



Fetal Heart Monitoring

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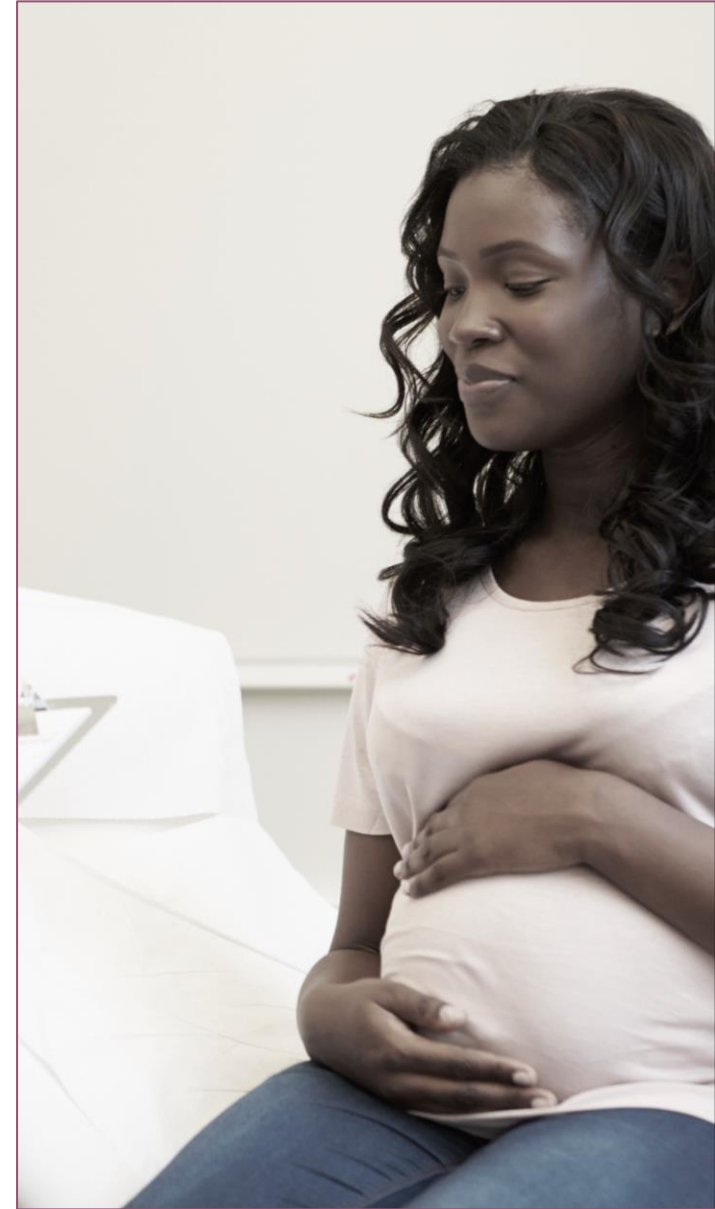
Objectives

Understand benefits and limitations of different fetal monitoring methods

Systematically interpret fetal heart rate monitoring using NICHD terminology

Describe clinical interventions to maximize fetal oxygenation

Demonstrate clear communication related to fetal heart rate monitoring and interventions





Fetal & Uterine Assessment

EXTERNAL

Handheld Fetal Doppler

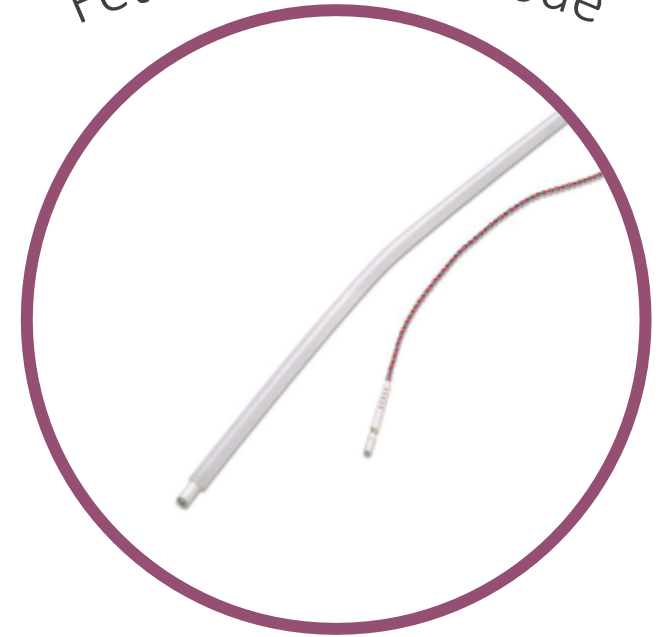


Ultrasound Transducer



INTERNAL

Fetal Spiral Electrode



Fetal Heart Rate Assessment

Handheld Fetal Doppler



Used for intermittent auscultation of fetal heart rate and rhythm.

