Antepartum Fetal Surveillance
History & Considerations

• Widespread use of technology attributed to wrongful life lawsuits (1978 & 1979)
• Recommended by ACOG and AAP
• Driving forces in ↑ fetal surveillance
  - Availability of technology
  - HCP’s who want to know and do more
  - Consumer pressure for quality outcomes & desire for more information
  - Fear of liability
Fetal Surveillance

- The availability of fetal surveillance has transformed the pregnancy experience from a miracle of nature to a risk-dominated and technology-guided event.
- Shifts the focus of the pregnancy to what could go wrong, not what could go right.
Indications for Surveillance - Assess Pregnancies At Risk

- ↓ fetal movement
- Hypertensive disorders
- Maternal disease
- Oligohydramnios
- IUGR
- Postdate pregnancy
- Diabetes (GDM & IDDM)
- Rh disease, isoimmunization
- Hemoglobinopathies
- Previous unexplained fetal demise
- Multiple gestation
- Advanced maternal age
Postdates Pregnancy (> 42 wks)

- Possible estrogen deficiency
  - Decreased production
  - Progesterone withdrawal theory
- Fetal cause
  - Estrogen deficiency
  - Lack of precursor hormone
- Maternal cause - 50% reoccurrence
  - ↑ in primips, 15-20 yrs & multips > 35 yrs
Amniotic Fluid Properties

- pH neutral
- Composed of a little water from maternal circulation, fetal lung fluid, & fetal urine
- Derived from maternal circulation and amniotic membrane
- Fluid volume changes due to fetal excretion of urine, fetal swallowing/respiratory tract, and water transport across the fetal skin and fetal membranes
Amniotic Fluid Volume

- 12 wks  50 cc
- 16 wks  250 cc
- 20 wks  400 cc
- 22 wks  800 cc
- 38 wks  1000-1200 cc
- 40 wks  800 cc
- 41 wks  600 cc
- 42 wks  400-500 cc
- 43 wks  300-400 cc
- 44 wks  160 cc
Functions of Amniotic Fluid

- Cushions fetus and umbilical cord from direct pressure and injury
- Allows fetus to move freely
- Assists in respiratory efforts
- Facilitates fetal lung development and surfactant development
- Anti-microbial properties to prevent infection
Fetus

Swallowing 500-1000

Lung fluid 340

Urine flow 800-1200

Intramembranous 200-500

Head

Amniotic Fluid

Transmembranous 10
**Amniotic Fluid Volume Regulation**

2. Fetal swallowing and reabsorption by intestine

4. Secretion from respiratory tract

5. Oral-nasal secretions

---

**Intramembranous Pathway = 3**

- Fetal urine
- Transfer across chorionic plate
- Net water movement between mother and fetus across placenta
- Exchange across fetal skin possible only for small lipid soluble gases

---

**Transmembranous Pathway**

6?
Pathophysiology of Postdates

• Amniotic fluid
  - ↓ fluid (oligohydramnios)
  - Meconium contamination (up to 30%)

• Placenta and umbilical cord
  - Placental aging - fibrin & calcium deposits cause infarcts
  - Decreased umbilical cord flow
Maternal Effects of Postdates Pregnancy

- Physical exhaustion
- Psychological depression
Fetal Effects of Postdates Pregnancy

- Macrosomia, birth injury
  - Baby too big, more time to grow
- Dysmaturity syndrome
  - Cracked, dry, peeling skin
  - Above + meconium stained skin/cord
  - Above + yellow staining skin/cord
- Fetal hypoxia
  - Poor placental or cord perfusion
Fetal Effects of Postdates Pregnancy

• Meconium aspiration syndrome
  - gasping respirations, compromised lung clearing

• Hypoglycemia
  - Exhausted CHO stores

• Polycythemia
  - ↑ RBC's, compensatory response

• Risk of shoulder dystocia -- ADOPE
ADOPE

• A  Advanced maternal age
• D  Diabetes
• O  Obesity
• P  Post-term or prior large baby
• E  Excessive weight gain
Surveillance via Ultrasound

