In the name of God

Dr. Seideh Hanieh Alamolhoda
Ph.D of Reproductive health
Assistant professor
Shahid Beheshti University Of Medical Sciences
ASSESSMENT OF FETAL WELL-BEING
• **Aims of antenatal fetal monitoring:**

• Primary objective: Avoid fetal death.

• To ensure satisfactory growth and well being of the fetus.
• **Common indications for antepartum fetal monitoring:**

• **Pregnancy with obstetric complications:**
  IUGR, Multiple pregnancy, Polyhydramnios or Oligohydramnios, Rhesus alloimmunization.

• **Pregnancy with medical complications:**
  Diabetes mellitus, Hypertension, Epilepsy, Renal or Cardiac disease, Infection (Tuberculosis), SLE.
• **Common indications for antepartum fetal monitoring:**

• **Others:**
  Advanced maternal age (> 35 years), previous still birth or recurrent abortion, previous birth of a baby with structural (anencephaly, spina bifida) or chromosomal (autosomal trisomy) abnormalities.

• **Routine antenatal testing.**
COMPONENTS OF FETAL ASSESSMENT

- Clinical monitoring
- Biophysical monitoring
- Biochemical monitoring
1. CLINICAL MONITORING
• **CLINICAL MONITORING:**
• 1. Maternal weight gain
• 2. Blood pressure
• 3. Assessment of size of uterus & height of fundus
• 4. Clinical assessment of liquor
• 5. Edema of feet
• 6. Abdominal girth in last trimester
• **1. Maternal weight gain:**

• In second half of pregnancy: average weight gain is 1 kg/fortnight.

• Excess weight gain: Could be 1st sign of pre-eclampsia.

• If weight gain less than normal, stationary or falling: Look for IUGR
• **2. Blood pressure:**

• Initial recording of BP prior to 12 weeks helps to differentiate pre-existing chronic hypertension from pregnancy induced hypertension.

• Hypertension, pre-existing or pregnancy induced may impair fetal growth.
• **3. Assessment of size of uterus & height of fundus:**

• Top of fundus is measured from superior border of symphysis pubis (bladder should be empty) using a tape.

• After 24 weeks of pregnancy, distance measured in cm normally corresponds to period of gestation in weeks.
Gestational age chart estimated from symphysis fundal height.
• 4. Clinical assessment of liquor

• 5. Edema of feet

• 6. Abdominal girth in last trimester
2. BIOPHYSICAL MONITORING

Antepartum Tests

Intrapartum Tests
BASIS OF TESTS

Hypoxia
\[\rightarrow\]
Metabolic acidosis
\[\rightarrow\]
CNS depression
\[\rightarrow\]
Changes in fetal biophysical activity.
A. Antepartum tests:
1. Fetal movement monitoring
2. The non stress test (NST)
3. The contraction stress test (CST)
4. The biophysical profile
5. Doppler usg of fetal umbilical artery blood flow

B. Intrapartum assessment of fetal well-being:
1. Continuous electronic fetal monitoring:
   - a. The fetal heart rate (FHR)
   - b. Uterine activity
2. Fetal scalp blood gas
ANTEPARTUM TESTS

• 1. Fetal movement monitoring
• **A. Antepartum tests:**
  • 1. Fetal movement monitoring
  • Simplest method of fetal assessment.

  • Mothers perceive 88% of the fetal movements detected by Doppler Imaging.

  • The count should be performed daily starting at 28 weeks of pregnancy.

  *If fetal movement is less → NST*
• **A. Antepartum tests:**
  • 1. Fetal movement monitoring
  • **Cardif ‘count 10’ formula:**
  • Mother counts fetal movements starting at 9 am.
  • Counting ends when 10 movements are perceived.

