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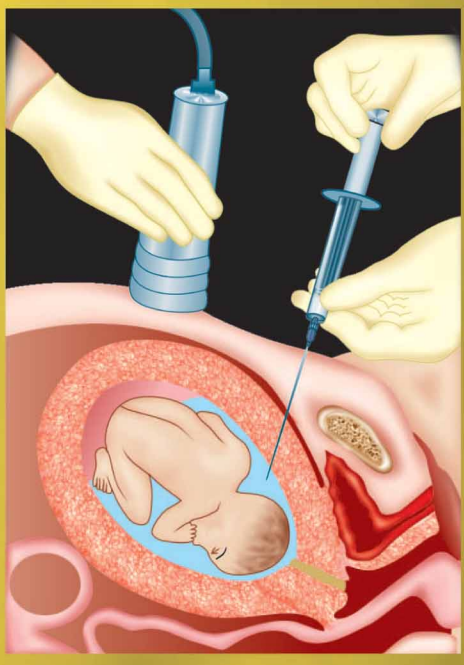

Series Editors
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Manual on ANTEPARTUM FETAL SURVEILLANCE

Fetus—Our Second Patient

JAYPEE

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3 CHAPTER

Contraction Stress Test

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Contraction stress test (CST) is also known as oxytocin challenge test. It is based on the principle of gradually developing uteroplacental insufficiency. A stage of fetal compromise can be identified by exposing the fetus to the graded stress.

Partial pressure of O_2 is transiently decreased in the fetus. If the fetus has a baseline O_2 deficit, then late decelerations with contractions can be apparent.

- Increase (IUP > 30 mm Hg)
- Increased intramyometrial pressure which exceeds arterial pressure.
- Cessation of uterine perfusion (Cessation of entry of oxygenated blood in intervillous space)
- Decreased O_2 supply to fetus.

PATHOPHYSIOLOGY

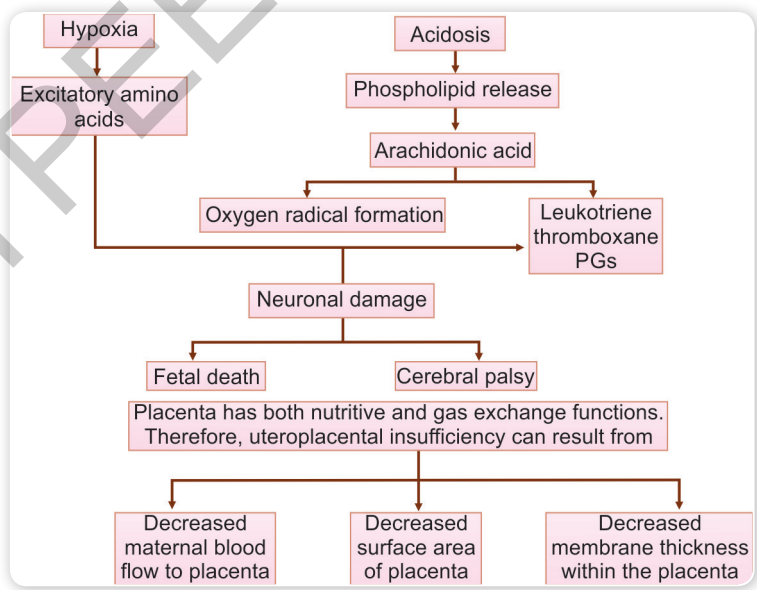

Figure 3.1 Pathophysiology of fetal acidosis and hypoxia

The two most common etiologies of fetal hypoxia and resultant acidosis are:
1. Cord compression
2. Uteroplacental insufficiency.

Determines the respiratory function of the fetoplacental unit

Indications
- Nonreactive NST
- IUGR
- Postmaturity
- Hypertensive disorders

Contraindications
- Compromised fetus
- History of LSCS
- Preterm labor
- APH

Procedure

- Left leteral position
- Baseline BP taken
- FHR recorded by electronic monitoring
- IV oxytocin infusion started 0.5 mu/min and increased every 20 minutes till adequate contractions achieved
- Clinical monitoring for uterine response is also done
- FHR during antiaction and one minute thereafter is recorded.