- Early pregnancy - confirm pregnancy, fetal number, crown-rump length
- 2nd & 3rd trimesters - fetal size, fetal anomalies, placental location, AFV, fetal position
- During diagnostic procedures
- Controversy over “routine” U/S
Doppler Flow Studies

- Assessment of flow patterns and velocities in fetal arteries
- Flow calculated using the difference between the systolic and diastolic flow
Fetal Activity Acceleration Determination Test (FAD) (Fetal Kick Counts)

- The evaluation of fetal movement (FM) & accels prior to the onset of labor
- May begin as early as 26 wks
- Both accels and FM are evaluated
- Accels are not a response to fetal movement, accels are associated w/FM
  - Fetus moves in response to activation of motor nerves in the brain
  - The stimulus that precedes motor nerve activation also precedes sympathetic nerve activation & spontaneous accels
FAD

- A well-oxygenated term fetus accelerates with 90% of FMs (women only feel ~ 30% of kicks)
- Cessation of fetal movements is correlated with fetal death
- Cardiff Count-To-Ten Method
  - Count same time each day
  - Report < 10 movements in 10 hr period for 2 consecutive days, or no fetal movements in 10 hrs
  - Based on assumption that <10 kicks in a 12 hour period is cause for concern
Fetal Kick Counts

- Sadovsky Method
  - Consistent time to do counts 3x daily
  - 4 or more movements in 1 hour
  - Call provider if < 4 movements in 1 hr

- Modified Kick Count
  - Count same time each day
  - Record time it takes to reach 10 kicks
  - Call provider if length of time varies greatly from norm or < 4 kicks in 1 hr
Fetal Movement Influences

- Gestational Age
- Diurnal rhythm
- Fetal behavior
- Drugs
- Smoking
- Fetal malformation
Fetal Movement Counting

- Woman should eat, drink, rest, and focus on fetal movement for 1 hour.
- Healthy fetus has 10 perceivable movements within 10 to 60 minutes.
- Recommend beginning at 28 weeks for at-risk women.
- \(\downarrow\) fetal movement is not necessarily ominous.
Implications of Non- Reactive FAD

- FM & FHR accels strongly predictive of fetal well-being
- A hypoxic fetus ↓ BLV and accel amplitude; eventually accels completely disappear
- Apply interventions to maximize perfusion and oxygenation to fetus
- Report to MD/CNM so additional testing/intervention can be determined
Electronic Fetal Monitoring

- Provides data about the response of the fetus to intrauterine events
- Fetal surveillance technique that can identify a healthy, well-oxygenated fetus, but is of limited use in identifying an at-risk or compromised fetus due to high incidence of false positives
Nonstress Test

- Most commonly performed antepartal test
- An evaluation of the FHR pattern in the absence of regular uterine contractions to determine fetal oxygenation, neurologic, and cardiac function
- Based on premise that the normal fetus moves at various intervals; CNS & myocardium responds to FM with acceleration of FHR
- Dependent on the integration of peripheral receptors, ANS, and myocardial function
- Acceleration is a sign of fetal well-being
NST

• Benefits:
  - Noninvasive
  - Takes less time to complete than CST
  - No contraindications
  - Can be performed in hospital, clinic, home

• If pregnancy was high-risk:
  - Weekly NST during 3rd trimester associated with stillbirth rate of 6.1 per 1000 births
  - Twice weekly NST, stillbirth rate 1.9 per 1000 births
NST Protocol

- Assess maternal VS & understanding of test and its purpose
- Assess last oral intake, including any meds and street drugs
- Assess when smoked last and what she smoked
- Obtain FM history and assess her concerns
Protocol

• Avoid supine positioning to optimize uterine perfusion and prevent false-positive results

• Apply toco & U/S transducer, palpate for UA
Oral Intake During Antepartal (AP) Tests

- Do not feed woman - should not be fed until fetal well-being has been confirmed due to risk of urgent cesarean birth
- Once thought juice or glucose would cause accels; myth NOT supported by research
  - No difference in average time it took for fetus to become reactive
  - Glucose does not alter a non-reactive FHR pattern
  - Theoretically, the splash of liquid in stomach may create an acoustic stimulation which might precede MF and accelerations
Classifications of NSTs

