

antepartum fetal surveillance

Outlines

- Introduction
- Principles of antepartum fetal surveillance
- Goals of antepartum fetal surveillance
- Rationale for antepartum surveillance
- Indications for antepartum surveillance
- Methods used for antepartum surveillance

Introduction

- Since the 1970s, technology to evaluate the health of the fetus has advanced remarkably.
- Techniques employed today to forecast fetal well-being focus on fetal biophysical findings.
- Most fetuses will be healthy, and negative or normal antepartum test result is highly reassuring.

Introduction

- Because fetal deaths within 1 week of a normal test are rare.
- Negative predictive values for most of the tests are $\geq 99.8\%$.
- Positive predictive values for abnormal test results are low 10-40 percent.
- Fetal surveillance is primarily based on circumstantial evidence.

Principles of Ideal Fetal Monitoring

- Any fetal monitoring technology
 - ✓ Should be taken as a screening test for fetal hypoxemia and acidosis.
 - ✓ Must have measurable test performance.
 - ✓ The ideal fetal monitoring system should have the following characteristics:

Principles of Ideal Fetal Monitoring

- Gather a wide range of information, with versatility for all maternal and fetal conditions and flexibility for all gestational ages.
- Detect fetal peril with specificity, sensitivity, and timeliness to allow preventive intervention.

Principles of Ideal Fetal Monitoring

- Have a low false-positive rate, especially at earlier gestational ages, when the consequences of prematurity from intervention
- Have high sensitivity for modest degrees of compromise to permit intervention early enough to prevent permanent fetal injury.

Principles of Ideal Fetal Monitoring

- Have a high and durable negative predictive value to exclude stillbirth or permanent injury over a predictable period, allowing a reasonable testing interval to be defined, with the possibility of acute change-like AP , a normal test should exclude abnormal outcomes for a clinically important length of time, commonly 7 days.

Principles of Ideal Fetal Monitoring

- Incorporate multiple variables to address both the complexity of normal fetal behavior and the individual nature of fetal compensation
- Detect fetal compromise from a variety of sources-**asphyxia, poisoning, metabolic abnormalities, and anemia**, to address the many origins of adverse outcomes.

Principles of Ideal Fetal Monitoring

- Be applicable in inpatient and outpatient settings, have readily available technology at a modest cost, and have a high likelihood of reproducibility.
- Have measurable benefits for high-risk populations in the reduction of perinatal mortality and morbidity, by safely extending intrauterine time.

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Principles of Ideal Fetal Monitoring

- Due to the great variability in normal behavior and the complex cascades of responses to abnormal conditions, **no single test can satisfy** all of these objectives.
- Balancing the risks of stillbirth from intrauterine decompensation against the likelihood of neonatal death from prematurity, the use of **multiple modalities** is more likely to yield reliable results

Antepartum Fetal Surveillance

- **Goals - ACOG**

- ✓ Prevention of fetal death and
- ✓ Avoidance of unnecessary interventions

- **Methods**

- ✓ Clinical
- ✓ Biochemical
- ✓ Biophysical

Methods

- **Clinical**

- ✓ Maternal BP, Wt. gain, uterine fundable Ht. and measurement of abdominal girth in the 3rd trimester.

- Useful as screening test for further investigation.

- **Biochemical** – mainly for assessment of pulmonary maturity.

Methods ...

- **Biophysical**

- ✓ BPP is a screening test for utero–placental insufficiency.
- ✓ Fetal biophysical activities are initiated, modulated and regulated through fetal nervous system.
- ✓ Fetal CNS is very much sensitive to diminished oxygenation.
- ❑ Hypoxia.....metabolic acidosisCNS depression changes in fetal biophysical activity.

Methods ...