INTERPRETATION

Negative	– No FHR deceleration with contractions in 10 minutes
Positive	– Persistent late deceleration
Suspicious	– Late deceleration present but not persistent
Hyperstimulation	– Late deceleration with contractions lasting > 90 seconds or frequency every 2 minutes
Unsatisfactory	– Poor quality contractions

Reversible causes of:

- Diabetic ketoacidoses
- Sickle cell crisis
- Asthmatic attack
- Dehydration
- Maternal anemia
  - A negative test is associated with good fetal outcome.
  - Positive test is associated with increased incidence of IUD and fetal distress in labor and poor Apgar.

When to do the Test?

Pre-eclampsia – Whenever diagnosed

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Previous stillbirths – 2 weeks prior to previous loss
IUGR – At diagnosis
Post dates – 41 weeks

CTG in Breech

In jootlings – Variable deceleration
In Brow – Compression of head—early deceleration
Pre-eclampsia – Variability is affected
Scan dehiscence – Variable decelerations

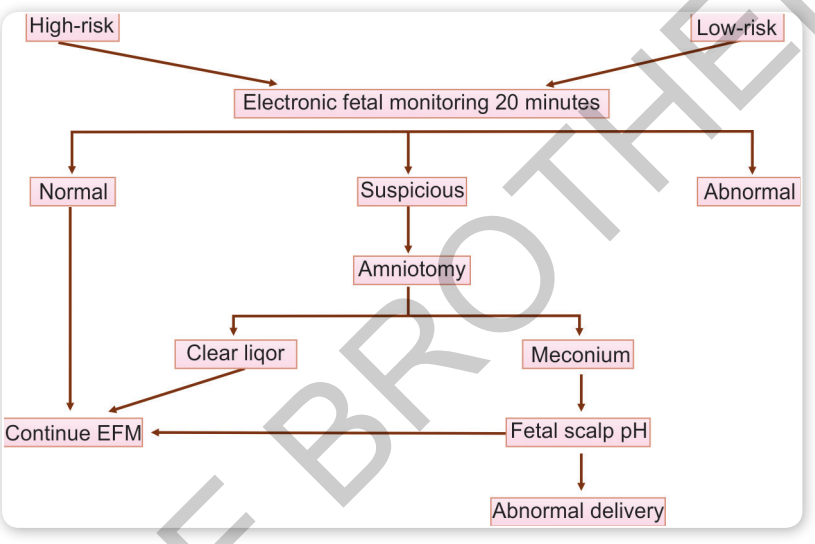

Figure 3.2 Decision-making on EFM

BIOPHYSICAL PROFILE

Uses real-time USG in evaluating the fetus.

Manning and SIPOS

Used five variables → FHR, Breathing, Movements, Fetal tone, AFI

Vintzileos

- Added Placental Grading
- Physical profile is used to evaluate fetal wellbeing distinguished between a healthy (nonasphyxiated) and a nonhealthy (asphyxiated) fetus.

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Table 3.1 Manning's scoring

	Criteria	*Score*
NST	Reactive	2
Fetal breathing	1 episode > 30 seconds	2
Body movement	3 movements	2
Muscle tone	1 episode of extension	2
AFI	pocket > 2 cm	2

Score

8–10—No asphyxia
4–6—Chronic asphyxia
0–2—Certain asphyxia

Pathophysiology

Acute Markers

- FHR
- Fetal breathing movements
- Fetal tone
- Fetal movements

Chronic Markers

- AFI
- Placental grading

Acute markers are initiated and controlled by CNS centers

Tone	-	Cortex
Movement	-	Cortex nuclei
Breathing	-	Ventral surface of IVth ventricle
HR	-	Posthypothalamus medulla

FHR and breathing get compromised during early hypoxia
Body movement and tone absent during advanced hypoxia

Chronic markers: AFI if shows oligo—reflects fetal hypoxia

Advantages

- Can be performed within 20 minutes
- Less fall positive results
- Provide complete information about fetus
- Widely applicable
- Assurance of high-risk pregnancy

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Disadvantages

- Needs a trained personnel
- Management decision based on score alone

MBBP

- 2 or more accelerations in 10 minutes
- AFI > 5 cm

Abnormal

- Variable/late decelerations
- AFI < 5 cm

Indications

- Postdatism
- IUGR
- Complaining of decreased movements
- HTN (Hypertension)
- Previous history of stillbirth

