Antepartum surveillance

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REFERENCES

- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds).William's Obstetrics 25th edition; 2018; chapter 17 FETAL ASSESSMENT
- Signore C, Spong C. Overview of antepartum fetal surveillance. www.uptodate.com. Updated February 2021
- ACOG Practice Bulletin. Antepartum Fetal Surveillance. Number 145. July 2014

OUTLINE

- Goal of Antenatal fetal surveillance
- Physiologic basis
- Indications
- Anterpartum fetal surveillance techniques:
  - maternal perception of fetal movement
  - contraction stress test (CST)
  - nonstress test (NST)
  - biophysical profile (BPP)
  - modified BPP
  - umbilical artery Doppler velocimetry.

Goal

- The goal of antepartum fetal assessment is to identify fetuses at risk of intrauterine death or neurologic complications from slowly progressive (chronic) intrauterine hypoxia and intervene to prevent these adverse outcomes, if possible.

Signore C, Spong C. Overview of antepartum fetal surveillance. www.uptodate.com. Updated February 2021

Physiologic basis

- **Antepartum** testing is based on the premise that the fetus responds to slowly progressive (chronic) hypoxemia with a detectable sequence of biophysical changes, beginning with signs of physiological adaptation and potentially ending with signs of physiological decompensation
- Studies in animal models demonstrated that fetal biophysical activities (eg, heart rate, movement, breathing, tone) are sensitive to fetal oxygenation and pH levels, and changes in fetal biophysical activities occur in response to, or in association with, hypoxemia and acidemia
- fetal biophysical parameters can also be affected by other factors such as gestational age, maternal medication, maternal smoking, fetal sleep-wake cycles, and fetal disease/anomalies.

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INDICATIONS FOR FETAL SURVEILLANCE

Maternal conditions

- Pregestational diabetes mellitus
- Hypertension
- Systemic lupus erythematosus
- Chronic renal disease
- Antiphospholipid syndrome
- Hyperthyroidism (poorly controlled)
- Hemoglobinopathies (sickle cell, sickle cell– hemoglobin C, or sickle cell–thalassemia disease)
- Cyanotic heart disease

Pregnancy-related conditions

- Gestational hypertension
- Preeclampsia
- Decreased fetal movement
- Gestational diabetes mellitus (poorly controlled or medically treated)
- Oligohydramnios
- Fetal growth restriction
- Late term or postterm pregnancy
- Isoimmunization
- Previous fetal demise (unexplained or recurrent risk)
- Monochorionic multiple gestation (with significant growth discrepancy)

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- Surveillance techniques such as cardiotocography, real-time ultrasonography, and maternal perception of fetal movement can identify the fetus that may be undergoing some degree of uteroplacental compromise.
- Identification of suspected fetal compromise provides the opportunity to intervene before progressive metabolic acidosis results in fetal death.
- However, acute, catastrophic changes in fetal status, such as those that can occur with placental abruption or an umbilical cord accident, are generally not predicted by tests of fetal well-being. Therefore, fetal deaths from such events are less amenable to prevention.

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Antepartum fetal surveillance techniques

- maternal perception of fetal movement
- contraction stress test (CST)
- nonstress test (NST)
- biophysical profile (BPP)
- modified BPP
- umbilical artery Doppler velocimetry.

1. Fetal Movement Counting

A decrease in the maternal perception of fetal movement may precede fetal death, in some cases by several days

- This observation provides the rationale for fetal movement assessment by the mother ("kick counts") as a means of antepartum fetal surveillance.

Neither the optimal number of movements nor the ideal duration for counting movements has been defined.

numerous protocols have been reported:

- woman is instructed to lie on her side and count distinct fetal movements→ Perception of 10 distinct movements in a period of up to 2 hours was considered reassuring.
  - The mean time interval to perceive 10 movements was 20.9 (± 18.1) minutes.
- woman is instructed to count fetal movements for 1 hour three times per week
  - The count was considered reassuring if it equaled or exceeded the woman's previously established baseline count.