- **Biophysical tests**

- I. Fetal movement count and breathing
- II. Ultrasonography
- III. Non-stress test (NST)
- IV. Fetal biophysical profile (BPP)
- V. Doppler ultrasound
- VI. Vibroacoustic stimulation test
- VII. Contraction stress test (CST)
- VIII. Amniotic fluid volume

Rationale

- Fetal **hypoxia and acidosis** represent the final common pathway to fetal injury and death.
- The fetus whose oxygenation in utero is challenged will respond with a series of **detectable physiologic** adaptive or decompensatory signs as hypoxemia or metabolic acidemia develop.

Rationale

- These signs include
 - ✓ Blood flow is directed to the **brain, heart, and adrenals** and away from the kidney.
 - ❑ Reduction in renal perfusion leads to decreased fetal urine production, which results in decreased amniotic fluid volume.

Rationale

- ✓ Fetal **movements** decrease to conserve energy
- ❑ Loss of fetal movement can be a sign of central nervous system hypoxia and injury.
- ✓ A **chemoreceptor** response to hypoxemia leads to vagally-mediated reflex slowing of FHR.
- ❑ Late decelerations with uterine contractions.

Fetal movement count

- Passive unstimulated fetal activity commences as early as **7 weeks** and becomes more sophisticated and coordinated by the end of pregnancy.
- Beyond **8 weeks**, fetal body movements are never absent for periods **>13 minutes**.
- Between **20 and 30** weeks general body movements become organized, and the fetus starts to show rest-activity cycles.

Fetal movement count

- Fetal movement maturation continues until **36 weeks**, when behavioral states (4 states) are established in most normal fetuses
- Fetal sleep cyclicity varies from ~ 20 minutes to as much as 75 minutes
- **State 1F** - a quiescent state—quiet sleep—with a narrow oscillation of the FHR.

Fetal movement count

- **State 2F** - frequent gross body movements, continuous eye movements, and wider oscillation of the FHR.
 - Analogous to rapid eye movement (**REM**) or active sleep in the neonate.
- **State 3F** - continuous eye movements in the absence of body movements and no FHR accelerations.
 - The existence of this state is disputed

Fetal movement count

- **State 4F** - vigorous body movement with continuous eye movements and FHR accelerations.
 - ❑ Corresponds to the awake state in newborns.
- Fetuses spend most of their time in states 1F and 2F.
 - ❑ 75 percent of time at 38 wks.

Determinant of fetal activity

- ✓ Fetal oxygenation
- ✓ Fetal sleep- wake cycle
- ✓ Amniotic fluid volume
- ✓ Prematurity
- ✓ Maternal medication exposure -narcotics
- ✓ Maternal smoking
- ✓ Fetal CNS abnormalities
- ✓ Obesity and anterior placenta

Fetal movement count

- Diminished fetal activity may be a harbinger of impending fetal death
- Methods to quantify fetal movement include
 - ✓ Uterine contraction tocodynamometer
 - ✓ Visualization with sonography, and
 - ✓ Maternal perceptions.

Fetal movement count

- **Fetal movement count**
- There is excellent correlation between maternally perceived fetal motion and movements documented by instrumentation.
- More than 80 percent of all movements observed during sonographic monitoring are perceived by the mother.
- Only 16% beyond 36 weeks.

Fetal movement count

- Fetal motions lasting more than 20 seconds are more likely to be identified than shorter episodes.
- Neither the optimal number of movements nor the ideal duration for counting has been defined.
- Reduced fetal movement is common complaint in 3rd TM.

Fetal movement count

- The two methods usually applied for fetal mov't count
- **Cardif “count 10” formula**
- Patient counts fetal movements starting at 9 am.
- Counting comes to an end as soon as 10 movements are perceived.

Fetal movement count

- She is instructed to report the physician if
- Less than 10 movements occur during 12 hours on 2 successive days or
- No movement is perceived even after 12 hours in a single day.

Fetal movement count

- **Daily fetal movement count (DFMC)**
- Three counts each of 1 hour duration morning, noon and evening
- Total counts multiplied by four gives daily (12 hour) fetal movement count (DFMC).
- If there is diminution of the number of “kicks” to less than 10 in 12 hours (or less than 3 in each hour), it indicates fetal compromise.