• Report to physician if:
  – (i) less than 10 movements occur during 12 hours on 2 successive days or
  – (ii) no movement is perceived even after 12 hours in a single day.
A. Antepartum tests:

1. Fetal movement monitoring

- Daily fetal movement count (DFMC):
- One hour duration each in morning, noon and evening. (Total 1+1+1 = 3 hours)
- Total counts multiplied by four gives daily (12 hour) fetal movement count (DFMC).

- If there is diminution of number of ‘kicks’ to less than 10 in 12 hours (or less than 3 in each hour), it indicates fetal compromise.
A. Antepartum tests:

1. Fetal movement monitoring

- RCT in Denmark: Fetal movement counting → 73% reduction in avoidable stillbirths (RR 0.27, 95% CI 0.08-0.93).

- In contrast, a large (N = 68,654) international trial → no significant difference in potentially avoidable late fetal deaths between women who were instructed to count routinely and controls.

- Cochrane review: Though more number of babies at risk of death were identified, NO REDUCTION IN PERINATAL MORTALITY.
ANTEPARTUM TESTS

- 2. The non stress test (NST):
• **A. Antepartum tests:**

• 2. The non stress test (NST):

  • **Advantages:**
    
    • It is simple to perform,
    
    • Relatively quick, and
    
    • Noninvasive.

  • *Testing should be started after 30 weeks and frequency should be twice weekly.*
• **A. Antepartum tests:**
  
  • 2. The non stress test (NST):  
  • **Principle:**  
    • Fetal activity → Reflex acceleration in heart rate.  
    
    • Required fetal maturity is reached by approximately 32 weeks of gestation.  
    
    • Test is valuable to identify the fetal wellness rather than illness.
• **A. Antepartum tests:**
  • **2. The non stress test (NST):**
  
  • Simultaneous recording of:
  • **1. Fetal heart rate (FHR)**
    – Doppler ultrasonographic device, or
    – Skin-surface electrodes on the maternal abdomen.
  • **2. Uterine activity**
    – Tocodynamometer,
    – Palpation by trained test personnel, or
    – Patient's report.
• **A. Antepartum tests:**

• **2. The non stress test (NST):**

  • The test result may be **reactive, nonreactive, or inadequate.**

  • The criteria for a **Reactive test (Reassuring) are:**
    
    (i) heart rate between **110 and 160,**

    (ii) normal beat-to-beat variability

    (5 beats/minute [bpm]), and

    (iii) **TWO accelerations of at least 15 bpm above baseline** lasting for not less than **15 seconds,** within a **20-minute period.**
• **A. Antepartum tests:**
• **2. The non stress test (NST):**

• **Nonreactive test (Non reassuring):**
  – Fails to meet the three criteria.
  – Absence of any fetal reactivity.

• **Inadequate test:** Adequate fetal heart tracing cannot be obtained.

• **Vibroacoustic stimulation (VAS) is used to change the fetal sleep state from quiet (non-REM) to active (REM) sleep. A reactive NST after VAS indicates a reactive fetus.**
• **A. Antepartum tests:**
• 2. The non stress test (NST):

  • If test is nonreactive:
    – Test is repeated later the same day (or)
    – Perform another test of fetal well-being.

  (Contraction stress test (CST) may be used as a confirmatory test when the NST is nonreactive or inadequate.)
• **A. Antepartum tests:**

• **2. The non stress test (NST):**

  • *Studies show that risk of fetal demise within the week following a reactive test is approximately 3 in 1,000.*

  • *But when the NST is nonreactive, perinatal death is about 40 per 1000.*
ANTEPARTUM TESTS

• 3. The contraction stress test (CST)
• A. Antepartum tests:
• 3. The contraction stress test (CST)

• Principle:
• Based on the idea that uterine contractions can compromise an unhealthy fetus.
• **A. Antepartum tests:**
  • 3. The contraction stress test (CST)

• **Principle:**
  • *Pressure generated during contractions can briefly reduce or eliminate perfusion of intervillous space.*
  • *Healthy fetoplacental unit has sufficient reserve to tolerate this short reduction in oxygen supply.*
  • *Under pathologic conditions, respiratory reserve may be so compromised that reduction in oxygen results in fetal hypoxia.*
• A. Antepartum tests:
• 3. The contraction stress test (CST)

• Similar to NST, CST monitors FHR and uterine contractions.

