ANTEPARTUM FETAL SURVEILLANCE

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OBJECTIVES

• Identify current indications for antepartum fetal surveillance
• Describe antepartum fetal surveillance techniques used to assess fetal well-being

ANTEPARTUM FETAL SURVEILLANCE

• When should it start?
  • 32 weeks for most at-risk patients (ACOG)
  • May start earlier if there are multiple high-risk conditions, and delivery at early gestational age would be considered
• How often should it be done?
  • No optimum regimen, BUT
    • If indication isn’t persistent, testing isn’t repeated
    • If indication persists, maternal condition is stable, and tests are reassuring… typically repeated weekly

ANTEPARTUM ASSESSMENT: GOALS

• Identify patients at risk for stillbirth
• Reduce risk of fetal demise
• Avoid unnecessary intervention

ANTEPARTUM FETAL SURVEILLANCE:
POSSIBLE INDICATIONS

<table>
<thead>
<tr>
<th>Maternal Medical Conditions</th>
<th>Pregnancy-related Conditions</th>
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<tbody>
<tr>
<td>Hypertensive disorders</td>
<td>Gestational hypertension</td>
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<td>Diabetes mellitus</td>
<td>Preeclampsia</td>
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<tr>
<td>Renal disease</td>
<td>Gestational diabetes</td>
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<tr>
<td>Metabolic disorders</td>
<td>Fetal growth restriction</td>
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<tr>
<td>Systemic lupus erythematosus (SLE)</td>
<td>Oligohydramnios</td>
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<td></td>
<td>Multiple gestation</td>
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<td>Previous stillborn</td>
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<td>Post-term pregnancy</td>
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<td>Decreased fetal movement</td>
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WHAT’S A PLACENTA DO?

• Fetal lung
• Kidney
• GI tract
• Skin
• Endocrine organ
UTERINE BLOOD FLOW

- Relies on maternal cardiac output (CO)
- \( CO = \text{Maternal Heart Rate (MHR)} \times \text{Stroke Volume (SV)} \)
- Maternal blood volume increases by 30-50% during pregnancy
- At term, approximately 500 ml blood per minute

HYPOXIA AND THE FETUS

Oxygen Deprivation

- \( \downarrow \) Cerebral Edema
- \( \downarrow \) Blood Flow to Periphery
  - Ventromedial & retrocordal
  - Affected Blood Flow to Vital Organs (brain, heart, & abdomen)
- \( \downarrow \) Blood Pressure
  - \( \downarrow \) HR

Fetal Well Being (Normal Placental Reserves)
- Nutritional Compromise

Fetal Growth Restriction (Decreased Nutrient Transfer)
- Marginal Placental Respiratory Function

Fetal Hyoxia With Stress (Decreased \( O_2 \) and \( CO_2 \) Transfer)
- Decreasing Respiratory Function

Some Residual Effects of Intermittent Hyoxia
- Profound Respiratory Compromise

Asphyxia
- Death

Placental Integrity Zones

- Normal
- Fetal Malnourishment
- Placental Respiratory Failure

Limit of optimum \( O_2 \) and \( CO_2 \) exchange

Poor nutrient transfer of large molecules

“Safety factor”

+ Placental reserves

- Poor \( O_2 \) and \( CO_2 \) transfer
ANTEPARTUM TESTING:
FETAL ASSESSMENT

- Fetal kick counts
- Non-stress test
- Biophysical Profile (BPP)
- Modified BPP
- Contraction Stress Test
- Amniocentesis
- Doppler Ultrasound

FETAL KICK COUNTS

- All patients should perform DAILY kick counts
- For high-risk patients, begin at 26 weeks gestation
- Performed daily at a consistent time
- 10 discrete movements in 2 hours;
  - Less than 10 movements? Call provider or L&D for follow-up testing
  - Call provider if changes in kick-counts

NON-STRESS TEST (NST)

- Outpatient external fetal monitoring (EFM)
- Minimum of 20 minutes
- Spontaneous or induced accelerations of fetal heart rate (FHR)
  - 32 weeks gestation and older:
    - At least 15 beats per minute (bpm), lasting at least 15 seconds
  - Less than 32 weeks gestation:
    - At least 10 bpm, lasting at least 10 seconds
- No decelerations
- Maximum of 40 minutes

NST TECHNIQUE

- Place patient in lateral or semi-fowlers position with tilt
- Apply EFM
- Apply blood pressure cuff and oxygen saturation monitor
- Vital signs assessed and documented
- If reactivity noted, test completed in 20 minutes
- May need extended EFM per licensed provider

NST INTERPRETATION

- Reactive
  - 2 or more qualifying accelerations in 20 minute period
- Nonreactive
  - Less than 2 accelerations or criteria for accelerations not met in 40 minutes
- Unsatisfactory
  - Inadequate quality of tracing
- Decelerations
  - Warrant further review

VIBROACOUSTIC STIMULATION

- 1-3 second stimulation placed over fetal head
  - If no response, may repeat up to 3 times for longer durations, up to 3 seconds
- 1 minute intervals
  - If still non-reactive, follow-up with further testing
  - Prior to 30 weeks, response may be single prolonged acceleration
CONTRACTION STRESS TEST (CST)