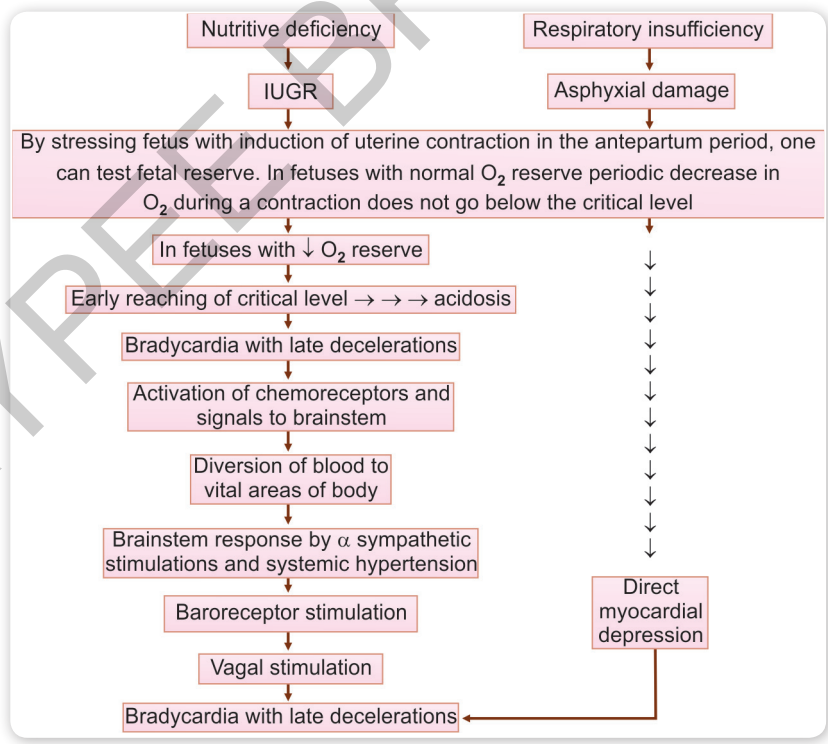

Figure 3.3 Pathophysiology of IUGR

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Initially mild stimulation of brainstem causes shallow late decelerations. As anerobic metabolism occurs, fetus becomes acidotic and autonomic reflexes get blunted.

When NST is nonreactive, CST can be helpful in discriminating false +ve from true +ve.

The only potential risk is the stimulation of uterine contractions.

Contraindications

It is contraindicated in those patients in whom prematurity is generally avoided; for example:

1. Preterm with multiple gestation
2. PROM
3. APH
4. Cervical incompetence
5. Previous preterm
6. Previous classical cesarean section
7. Placenta previa

When to Begin Testing?

It varies from institution to institution depending on the quality of neonatal care available and the potential to salvage preterm fetuses.

Table 3.2 When to begin testing

Indications	*Gestational age*
• Pre-eclampsia	• At diagnosis
• Previous stillbirth	• 2 weeks prior to previous loss
• IUGR	• At diagnosis
• Postdatism	• At 41 weeks

When to Start Testing in a Diabetic Patient?

Table 3.3 When to begin testing in a diabetic patient

Diabetic class	*Associated HT/PIH*	*Gest age*
A2/B	Without HT/PIH	34 weeks
C/D	Without HT/PIH	34 weeks
R/F	-	27 weeks
A2 B C D	Without HT/PIH	27 weeks

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When to Start Testing in Chronic Hypertensives?

Chronic HT alone	34 weeks
Chronic HT with DM	27 weeks
Chronic HT with SLE	At viability
With associated IUGR/PIH	Start at the time of diagnosis

Procedure

- **Semi-fowler's position/Left lateral position**
- **Baseline BP to be taken**
- **BP to be repeated during the test**
- **FHR recording** → Phonocardiography
  → Abdominal fetal electrocardiography
  → Doppler ultrasound.
- **Baseline FHR and uterine activity recorded for 30 minutes.**
- **Adequate test: 3 contractions/10 mins.**
- If uterine action is inadequate, then contractions are stimulated by **oxytocin stimulation or nipple stimulation.**
- IV oxytocin infusion started at (0.5 mu/min) and (increased every 15 minutes till adequate contractions achieved). The oxytocin infusion rate is doubled until a uterine response is seen.
- *Nipple stimulation: Now, method of choice.*
  - Patient stimulates one nipple by rubbing briskly over the clothing with palm of the hand.
  - Unilateral stimulation is continued for 2 minutes with a 2 minutes' rest period for 4 cycles.
  - If still inadequate, then the other breast is also stimulated and finally oxytocin infusion is suggested.