• If no spontaneous contractions occur, they can be induced with intravenous oxytocin (oxytocin challenge test)
• A. Antepartum tests:
• 3. The contraction stress test (CST)
A. Antepartum tests:

3. The contraction stress test (CST)

A CST is considered completed if
- uterine contractions have spontaneously occurred within 30 minutes,
- lasted 40 to 60 seconds each, and
- occurred at a frequency of three within a 10-minute interval.
• A. Antepartum tests:
  
• 3. The contraction stress test (CST) : Interpretation
  
• **Positive**: If late decelerations are consistently seen in association with contractions.
  
• **Negative**: If at least three contractions of at least 40 seconds each occur within a 10-minute period without associated late decelerations.
  
• **Suspicious**: If there are occasional or inconsistent late decelerations.

**Negative is good!**
• A. Antepartum tests:

• 3. Contraction stress test (CST):

• Negative CST is more reassuring than a reactive NST, with the chance of fetal demise within a week of a negative CST being approximately 0.4 per 1,000.

• However, if a positive CST follows a nonreactive NST, the risk of stillbirth is 88 per 1,000, and the risk of neonatal mortality is also 88 per 1,000.
• A. Antepartum tests:
• 3. Contraction stress test (CST):

• Statistically, about one-third of patients with a positive CST will require cesarean section for persistent late decelerations in labor.
ANTEPARTUM TESTS

• 4. Biophysical profile:
• **A. Antepartum tests:**

• **4. Biophysical profile:**

• Combines NST with other parameters by real-time ultrasonic examination.

• A score of 0 or 2 is assigned for each.

• The total score determines the course of action
### Biophysical Profile Scoring (Manning—1992)

**Observation for 30 minutes**  
Normal score = 2  Abnormal = 0

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Minimal normal criteria</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-stress Test (NST)</td>
<td>Reactive pattern</td>
<td>2</td>
</tr>
<tr>
<td>Fetal breathing movements</td>
<td>≥ 1 episode lasting &gt; 30 second</td>
<td>2</td>
</tr>
<tr>
<td>Gross body movements</td>
<td>≥ 3 discrete body/limb movements</td>
<td>2</td>
</tr>
<tr>
<td>Fetal muscle tone</td>
<td>≥ 1 episode of extension (limb or trunk) with return of flexion</td>
<td>2</td>
</tr>
<tr>
<td>Amniotic fluid</td>
<td>≥ 1 pocket measuring 2 cm in two perpendicular planes (2 × 2 cm pocket)</td>
<td>2</td>
</tr>
</tbody>
</table>
### BPP Scoring, interpretation and management

<table>
<thead>
<tr>
<th>BPP Score</th>
<th>Interpretation</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>8–10</td>
<td>No fetal asphyxia</td>
<td>Repeat testing at weekly interval or more</td>
</tr>
<tr>
<td>6</td>
<td>Suspect chronic asphyxia</td>
<td>If &gt; 36 weeks → deliver; but if L/S &lt; 2.0 repeat test in 4–6 hours</td>
</tr>
<tr>
<td>4</td>
<td>Suspect chronic asphyxia</td>
<td>If ≥ 36 weeks deliver, if &lt; 32 weeks repeat testing in 4–6 hours</td>
</tr>
<tr>
<td>0–2</td>
<td>Strongly suspect asphyxia</td>
<td>Test for 120 minutes → persistent score ≤ 4 → deliver regardless of gestational age</td>
</tr>
</tbody>
</table>
• A. Antepartum tests:
  • 4. Biophysical profile:

  • The likelihood of in-utero fetal demise within 1 week of a reassuring test is approximately 0.6 to 0.7 per 1,000.
ANTEPARTUM TESTS

5. Doppler ultrasonography of fetal umbilical artery blood flow:
• A. Antepartum tests:
• 5. Doppler ultrasonography of fetal umbilical artery blood flow:

• Principle:

• Poorly functioning placentas with extensive vasospasm or infarction have an increased resistance to flow.