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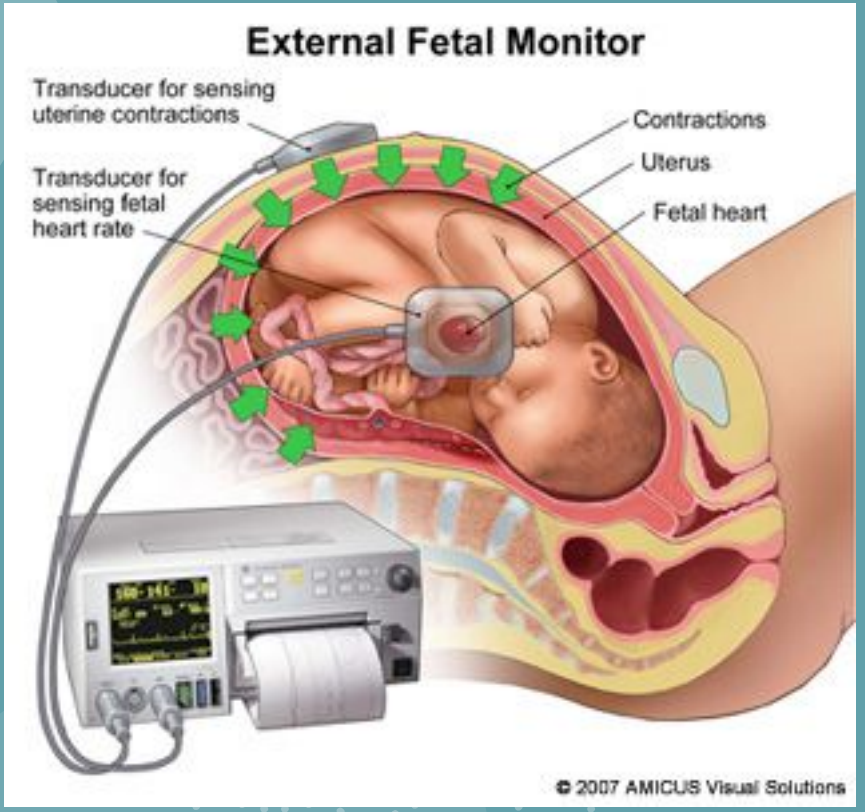
2. Contraction stress Test (CST)



- The CST is based on the response of the FHR to uterine contractions.
- It relies on the premise that fetal oxygenation will be transiently worsened by uterine contractions.
- As amnionic fluid pressure rises with uterine contractions, myometrial pressure exceeds collapsing pressure for vessels coursing through uterine muscle
  - →This ultimately lowers blood flow to the intervillous space. Brief periods of impaired oxygen exchange result, and if uteroplacental pathology is present, these elicit late fetal heart rate decelerations
- Uterine contractions also may produce a pattern of variable decelerations caused by fetal umbilical cord compression, which in some cases is associated with oligohydramnios.

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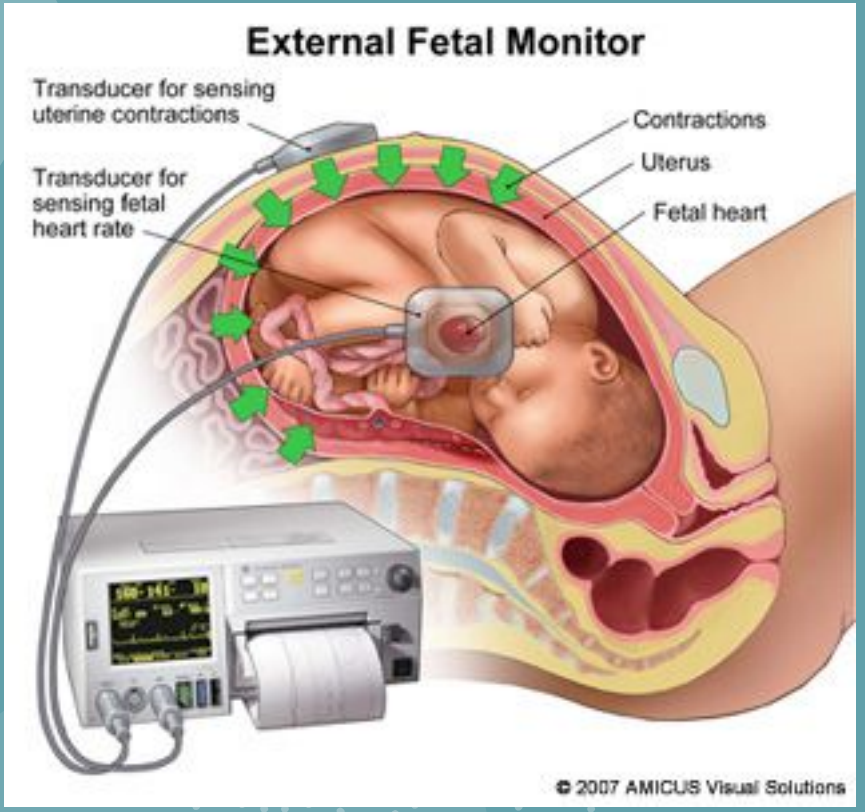

- the FHR and uterine contractions are simultaneously recorded with an external fetal monitor.
- contractions are induced with either nipple stimulation or intravenous oxytocin.
- An adequate uterine contraction pattern is present when at least three contractions persist for at least 40 seconds each in a 10-minute period.
- For oxytocin use: a dilute intravenous infusion is initiated at a rate of 0.5 mU/min and doubled every 20 minutes until a satisfactory contraction pattern is established