Interpretation

a. Negative
b. Positive
c. Equivocal
d. Unsatisfactory

a. *Negative* → **No FHR deceleration with contractions** of at least three in **10 minutes**.

b. *Positive* → **When late decelerations** are present in majority (> 50 %) of contractions.
→ Presence of persistent late decelerations.

c. *Equivocal* → **i. Suspicious**
→ **ii. Hyperstimulation.**

i. *Suspicious:* If late decelerations are present but not persistent, i.e. seen with < 50% of contractions.

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ii. ***Hyperstimulation:*** If late decelerations occur with contractions lasting >90 seconds or if contractions, frequency is >2 minutes.

d. ***Unsatisfactory:*** If adequate contractions cannot be achieved or if the FHR tracing is not sufficient for adequate interpretation.

Reversible Causes of an Abnormal CST

- Diabetic ketoacidosis
- Sickle cell crisis
- Asthmatic attack
- Dehydration
- Maternal anemia.

False +ve rate of CST is *30%*. The presence or absence of reactivity is the best way to the false +ve rate of the positive group of CST results.

ADMISSION TEST (AT)

- The admission test is a short, electronic FHR recording made immediately on admission.
- It is routinely performed in all patients. It gives a better impression of the fetal condition than traditional assessment. It has to be done immediately on admission in all patients, both high-risk and low-risk.
- During auscultation, the baseline FHR can be measured but other features and decelerations are difficult to quantify.
- Barring acute events like cord prolapse or placental abruption may be a good predictor of fetal condition at the time of admission and during the next few hours of labor, in terms of fetuses labeled as low-risk.
- It is known that if a well-grown fetus with clear amniotic fluid and a reactive trace starts developing an abnormal FHR pattern, it takes some time with these changes before acidosis actually develops.

Planning Management

High-risk women or women with suspicious or abnormal at risk should have continuous electronic fetal monitoring throughout labor.

A normal AT ensures fetal health for 3–4 hours or until signs of late first stage of labor are apparent. Even in the second stage of labor, a one-minute trace of EFM after contraction should be enough in low-risk women.

How Long Should a CTG Last?

It should last as long as necessary until it is normal.

This implies a consideration of fetal sleep and fetal behavioral states. If two accelerations, a normal FHR and normal variability are seen in the first *5* minutes. It is very reassuring.

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If done in the quiet phase, it should be continued till the fetus awakes.

Mostly, it should last 15–30 minutes; however, a mother with a normal trace in *5* minutes and keen for ambulation and natural labor should not be unduly monitored.

Intrapartum Cardiotocography (Fetal Surveillance During Labor)

- Labor poses a physiological stress to all fetuses during transition from intrauterine to extrauterine environment.
- The most common stress results from the intermittent interruption maternal to fetal O_2 transfer.
- Intrapartum fetal surveillance detects the fetus at risk of developing asphyxia.
- Fetal neuronal damage, its occurence and site are dependent on the degree of asphyxia insult.
- Graded/incomplete hypoxia or intermittent repetitive cord occlusion leads to parietal subcortical white matter and basal ganglia necrosis.
- This damage is caused predominantly by two profoundly neurotoxic compounds, viz. glutamate and free O_2 radicals.