• Particularly noticeable in fetal diastole.
• **A. Antepartum tests:**
  
  5. Doppler ultrasonography of fetal umbilical artery blood flow:

  • The two commonly used indices of flow are:
    - Systolic : diastolic ratio (S/D) and
    - Resistance index (S-D/S).

  • S = Peak systolic frequency shift
  • D = End-diastolic frequency shift
• **A. Antepartum tests:**

  5. Doppler ultrasonography of fetal umbilical artery blood flow:

  • Umbilical artery Doppler velocimetry measurements - only in IUGR.

  • Absent or reversed end-diastolic flow is seen in the most extreme cases of IUGR and is associated with a high mortality rate.
• **A. Antepartum tests:**
• 5. Doppler ultrasonography of fetal umbilical artery blood flow:

• Umbilical artery Doppler velocimetry measurements, in conjunction with other tests of fetal well-being, can reduce the perinatal mortality in IUGR by almost 40%.

• Doppler measurements of the **middle cerebral artery** can also be used in the assessment of the fetus at risk for either IUGR or anemia.
• Umbilical artery flow velocity waveform

- Normal
- Reduced end-diastolic flow
- Absent end-diastolic flow
- Reversed end-diastolic flow
A. Antepartum tests:

OTHER ASSESSMENTS BY ANTENATAL USG:

1. Viability of the fetus
2. Pregnancy dating
3. Detection of multiple pregnancy
4. Detection of congenital anomalies
5. Placental localization
6. Monitoring of high risk pregnancy (biophysical scoring)
7. Adjunct to any procedure, e.g. amniocentesis, cordocentesis, cervical circlage, external cephalic version
• **A. Antepartum tests:**
  • **Ultrasonic estimation of gestational age:**
  
  • **During 1st trimester:** Fetal crown rump length → accurate predictor of gestational age.
  • **Crown-rump length estimation of gestational age:** within 7 days of true gestational age.

  • **During 2nd and 3rd trimesters:** Biparietal diameter (BPD) & fetal femur length.
• **A. Antepartum tests:**
  
  • **Ultrasonic estimation of gestational age:**

  • Owing to normal biologic variability, accuracy of gestational age estimated by BPD decreases with increasing gestational age.

  • For measurements made
    - at 14 to 20 weeks of gestation: Variation is up to 11 days
    - at 20 to 28 weeks: Variation is up to 14 days
    - at 29 to 40 weeks: Variation can be up to 21 days.
• **A. Antepartum tests:**
  • 1. Fetal movement monitoring
  • 2. The non stress test (NST)
  • 3. The contraction stress test (CST)
  • 4. The biophysical profile
  • 5. Doppler usg of fetal umbilical artery blood flow

• **B. Intrapartum assessment of fetal well-being:**
  • 1. Continuous electronic fetal monitoring:
    – a. The fetal heart rate (FHR)
    – b. Uterine activity
  • 2. Fetal scalp blood gas
INTRAPARTUM TESTS

1. Continuous electronic fetal monitoring:
• **B. Intrapartum tests:**
  • **1. Continuous electronic fetal monitoring:**

  • Monitors simultaneously record FHR and uterine activity for ongoing evaluation.

  • **Primary goal:** Identify hypoxemic & acidotic fetuses in whom timely intervention will prevent death.

  • **Secondary goal:** Avoid fetal neurologic injury.
• **B. Intrapartum tests:**
  • 1. Continuous electronic fetal monitoring:

• **Fetal heart rate monitoring:**
  • **Noninvasive:**
    1. Ultrasonic monitoring
    2. Surface-electrode monitoring from maternal abdomen.

