Antepartum assesment of fetal well-being

The primary objective of antenatal fetal assessment is to avoid fetal death.

As such simultaneously with good maternal care during pregnancy and labor, the fetal health in utero should be supervised with equal vigilance.

Aims of antenatal fetal monitoring:

1.To ensure satisfactory growth and well-being of the fetus throughout pregnancy.

2. To screen out the high-risk factors that a!ect the growth of the fetus.

Rationality of Antenatal Fetal Tests

Tests must provide information superior to that of clinical evaluation

Test results should be helpful in management to improve perinatal outcome

Benefits of tests must outweigh the potential risks and the costs

ANTEPARTUM FETAL SURVEILLANCE (LATE PREGNANCY)

OBJECTIVES ARE (ACOG)—(1) Prevention of fetal death and (2) avoidance of unnecessary interventions.
1. **Biophysical** 2.**Biochemical** 3.**Clinical** METHODS:

CLINICAL: The clinical assessment of fetal growth can be evaluated by the SFH. **They may be useful as screening test for further investigation**.

BIOCHEMICAL: Biochemical tests are mainly done for assessment of **pulmonary maturity** .

BIOPHYSICAL: **Principle**—*Biophysical profile* is a **screening test** for utero–placental insufficiency.
The fetal biophysical activities are initiated, modulated and regulated through fetal nervous system.

The fetal CNS is very much sensitive to diminished oxygenation. Hypoxia o metabolic acidosis o CNS depression o changes in fetal biophysical activity

The following biophysical tests are used:

(1)Fetal movement count

(2) Ultrasonography

(3) Cardiotocography

(4) Non-stress test (NST)

(5) Fetal biophysical profile (BPP)

(6) Doppler ultrasound

(7) Vibroacoustic stimulation test

(8) Contraction stress test (CST)

(9) Amniotic fluid volume

1.Fetal movement count—Any of the two methods can be applied:

1.**Cardif** "**count 10**" **formula:** "a patient counts fetal movements starting at 9 am."a counting comes to an end as soon as 10 movements are perceived. **She is instructed to report the physicianif—**
(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.

2.Daily fetal movement count (DFMC): "three counts each of 1 hour duration (morning, noon and evening) are recommended. "a 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.

Mothers perceive 88% of the fetal movements detected by Doppler imaging.
the count should be performed daily starting at 28 weeks of pregnancy.

Loss of fetal movements is commonly followed by disappearance of FHR within next 24 hours.

In either of the earlier methods, if the result is ominous, the candidate is subjected to NST.
Maternal hypoglycemia is associated with increased fetal movements.

Maternal perception of fetal movements may be reduced with fetal sleep (quiet), fetal anomalies (CNS), anterior placenta, hydramnios, obesity, drugs (narcotics), chronic smoking and hypoxia.

2.Non-stress test (NST): In non-stress test, a continuous electronic monitoring of the fetal heart rate along with recording of fetal movements (cardiotocography) is undertaken.

There is an observed association of FHR acceleration with fetal movements, **which when present**, **indicates a healthy fetus.**

It can reliably be used as a **screening test**.

The accelerations of the FHR associated with fetal movements are presumably reflex mediated.

It should be emphasized that **the test is valuable to identify the fetal wellness rather than illness**.

Interpretation:

Reactive (Reassuring)—When two or more accelerations of more than 15 beats per minute above the baseline and longer than 15 seconds in duration are present in a 20 minute observation.

Non-reactive (Non-reassuring)—Absence of any fetal reactivity.

A **reactive NST** is associated with perinatal death of about 5 per 1,000. But perinatal death is about 40 per 1,000 when the **NST is nonreactive**.

Testing should be started after 30 weeks and frequency should be twice weekly.

The test has a *false negative rate of 0.5% and false positive rate of 50%*

3.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. The procedure is harmless.

4.Fetal Biophysical Profile (BPP)—considers several parameters .

BPP using real time ultrasonography has a high predictive value

Indications
1—Non-reactive NST,
2. high-risk pregnancy.

Test frequency
weekly after a normal NST,
twice weekly after an abnormal test.

Modified Biophysical Profile consists of NST and ultrasonographically determined amniotic fluid index (AFI).

Modified BPP is considered abnormal (nonreassuring) when the NST is non-reactive and/or the AFI is < 5.

