The Nonstress Test (NST) and Contraction Stress Test (CST)
Learning Objectives

- Understand the rationale for fetal assessment
- Describe approaches for assessment of fetal well being
- Prerequisites:
  - FLAME LECTURE 53: Overview of Interpreting Fetal Heart Rate Tracings
  - FLAME LECTURE 54: Outpatient Antenatal Testing
- See also – for closely related topics
  - FLAME LECTURE 56: The Biophysical profile
  - FLAME LECTURE 57: Assessment of fetal movement
  - FLAME LECTURE 59: Assessment of amniotic fluid volume
Rationale of Prenatal Outpatient Fetal Assessment

- **Goals**
  - Detect uteroplacental insufficiency
  - Prevent stillbirth
  - Avoid unnecessary iatrogenic preterm delivery

- **Physiologic basis** — The fetal brain is incredibly sensitive to changes in $O_2$ and pH, and under stress:
  - Chemoreceptor response to acidemia → vagally-mediated deceleration of the fetal heart rate
  - Fetal movements decrease as the fetus attempts to conserve energy$^{1,2}$
  - Blood flow is directed to the brain, heart and adrenals and away from the kidneys → a decrease in renal perfusion → a decrease in fetal urine production → oligohydramnios

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2. Manning FA. AJOG 1993
Antepartum Fetal Distress Cascade

- Late Decelerations Appear (CST)
- Accelerations Disappear (NST)
- Breathing Stops (BPP)
- Movement Ceases (BPP, FMC)
- Fetal Tone Absent (BPP)

Porto M. Clin Ob Gyn. 1987
Nonstress Test (NST)

- Looks to accelerations in FHR as an indication of fetal well-being; a fetus that is NOT acidotic or neurologically depressed will have a HR that temporarily accelerates with fetal movement
  - REACTIVE: \( \geq 2 \) accelerations within 20 minutes
  - NONREACTIVE: <2 accelerations in 40 minutes
- Accelerations \( \geq 32 \) weeks: 15 BPM above baseline + lasting \( \geq 15s^{4-5} \)
- Accelerations < 32 weeks: 10 BPM above baseline + lasting \( \geq 10s \)
- If it is believed that there is an absence of accelerations 2/2 fetal sleep cycles, vibroacoustic stimulation-elicited accelerations are a valid prediction of FWB\(^6-9\)
- Advantages: doesn’t require an IV, oxytocin, or contractions
  - no contraindications

4. Cousins LM. AJOG 2012
5. Glantz JC. Obstet Gynecol 2011
7. Miller DA. AJOG 1996
8. Smith CV. AJOG 1986
Nonstress Test: Significance

- Nonreactivity is associated with:
  - Fetal distress in labor (5x)
  - Low 5 min. Apgar scores (6x)
  - Increased Fetal Death Rate (7-12x)
- Decelerations during a Reactive NST:
  - Increased distress in labor (2 – 3X)
  - IUGR (8 – 12X)
  - Fetal Death (5X)

12. Lavin JP. Obstet Gynecol, 1984
13. Druzin ML. AJOG 1985
Contraction Stress Test (CST)

- Is based on the premise that uterine contractions transiently restrict $O_2$ delivery to the fetus $\Rightarrow$ chemoreceptor-mediated recurrent late decelerations

- Can be instituted via nipple stimulation (works $\frac{1}{2}$ of the time) or by titrating IV oxytocin
  
  $\text{OCT} = \text{oxytocin challenge test}$
Contraction Stress Test (cont’d)

- Includes CFM and visualization of 3+ contractions of >40s duration within 10 minutes to be valid

- Results/scoring
  - Negative: no late or significant variable decels
  - Positive: late decels following >50% contractions (even if <3 contractions in ten minutes)
  - Equivocal-suspicious: intermittent late decels or significant variable decels
  - Equivocal-hyperstimulatory: decels with contractions occurring more frequently than q2mins or lasting >90 seconds
  - Unsatisfactory: <3 contractions in 10min or interpretable FHR tracing

- Also categorized as “Reactive” or “Non-reactive”
Contraction Stress Test

Negative CST

FHR

UC

Positive CST

FHR

UC

Suspicious CST

FHR

UC

Unsatisfactory

FHR

UC

min
REASSURANCE?

- Incidence of stillbirth within 1 week after a normal fetal assessment modality\textsuperscript{14-16}
  - 1.9/1000 NSTs - NPR of 99.8%
  - 0.3/1000 CSTs – NPR of 99.9%
  - 0.8/1000 BPPs – NPR of 99.9%
  - 0.8/1000 mBPPs – NPR of 99.9%
  - 0/214 UA Dopplers in IUGR fetuses – NPR of 100\%\textsuperscript{17}
- They do NOT predict stillbirths related to acute changes in maternal-fetal status
  - Abruptio placentae
  - Umbilical cord accident
- Achilles heel is high false positive rate (~35\% CST, 55\% NST)

\textsuperscript{14} Freeman RK. AJOG 1982
\textsuperscript{15} Miller DA. AJOG 1996
\textsuperscript{16} Manning FA. AJOG. 1987
\textsuperscript{17} Almstrom H. Lancet. 1992
(KIND OF) Benign Reasons for Abnormalities upon Surveillance

- Sleep (especially deep sleep)
  - However, since the sensitivity to depth and duration of sleep varies by a discrete regulatory center, it is unusual to observe abnormalities of more than one variable 2/2 to sleep
- Fetal immaturity
- Maternal smoking in close proximity to test
- Maternal medication/elicit drug exposure
- Fetal central nervous system abnormalities
Abnormal testing... now what?

- Fix the offending disease process if possible
  - Ex. DKA, Pneumonia

- Perform a ‘back-up’ test if NST equivocal (CST, BPP or prolonged monitoring), or repeat testing in short intervals.\(^{18}\)
  - Ex. Decreased fetal movement + nonreactive NST
    - If $\geq 37$ weeks: CST $\rightarrow$ deliver if positive or equivocal
    - If $< 37$ weeks: BPP $\rightarrow$ deliver, continuously monitor, or retest in 24 hours depending on results

- If not reassured, hospitalize and weigh the risks and benefits of expediting delivery following consideration of gestational age and the disease state

18. Manning FA. AJOG. 1990
IMPORTANT LINKS

- **PRACTICE BULLETIN 145 – Antepartum Fetal Surveillance**
  - Manning FA. AJOG 1993
  - Porto M. Clin Ob Gyn.1987
  - Cousins LM. AJOG 2012
  - Glantz JC. Obstet Gynecol 2011
  - Clark SL. Obstet Gynecol 1989
  - Miller DA. AJOG 1996
  - Smith CV. AJOG 1986.

- Bishop EH. AJOG. 1981.
- Lavin JP. Obstet Gynecol. 1984
- Manning FA. AJOG. 1990.
- Freeman RK. AJOG 1982
- Miller DA. AJOG 1996.
- Almstrom H. Lancet. 1992