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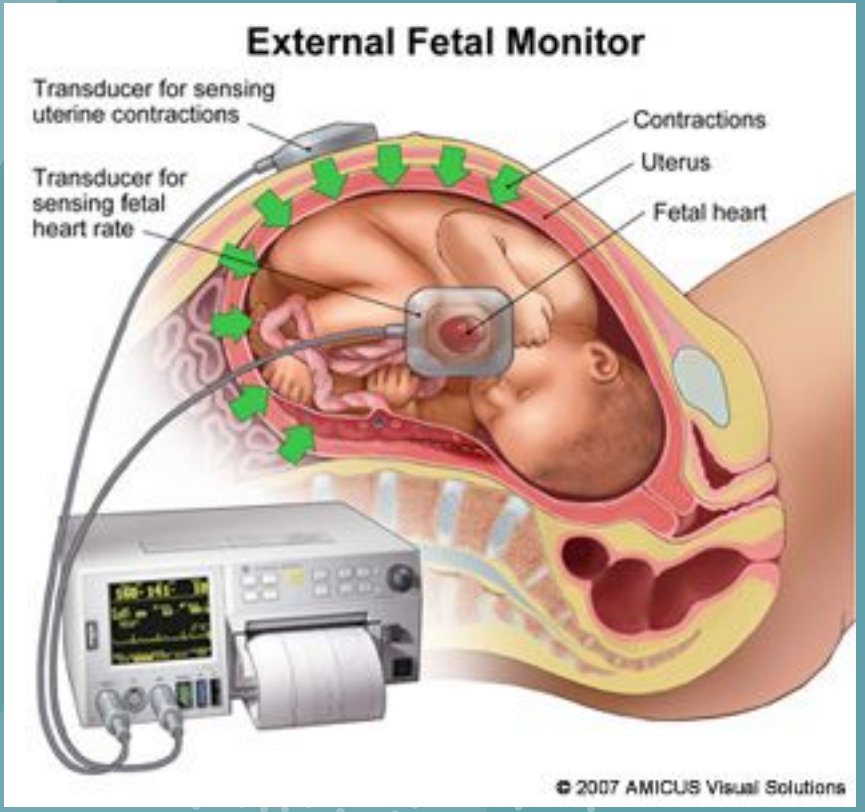

- Nipple stimulation: a woman rubbing one nipple through her clothing for 2 minutes or until a contraction begins.
  - This 2-minute nipple stimulation ideally will induce a pattern of three contractions per 10 minutes.
  - If not, after a 5-minute interval, she is instructed to retry nipple stimulation to achieve the desired pattern.
  - If this is unsuccessful, then dilute oxytocin may be used. Advantages include reduced cost and shortened testing times.

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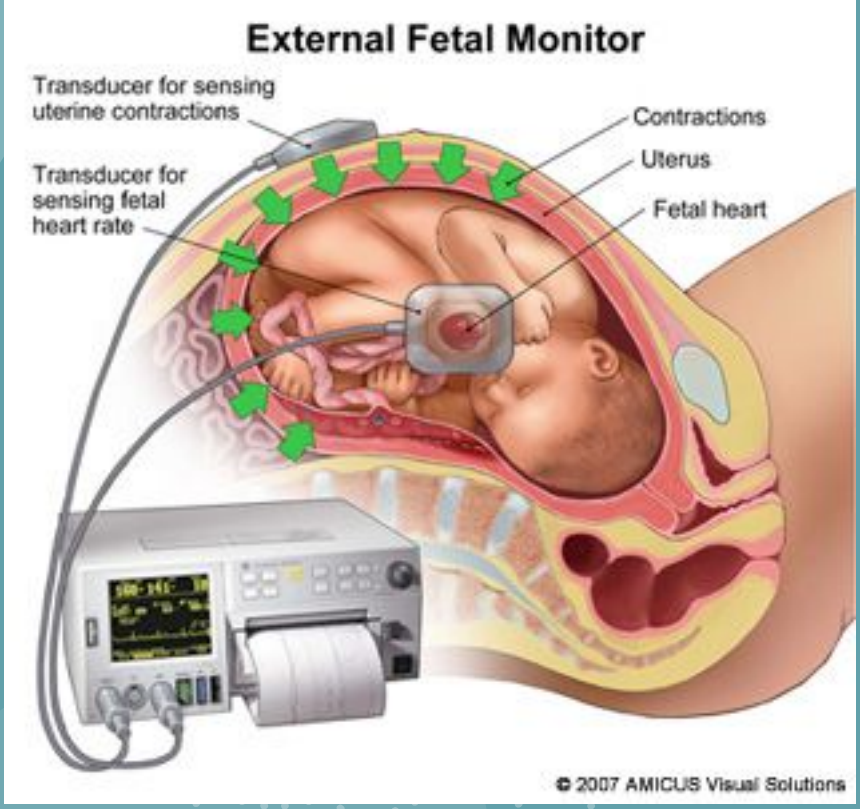
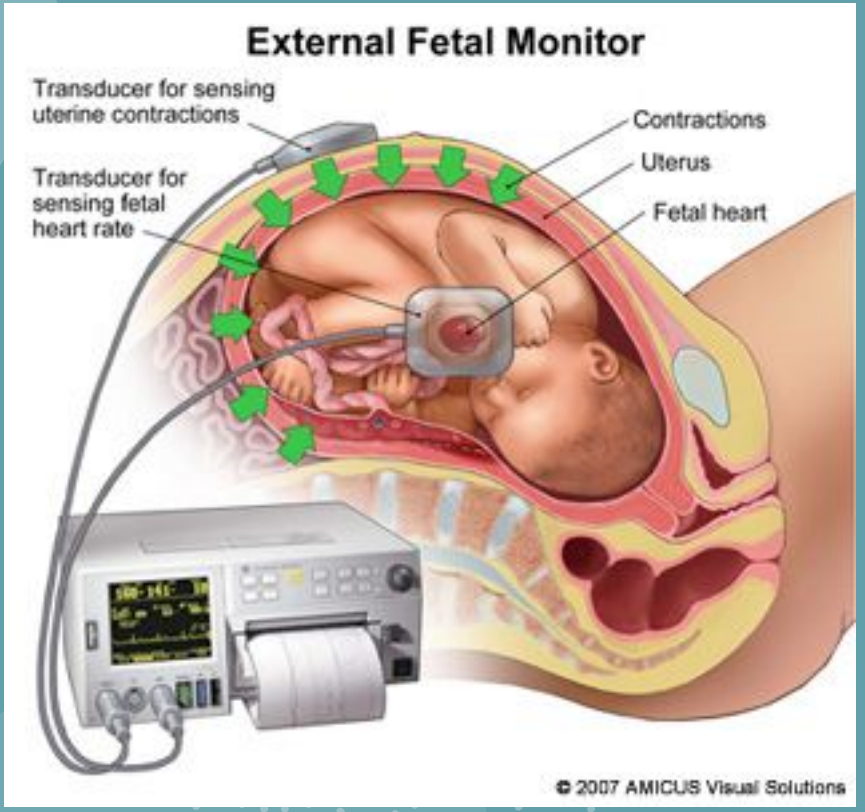