Table 11.1: Biophysical Profile Scoring (Manning—1992)

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

Parameters	Minimal Normal Criteria	Score
Non-stress Test (NST)	Reactive pattern (p. 122)	2
Fetal breathing movements	≥ 1 episode lasting > 30 second	2
Gross body movements	≥ 3 discrete body/limb movements	2
Fetal muscle tone	≥ 1 episode of active extension (limb or trunk) with return of flexion; opening and closing of hand, considered normal	2
Amniotic fluid	≥ 1 pocket measuring 2 cm in two perpendicular planes (2 × 2 cm pocket)	2

Table 11.2: BPP Scoring, Interpretation and Management

BPP Score	Interpretation	Management
8–10	Normal; Less risk of fetal asphyxia	Repeat testing at weekly interval or more
6	Suspect chronic asphyxia	If ≥ 36 weeks → deliver; but if L/S < 2.0 repeat test in 4–6 hours
4	Suspect chronic asphyxia ↓	If ≥ 36 weeks deliver, if < 32 weeks repeat testing in 4–6 hours
0–2	Strongly suspect asphyxia	Test for 120 minutes ↓ persistent score ≤ 4 ↓ deliver regardless of gestational age

An abnormal score of 4 or less is associated with fetal acidemia. Abnormal BPP is associated with high risks of stillbirth and perinatal mortality.

5.Fetal Cardiotocography (CTG):

A normal tracing after 32 weeks, would show baseline heart rate of 110–160 beats per minute (bpm) with an amplitude of baseline variability 5–25 bpm. There should be no deceleration or there may be early deceleration of very short duration.

Importantly, **there should be two or more accelerations during a 20-minute period**

6.Ultrasonography:
IUGR can be diagnosed accurately with serial measurement of BPD, AC, HC, FL and amniotic fluid volume.

AC is the single measurement which best reflects fetal nutrition.

The average increase of biparietal diameter beyond 34 weeks is 1.7 mm per week.

When the HC/AC ratio is elevated (> 1.0) after 34 weeks, IUGR is suspected .

Ultrasound examination is the main diagnostic tool to assess fetal growth

7.Amniotic fluid volume (AFV):

Amniotic fluid volume is primarily dependent upon the fetal urine output, pulmonary fluid production and fetal swallowing.

Decreasing AFV may be the result of fetal hypoxia and placental insufficiency.

A vertical pocket of amniotic fluid > 2 cm is considered normal.

Amniotic fluid index (AFI) is the sum of vertical pockets from four quadrant of uterine cavity.

AFI < 5 is associated with increased risk of perinatal mortality and morbidity

8.Doppler Ultrasound Velocimetry:

Doppler flow velocity waveforms are obtained from arterial and venous beds in the fetus .

Arterial Doppler (umbilical artery) waveforms are helpful to assess the downstream vascular resistance.

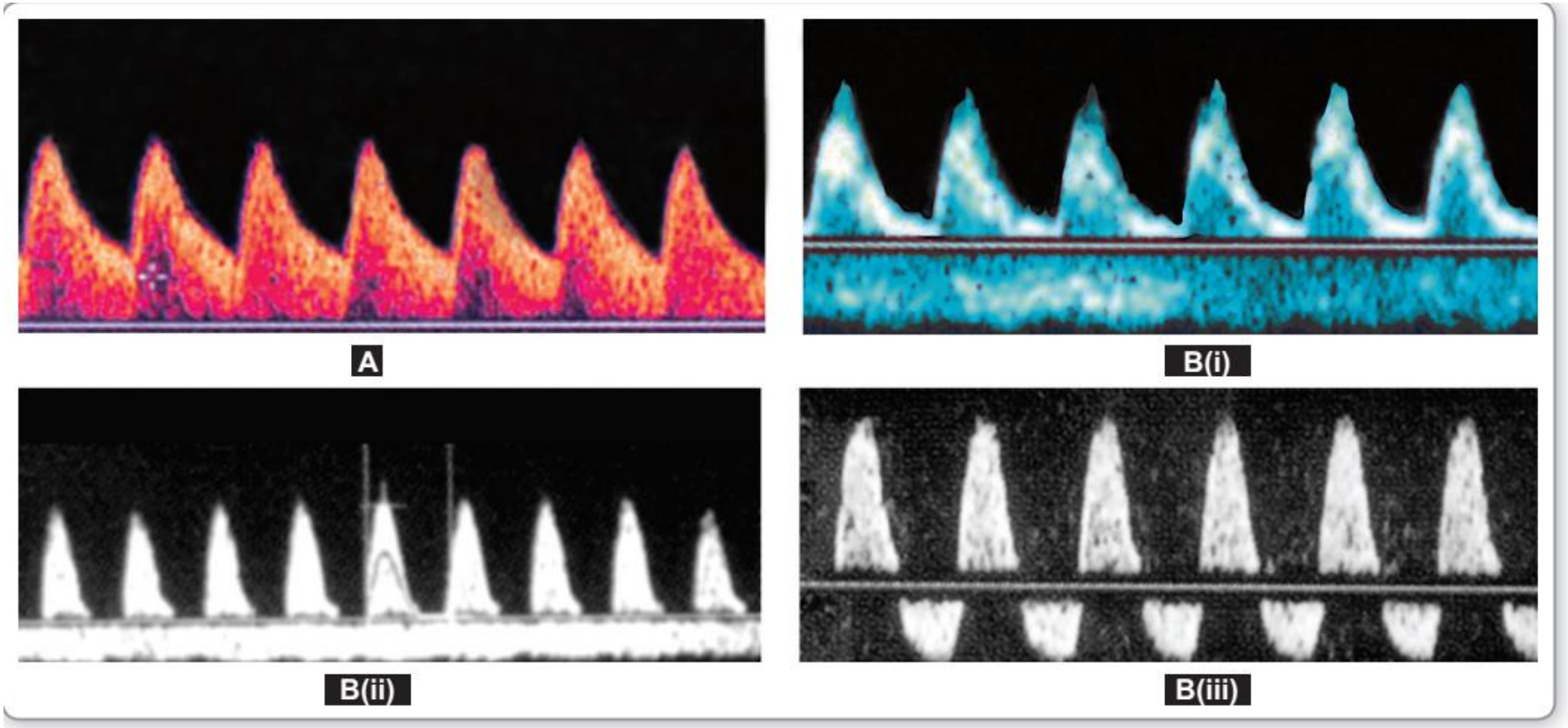
The arterial Doppler waveform is used to measure the peak systolic (S), peak diastolic (D)and mean (M) volumes. From these values **S/D ratio**, **pulsatility index (PI)** [PI = (S–D)/M] or **resistance index (RI)** [RI = (S–D)/S] are calculated

