Intrapartum Fetal Monitoring (CTG)

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- 5th & 6th Year Medical Class
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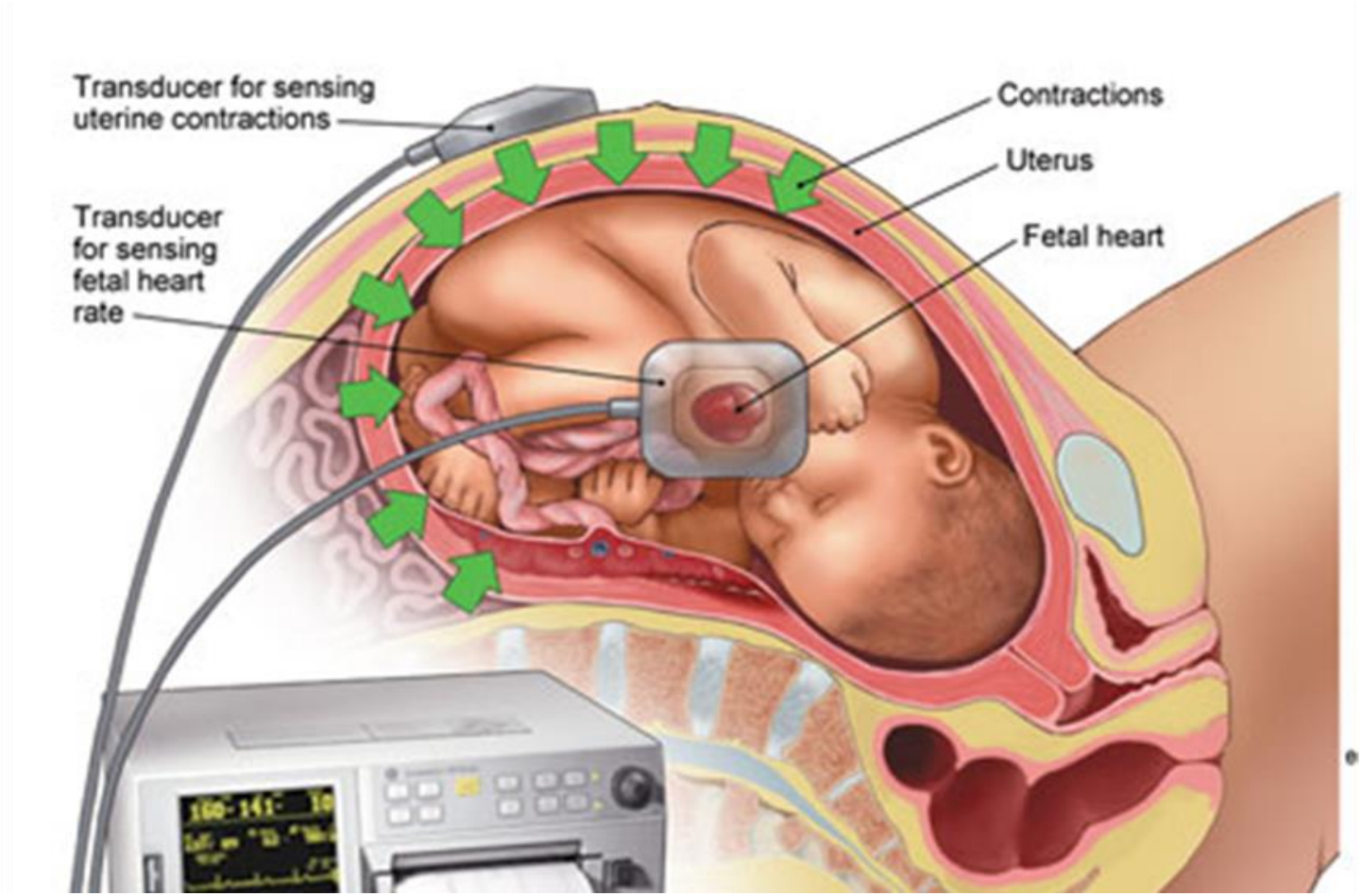
OBJECTIVES

- **Discuss the modality used to monitor fetal wellbeing in labor**
- **How to read a normal CTG?**
- **List causes of abnormal CTG in labor**

Fetal Heart Rate (FHR) Monitoring

- **Fetal heart rate (FHR) monitoring can be done by:**
  - Structured Intermittent Auscultation
  - Continuous Electronic Fetal Monitoring (EFM)
  - 1) External
  - 2) Internal

External Electronic Continuous Fetal Monitoring



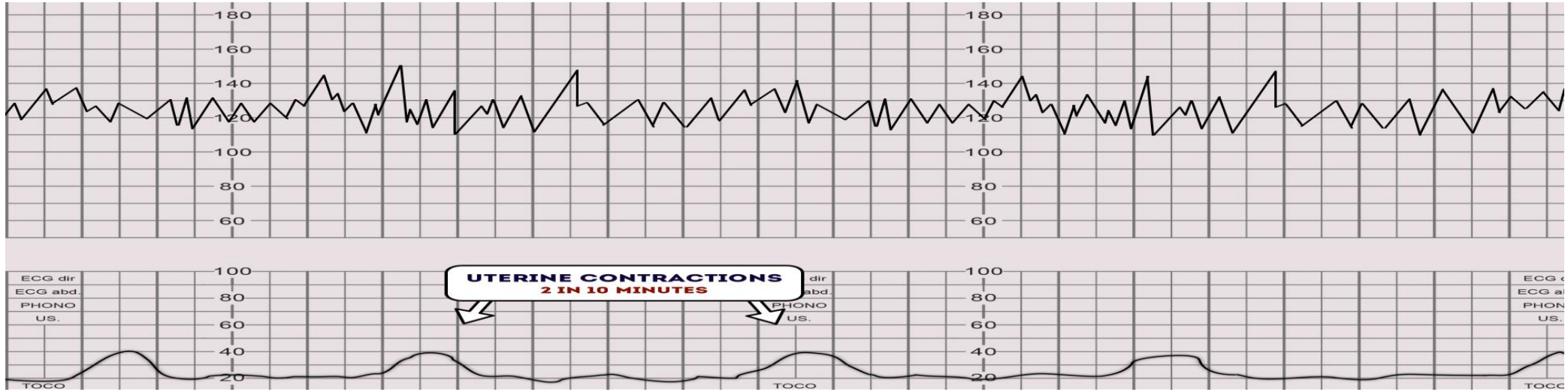
CTG

- **The CardioTocoGraph (CTG) has two components:**

- **Contractions**
- **Fetal Heart**

Normal CTG

A normal cardiotocograph (CTG), showing a baseline fetal heart rate of approximately 120 bpm, frequent accelerations, baseline variability of 10–15 bpm and no decelerations.
The uterus is contracting approximately once every 5 minutes



How to read a CTG?

- Name of the patient & Date
- Define the risk
- Contractions (frequency & duration)
- Baseline FHR (normal 110 bpm – 160 bpm)
- FHR variability (beat to beat variation ranges from 5 to 25 bpm)
- Acceleration (present or absent)
- Deceleration (Early, Late & Variable, Prolonged)
- Assessment & plan of management
- The overall impression can be described as either **reassuring**, **suspicious** or **abnormal**.