- Reactive
- Non-reactive
- If pattern unclear, classified as inconclusive or unsatisfactory
Reactive NST (ACOG)

- Recognition Criteria:
  - 2 or more accels that
  - Peak at least 15 bpm above the baseline (BL) and
  - Last 15 seconds from BL to BL (at their base) within
  - 20 minute period
  - *With or without discernible movement by the woman (ACOG)*
NST False Negative Rate

- Reactive NST and negative CST are equally good predictors of fetal status and “good outcomes”
- False negative refers to the incidence of stillbirths occurring within one week of a reactive NST
  - When corrected for congenital anomalies, the false negative rate for NST was 1.4 per 1000 births meaning 1 in 1000 will die before the end of the week, even with a reactive NST (false negative for CST is 0 in 1000 births)
  - Hence, the NST is only good at the time of the test
Classification: Non-reactive (NR) NST

- Recognition criteria:
  - No accels or
  - Only 1 accel that meets the 15 x 15 criteria
  - 2 or more accels that do not meet the 15 x 15 criteria in any 20 minute period of time during a total monitoring period of 40 minutes
Non-Hypoxic Causes of NR NST

- While a reactive NST is predictive of a well-oxygenated fetus, a NR NST has a high false positive rate
- False + test means the baby is well-oxygenated, even though no accels
  - Fetal sleep/quiescence
  - Preterm gestation
  - Smoking prior to test (depresses CNS & ↓ FM)
  - CNS depressant drugs ingested or administered
  - B-blocker (i.e., atenolol)
  - Congenital cardiac or CNS anomalies
Additional Testing Time

- To reduce false positive rate and decrease additional unnecessary testing (CST or BPP), the provider may extend testing time
- ACOG has recommended the NST be classified as NR if after 40 minutes, 2 accels do not meet reactive criteria within 20 min. of time
  - Vigorous shaking no longer recommended; 90% of fetuses do not respond and it did not change the fetal behavioral state
Additional Testing Time

• Acoustic stimulation may be used after the first 20 minutes of monitoring

• Notify provider if NR after 40 minutes of testing
Additional Time

- 60 min. test time:
  - Oxygenated fetuses who became reactive after 60 total min. were at no higher risk for perinatal complications than those who were reactive within 30 minutes
  - (Davoe, McKenzie, Searle, & Sherline, 1985)

- 80 minutes
  - If fetus anatomically normal and no drugs in fetus, a NR NST after 80 min. of testing suggests fetus may be significantly compromised
NR NST Related to Hypoxia

- When FHR pattern non-reactive after a total monitoring time of 80 minutes, there was ↑ risk of:
  - Oligohydramnios
  - IUGR
  - Fetal acidosis
  - Meconium-stained amniotic fluid and/or
  - Placental infarction
Fetal Acoustic Stimulation Test (FAST)

• Stimulation of the fetus with a loud sound and identification of the FHR response
• Acoustic stimulation startles the fetus
  - May pass urine, but no reports of meconium passed after FAST
  - Does not impair fetal hearing
• Purpose
  - Evaluate fetal acid-base status and
  - Reduce antepartal testing time
Benefits

- Noninvasive
- Low false negative rate (similar to reactive NST, i.e., if fetus accels and tracing reactive, the fetus is not metabolically acidotic)
- A follow-up test after NR NST
  - 70-80% of fetuses who had NR NST had a reactive FHR after acoustic stim
- May shorten testing time
- Has been used to startle a fetus who was holding its cord causing variable decels
- Has been used to move fetus during external cephalic version
Limitations

- Deaf, oxygenated fetus will not respond (fetus begins to hear at 25 wks EGA)
- Fetuses with middle ear infections may not respond
- Response depends on gestational age, i.e., < 30 wks fetus may accelerate, > 30 wks fetus may increase BL rate and accel for up to 1 hour
- Some fetuses habituate to repetitive sound stimuli and progressively ↓ their response
Limitations (con't)

• High false positive rate (only 50% of fetuses who did not respond to the sound were acidotic)

• Testing time may lengthen if the accel lasts 15 or more minutes (tachycardic BL)