• **Invasive:** (Most accurate)
  • Placing electrode into skin of fetal presenting part to record fetal electrocardiogram.
B. Intrapartum tests:

1. Continuous electronic fetal monitoring:

Parameters of the fetal monitoring record:

1. Baseline heart rate
2. Beat-to-beat variability
3. Accelerations
4. Decelerations
   - Early
   - Late
   - Variable
• **B. Intrapartum tests:**
  • 1. Continuous electronic fetal monitoring:
  • Parameters of the fetal monitoring record:
    1. **Baseline heart rate:**
       • Normally between 110 and 160 bpm.
       • The baseline must be apparent for a minimum of 2 minutes in any 10-minute segment
B. Intrapartum tests:
1. Continuous electronic fetal monitoring:
   • Parameters of the fetal monitoring record:

1. Baseline heart rate:
   • Baseline fetal bradycardia (FHR < 110 bpm), may result from congenital heart block
   • Baseline tachycardia (FHR > 160 bpm), may result from maternal fever, infection, stimulant medications or drugs, and hyperthyroidism.
   • Fetal dysrhythmias are typically associated with FHR > 200 bpm.
• B. Intrapartum tests:
  • 1. Continuous electronic fetal monitoring:
  • Parameters of the fetal monitoring record:
  1. **Baseline heart rate:**
• **B. Intrapartum tests:**
  • 1. Continuous electronic fetal monitoring:
  • Parameters of the fetal monitoring record:
  2. **Beat-to-beat variability:**
     • Recorded from calculation of **each RR interval.**
     • Autonomic nervous system of healthy, awake term fetus constantly varies the heart rate from beat to beat by approximately **5 to 25 bpm.**
B. Intrapartum tests:

1. Continuous electronic fetal monitoring:

   Parameters of the fetal monitoring record:

2. Beat-to-beat variability:

   Reduced beat-to-beat variability may result from depression of the fetal central nervous system due to:
   - fetal immaturity,
   - hypoxia,
   - fetal sleep, or
   - maternal medications such as narcotics, sedatives, Beta blockers, and intravenous magnesium sulfate.
B. Intrapartum tests:
1. Continuous electronic fetal monitoring:
   Parameters of the fetal monitoring record:
2. Beat-to-beat variability:
• B. Intrapartum tests:
  • 1. Continuous electronic fetal monitoring:
  • Parameters of the fetal monitoring record:
  2. Beat-to-beat variability:

![Absent variability graph](image)
B. Intrapartum tests:
1. Continuous electronic fetal monitoring:
2. Parameters of the fetal monitoring record:
   3. Accelerations:
      - Reassuring
   4. Decelerations: (Should note the Shape & Timing)
      a. Early
      b. Late
      c. Variable
Normal FHR, Baseline variability, Normal accelerations, No decelerations
a) **Early decelerations:**

- Symmetric in shape

- Closely mirror uterine contractions in time of onset, duration, and termination.

- Benign

- More commonly seen in active labor when fetal head is compressed in the pelvis, resulting in a parasympathetic effect.
Early decelerations: onset of the deceleration occurs with the onset of the uterine contraction
Early decelerations: onset of the deceleration occurs with the onset of the uterine contraction
b) **Late decelerations:**

- The onset, nadir, and recovery of the deceleration occur **after** the beginning, peak, and end of the contraction, respectively.

- A fall in heart rate of only 10 to 20 bpm below baseline (even if still within the range of 110-160) is significant.

- Late decelerations are the result of utero-placental insufficiency and possible fetal hypoxia.
b) **Late decelerations:**

As the uteroplacental insufficiency/hypoxia worsens,
(i) beat-to-beat variability will be reduced and then lost,
(ii) decelerations will last longer,
(iii) they will begin sooner following the onset of a contraction,
(iv) they will take longer to return to baseline, and
(v) the rate to which the fetal heart slows will be lower.