Assessment of uterine contractions

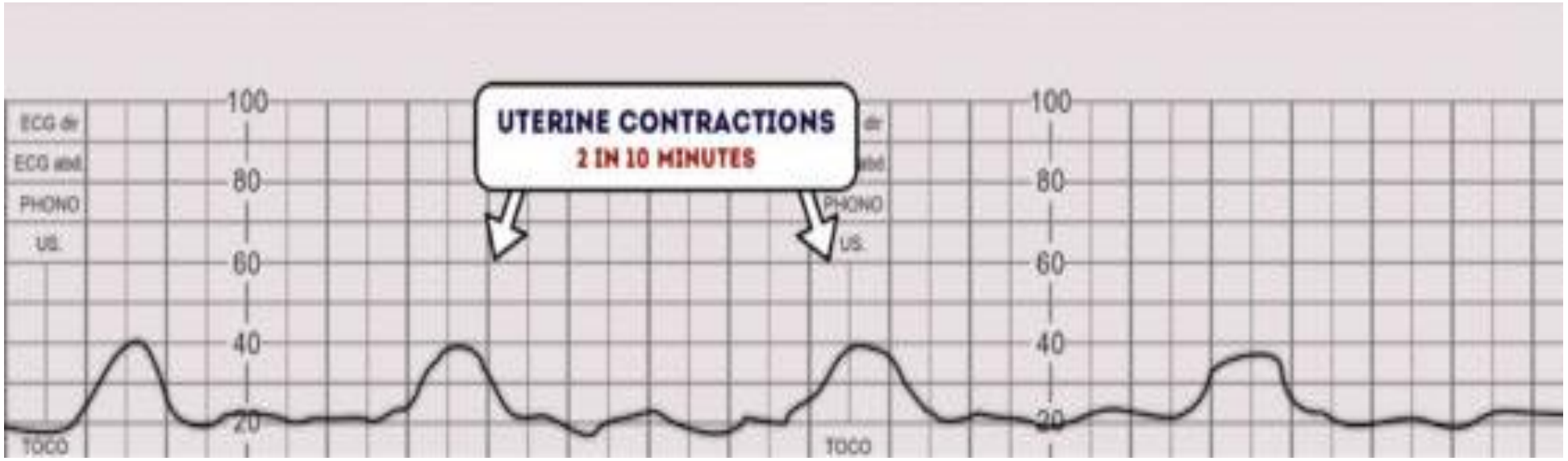
- The lowest intrauterine pressure between contractions is called resting tone.
- Normal resting tone is 5-10 mmHg, but during labor it may rise to 10-15 mmHg.
- Pressure during contractions rises to ~25-100 mmHg (varies with stage).
- A resting pressure above 20 mmHg causes decreased uterine perfusion.

Montevideo Units

- Montevideo Units (MVUs) are a standardized way to quantify the strength of uterine contractions during labor.
- It is calculated by internally (not externally) measuring peak uterine pressure amplitude (in mmHg).
- MVUs = The sum of contraction intensities (in mmHg) above baseline tone during a 10-minute window.
- Subtracting the resting tone of the contraction, and adding up the numbers in a 10-minute period.
- **Generally, above 200 MVUs is considered necessary for adequate labor during the active phase**

Contractions

- The number & duration of contractions in a 10-minute period is recorded.
- Hyperstimulation : More than 5 contractions in 10 minutes.
- Hyperstimulation can result in hypoxia, acidosis & abnormal fetal heart rate



CTG

- **Comment on:**
- **Baseline (110-160 bpm)**
- **Variability (5-25 bpm)**
- **Acceleration**
- **Deceleration (Early (I), Variable (II), Late (III), Prolonged**

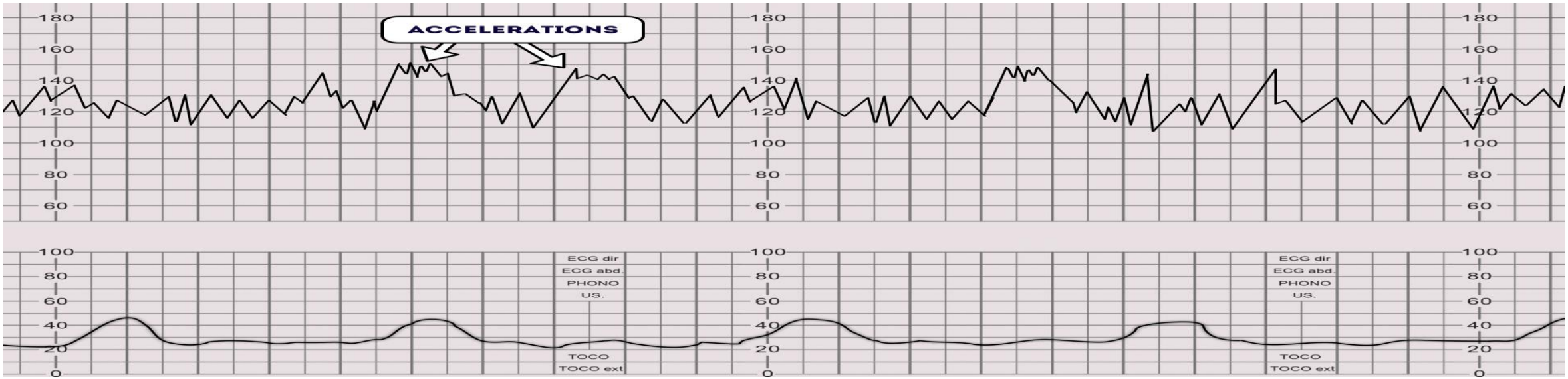
BASELINE RATE

- **Normal fetal heart rate: Between 110-160 bpm**

Accelerations: Abrupt increase in the fetal heart rate above the baseline.

Gestational Age Specific:
≥32 weeks: 15 bpm for ≥15 seconds
<32 weeks: 10 bpm for ≥10 second

