissue overlying os by transab u/s
    - <2.8 cm from internal cervical os highly specific*
    - > 4.2 cm highly specific*
    - Low-lying placenta
  - Typical presentation
    - Painless vaginal bleeding
    - 2nd half of pregnancy and later
  - CONTRAINDICATION TO DIGITAL EXAM


Placental Positioning

- Ultrasound assessment
  - Placenta visualized at or near the fundus
    - 92-98% sensitive for placenta previa*
  - Placenta visualized near the cervix
    - Low-lying placenta
    - Concerning for possible previa
  - Placenta visualized overlying the os
    - Confirms diagnosis of placenta previa
    - Can confirm with
      - Transvaginal u/s
      - Transabdominal ultrasound


Placental Positioning

- Normal placentation positioning

Placental Positioning

- Low-lying placenta

Placental Positioning

- Placenta previa
**Placental Positioning**

- Placenta previa

**Case: The Combative Gravid**

- What do you want to know?
  - Is she actually in labor? YES
  - FHR 136
  - Placental position low-lying, ? previa
    - Fetal presentation
    - Estimated gestational age

**Case: The Combative Gravid**

- What do you want to know?
  - Is she actually in labor? YES
  - FHR 136
  - Placental position low-lying, ? previa
  - Fetal presentation
    - Estimated gestational age

**Fetal presentation**

- Malpresentations
  - Transverse lie
  - Breech presentation

**Fetal presentation**

- Breech presentation
  - 3-4% term pregnancies
  - Complications
    - Umbilical cord prolapse
    - Trauma
    - Hypoxia
    - Fetal distress
    - Head entrapment
    - Premature infants
Fetal Presentation

- Breech presentation
  - OK to allow delivery:
    - Frank breech
    - Complete breech
  - Not safe for vaginal delivery
    - Footling breech
    - Incomplete breech

http://www.michigancerebralpalsyattorneys.com

Fetal Presentation

- Presentation
  - Is the head down or not?
    - If not: breech or transverse lie

Case: The Combative Gravid

- Head NOT down
  - Uh-oh
Case: The Combative Gravid

• What do you want to know?
  – Is she actually in labor? YES
  – FHR 136
  – Placental position low-lying, ? previa
  – Fetal presentation BREECH
  – Estimated gestational age

Estimated Gestational Age

• Viability
  – 0% survival 21 weeks
  – 75% survival at 25 weeks
  – <32 weeks gestation highest risk for adverse events
  – Varies from hospital to hospital
    • 22 weeks gestation or older, initiate resuscitation

Estimated Gestational Age

• By LMP
  – From first day of LMP
  – Fetal viability > 24 weeks

Estimated Gestational Age

• By ultrasound
  – Methods
    • First trimester: 0 – 12 wks
      – CRL
    • Second (13 – 28 wks) and Third (29 – 40 wks)
      – Head circumference
      – Biparietal diameter
      – Femur length

Estimated Gestational Age

• By ultrasound
  – GA assessment less accurate later in pregnancy

| TABLE 1: Precision of Estimates of Gestational Age in the Second and Third Trimesters |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
| GA | 7+00 | 28+00 | 36+00 | 42+00 |
| BPD | 1.9 (1.8) | 2.1 (2.0) | 2.6 (2.5) | 3.3 (3.2) | 4.1 (4.0) |
| CRL | 1.9 (1.8) | 2.1 (2.0) | 2.6 (2.5) | 3.5 (3.4) | 4.3 (4.2) |
| FL | 2.0 (1.9) | 2.2 (2.1) | 2.8 (2.7) | 3.7 (3.6) | 4.4 (4.3) |
| AC | 2.3 (2.2) | 2.5 (2.4) | 3.2 (3.1) | 3.9 (3.8) | 4.5 (4.4) |

Note: Numbers are mean (95% CI) of weeks for specific gestational age based on number of patients enrolled in parentheses. BPD = biparietal diameter, FL = femur length, AC = abdominal circumference.
Estimated Gestational Age

- By ultrasound
  - GA assessment less accurate later in pregnancy
    - Variability of GA estimate = 8% of predicted age*
      - E.g. GA = 32 weeks, true GA +/-18 days
    - Alternative if history or patient unreliable


Estimated Gestational Age

- Second trimester
  - Head circumference
    - Better predictive validity
  - Biparietal diameter
    - Any plane will do
      - Must intersect thalamus and third ventricle

- Third trimester
  - Femur length
    - Better than BPD
  - BPD
    - Ossified distal epiphysis
      - > 29 weeks
    - Still fairly accurate
      - Can be difficult if head engaged


Estimated Gestational Age

- Biparietal diameter
  - Best choice after 14 weeks
    - Predictive validity
      - Ease of measurement
    - Better than LMP up to 20 weeks gestation
    - Less accurate than HC, but less operator-dependent
    - BPD > 54mm single best predictor of survival*


Estimated Gestational Age

- Technique
  - Fan through skull to level of the 3rd ventricle and paired thalami
    - Thalami often mistaken for ventricles
  - Look for the “arrow sign”
    - Junction of 3rd ventricle and quadrigeminal cistern
  - Measure from OUTER skull table to INNER skull table

Case: The Combative Gravid

- What do you want to know?
  - Is she actually in labor? YES
  - FHR 136
  - Placental position low-lying, ? previa
  - Fetal lie BREECH
  - Estimated gestational age 18w4d

Case: The Combative Gravid

- Admitted to OB
- Patient delivered non-viable preterm infant

Final Thoughts

- Ultrasound is awesome
- Excellent tool for evaluating pregnancy
- Helpful in assessment of emergent delivery
- Basic or advanced
Cheers