Repetitive late decelerations demand action.
b) **Late decelerations:**

Associated with decreased uterine blood flow and can occur as a result of:

- Hypoxia
- Placental abruption
- Cord compression / prolapse
- Excessive uterine activity
- Maternal hypotension / hypovolaemia
Late decelerations: Onset, nadir, and recovery of deceleration occur after beginning, peak, and end of contraction, respectively.
Late decelerations: Onset, nadir, and recovery of deceleration occur after beginning, peak, and end of contraction, respectively.
c) Variable decelerations:

- Vary in shape and timing relative to contractions.

- Result from fetal umbilical cord compression.

- Variable decelerations are a cause for concern if:
  - severe (60 bpm or last for 60 seconds, or both),
  - associated with poor beat-to-beat variability, or
  - mixed with late decelerations
Variable decelerations: Decelerations variable in timing & size. May be accompanied by increased variability of FHR
Variable decelerations: Decelerations variable in timing & size. May be accompanied by increased variability of FHR
Graphic representation showing various types of decelerations in relation to uterine contractions.
### Causes of fetal tachycardia (FHR > 160 bpm)

(a) Drugs to mother: (i) β-sympathomimetic agents used to inhibit preterm labor (isoxsuprine, ritodrine);
(ii) Vagolytic: atropine
(b) Infection—both maternal and fetal
(c) Anemia—both maternal and fetal
(d) Fetal hypoxia

### Causes of fetal bradycardia (FHR < 110 bpm)

(a) Fetal hypoxia, acidosis
(b) Fetal sepsis, anomalies
(c) Use of local anesthetic drugs, epidural analgesia
(d) Drugs to mother, e.g. pethidine, antihypertensives (methylldopa, propranolol), MgSO₄
(e) Fetal heart conduction defect (SLE)
<table>
<thead>
<tr>
<th>Feature</th>
<th>Baseline (bpm)</th>
<th>Variability (bpm)</th>
<th>Deceleration</th>
<th>Accelerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reassuring</td>
<td>110–160</td>
<td>&gt; 5</td>
<td>None</td>
<td>Present</td>
</tr>
</tbody>
</table>
| Non-reassuring | 100–109  161–180 | < 5 for ≥ 40 but less than 90 minutes | • Early deceleration  
• Variable deceleration  
• Single prolonged deceleration up to 3 minutes | Absence of accelerations with an otherwise normal CTG is of uncertain significance |
| Abnormal     | < 100  > 180  Sinusoidal pattern for ≥ 10 minutes | < 5 for > 90 minutes | • Atypical variable deceleration  
• Late decelerations > 30 min  
• Single prolonged decelerations > 3 minutes | Absence of accelerations with an otherwise normal CTG is of uncertain significance |
<table>
<thead>
<tr>
<th>Category</th>
<th>Feature</th>
<th>Baseline FHR, variability, decelerations, accelerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reassuring</td>
<td>11 or more</td>
<td>Present</td>
</tr>
<tr>
<td>Non-reassuring</td>
<td>10 or less</td>
<td>Present</td>
</tr>
<tr>
<td>Abnormal</td>
<td>&lt;9 or &gt;16</td>
<td></td>
</tr>
</tbody>
</table>

**Categorization of CTG Traces**

- **Normal**: All four features are reassuring.
- **Suspicious**: One non-reassuring and the rest are reassuring.
- **Pathological**: Two or more features nonreassuring or one or more abnormal categories in minutes.

Absence of accelerations with an otherwise normal CTG is of uncertain significance.
A 2006 systematic review of **12 randomized trials** including **>37,000 women** (both low and high risk) comparing continuous electronic FHR monitoring and intermittent auscultation showed:

1. Intrapartum fetal death rate approximately 0.5/1000 births with either approach.

2. Use of electronic FHR monitoring instead of intermittent auscultation did not result in a significant reduction in overall risk of perinatal death (RR 0.85, 95% CI 0.59-1.23).
3. Apgar scores & NICU admission rates were similar for both modalities.