BENEFITS

- Freedom of maternal movement
- Able to detect fetal heart rate in many positions of the laboring person

LIMITATIONS

- Indicated only for low-risk pregnancies
- Cannot determine fetal heart rate baseline, variability or type of deceleration

Ultrasound Transducer



Sound waves detect fetal heart movement.

Assess fetal heart baseline rate, variability, accelerations and decelerations.

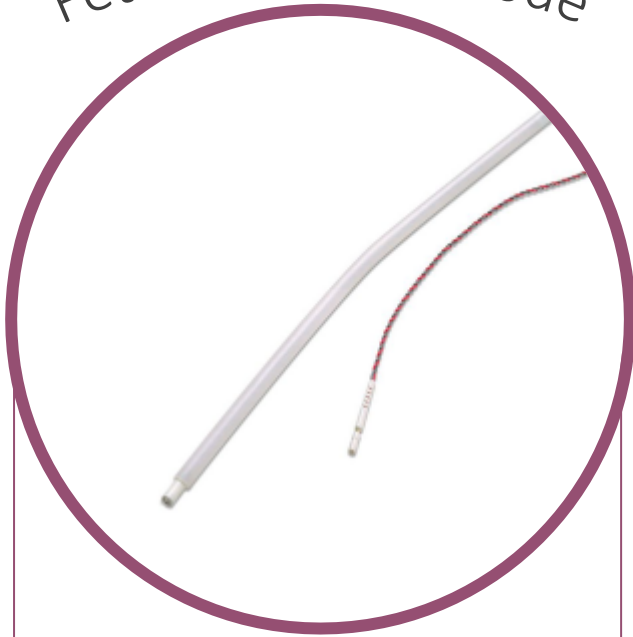
BENEFITS

- Non-invasive
- Does not require ROM
- Provides a permanent record

LIMITATIONS

- Restricts maternal movement
- Difficult transmissions:
 - Maternal and/or fetal movement
 - Maternal obesity
 - Fetal position
- Monitor may half/double count with tachycardia or bradycardia

Fetal Spiral Electrode



Detects electrical activity of fetus' heart.

Assess fetal heart baseline rate, variability, accelerations and decelerations.

BENEFITS

- Continuous detection of fetal heart rate
- Allows for more freedom of movement for patients than does U/S



LIMITATIONS

- Requires ROM, adequate cervical dilation, appropriate fetal presenting part
- Potential for transmission of maternal infection
- Potential for fetal injury
- May record maternal HR with fetal demise

EXTERNAL

Palpation

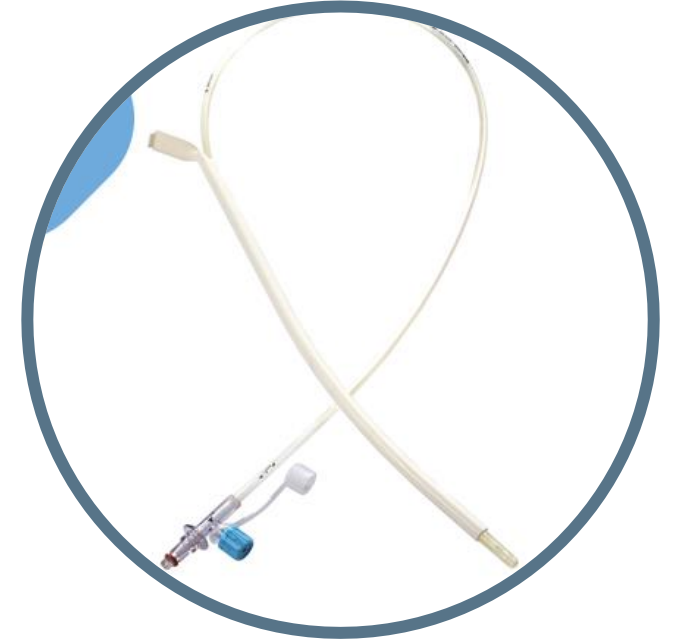


Tocodynamometer



INTERNAL

IUPC



Uterine Activity Assessment



Palpation

**Important to use with all other methods of monitoring uterine activity to verify accuracy of information.*

BENEFITS

- Non-invasive
- Hands on; human touch
- Mobility of mother
- No equipment necessary

LIMITATIONS

- Maternal size can limit ability to palpate contractions
- Subjective
- No hard copy generated



Tocodynamometer (TOCO)

BENEFITS

- Minimally invasive
- Does not require ROM
- Tracing generated

LIMITATIONS

- Does not objectively measure intensity and resting tone
- Maternal size can interfere with ability of TOCO to sense changes in abdomen
- Location sensitive
- Limit maternal mobility