Fetal movement count

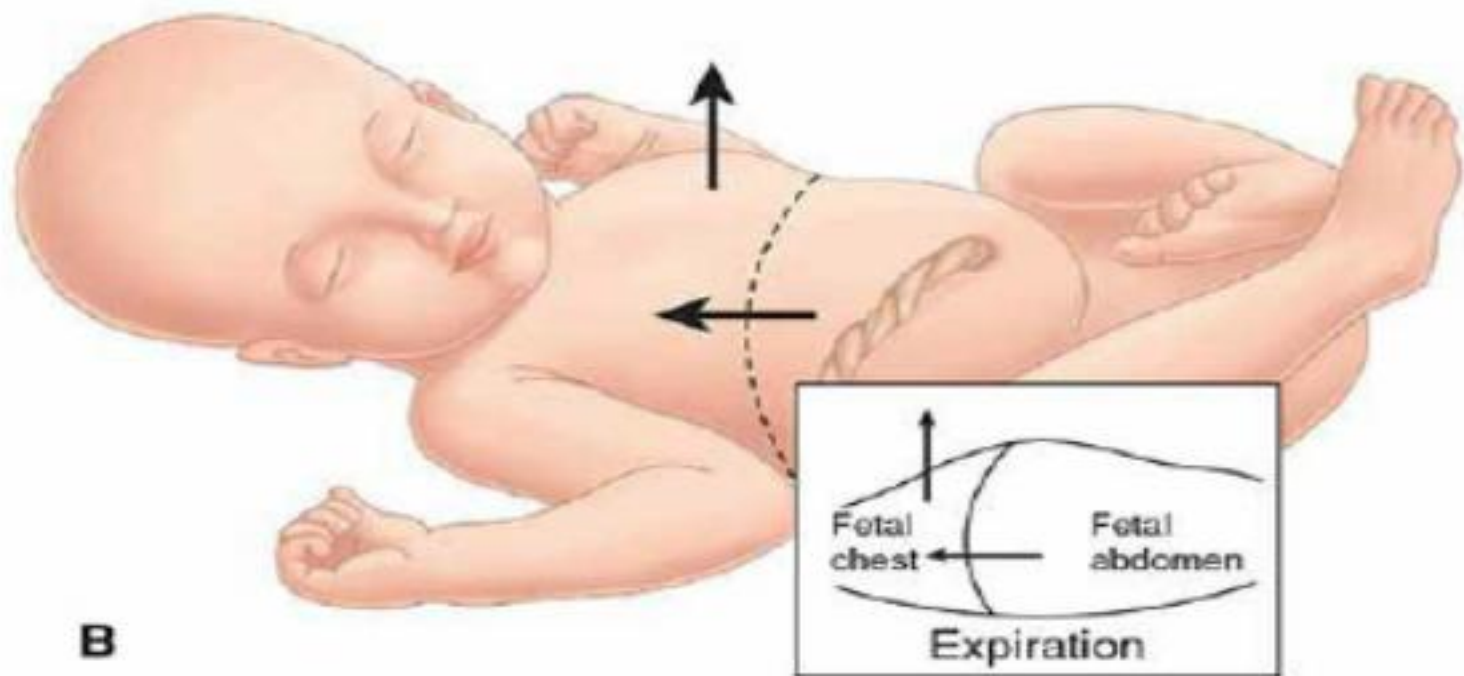
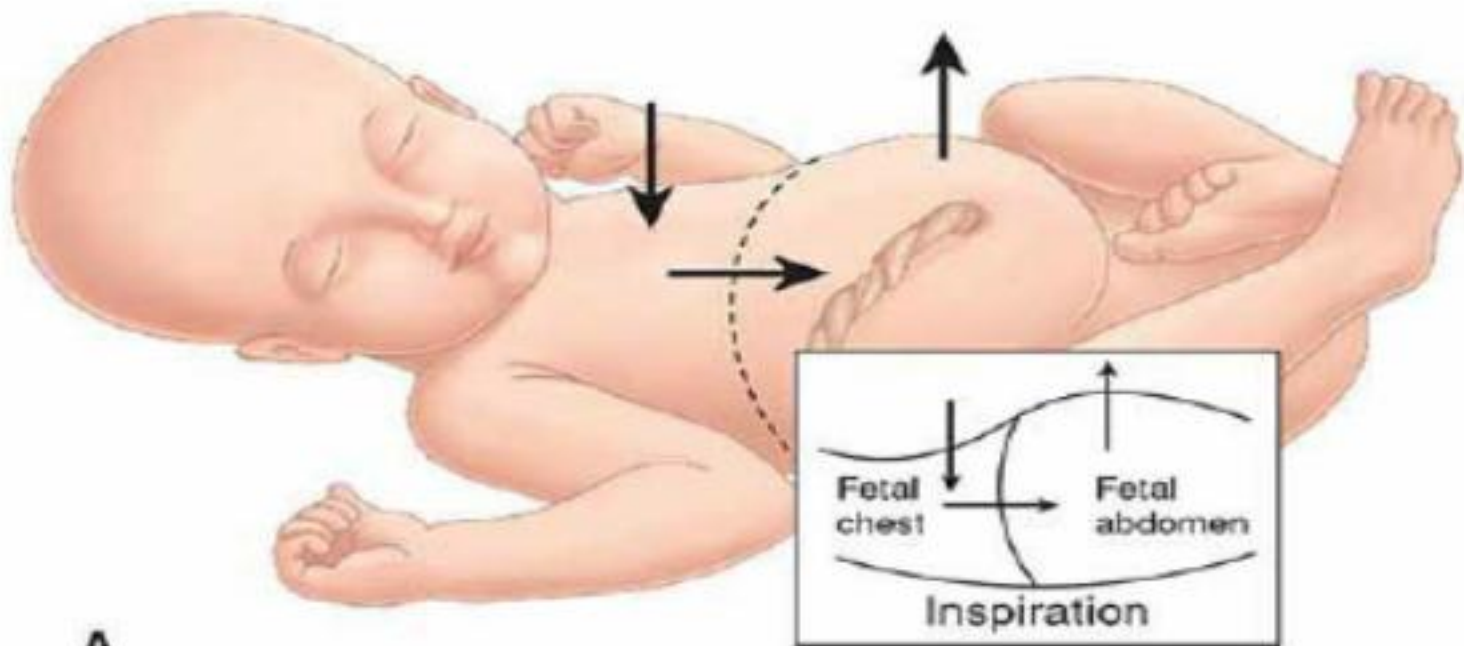
- Count should be performed daily starting at 28 weeks.
- **Loss of fetal movements** is commonly followed by disappearance of FHR within next 24 hours.
- If the result is ominous, the candidate is subjected to NST.

