Objectives
- Define the role of antenatal fetal assessment
- List the methods of antenatal fetal assessment in common use
- Understand the application and interpretation of the various methods of fetal assessment
- State the limitations of the methods of assessment
- Review clinical indications and timing of the various methods

Introduction
- Goal
  - Identify fetuses at risk for intrauterine injury or death and to prevent these adverse outcomes
  - Recognize the fetus that will benefit from early intervention/delivery without preterm delivery of the healthy fetus leading to different morbidity/mortality

Premise
- Fetal hypoxia and acidosis is the final common pathway to fetal morbidity and mortality
- Fetus whose oxygenation in utero is challenged will respond with a series of detectable signs as hypoxemia progresses to metabolic acidemia

Example Indications
Maternal Conditions
- Anti-phospholipid syndrome
- Chronic renal disease
- Cyanotic heart disease
- Hemoglobinopathies
- Hypertensive disorders
- Hyperthyroidism
- Systemic lupus erythematosus
- Type 1 diabetes mellitus

Pregnancy Related Conditions
- Decreased fetal movement
- Intrauterine growth restriction
- Immunization
- Multiple gestation
- Oligohydramnios
- Polyhydramnios
- Post-term pregnancy
- 41 weeks' gestation
- Pregnancy-induced hypertension
- Previous fetal demise

Fetal surveillance
- General limitations of tests of fetal surveillance
  - In the 3rd trimester
    - Fetuses spend 25% of time in a sleep state
    - Increase the risk of non-reassuring fetal testing
  - Which pregnancies should undergo antenatal fetal surveillance
    - 30 to 50 percent of perinatal deaths occur in low risk pregnancies
  - Acute catastrophic events such as abruptio placenta or cord accidents will not be detected

- Need to be able to identify fetal compromise in enough time to make a difference with an intervention
Introduction

- A combination of antenatal fetal assessment methods may be the optimal management strategy to balance the risks of false positive and false negative results.

Common Methods of Antepartum Fetal Assessment

- Fetal movement assessment
- Nonstress test
- Biophysical profile
- Modified biophysical profile
- Contraction stress test
- Fetal vascular interrogation
  - Umbilical artery
  - Middle cerebral artery
  - Ductus venosus

Fetal Movement Assessment

- Introduced by Sadovsky and Cardiff – 1970’s
- Fetal movement decreases in response to hypoxemia
  - Maternal perception of decreased fetal movement may precede fetal death in some by several days
- Many methods for fetal “kick” counting
  - No one method appears to be better/more predictive of a compromised fetus than another
  - Initiated between 26 and 32 weeks’ gestation

Cardiff Count-to-Ten Movement Counting Method

- Choose one period during the day to count
- Count at the same time every day
- Chart how long it takes to reach 10 movements
  - Count all recognizable movements
  - Do not count hiccups
  - Fill in all blanks on the chart
- At least 10 movements in 10 hours
  - Less than 10 movements within 10 hour period or a trend of steadily decreasing movements

Fetal Movement Assessment

- Sadovsky
  - Fetal movements are counted three times a day after meals
  - Concern with decreasing movement compared with prior counts

Fixed-period method

- Fetal movement counted in a period of one hour daily
  - Fewer than four fetal movements in one hour – repeat counting over next hour
  - Less than 4 movements triggers need for a secondary method of fetal assessment
Fetal Movement Assessment

- Common instructions
  - Patient lies on her side to count fetal movement
  - Count of 10 distinct fetal movements during a 2-hour period reassuring
  - Count fetal movements for 1 hour 3 times per week
  - Count is reassuring if it is at least equal to the previously established baseline count
  - Review your individual hospitals and/or office guidelines

Fetal Movement Assessment

- Results of studies for reduction of stillbirth are inconsistent
- Randomized trial - Denmark
  - Associated with 73% reduction in avoidable stillbirths
- Results of studies difficult to compare due to differences in methods
- No specific fetal movement threshold as a limit for concern
- Maternal sense that fetal activity is reduced may be the most important factor
- Cochrane database review concluded
  - Insufficient evidence to recommend routine fetal movement counting to prevent stillbirth in high risk or low risk pregnancies

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- Multiple studies have shown decreased fetal movement increases risk of adverse perinatal outcomes
- Effectiveness of fetal kick counting in preventing stillbirth uncertain
- Evidence that formal program of fetal movement assessment in low-risk women results in reduction in fetal deaths is lacking
- Whether fetal movement assessment adds benefit to a program of regular fetal surveillance unknown
- Does not appear to increase number of antepartum visits or interventions (RCT)
- Although not all women need to perform daily fetal movement assessment, if a decrease in fetal activity is noted further assessment should be performed

Nonstress Test (NST)

- Premise
  - Fetal heart rate of non-compromised fetus will accelerate with fetal movement
- Predictive value
  - Low false negative rate
  - 0.19% to 1%
  - Negative predictive value is 99.8%
  - High false positive rate
  - 55% to 90%
  - Absence of reactivity not necessarily pathologic
  - Sleep cycle
  - Acidosis
  - 15% of all NSTs will be nonreactive

Biophysical Profile (BPP)

- Combines NST with fetal ultrasound assessment
- More time intensive than NST alone and requires training
- Predictive value
  - Low false negative rate
  - ~0.07%
  - High false positive rate
  - Slightly lower than NST alone