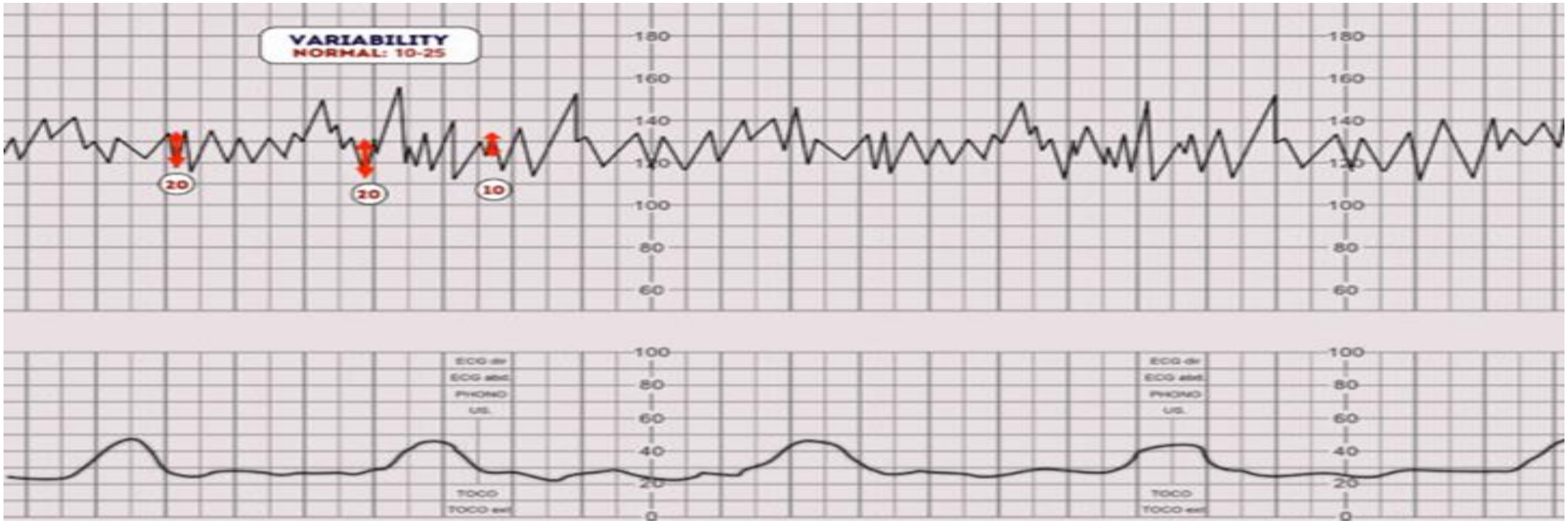
The presence of accelerations is reassuring
The absence of accelerations with an otherwise normal CTG is of uncertain significance



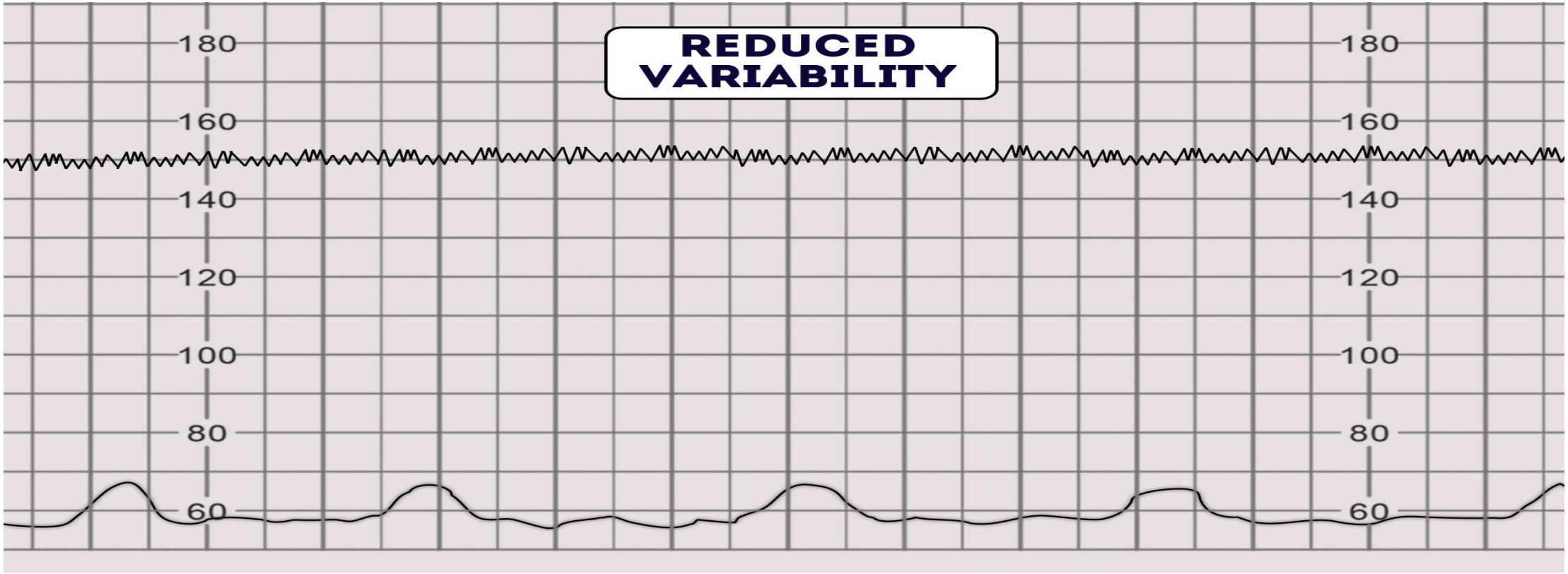
Variability

- It refers to the fluctuations in the baseline FHR
- **Variability** occurs as a result of the interaction between the nervous system, chemoreceptors, baroreceptors and cardiac responsiveness.
- Normal variability indicates an intact neurological system in the fetus
- Persistently minimal or absent FHR variability appears to be the most significant intrapartum sign of fetal compromise.
- **Normal variability is between 5-25 bpm.**
- Absent variability = Amplitude range undetectable
- Minimal = < 5 BPM
- Moderate = 6 to 25 BPM
- Marked = > 25 BPM

Normal Variability
Normal: (5-25 bpm)