Fetal breathing

- There is small inward and outward flows of tracheal fluid in fetuses , indicating thoracic movement.
- The chest wall movements are discontinuous and paradoxical
- Physiological basis for the breathing reflex is unclear.
- Exchange of amnionic fluid appears to be essential for normal lung development

Fetal breathing

- **Types of respiratory movements**
- **Gasps or sighs** -occurred at a frequency of 1 to 4 per minute.
- **Irregular bursts of breathing** - up to 240 cycles/minute ,associated with rapid eye movement
- Fetal respiratory rate declined with increased respiratory volume at 33 to 36 weeks , coincidental with lung maturation.



Fetal breathing

- Variables that affect fetal respiratory movements.
 - ✓ Hypoxia
 - ✓ Hypoglycemia
 - ✓ Sound stimuli
 - ✓ Cigarette smoking
 - ✓ Amniocentesis
 - ✓ Impending preterm labor
 - ✓ Gestational age
 - ✓ Labor during which it is normal for respiration to cease.

Fetal breathing

- Because fetal breathing movements are episodic, interpretation of fetal health when respirations are absent may be tenuous.
- There is diurnal variation, because breathing substantively diminishes during the night.
- Increases following maternal meals.
- May be absent in some normal fetuses for up to 122 minutes.

Contraction stress testing

- **Basis**
- Rises in AF pressure with uterine contractions
→ myometrial pressure exceeding collapsing pressure for vessels through uterine muscle → lower blood flow to the intervillous space.

Contraction stress testing

- Brief periods of impaired oxygen exchange result, and if uteroplacental pathology is present → FHR decelerations or variable decelerations as a result of cord compression, suggesting oligohydramnios , often a concomitant of placental insufficiency

Contraction stress testing

- Iv oxytocin or nipple stimulation used to elicit contractions.
- Negative CST results, forecasts fetal health.
- The major disadvantage is the average test requires 90 minutes to complete.

Contraction stress testing

- The fetal heart rate and uterine contractions are recorded simultaneously with an external monitor.
- If at least three spontaneous contractions of 40 seconds or longer are present in 10 minutes, no uterine stimulation is necessary (ACOG 2016).

Contraction stress testing

- **Criteria for Interpretation of CST**

- ☐ **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

Contraction stress testing

- ❑ **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

Non stress test

- Involves use of Doppler-detected FHR acceleration coincident with fetal movements perceived by the mother.
- Easier to perform, and normal results used to discriminate false-positive contraction stress tests.

Non stress test

- NST is primarily a test of fetal condition, unlike CST , which is a test of uteroplacental function.
- NST is the most widely used primary testing method for assessment of fetal well-being

Non stress test

- **FHR accelerations**
- Autonomic nervous system mediated by sympathetic or parasympathetic impulses from brainstem centers control FHR and *beat-to-beat variability*.
- So , pathological loss FHR acceleration may be seen with significantly decreased beat-to-beat variability.

Non stress test

- **FHR accelerations**
- Loss of such reactivity, however, is most commonly associated with sleep cycles.
- Also may be caused by central depression from medications or smoking.

Non stress test

- **Basis for NST**
- The heart rate of a fetus that is not acidemic as a result of hypoxia or neurological depression will temporarily accelerate in response to fetal movement identified by the mother and recorded.
- If hypoxia develops, these accelerations diminish.

Non stress test

- **Basis for NST**
- The percentage of body movements accompanied by accelerations and the amplitude of these accelerations both increase with GA.
- Between 25 and 28 weeks' Only 70 percent of normal fetuses demonstrate the required 15 beats per minute (bpm) or more of heart rate acceleration.
- 10 bpm, in 90 percent of the fetuses.

Non stress test

- **Normal acceleration based on gestational age**
- At or beyond 32 weeks' gestation, the acceleration acme is ≥ 15 bpm above the baseline rate, and lasts ≥ 15 seconds but less than 2 minutes.
- Before 32 weeks, it is 10 bpm or more above baseline for 10 seconds or longer.

Non stress test

- **Normal Nonstress Tests**
- Vary regarding the number, amplitude, and duration of accelerations and the test duration.
- ACOG-2016 -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

Non stress test

- **Accelerations** with or without fetal movements be accepted.
- A 40-minute or longer tracing—to account for fetal sleep cycle before concluding fetal reactivity is insufficient
- Normal NST result seems to reflect fetal well-being.
- Abnormal results do not invariably predict fetal compromise

Non stress test

- ≥ 90 -percent false-positive rates because healthy fetuses may not move for periods of up to 75 minutes.
- Longer duration of nonstress testing might increase the positive-predictive value of an abnormal test.
- Either the test became reactive during a period up to 80 minutes or nonreactive for 120 minutes, which indicated that the fetus is very ill.

Non stress test

- **Abnormal tests indicating fetal jeopardy**
 - ✓ *Silent oscillatory pattern* -baseline oscillation of less than 5 bpm
 - ✓ Absent accelerations, and
 - ✓ Late decelerations.