Criteria for Interpretation of the Contraction Stress Test

- **Negative:** no late or significant variable decelerations
- **Positive:** late decelerations following 50% or more of contractions (even if the contraction frequency is fewer than three in 10 minutes)
- **Equivocal-suspicious:** intermittent late decelerations or significant variable decelerations
- **Equivocal-hyperstimulatory:** fetal heart rate decelerations that occur in the presence of contractions more frequent than every 2 minutes or lasting longer than 90 seconds
- **Unsatisfactory:** fewer than three contractions in 10 minutes or an uninterpretable tracing

Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds).William's Obstetrics 25th edition; 2018; chapter 17 FETAL ASSESSMENT

3. Non stress Test (NST)



- The NST is based on the premise that the heart rate of a fetus that is not acidotic or neurologically depressed will temporarily accelerate with fetal movement.
- Heart rate reactivity is thought to be a good indicator of normal fetal autonomic function.
- Loss of reactivity is most commonly associated with a fetal sleep cycle but may result from any cause of central nervous system depression, including fetal acidemia.
- nonstress test is primarily a test of fetal condition, and it differs from the contraction stress test, which is considered a test of uteroplacental function.
- most widely used primary testing method for assessment of fetal well-being.

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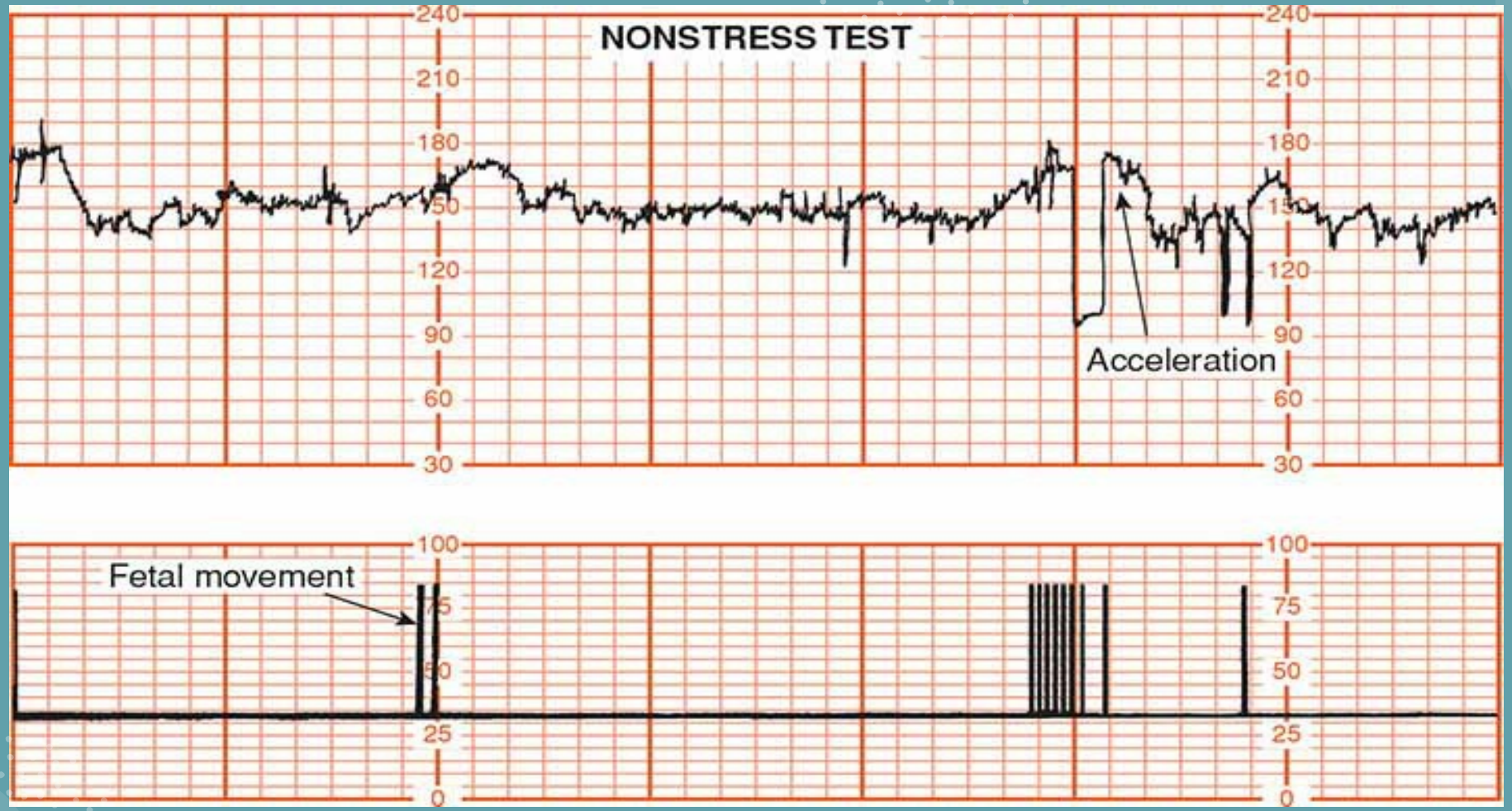
Normal NST



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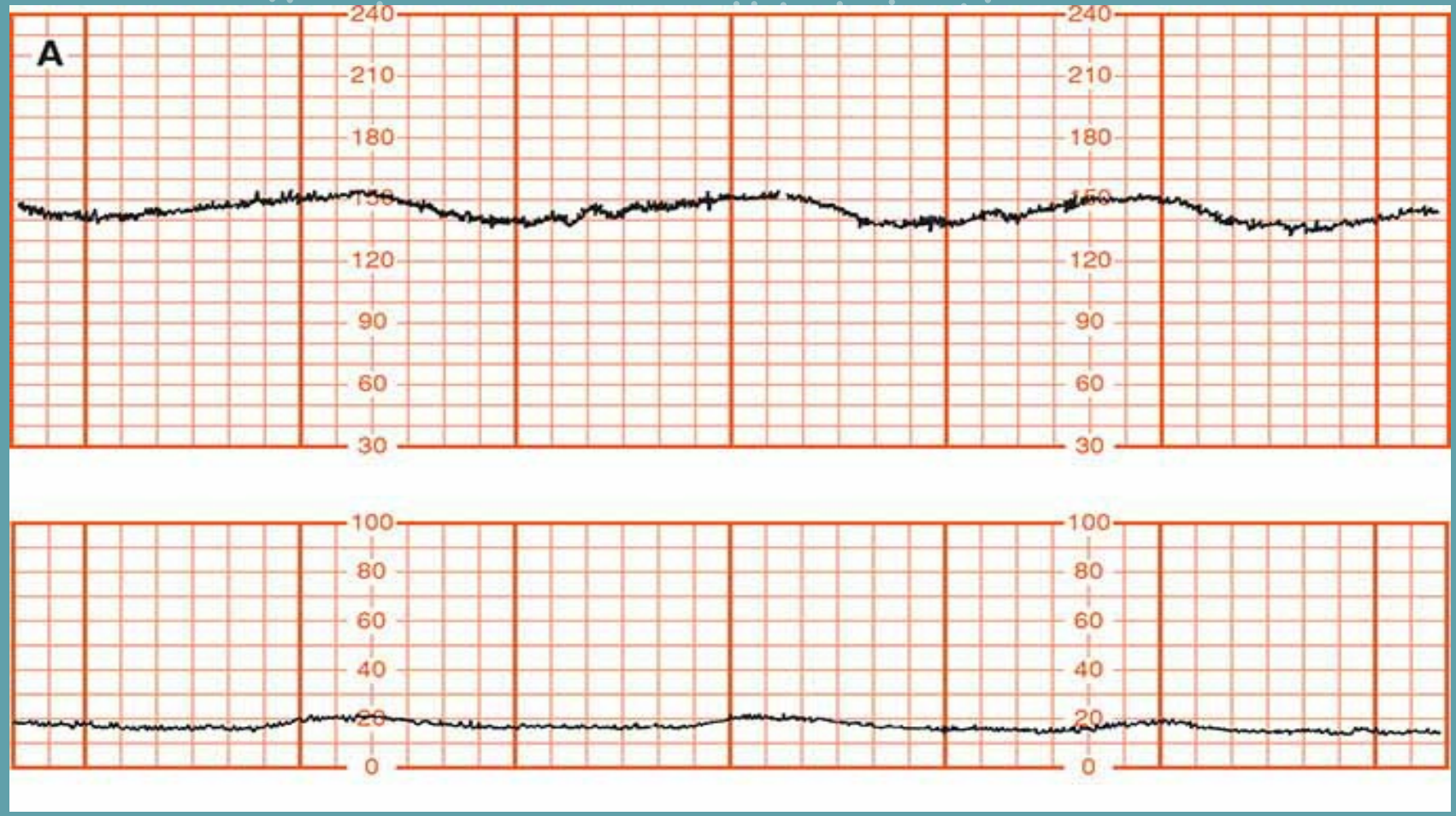
Abnormal NST