In a normal pregnancy the S/D ratio, **PI and RI decreases as the gestational age advances**.

Higher values greater than 2 SDs above the gestational age mean indicate reduced diastolic velocities and increased placental vascular resistance. These features are at increased risk for adverse pregnancy outcome.

Venous Doppler (Ductus Venosus, Umbilical Vein) parameters provide information about cardiac forward function (cardiac compliance, contractility and after-load).

Fetuses with abnormal cardiac function show pulsatile flow in the umbilical vein (UV). Normal UV flow is monophasic



Figs 11.2A and B: Umbilical artery flow velocity waveform: (A) Normal; (B) Abnormal—(i) Reduced end-diastolic flow; (ii) Absent end-diastolic flow; (iii) Reversed end-diastolic flow

Table 11.3: Antenatal Doppler Ultrasound Changes and the Suggestive Features of a Compromised Fetus

Vessel	Change	Pathophysiological Basis	Clinical Significance
Umbilical artery (UA)	Reduced or absent or reversed end diastolic flow (Fig. 11.2)	Failure of villous trophoblast invasion (see p. 37, 39)	↑ resistance in fetoplacental circulation → IUGR, pre-eclampsia
Middle cerebral artery (MCA)	↑ Diastolic velocity; ↓ S/D or Pulsatory index	Dilatation of cerebral vessels	"Brain Sparing" effect in response to hypoxemia
Ductus venosus (DV)	↑ Doppler index*; Absent/ Reversed flow (a-wave)	↑ Central venous pressure (CVP)	Fetal acidemia
Umbilical vein (UV)	↑ Doppler index; Pulsatile flow	↑ CVP or ↓ Cardiac compliance	Fetal acidemia

* Increased Doppler indices means there is increased vascular flow resistance.

The fetuses having UA Doppler flow abnormalities (AEDV or REDV) are at higher risk of intrauterine hypoxia.

Risk of stillbirth is high when the Doppler flow in the ductus venosus (venous parameter) is abnormal.

Use of ultrasonography for fetal biometry and Doppler study for umbilical artery flow velocimetry has reduced perinatal mortality and unnecessary early intervention significantly.

9.Contraction stress test (CST) is based to observe the response of the fetus at risk for uteroplacental insufficiency in relation to uterine contractions

OTHER INVESTIGATIONS IN LATE PREGNANCY

Amniocentesis in late pregnancy:

1.**Assessment of severity of Rh iso-immunization**2.**Test for fetal pulmonary maturity**

Pulmonary maturity: Confirmation of lung maturation reduces the incidence of **respiratory distress syndrome (RDS) in the newborn**. The risk of RDS is high for infants that are delivered preterm (< 37 weeks).

RDS is caused by the deficiency of pulmonary surfactant, which is synthesized by the type II alveolar cells. Surfactant is packaged in lamellar bodies o discharged in the lung alveoli

2.Assessment of severity of Rh–isoimmunization is done by amniocentesis for estimation of bilirubin in the amniotic fluid by spectrophotometric analysis.

The optical density difference at 450 nm gives the prediction of the severity of fetal hemolysis