Non stress test

- **Cuases**

- ✓ IUGR
- ✓ Oligohydramnios
- ✓ Fetal acidemia
- ✓ Meconium and
- ✓ Placental infarction.

Non stress test

- **Interval between Testing**
- Arbitrarily at 7 days-ACOG 2016
- More frequent for -2x weekly with additional test for
 - ✓ Maternal or fetal deterioration
 - ✓ Postterm pregnancy
 - ✓ Multifetal gestation
 - ✓ Pregestational diabetes
 - ✓ Fetal-growth restriction
 - ✓ Pregnancy induced hypertension.

Non stress test

- **Decelerations During Nonstress Testing**
- Fetal movements commonly produce heart rate deceleration-1/2 to 2/3 depending on the vigor of the fetal motion are not usually problematic.
- ACOG -2016 variable decelerations, if non repetitive and brief—less than 30 seconds—do not indicate fetal compromise or the need for obstetrical intervention.

Non stress test

- Repetitive variable decelerations—at least three in 20 minutes—even if mild, are associated with a greater risk of cesarean delivery for fetal distress.
- Decelerations lasting ≥ 1 minute have even worse prognosis especially if there is concomitant decrease in AFV.

Non stress test

- **False-Normal Nonstress Tests**
- Fetal death may occur within 7 days of normal nonstress tests.
- The most common autopsy finding in this fetuses is meconium aspiration, often with some type of umbilical cord abnormality.
- Thus an acute asphyxial insult had provoked fetal gasping.

Non stress test

- NST is inadequate to preclude such an acute asphyxial event and other biophysical characteristics are needed.
- Causes of fetal death in this setting includes
 - ✓ Oligohydramnios
 - ✓ Intrauterine infection
 - ✓ Abnormal cord position
 - ✓ Malformations
 - ✓ Placental abruption.

ACOUSTIC STIMULATION TESTS

- Loud external sounds have been used to startle the fetus and thereby provoke heart rate acceleration—an *acoustic stimulation nonstress test*.

ACOUSTIC STIMULATION TESTS

- **ACOG 2016**

- ✓ Acoustic stimulator on the maternal abdomen
- ✓ Stimulus of 1 to 2seconds is applied
- ✓ Repeated up to three times for up to 3 seconds.
- ✓ A positive response is defined as the rapid appearance of a qualifying acceleration following stimulation

BIOPHYSICAL PROFILE

- Five fetal biophysical variables
- Proposed as a more accurate means of assessing fetal health than a single element.
- Require 30 to 60 minutes

BIOPHYSICAL PROFILE

- **Biophysical components assessed**
 - 1) Heart rate acceleration
 - 2) Breathing
 - 3) Movements
 - 4) Tone and
 - 5) Amnionic fluid volume.

BIOPHYSICAL PROFILE

- Normal variables assigned a score of 2 each, and abnormal variables given a score of 0.
- Maternal medications such as narcotics and sedatives can significantly lower the
- A test performed in late evening results in higher score.

BIOPHYSICAL PROFILE

- More than 97 percent of the pregnancies has tested normal test results.
- A false-normal test rate—defined by an antepartum death of a structurally normal fetus of ~1 per 1000.

BIOPHYSICAL PROFILE

- Common identifiable causes of fetal death after a normal BPP include
 - ✓ Fetomaternal hemorrhage
 - ✓ Umbilical cord accidents, and
 - ✓ Placental abruption

Components and Scores for the Biophysical Profile

Component	Score 2	Score 0
Nonstress test ^a	≥ 2 accelerations of ≥ 15 beats/min for ≥ 15 sec within 20–40 min	0 or 1 acceleration within 20–40 min
Fetal breathing	≥ 1 episode of rhythmic breathing lasting ≥ 30 sec within 30 min	< 30 sec of breathing within 30 min
Fetal movement	≥ 3 discrete body or limb movements within 30 min	< 3 discrete movements
Fetal tone	≥ 1 episode of extremity extension and subsequent return to flexion	0 extension/flexion events
Amnionic fluid volume ^b	A pocket of amnionic fluid that measures at least 2 cm in two planes perpendicular to each other (2 x 2 cm pocket)	Largest single vertical pocket ≤ 2 cm