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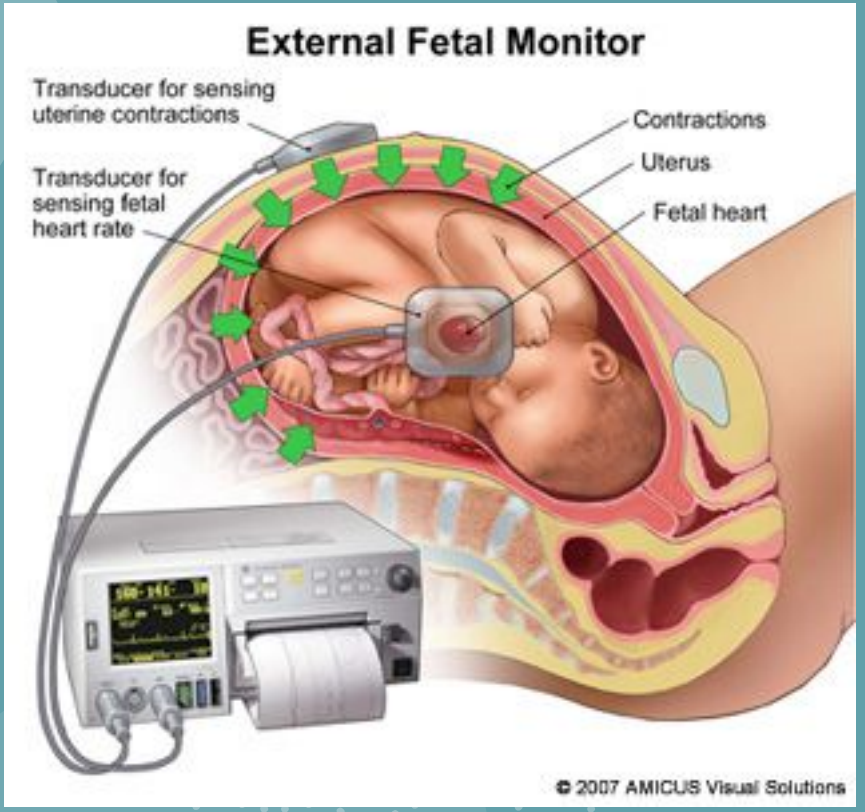

- The patient may be positioned in either the semi-Fowler position (sitting with the head elevated 30 degrees) or lateral recumbent position
  - The FHR is monitored with an external transducer.
  - The tracing is observed for FHR accelerations that peak (but do not necessarily remain) at least 15 beats per minute above the baseline and last 15 seconds from baseline to baseline.
  - The NST should be conducted for at least 20 minutes.
  - Vibroacoustic stimulation may elicit FHR accelerations that are valid in the prediction of fetal well-being.