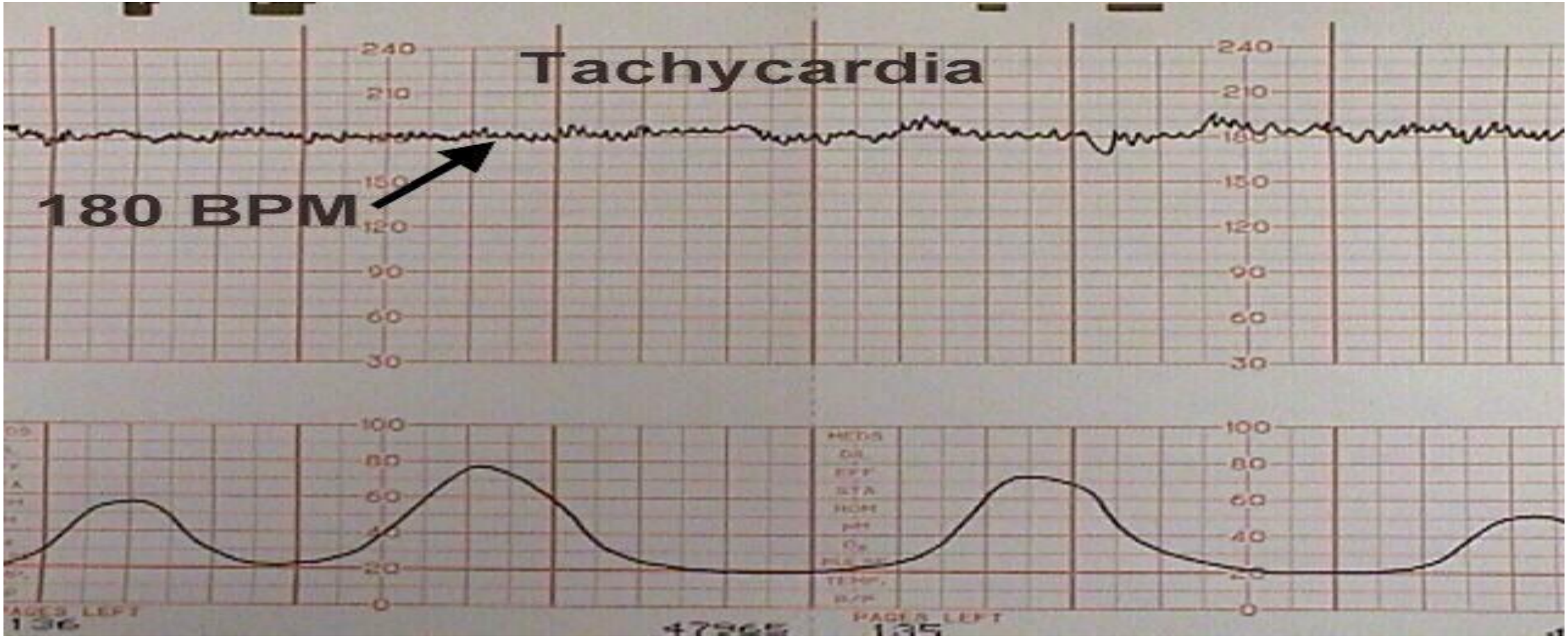
Reduced variability



Reduced variability

- **Reduced variability can be caused by any of the following:**
- **Fetal sleeping**: this should last no longer than 40 minutes (this is the most common cause)
- **Fetal acidosis (due to hypoxia):** more likely if late decelerations are also present
- **Fetal tachycardia**
- **Drugs**: **opiates, benzodiazepines, methyldopa, dexamethasone and magnesium sulphate.**
- **Prematurity:** variability is reduced at earlier gestation (<28 weeks)
- **Congenital heart abnormalities**

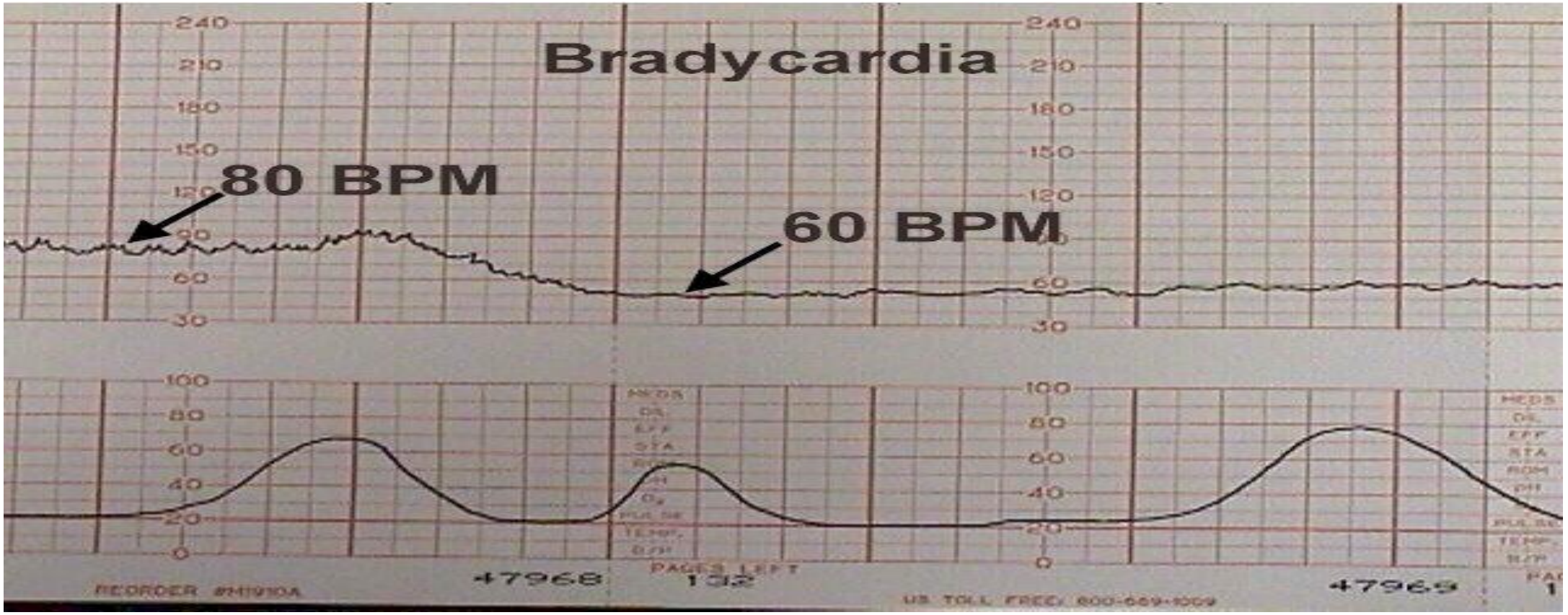
Fetal Tachycardia



Fetal Tachycardia

- **Tachycardia: A baseline value above 160 bpm lasting more than 10 minutes.**
- **Causes of fetal tachycardia include:**
- **Maternal pyrexia (infection, chorioamnionitis)**
- **Fetal hypoxia.**
- **Medications: (beta-agonist (Ritodrine (Yutopar)Terbutaline (Bricanyl) (drugs used for tocolysis) (Atropine) (Sympathomimetic drugs) (Parasympatholytic drugs)**
- **Fetal arrhythmias (SVT).**
- **Fetal or maternal anemia.**
- **Fetal hypoxia**
- **Hyperthyroidism**
- **Prematurity**

Fetal Bradycardia



Fetal Bradycardia

- **Bradycardia: A baseline value below 110 bpm lasting more than 10 minutes.**
- Values between 100 and 110 bpm may occur in normal fetuses, especially in postdate pregnancies.
- **Causes of fetal bradycardia include:**
- Maternal hypothermia, Hypotension, Hypoglycemia
- Administration of beta-blockers
- Fetal arrhythmias such as atrioventricular block
- (SSA/Ro positive pregnancies (systemic lupus erythematosus (SLE) and Sjögren's syndrome (SS)) associated with heart block)
- Fetal metabolic acidosis

CTG Interpretation

CTG Interpretation

Baseline Fetal Heart Rate

- Normal: 110–160 bpm
- Tachycardia: >160 bpm – causes: maternal fever, infection, fetal hypoxia, β-agonists
- Bradycardia: <110 bpm – causes: cord compression, hypoxia, hypotension, β-blocke

Baseline Variability

- Normal (Reassuring): 5–25 bpm
- Reduced (<5 bpm): may indicate sleep, hypoxia, or drugs (opioids, MgSO4)
- Absent: very concerning → severe hypoxia/acidemia
- Increased (>25 bpm): fetal distress or acute hypoxia (saltatory pattern)

Accelerations

- Temporary rise in FHR of ≥15 bpm lasting ≥15 seconds
- Presence is reassuring → indicates a well-oxygenated fetus
- Absence is not always pathological (e.g., during sleep)