Interpretation 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)	Normal, nonasphyxiated fetus	No fetal indication for intervention; repeat testing per protocol
8/8 (NST not done)		
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

BIOPHYSICAL PROFILE

- Biophysical profile has limited value in the prediction of fetal pH.
- There is insufficient evidence to support the use of the BPP as a fetal wellbeing test in high-risk pregnancies.

Modified Biophysical Profile

- Designed because of labor intensity and required personnel for BPP.
- Used as abbreviated BPP and as first-line screening test.
- Involves a vibroacoustic nonstress test twice weekly and combined with AFI for w/c values 5 or less considered abnormal.

Modified Biophysical Profile

- Required ~10 minutes to perform, and
- It is a superb antepartum surveillance method because unexpected fetal deaths is rare.
- Biweekly nonstress tests with the AFI and considered measures ≤ 5 cm to be abnormal was used and found to be an excellent fetal surveillance tool..

Modified Biophysical Profile

- Modified BPP is as predictive of fetal well-being as other approaches to biophysical fetal surveillance(ACOG 2016).

Antenatal testing methodologies summary

Name	Components	Results/scoring	False negative	False positive
Contraction stress test (oxytocin challenge test)	Continuous FHR monitoring At least 3 contractions of ≥ 40 s duration within 10 min	Negative: no late or significant variable decelerations Positive: late decelerations following ≥ 50 percent of contractions, even if there are < 3 contractions in 10 min Equivocal - suspicious: intermittent late decelerations or significant variable decelerations Equivocal - hyperstimulatory: decelerations with contractions occurring more frequently than q 2 min. or lasting > 90 s Unsatisfactory: < 3 contractions in 10 min. or uninterpretable FHR tracing	0.04 percent	35-65 percent
Nonstress Test	Continuous FHR monitoring FHR accelerations: ≥ 32 w: reaching 15 bpm above baseline and lasting ≥ 15 s	Reactive: ≥ 2 accelerations within 20 min (may be extended to 40 min) Nonreactive: < 2 accelerations in 40 min	0.2-0.65 percent	55-90 percent
Biophysical profile	Presence or absence of 5 components within 30 min: <ul style="list-style-type: none"> • Reactive NST • ≥ 1 episode of fetal breathing movements lasting ≥ 30s • ≥ 3 discrete body or limb movements • ≥ 1 episode of extremity extension with return to flexion or opening or closing of a hand • Maximum vertical AF pocket > 2 cm or AFI > 5 cm 	Each component present is assigned score of 2 points; maximum score is 10/10 <ul style="list-style-type: none"> • Normal: $\geq 8/10$ or 8/8 excluding NST • Equivocal: 6/10 • Abnormal: $\leq 4/10$ 	0.07-0.08 percent	40-50 percent
Modified biophysical profile	NST AFI	Normal: Reactive NST and AFI > 5 cm Abnormal: Nonreactive NST and/or AFI ≤ 5 cm	0.08 percent	60 percent

AMNIONIC FLUID VOLUME

- Amnionic fluid volume estimation is included into virtually all fetal health is assesement.
- Rationale is that diminished uteroplacental perfusion may lead to lower fetal renal blood flow, decreased urine production, and ultimately, oligohydramnios

AMNIONIC FLUID VOLUME

- The deepest vertical pocket measurement, as opposed to the AFI, to diagnose oligohydramnios is associated with a reduction in unnecessary interventions without an increase in adverse perinatal outcomes(ACOG 2016).

DOPPLER VELOCIMETRY

- Blood flow velocity measured by Doppler ultrasound reflects downstream impedance
- For growth-restricted fetuses, several fetal vascular circuits including the umbilical artery, middle cerebral artery, and ductus venosus have been evaluated as diagnostic tools for fetal well-being.