4. Electronic FHR monitoring instead of intermittent auscultation did not reduce the risk of hypoxic ischemic encephalopathy, long-term neurologic impairment, or cerebral palsy.

5. Frequency of neonatal seizures was reduced in the electronically monitored group (RR 0.50, 95% CI 0.31-0.80)
6. Use of electronic FHR monitoring instead of intermittent auscultation increased the frequency of operative delivery (cesarean delivery RR 1.66, 95% CI 1.30-2.13; instrumental vaginal delivery RR 1.16, 95% CI 1.01-1.32)

**US Department of health and human services 2011:**

EFM during labour significantly lowered early neonatal and infant mortality (RR 0.50, p < .001)
INTRAPARTUM TESTS

• 2. Fetal scalp blood sample
• **B. Intrapartum tests:**
  • 2. A fetal scalp blood sample for blood gas analysis:
    • Intrapartum scalp pH above 7.20
    • Base deficit <6 mmol/L.
    \[\text{Normal}\]
INTRAPARTUM TESTS

3. OTHER TESTS:
• **B. Intrapartum tests:**

• **3. OTHER TESTS:**

  • **Fetal pulse oximetry:**

  Data from human and animal studies suggest that fetal arterial oxygen saturation (SaO2 by blood gas co-oximetry) >30 percent is usually associated with pH >7.13.
• **B. Intrapartum tests:**
• **3. OTHER TESTS:**

• **STAN fetal heart monitor (ST analysis)** —
  STAN S31 fetal heart monitor, monitors fetal ECG during labor.

• Based on principle that fetal hypoxemia can result in elevation or depression of the ST segment.

• **STAN S31 fetal heart monitor has been approved by US Food and Drug Administration as an adjunct to assessment of nonreassuring FHR tracings in pregnancies over 36 weeks of gestation, in labor, with vertex presentation and ruptured fetal membranes.**
3. BIOCHEMICAL MONITORING
• **Maternal serum alpha fetoprotein (MSAFP):**

  • AFP is an oncofetal protein (Molecular weight 70,000).

  • Produced by yolk sac & fetal liver.

  • Maternal serum level reaches a peak around 32 weeks.

  • Test done between 15–20 weeks.

  • MSAFP value of 2.5 multiples of the median (MOM) when adjusted with maternal weight and ethnicity, is taken as cut off point.
• Maternal serum alpha fetoprotein (MSAFP):
  • MSAFP elevated in:
    (a) wrong gestational age
    (b) open neural tube defects (NTDs)
    (c) multiple pregnancy,
    (d) Rh isoimmunization
    (e) IUFD
    (f) anterior abdominal wall defects
    (g) renal anomalies.
  • Low levels of MSAFP in
    (a) Trisomies (Down syndrome),
    (b) Gestational trophoblastic disease.
• **Maternal serum alpha fetoprotein (MSAFP):**

  • Elevated MSAFP detects 85% of all neural tube defects.

  • High values → High resolution USG and/or amniocentesis.
Screening for Down syndrome:

1st Trimester Screening Tests
Maternal Serum Markers
- Preg. asso. Placental Protein A (PAPP-A)
- Free ß hCG
Fetal Marker - Nuchal fold > 4mm at 8-12 wks GA
65% 57-73% 85%