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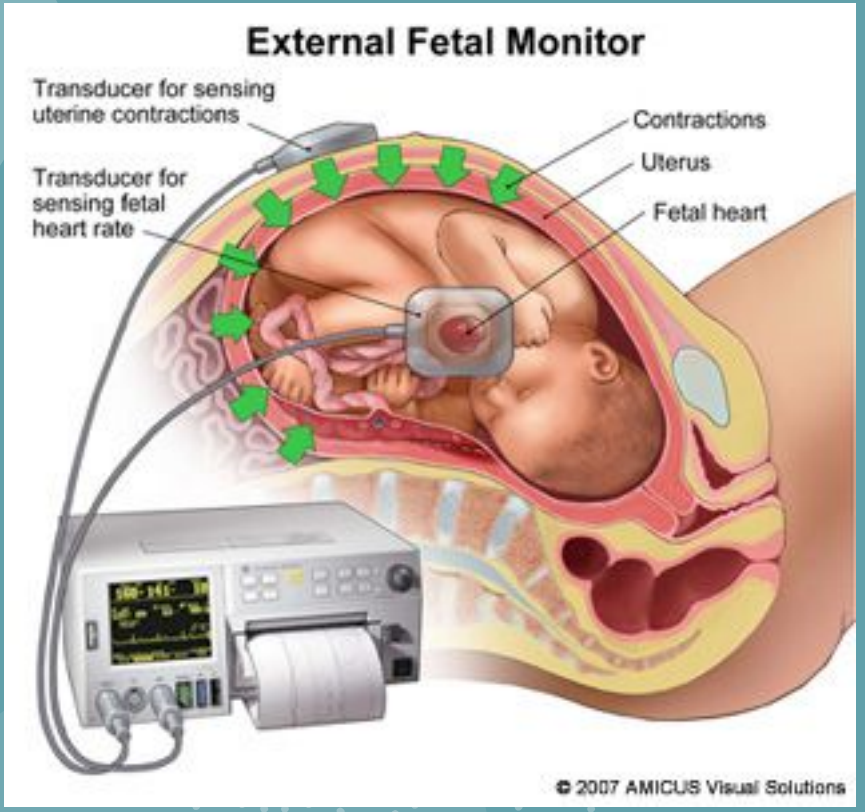
3. Non stress Test (NST)



- Nonstress test results are categorized as reactive or nonreactive.
  - Reactive, or normal, NST: two or more accelerations peaking at 15 bpm or more above baseline, each lasting 15 seconds or more, and all occurring within 20 minutes of beginning the test
  - Nonreactive NST: is one that lacks sufficient FHR accelerations over a 40-minute period.
- The NST of the normal preterm fetus is frequently nonreactive:
  - from 24 weeks to 28 weeks of gestation, up to 50% of NSTs may not be reactive
  - from 28 weeks to 32 weeks of gestation, 15% of NSTs are not reactive
- Variable decelerations that are nonrepetitive and brief (less than 30 seconds) are not associated with fetal compromise or the need for obstetric intervention
- abnormal nonstress test is not always ominous and can be seen with a sleeping fetus. Also, an abnormal test can revert to normal as the fetal condition changes

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Fetal vibroacoustic stimulation (VAS)

- When the heart-rate pattern is not reassuring, extra tests may help to indicate which babies need help.
- Fetal vibroacoustic stimulation (VAS) is a simple, non-invasive technique where a device is placed on the maternal abdomen over the region of the fetal head and sound is emitted at a predetermined level for several seconds.
- Basis: the resultant startle reflex in the fetus and subsequent fetal heart rate (FHR) acceleration or transient tachycardia following VAS provide reassurance of fetal well-being.
  → *This technique has been proposed as a tool to assess fetal well-being in the presence of a nonreassuring cardiotocographic (CTG) trace*
- For healthy babies it produces a positive response, and absence of this could be a sign that the baby is having difficulty.

Christine E East, Rebecca MD Smyth, Leo R Leader, Naomi E Henshall, Paul B Colditz, Rosalind Lau, Kelvin H Tan. Cochrane Pregnancy and Childbirth Group. **Vibroacoustic stimulation** for **fetal assessment** in **labour** in the **presence** of a **nonreassuring fetal heart rate trace**. Cochrane Database Syst Rev. 2013 Jan; 2013(1): CD004664. Published online 2013 Jan 31. doi: 10.1002/14651858.CD004664.pub3

4. Biophysical Profile (BPP)

- BPP comprises five components:
  - Nonstress test—may be omitted without compromising test validity if the results of all four ultrasound components of the BPP are normal
  - Fetal breathing movements—one or more episodes of rhythmic fetal breathing movements of 30 seconds or more within 30 minutes
  - Fetal movement—three or more discrete body or limb movements within 30 minutes
  - Fetal tone—one or more episodes of extension of a fetal extremity with return to flexion, or opening or closing of a hand
  - Determination of the amniotic fluid volume—a single deepest vertical pocket greater than 2 cm is considered evidence of adequate amniotic fluid
- Each of the five components is assigned a score of either 2 (present, as previously defined) or 0 (not present).