DOPPLER VELOCIMETRY

- Maternal uterine artery Doppler velocimetry has also been assessed as a modality to predict placental dysfunction, with the goal to balance stillbirth against the risks of preterm delivery.

Doppler Blood Flow Velocity

- First studied in the umbilical arteries late in pregnancy
- Abnormal waveforms correlated with placental villous hypovascularity.
- 60 to 70 percent of placental arterial channel need to be obliterated before the umbilical artery Doppler waveform becomes abnormal.
- This has a major effect on fetal circulation.

Doppler Blood Flow Velocity

- Because >40 percent of the combined fetal ventricular output is directed to the placenta, obliteration of placental vascular channel increases afterload and leads to fetal hypoxemia leading to ventricular dilation and redistribution of middle cerebral artery blood flow.

Doppler Blood Flow Velocity

- Ultimately, pressure rises in the ductus venosus due to afterload in the right side of the fetal heart.
- Abnormal Doppler waveforms in the ductus venosus are a late finding in the progression of fetal deterioration due to chronic hypoxemia

Umbilical Artery Velocimetry

- The umbilical artery systolic-diastolic (S/D) ratio is considered abnormal if
 - ✓ It is >95th percentile for gestational age or
 - ✓ Diastolic flow is either absent or reversed

Umbilical Artery Velocimetry

- Absent or reversed end-diastolic flow signifies greater impedance to umbilical artery blood flow resulted from poorly vascularized placental villi and is seen in extreme fetal growth restriction.

Umbilical Artery Velocimetry

- Perinatal mortality rate for absent end-diastolic flow was about 10 percent, and for reversed end-diastolic flow, it ~33 percent.
- It increases later neurodevelopmental abnormalities like cerebral palsy.

Umbilical Artery Velocimetry

- No benefit has been demonstrated other than in pregnancies with suspected fetal growth restriction(ACOG 2016).
- Not proved valuable as a screening test
- Doppler investigations of other blood vessels besides the umbilical artery have not been shown to improve perinatal outcome(ACOG 2016).

Middle Cerebral Artery

- Has got attention based on the observations showing a hypoxic fetus attempts brain sparing by reducing cerebrovascular impedance and thus increasing blood flow
- Such brain sparing in growth-restricted fetuses has been documented to undergo reversal leading to increases perinatal mortality.

Middle Cerebral Artery

- Not recommended to detect fetal compromise.
- Proven valuable to detect severe fetal anemia in fetuses with D-antigen alloimmunization or other causes.

Ductus Venosus

- Doppler also used to assess the fetal venous circulation.
- Negative or reversed flow in the ductus venosus is a late finding because these fetuses had already sustained irreversible multiorgan damage due to hypoxemia.

Ductus Venosus

- Absent or reversed flow in the ductus venosus is associated with fetal metabolic collapse with GA as powerful cofactor in ultimate perinatal outcome for growth-restricted fetuses delivered before 30 weeks.

Ductus Venosus

- Ductus venosus velocimetry was the best predictor of perinatal outcome.
- By the time severely abnormal flow is seen in the ductus venosus, it is too late because the fetus is already near death.

Uterine Artery

- Doppler U/S shows vascular resistance in the uterine circulation normally decreases in the first half of pregnancy due to invasion of maternal uterine vessels by trophoblastic tissue.
- So ,uterine artery Doppler may be helpful in assessing pregnancies at risk of uteroplacental insufficiency

Uterine Artery

- Persistence or development of high-resistance patterns has been linked to various pregnancy complications like increased perinatal mortality, abruption, preeclampsia, or fetal-growth restriction, was significantly linked to high resistance flow.

Uterine Artery

- Because standards for the study technique and criteria for an abnormal test are lacking, uterine artery Doppler studies should not be considered standard practice in either low- or high-risk populations.

Thank you