Decelerations

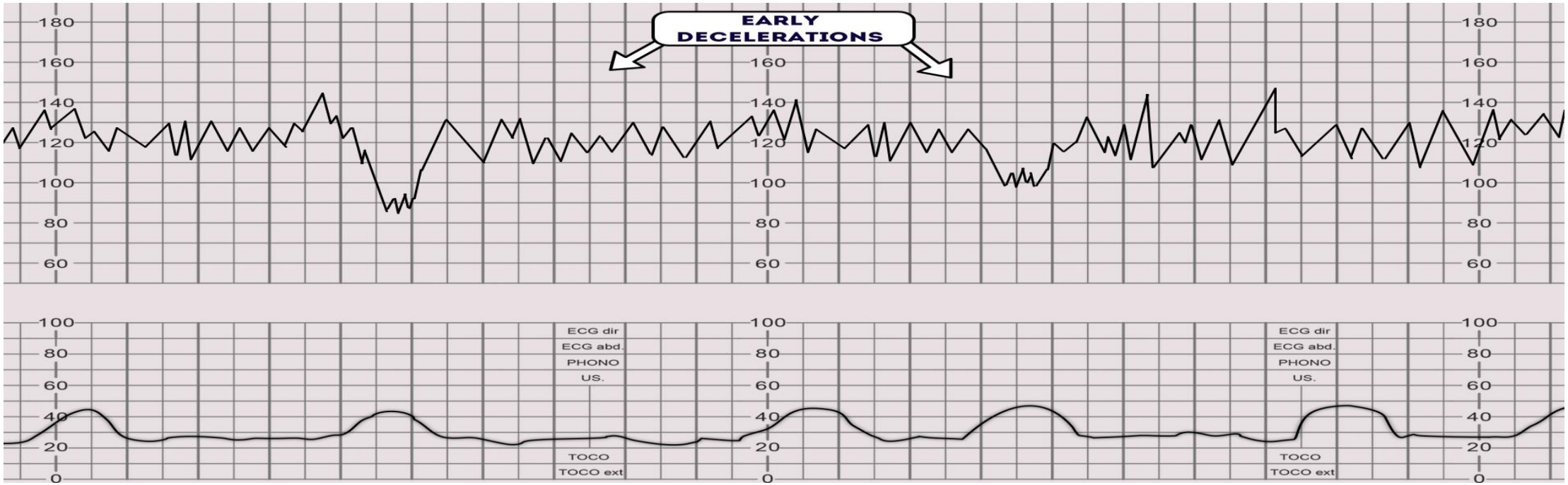
- Early: mirror contractions – due to head compression → benign
- Variable: abrupt drops → cord compression → non-reassuring if repetitive
- Late: start after contraction peak → fetal hypoxia/acidosis → pathological
- Prolonged: >90 sec → needs urgent evaluation

Decelerations

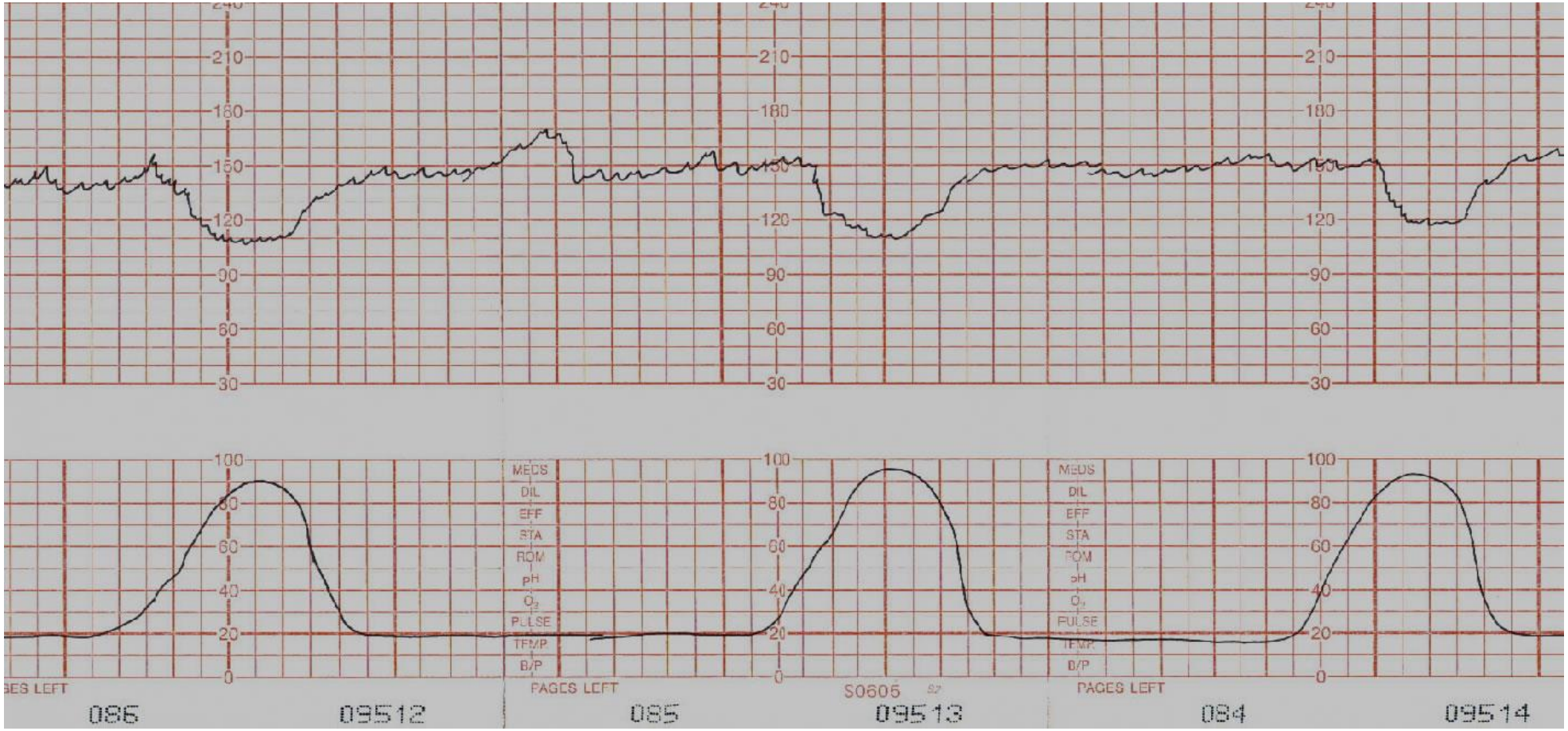
- Decelerations are an abrupt decrease in the baseline fetal heart rate of greater than 15 bpm for greater than 15 seconds.