Fetal Metabolic Acidosis—Prevalence and Significance (Causes of Asphyxial Brain Damage)

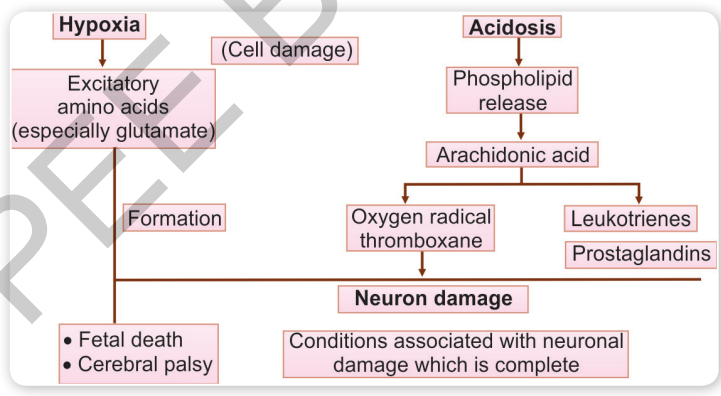

Figure 3.4 Physiology of fetal metabolic acidosis

HIE: Asphyxial insult but after the initial acute episode survive with little impairment.

Internal (Direct) Uterine Activity Monitoring

Deficiency: A technique using transcervical intrauterine catheter inserted in the uterine cavity to measure amniotic fluid pressure.

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Advantage: Accurately measures intensity of contraction and resting tone.

Limitations:
– Membrane must be ruptured.
– Cervix must be 2 cm dilated.
– Can cause trauma if catheter is improperly inserted
– Risk of infection.

Indications:
– Abnormal progress of labor
– Oxytocin administration
– Trial of labor for previous LSCS
– Abruptio placenta.

Contraindications :
– Factors precluding rupture of membrane
– Placenta previa.

EXTERNAL (INDIRECT) ACTIVITY MONITORING

Deficiency: A techique using a tocodynamometer applied to the maternal abdomen to obtain a continuous recording of uterine activity.

Advantages:
– Noninvasive.
– Can be used with intact membrane and no cervix dilation. No known risk to mother and fetus.

Limitations:
– Imprecise.
– Information is limited to frequent and duration of contraction.
– Uncomfortable belts.

Indication: Uterine activity and/or fetal movement recording.

Contraindications: None known.

- *Normal uterine pressure in the first stage of labor is 25–50 mm Hg with a baseline tone of 8–12 mm Hg.*
- *In the second stage ® 80–100 mm Hg.*
- *Uterine action is clinically palp if > 10 mm Hg.*

ELECTRONIC FETAL HEART MONITORING

- It was initially introduced to prevent intrapartum turn stillbirth but is now extended to detect evidence of fetal stress which may be associated with cerebral damage.
- It is used to predict the fetus which was developing acidemia in labor, and enable intervention before permanent damage sets in.
- **Pitfall**: It has led to an increase in operative intervention in labor without any clear evidence of benefit in terms of neonatal outcomes.

Defining the Intrapartum CTG

- Baseline FHR 110–160 BPM.
- Long-term variability 5–25 BPM.

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- Tachycardia > 160 BPM.
- Bradycardia < 100 BPM.
- Unreactive (flat) Loss of long-term variability > 35 minutes trace
- Accelerations ↑ in FHR ≥ 15 BPM for ≥ 15 seconds.
- Decelerations ↓ in FHR ≥ 15 BPM for ≥ 15 seconds.
- Early deceleration Lowest patient of FHR occuring within 20 seconds of peak of contraction.
- Late deceleration Lowest patient of FHR > 20 seconds of peak of contraction.
- Variable deceleration All decelerations other than above.

CTG interpretation in clinical scenarios

- Breech presentation: Risk cord compression IUGR.
- The footing breech has a great chance of cord compression giving rise to variable deceleration
- If cord prolapse occurs, dramatic decelerations are seen
- Brow presentation: There is compression of the head due to an unfavorable mentovertical diameter of 13 cm leading to early decelerations
- Methyldopa leads to baseline variability and accelerations
- Eclampsia: Uteroplacental circulation is hampered
- Previous LSCS
- Scar dehiscence outpouching of AMN. SAC cord compression variable decelerations.
- Scar rupture interruption of uteroplacental perfusion, late decelerations, severe bradycardia with poor baseline FHR.
- Twin pregnancy: Simultaneous monitoring of both twins should be done. Continuous EEM should be ensured during interval between deliveries.

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Manual on
ANTEPARTUM FETAL SURVEILLANCE
Fetus—Our Second Patient

This manual is aimed at simplifying the fetal surveillance. Busy practitioners, consultants and PG students need to know how to be systematic in evaluating the second patient and we hope this manual will help simplify fetal testing.

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