• Variable and/or prolonged decels may occur after sound stimulus
Sound-Producing Devices

- Fetal Acoustic Stimulator
- Radio
- Telephone
- Electric toothbrush
- Pager
- Bedpan pounded with spoon
- Tambourine
- Electric shaver
- 2 spoons or 2 metal instruments taped together
- Clapping hands
Test Protocol

- Allow woman to touch/feel acoustic stimulator prior to application
- Monitor fetus at least 10 min. prior
- Notify provider if FHR NR prior to stimulus and withhold stimulus until further orders received
Number & Duration of Stimulus

• Some prefer to start with the sound-producing device on woman’s thigh or some distance away from fetal ear
  - Can move closer to fetal head with each successive stimulus

• Series of 1-7 stimuli with duration of 1-10 seconds may be emitted
  - Reasonable protocol would be to have a total of 3 sound stimuli one minute apart (Murray, 2007, pg. 470)
Interpretation

- **Reactive**
  - 2 accels peaking at least 15 bpm above BL, lasting > 15 sec. at the base w/in 20 min.
  - Accels are often taller & longer than accels w/NST
  - BL FHR may also ↑ for up to 30 min. after stim.

- **Nonreactive**
  - Accels that do not meet criteria within 40 minutes of monitoring, or
  - After 3 applications of acoustic stim at 5 minute intervals, no acceptable accels within 5 minutes of the 3rd stimulus
Follow-Up

- Lack of accel following acoustic stim may be followed by BPP or CST
Contraction Stress Test
(Helps assess fetal reserve)

- Evaluates FHR response to UC's, assesses fetal reserves
- Obtain BL FHR tracing for 20 minutes
- If no spontaneous UC's, need to stimulate UC's until 3 UC's of at least 40 seconds duration occur within 10 minutes
- IV oxytocin or nipple stimulation
Interpretation of CST

- **Negative CST (normal)** - no late decels
- **Positive CST (abnormal)** - lates with >50% UC's even if UC frequency <3 in 10”
- **Equivocal CST (suspicious)** - intermittent late or significant variables
- **Unsatisfactory CST** - < 3 UC's/10 min. or quality of tracing inadequate for interpretation
Contraindication to CST

• Preterm labor or at-risk for PTL
• Preterm rupture of membranes
• Classical uterine incision or prior uterine surgery
• Known placenta previa
Biophysical Profile

- Helps assess both immediate fetal well-being & longer term placental function
- Progressive fetal hypoxia manifested as a loss of biophysical function
- Components
  - Fetal movement (NST)
  - Fetal breathing
  - Fetal movement
  - Fetal tone
  - Amount of amniotic fluid
BPP Scoring

• 8-10 Reassuring. Repeat weekly for high risk patient except if diabetic or post-term, then 2x weekly

• 4-6 Non-reassuring. If baby mature and cervix ripe, deliver; otherwise repeat in 24 hrs.

• 0-2 Immediate delivery
Amniotic Fluid Volume

- Single pocket of fluid exceeding 2 cm. in two perpendicular planes
- Amniotic fluid index (4 quadrant measurement)
- Measure pockets of fluid in all 4 quadrants, add up total cm’s of fluid. Pockets must be free of fetal parts and cord.
AFV

- Gives you an idea of longer term placental function
  - < 5 cm. of fluid - abnormally low, need to deliver
  - 5-10 cm. - borderline, repeat biweekly
  - 10-12 cm - normal (up to 15 cm may be normal)
  - 15-20 cm - increased
  - > 20 cm - hydramnios
Modified BPP

• Assess only 2 parameters:
  • NST as a short-term indicator of fetal acid-base status
  • Amniotic fluid index as indication of long-term placental function

  - Less time consuming than full BPP - appears equivalent in establishing likelihood that fetal death will not occur
Nursing Responsibilities

• Assess for need for fetal surveillance

• Instruct parents:
  - Indications for fetal surveillance/testing
  - Assure informed consent for invasive procedures
  - Explain test, procedures
  - When to notify primary care provider

• Assist with procedure as appropriate

• Document (procedure, results, tolerance)