- Early (Type I)
- Late (Type II)
- Variable (Type III)
- Prolonged decelerations

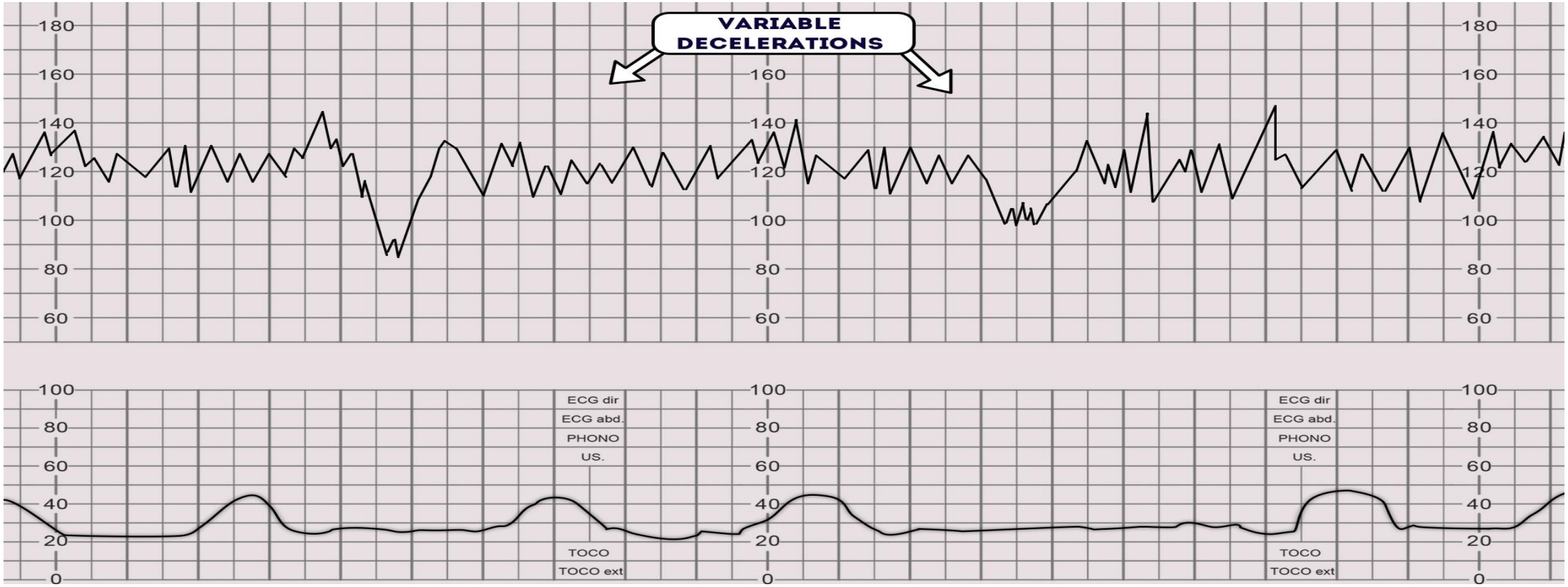
- **Early deceleration caused by head compression**
  It is considered to be physiological and not pathological



Early decelerations



Variable decelerations caused by umbilical cord compression



Variable Decelerations

- Variable decelerations are V-shaped. Variable in onset, duration and depth. They may occur with contractions or between contractions.

- Typically, they have an abrupt onset and rapid recovery (in contrast to other types of decelerations which gradually slow and gradually recover).

Variable Decelerations

- **The accelerations before and after a variable deceleration are known as the shoulders of deceleration.**
- Their presence indicates the fetus is not yet hypoxic and is adapting to the reduced blood flow.
- The presence of persistent variable decelerations indicates the need for close monitoring.
- Variable decelerations without the shoulders are more worrying, as it suggests the fetus is becoming hypoxic

Management of Variable Decelerations

- Changing maternal position to improve uterine blood flow
- IV hydration to increase maternal blood volume, presumably leading to increased uterine blood flow
- Administering oxygen to the mother to try to get some additional oxygen through to the fetus. (The least useful).
- Decreasing or discontinuing oxytocin infusion to slow down or stop contractions that are provoking the decelerations.
- We may consider Amnioinfusion to improve oligohydramnios
- We may consider Tocolytic drugs to slow down or stop contractions that are provoking the decelerations.
- Digital elevation of the fetal head out of the maternal pelvis to ease pressure on the umbilical cord

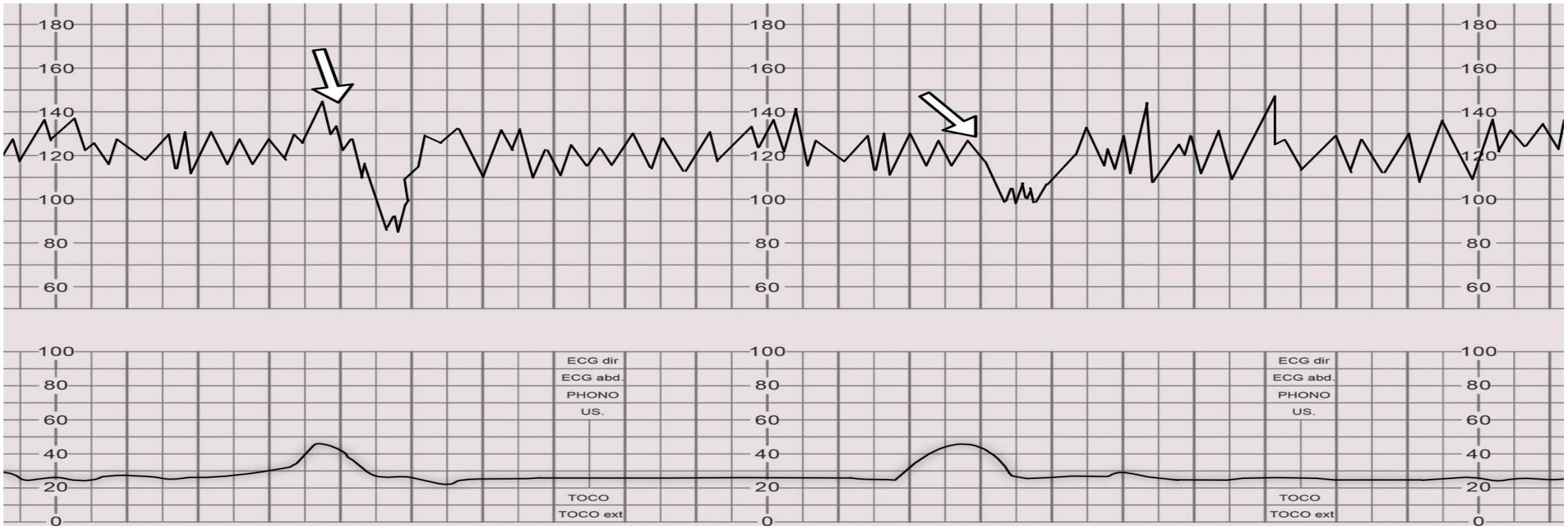
Management of Variable Decelerations

- Occasional mild or moderate variable decelerations are common and not considered threatening.
- Severe variable decelerations dip below 60 BPM for at least 60 seconds ("60 x 60").
- If persistent and not correctable by simple means, they can be threatening to fetal well-being.
- Like persistent, non-remediable late decelerations, fetuses demonstrating persistent, non-remediable severe variable decelerations should be delivered promptly.

Late decelerations

- **Cause**: **Uteroplacental Insufficiency**
- **Insufficiency is caused by uterine tachysystole (uterine hyperstimulation), maternal hypotension, epidural or spinal anesthesia, IUGR, hypertension & preclampsia, intraamniotic infection, or placental abruption**.
- Late decelerations begin at the peak of the uterine contraction and recover after the contraction ends
- **Severe, repetitive late decelerations usually indicate fetal metabolic acidosis**.