The Biophysical Profile

<table>
<thead>
<tr>
<th>Factor</th>
<th>NORMAL (Score = 2)</th>
<th>ABNORMAL (Score = 0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fetal Breathing Movements (FBM)</td>
<td>1 episode of FBM of 30 seconds duration</td>
<td>&lt; 30 seconds of sustained FBM</td>
</tr>
<tr>
<td>Fetal Movements (FM)</td>
<td>3 discrete body/limb movements</td>
<td>&lt; 2 episodes of FMs</td>
</tr>
<tr>
<td>Fetal Tone</td>
<td>1 episode of active extension with rapid return to flexion of fetal limb(s), trunk, or hand</td>
<td>Either slow extension with return to partial flexion or absent fetal movement</td>
</tr>
<tr>
<td>Nonstress Test</td>
<td>2 accelerations of 15 bpm peak amplitude lasting 15 seconds at the baseline within 20 minutes</td>
<td>Lack of criteria for reactivity</td>
</tr>
<tr>
<td>Amniotic Fluid Volume</td>
<td>Amniotic fluid index greater than 5 cm or maximum vertical pocket of greater than 2 cm</td>
<td>Decreased AFV</td>
</tr>
</tbody>
</table>
The Biophysical Profile

- Biophysical profile: 8-10
  - Reassuring
  - Follow-up as clinically indicated

- Biophysical Profile: 4
  - Non-reassuring
  - Delivery considerations
  - Gestational age >36 weeks

- Biophysical Profile: 6
  - Equivocal
  - Repeat Biophysical Profile in 24 hours

- Biophysical Profile: 0-2
  - Alarming
  - Calls for delivery

Oligohydramnios calls for further monitoring or delivery

Biophysical Profile

- Factors which may affect fetal parameters assessed
  - Hypoxemia
  - Acidosis
  - Gestational age
  - Magnesium sulfate
  - Excessive transducer pressure on the maternal abdomen
  - Others

Modified Biophysical Profile

- NST and amniotic fluid volume assessment
  - Combination of short term marker of fetal acid base status with the chronic marker of amniotic fluid
  - Amniotic fluid assessment
  - Normal
    - NST reactive and amniotic fluid volume in deepest vertical pocket ≥ 2 cm
  - Abnormal
    - NST nonreactive and amniotic fluid volume in deepest vertical pocket < 2 cm

- Additional data does not exist to recommend or not recommend the modified BPP
  - Similar reassuring false-negative rate and potentially a lower false-positive rate than the nonstress test alone

Modified Biophysical Profile

- Benefits
  - Less training than full BPP to perform
  - Less time consuming than full BPP
  - Negative predictive value similar to full BPP

- Limitations
  - False-positive rate high
    - 60% of those delivered because of an abnormal antepartum test had no evidence of fetal compromise
    - Led to preterm delivery in 1.5% of those tested before term

- Adequate data does not exist to recommend or not recommend the modified BPP

  - Similar reassuring false-negative rate and potentially a lower false-positive rate than the nonstress test alone

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Contraction Stress Test

- Fetal heart rate response to uterine contractions
- Premise
  - Compromised fetus will have transient worsening in oxygen status with uterine contraction due to lack of reserve resulting in late decelerations

Common Method

- External monitoring of FHR and uterine activity
- Three contractions of at 40 seconds duration or longer in a 10-minute period
- Spontaneous or induced contractions
- Interpreted according to the presence or absence of late decelerations

Interpretation

- Negative
  - No late or significant variable decelerations
- Positive
  - Late decelerations following 25% or more of contractions
- Equivocal
  - Interpreted late decelerations/significant variable decelerations
  - Fetal decelerations with contractions, even if frequent/brief, not ≥ 1 minute or ≤ 90 seconds
  - Intermittent late decelerations
- Unsatisfactory
  - Fewer than 3 contractions in 10 minutes or an uninterrupted tracing

Limitations

- Time consuming
- Usually requires intravenous infusion of oxytocin
- Contraindications
  - Preterm rupture of membranes,
  - History of extensive uterine surgery
  - Placenta previa
  - Preterm labor or history of preterm labor

Negative predictive value of greater than 99.9%

Contraindications limit use of the contraction stress test in many high-risk situations

Few demonstrated benefits over other methods of fetal assessment

Should not be used routinely

No large clinical trials to guide frequency of testing

Should be individualized and based on clinical judgment

One time concern vs persistent clinical condition

If maternal medical condition stable and test results reassuring, tests of fetal well-being typically repeated at weekly intervals

In pregnancies complicated by fetal growth restriction

Optimal interval not established

Ultrasoundographic assessment of growth should not be performed more frequently than every 2 weeks

Any significant change in maternal or fetal status requires further reevaluation

Frequency of Testing
Management of Abnormal Surveillance

- Abnormal antepartum fetal test result should be interpreted in the context of the overall clinical picture
- Certain acute maternal conditions can result in abnormal test results that normalize as maternal condition improves
- Stepwise approach for assessment of the fetal condition should be undertaken
  - Antepartum fetal surveillance tests have high false-positive rates and low positive predictive values
  - Minimizes the potential for unnecessary delivery based on a single false-positive test result
- Response to abnormal test result should be tailored to the clinical situation

Thank you!