2nd Trimester Screening Tests
Maternal Serum Markers
- AFP
- ßE3
- hCG
- Inhibin
Triple Test 69% 76%
Quadruple Test
<table>
<thead>
<tr>
<th></th>
<th>Chorion villus sampling</th>
<th>Amniocentesis</th>
<th>Cordocentesis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time</strong></td>
<td>Transcervical 10–12 weeks, Transabdominal 10 weeks to term</td>
<td>14–16 weeks (early 12–14 weeks)</td>
<td>18–20 weeks</td>
</tr>
<tr>
<td><strong>Materials for study</strong></td>
<td>Trophoblast cells</td>
<td>Fetal fibroblasts</td>
<td>Fetal white blood cells (others—infection and biochemical study)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fluid for biochemical study</td>
<td></td>
</tr>
<tr>
<td><strong>Karyotype Result</strong></td>
<td>• Direct preparation—24–48 hours.</td>
<td>• Culture 3–4 weeks</td>
<td>• Culture 24–48 hours</td>
</tr>
<tr>
<td></td>
<td>• Culture—10–14 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fetal loss</strong></td>
<td>0.5–1%</td>
<td>0.5%</td>
<td>1–2%</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>Accurate; may need amniocentesis for confirmation</td>
<td>Highly accurate</td>
<td>Highly accurate</td>
</tr>
<tr>
<td><strong>Termination of pregnancy when indicated</strong></td>
<td>1st trimester—safe</td>
<td>2nd trimester—risky</td>
<td>2nd trimester—risky</td>
</tr>
<tr>
<td><strong>Maternal effects following termination of pregnancy</strong></td>
<td>Very little</td>
<td>More traumatic; physically and psychologically</td>
<td>Same as amniocentesis</td>
</tr>
</tbody>
</table>
ASSESSMENT OF FETAL PULMONARY MATURITY
• **Assessment of fetal pulmonary maturity**

• 1. Amniotic fluid Lecithin/Sphingomyelin (L/S) ratio.

  - L/S ratio at 31–32 weeks = 1
  - L/S ratio at 35 weeks = 2.
  - L/S ratio > 2 indicates pulmonary maturity.
• **Assessment of fetal pulmonary maturity**

• 2. Shake test or Bubble test (Clement’s):

  • Based on ability of pulmonary surfactant to form a foam or bubble on shaking *which remains stable for at least 15 minutes.*

  • Increasing dilutions of amniotic fluid are mixed with 96% ethanol, shaken for 15 seconds and inspected *after 15 minutes* for the presence of a complete ring of bubbles at the meniscus.

  • Indicates maturity of the fetal lungs.
• **Assessment of fetal pulmonary maturity**

• 3. Foam Stability Index (FSI):
  - Based on surfactant detection by shake test.
  - Serial dilutions of amniotic fluid to quantitate amount of surfactant present.
  - FSI >47 virtually excludes risk of RDS.

• 4. Presence of phosphatidyl glycerol (PG) in amniotic fluid:
  - Indicates lung maturation.
  - Thin layer chromatography.
• **Assessment of fetal pulmonary maturity**

• 5. Saturated phosphatidyl choline:
  • > 500 ng/mL indicates pulmonary maturity.

• 6. Fluorescence polarization:
  • Polarized light to quantitate surfactant.
  • Ratio of surfactant to albumin measured by automatic analyzer.
  • Presence of 55 mg of surfactant per gram of albumin indicates fetal lung maturity.
• **Assessment of fetal pulmonary maturity**

• 7. Amniotic fluid optical density:
  • > 0.15 at 650 mμ indicates lung maturity.

• 8. Lamellar body:
  • Storage form of surfactant in amniotic fluid.
  • Can be counted as size is same as that of platelets.
  • Lamellar body count > 30,000/μL indicates pulmonary maturity.
• **Assessment of fetal pulmonary maturity**

• 9. Orange colored cells:
• Desquamated fetal cells obtained from centrifuged amniotic fluid are stained with 0.1% Nile blue sulfate.
• Presence of orange coloured cells > 50% suggests pulmonary maturity.

• 10. Amniotic fluid turbidity:
• At term, amniotic fluid is turbid due to vernix.
INTRA UTERINE
FETAL RESUSCITATION:
• **INTRA UTERINE FETAL RESUSCITATION:**
  • Steps to improve fetal oxygenation before delivery.

• **SPOILT:**
  • 1. Syntocinon off
  • 2. Position: Full Left Lateral
  • 3. Oxygen
  • 4. I.V infusion of Crystalloid fluids
  • 5. Low BP if present : IV Vasopressor
  • 6. Tocolysis:
Thank You!