Late Deceleration



Management of Late decelerations

❖Maternal left lateral position to improve uterine blood flow

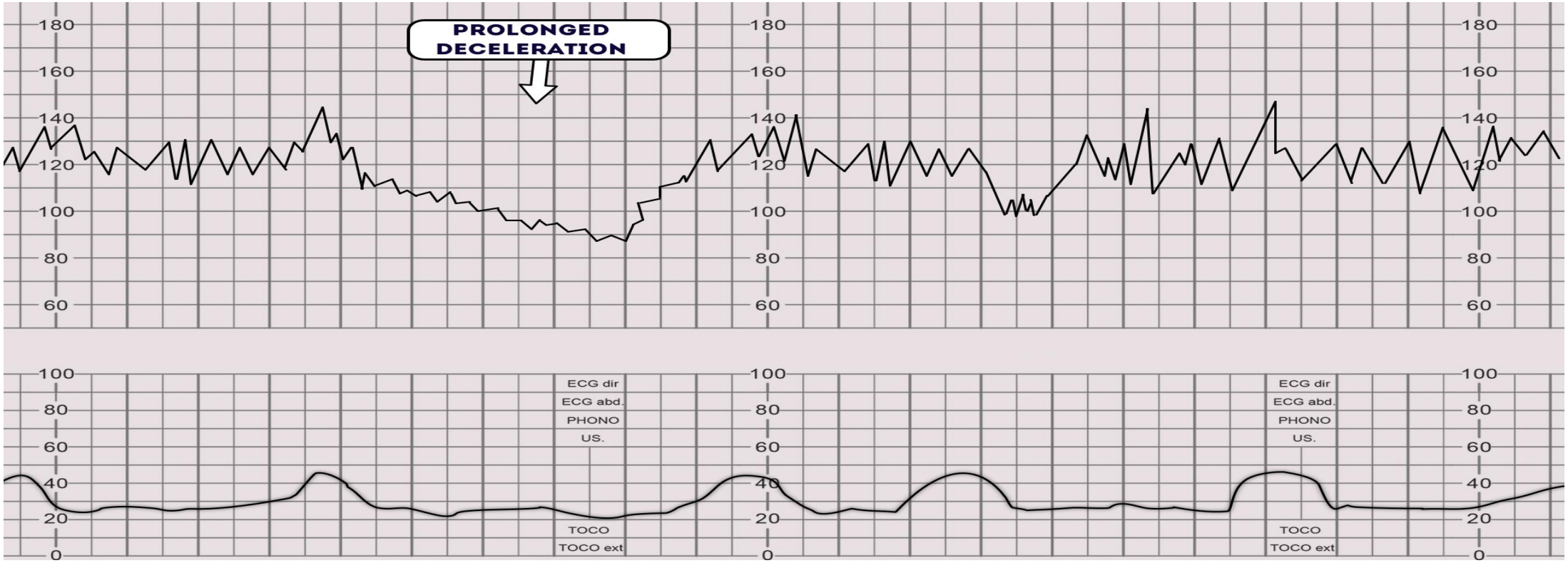
- Correct maternal hypotension with IV fluids
- Administer O2 by mask
- Stop oxytocin infusion
- Consider tocolytic drugs to slow down or stop contractions that are provoking the decelerations

❖**Vaginal examination (To evaluate cervical condition & descent**)

- If persistent perform fetal scalp PH
- If persistent consider immediate delivery

•Prolonged deceleration:

If it lasts **between 2-3 minutes** it is classed as **non-reassuring**.
If it lasts **longer than 3 minutes** it is immediately classed as **abnormal**.



Causes of prolonged decelerations

- **Severe bradycardia: FHR less than 80 beats per minute, lasting longer than 3 minutes is an ominous finding and may be associated with fetal acidosis.**
- **Could be transient due to:**

1. Supine hypotension
2. Paracervical block
3. Epidural and spinal anesthesia

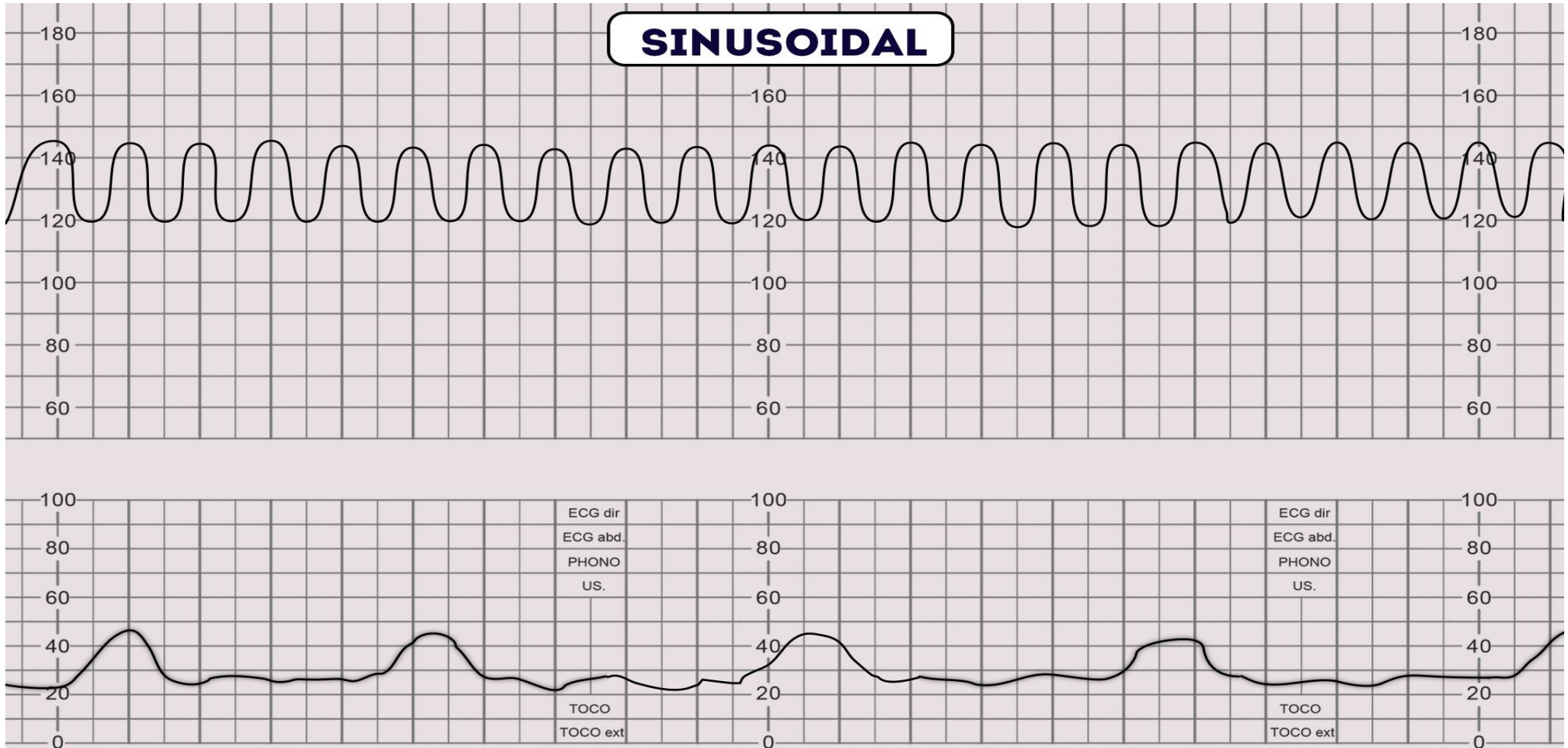
- **Other important possible causes:**
- Prolonged cord compression
- Cord prolapse
- Tetanic uterine contractions (Hyper stimulation of the uterus with oxytocin or prostaglandin)
- Maternal seizures
- Rapid fetal descent may cause strong vagal response
- Vigorous vaginal examination may cause strong vagal response
- **If associated with vaginal bleeding we have to think of:** Major abruptio placenta, rupture uterus and vasa previa.