- Assumes that fetal oxygenation will be affected by uterine activity
  - If baby’s oxygenation is already compromised, we should see late decelerations
- Requires adequate contraction pattern
  - At least 3 contractions
  - Lasting at least 40 seconds each
  - In a 10 minute period of time
- Contraindicated when labor or vaginal delivery is contraindicated

CST: STIMULATING CONTRACTIONS

- Spontaneous contractions
- Nipple stimulation
  - Often successful with quicker results
- Intravenous oxytocin

CST INTERPRETATION

- Negative
  - No late decelerations, with contractions meeting criteria
- Positive
  - Late decelerations with more than 50% of contractions
  - Does not require 3 contractions in 10 minutes
- Equivocal/Suspicious
  - Late decelerations with less than 50% of contractions
  - Equivocal
    - FHR decelerations in presence of contractions more frequent than every 2 minutes or lasting longer than 90 seconds
  - Unsatisfactory
    - Unable to adequately monitor or complete test

NST VS. CST

- Main advantage of NST is that it doesn’t require contractions
- NSTs have a higher false negative rate than CSTs
  - False negative: stillbirth occurs within one week of a reactive tracing
- NSTs have a higher false positive rate
  - False positive: non-reactive NST followed by a normal follow-up test

BIOPHYSICAL PROFILE (BPP)

- Combines results of NST with ultrasound testing
- Ultrasound test that captures a snapshot of fetal health by measuring
  - Fetal tone
  - Breathing movements
  - Gross body movement
  - Amniotic fluid volume
  - NST

BPP SCORING CRITERIA

<table>
<thead>
<tr>
<th>FETAL PHYSIOLOGIC PARAMETER</th>
<th>NORMAL (SCORE = 10)</th>
<th>ABNORMAL (SCORE = 0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing movements</td>
<td>≥ 3 episodes of ≥ 15 sec in ≥ 30 min observation period</td>
<td>If breathing movements are absent or ≤ 1 episode of ≥ 15 sec in ≥ 30 min observation period</td>
</tr>
<tr>
<td>Gross body movements</td>
<td>≥ 3 observable body or limb movements in ≥ 10 min</td>
<td>≥ 3 observable body or limb movements in ≥ 10 min</td>
</tr>
<tr>
<td>Tone</td>
<td>A 3 episode ≥ 20 bpm increase in baseline ≥ 10 bpm or ≥ 15% increase in baseline is considered normal (mean)</td>
<td>Either slow correction or return to previous baseline, ≥ 20 bpm increase in baseline ≥ 15% of baseline or absent movement</td>
</tr>
<tr>
<td>Reactive fetal heart rate</td>
<td>≥ 2 accelerations ≥ 15 bpm lasting ≥ 15 sec associated with fetal movement in ≥ 50% of occasions</td>
<td>2 accelerations or accelerations ≥ 15 bpm lasting ≤ 15 sec associated with fetal movement in &lt; 50% of occasions</td>
</tr>
<tr>
<td>Amniotic fluid volume</td>
<td>≥ 1 pocket of fluid ≥ 2 cm in ≥ 2 perpendicular planes</td>
<td>Either no pockets or a pocket, &lt; 2 cm in 2 perpendicular planes</td>
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BPP AND FETAL RESPONSE TO STRESS

- Fetus responds to hypoxemia in a predictable, physiological basis.
  - Non-reactive NST
  - Loss of fetal breathing movements
  - Loss of gross body movements
  - Loss of tone
  - Fetal death
- This helps us estimate the presence and severity of fetal hypoxemia, based on the BPP

MODIFIED BPP

- Combines NST and assessment of amniotic fluid index (AFI)
- Evaluates long-term uteroplacental function
- Amniotic fluid volume reflects fetal urine production
  - AFI more than 5cm considered adequate
- Placental dysfunction
  - Fetal blood shunted to brain, heart, adrenals
  - Decreased renal perfusion leads to oligohydramnios

AFI PROCEDURE

- Imaging of uterus in four quadrants
- Measurement of largest vertical drop pocket of amniotic fluid
- Total of four quadrants added together for total index or volume
- 5 cm or more is considered adequate
  - Normal: Reactive NST and AFI > 5cm
  - Abnormal: Nonreactive NST and AFI < 5cm

FETAL DOPPLER FLOW STUDIES

- Only indicated for intrauterine growth restriction (IUGR) and severe hypertension – not normal pregnancies!
- Measures pulsatile blood flow of umbilical arteries and other fetal vessels
  - Umbilical flow velocity of normally grown fetus ➔ high-velocity diastolic flow
  - Umbilical flow velocity of IUGR fetus ➔ diastolic flow is diminished, absent, or reversed
  - Poor diastolic flow = blood flow resistance in the placenta
- Reflects current, up-to-the-minute status of placental blood flow
- Used in conjunction with NSTS or BPPs
AMNIOCENTESIS

- Sample of amniotic fluid collected via needle in maternal abdomen
- Guided by ultrasound
- Amniotic fluid tested for the lecithin-sphingomyelin ratio (L/S ratio) to determine lung maturity

CLINICAL MANAGEMENT

- Communicating with provider
- View tracing of FHR and all test results
- Tests with abnormal results are followed up with more sensitive and specific tests

COMMUNICATION WITH PATIENT

- Open communication regarding status
- Inform about necessary follow-up appointments and tests
- Education
  - Fetal movement and warning signs
  - Who patient should call with concerns
  - Signs and symptoms of preterm labor
  - Emphasize there are no stupid questions

REFERENCES