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4. Biophysical Profile (BPP)

- Each of the five components is assigned a score of either 2 (present, as previously defined) or 0 (not present).
- A composite score of 8 or 10 is normal, a score of 6 is considered equivocal, and a score of 4 or less is abnormal.
- Regardless of the composite score, *oligohydramnios* (defined as an amniotic fluid volume of 2 cm or less in the single deepest vertical pocket) should prompt further evaluation

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rpretation of Biophysical Profile Score

Biophysical Profile Score	Interpretation	Recommended Management
10	Normal, nonasphyxiated fetus	No fetal indication for intervention; repeat test weekly except in diabetic patients and postterm pregnancy (twice weekly)
8/10 (Normal AFV) 8/8 (NST not done)	Normal, nonasphyxiated fetus	No fetal indication for intervention; repeat testing per protocol
8/10 (Decreased AFV)	Chronic fetal asphyxia suspected	Deliver
6	Possible fetal asphyxia	If amnionic fluid volume abnormal, deliver If normal fluid at >36 weeks with favorable cervix, deliver If repeat test ≤6, deliver If repeat test >6, observe and repeat per protocol
4	Probable fetal asphyxia	Repeat testing same day; if biophysical profile score ≤6, deliver
0 to 2	Almost certain fetal asphyxia	Deliver

AFV = amnionic fluid volume; NST = nonstress test.
Reproduced with permission from Manning FA, Morrison I, Harman CR, et al: Fetal assessment based on fetal biophysical profile scoring: experience in 19,221 referred high-risk pregnancies. II. An analysis of false-negative fetal deaths, Am J Obstet Gynecol. 1987 Oct;157(4 Pt 1):880–884.

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4. Modified Biophysical Profile

- The modified BPP combines the NST, as a short-term indicator of fetal acid–base status, with an amniotic fluid volume assessment, as an indicator of long-term placental function

- the results of the modified BPP are considered normal if the NST is reactive and the amniotic fluid volume is greater than 2 cm in the deepest vertical pocket and are considered abnormal if either the NST is nonreactive or amniotic fluid volume in the deepest vertical pocket is 2 cm or less (ie, oligohydramnios is present).

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5. Umbilical Artery Doppler Velocimetry

- Doppler ultrasonography is a noninvasive technique used to assess the hemodynamic components of vascular resistance in pregnancies complicated by fetal growth restriction.
- Umbilical artery Doppler velocimetry has been adapted for use as a technique of fetal surveillance for the growth-restricted fetus, based on the observation that flow velocity waveforms in the umbilical artery of normally growing fetuses differ from those of growth-restricted fetuses.
- the umbilical flow velocity waveform of normally growing fetuses is characterized by high-velocity diastolic flow, whereas in growth-restricted fetuses, there is decreased umbilical artery diastolic flow
- In some cases of severe fetal growth restriction, diastolic flow is absent or even reversed.

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5. Umbilical Artery Doppler Velocimetry

- Abnormal flow velocity waveforms have been correlated histopathologically with small-artery obliteration in placental tertiary villi and functionally with fetal hypoxemia and acidemia as well as with perinatal morbidity and mortality
- Commonly measured flow indices, based on the characteristics of peak systolic velocity and frequency shift (S), end-diastolic frequency shift (D), and mean peak frequency shift over the cardiac cycle (A), include the following:
  - Systolic to diastolic ratio (S/D)
  - Resistance index (S-D/S)
  - Pulsatility index (S-D/A)
- To maximize interpretability, multiple waveforms should be assessed, and wall-filter settings should be set low enough (typically less than 150 Hz) to avoid masking diastolic flow.

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When to start testing?

When to do repeat testing?

In general, with most high-risk pregnancies, testing begins by 32 to 34 weeks' gestation.

Pregnancies with severe complications might require testing as early as 26 to 28 weeks.

The frequency for repeating tests has been arbitrarily set at 7 days, but more frequent testing is often done.

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ACOG 2016

- According to the American College of Obstetricians and Gynecologists (2016), a normal antepartum fetal test result is highly reassuring that a stillbirth will not occur within 1 week

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ACOG RECOMMENDATIONS

In growth-restricted fetuses, umbilical artery Doppler velocimetry used in conjunction with standard fetal surveillance, such as NSTs, or BPPs, or both, is associated with improved outcomes. (LEVEL A)

Abnormal results from an NST or from a modified BPP generally should be followed by additional testing with either a CST or a BPP. (LEVEL B)

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ACOG RECOMMENDATIONS

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

however, in the presence of certain high-risk conditions, some investigators have performed more frequent testing, although the optimal regimen has not been established (LEVEL C)

In the setting of otherwise uncomplicated isolated and persistent oligohydramnios, delivery at 36–37 weeks of gestation is recommended.

In pregnancies at less than 36 0/7 weeks of gestation with intact membranes and oligohydramnios, the decision to proceed with expectant management or delivery should be individualized based on gestational age and the maternal and fetal condition. (LEVEL C)

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SUMMARY

Goal of Antenatal fetal surveillance

Physiologic basis

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Anterpartum fetal surveillance techniques:

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Thank you!

youtube channel: Ina Irabon

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