A sinusoidal pattern usually indicates one or more of the following:

Severe fetal hypoxia

Severe fetal anaemia (Rh disease)

Fetal/maternal haemorrhage



Causes of Sinusoidal Pattern

- Sinusoidal pattern is **very concerning** as it is associated with high rates of **fetal morbidity** and **mortality.**

- **It occurs in association with:**
- Severe fetal hypoxia
- Severe fetal anemia
- Fetal-maternal hemorrhage
- Ruptured vasa previa

Remember

- Uterine hyper-contractility is the most frequent cause of a pathological CTG
- Baseline and variability are the most important features on a CTG – they are indicative of hypoxia.
- Remember a fetus will protect its heart muscle as a priority…….the other organs and the brain will suffer the hypoxia first.
- Interpret the CTG in the full clinical context and understanding of the fetal reserve.

Category1: Strongly predictive of normal fetal acid-base status at the time of observation. Requires no specific management

Category I (Normal)

Category I FHR tracings include **all** of the following:

- Baseline rate: 110-160 beats/min
- Baseline FHR variability: moderate
- Late or variable decelerations: absent
- Early decelerations: present or absent
- Accelerations: present or absent

Category II FHR (Intermediate)

- The fetal heart rate tracing shows **ANY** of the following:
- Tachycardia, bradycardia without absent variability, minimal variability, absent variability without recurrent decelerations, marked variability, absence of accelerations after stimulation, recurrent variable decelerations with minimal or moderate variability, prolonged deceleration ≥ 2minute but less than 10 minutes, recurrent late decelerations with moderate variability, variable decelerations with other characteristics such as slow return to baseline, and "overshoot".
- Not predictive of abnormal fetal acid-base status, but requires continued surveillance and reevaluation.

Category II FHR (Intermediate)

- Not predictive of abnormal fetal acid-base status, so management depends on clinical circumstances.
- Search for the underlying cause (ex: maternal hypotension) and correct it.
- Some interventions:
  - Change the mother's position to the left lateral recumbent.
  - Reduce the infusion rate of oxytocin
  - Increase intravenous fluids.

Category III: Predictive of abnormal fetal acid-base status.
In addition to measures in category II treatment, may consider:
Fetal scalp blood sampling
Ultrasound doppler velocimetry
Delivery

Category III (Abnormal)

Category III FHR tracings include either of the following:

- Absent baseline FHR variability and any of the following:
  - Recurrent late decelerations
  - Recurrent variable decelerations
  - Bradycardia
- Sinusoidal pattern

Secondary Tests of Fetal Wellbeing

- Fetal Scalp Sampling
- Scalp stimulation
- Acoustic stimulation
- Fetal pulse oximetry
- Fetal Electrocardiogram Analysis

Fetal Blood Sampling (Fetal Scalp PH)

- FBS may be used in cases of abnormal CTG.
- A vaginal examination needs to be performed prior to the procedure to assess the nature and position of the presenting part.
- **Contraindications** : maternal infection, women seropositive to hepatitis B, C, or to HIV, suspected fetal blood disorders, uncertainty about the presenting part, preterm fetus.
- CTG + FBS results in a reduction in cesarean deliveries when compared with CTG alone

Fetal Scalp PH

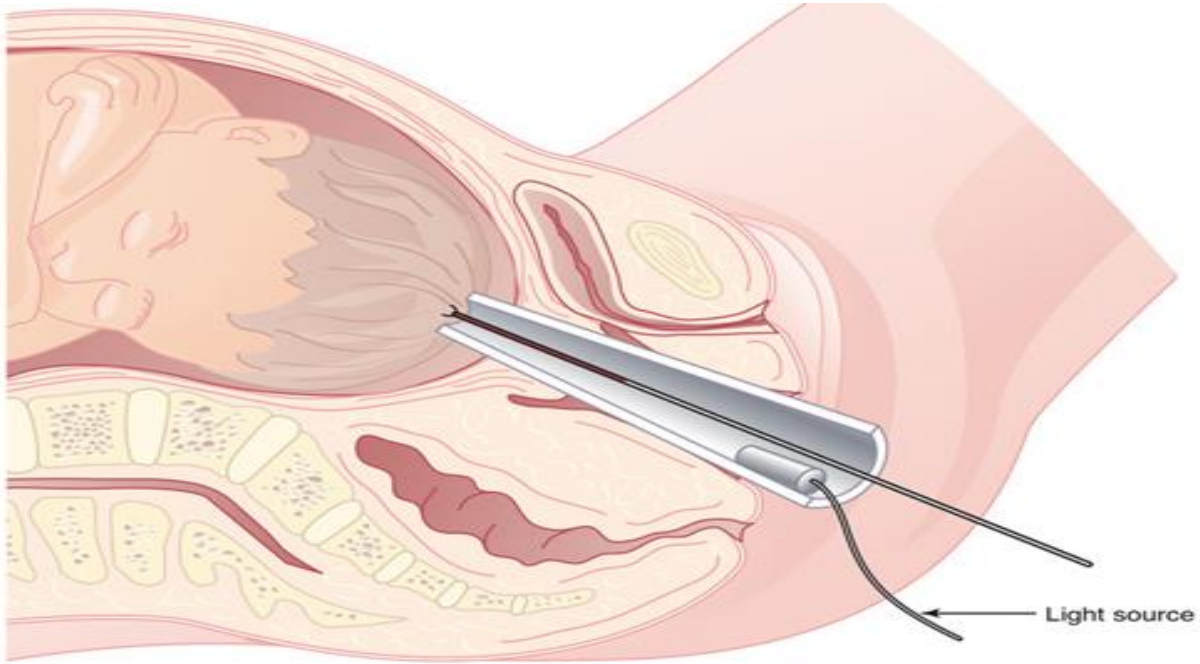


FIGURE 9-6 This technique of fetal scalp blood sampling via an amnioscope is still used in many centers. After making a small stab incision in the fetal scalp, the blood is drawn off through a long, heparinized capillary tube.

Fetal Blood Sampling (Fetal Scalp PH)

Interpretation	pH	Lactate (mmol/L)
Normal	≥ 7.25	< 4.2
Repeat in 30 mins	7.21 – 7.24	4.2 – 4.8
Birth expedited	≤ 7.20	> 4.8
Urgent delivery	< 7.15	> 5.0

Dr Amal Barakat

Thank you

The End of Intrapartum Fetal Monitoring