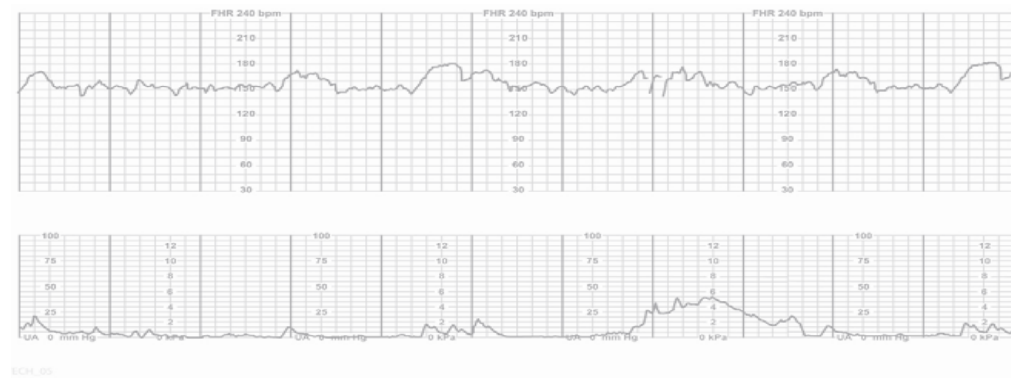
Intrauterine Pressure Catheter (IUPC)

BENEFITS

- Objective measurement of frequency, duration, intensity and resting tone in mmHg or MVUs
- Tracing generated
- Amnioinfusion

LIMITATIONS

- Requires ROM and cervical dilation
- Invasive procedure
- Increased risk of uterine infection, perforation or placental separation
- Limits maternal mobility



1. Fetal heart rate **BASELINE**
2. Baseline **VARIABILITY**
3. Presence of **ACCELERATIONS**
4. Presence of **DECELERATIONS**
5. **UTERINE ACTIVITY**
6. **CATEGORY** of tracing
7. **TRENDS** over time

FHR Systematic Assessment

Consistency is Key:

Look at it the same way every time!

1

Fetal Heart Rate Baseline

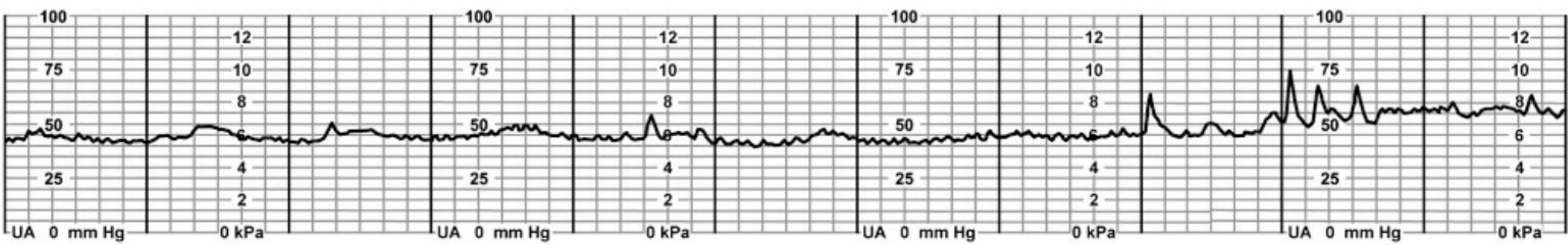
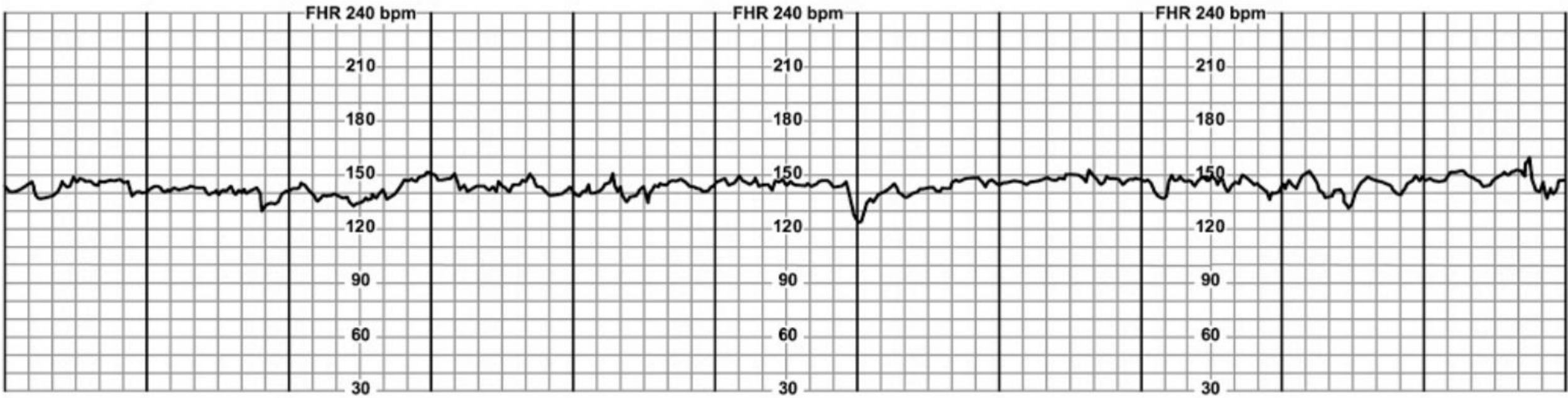
Mean FHR rounded to the nearest 5bpm during a 10-minute window

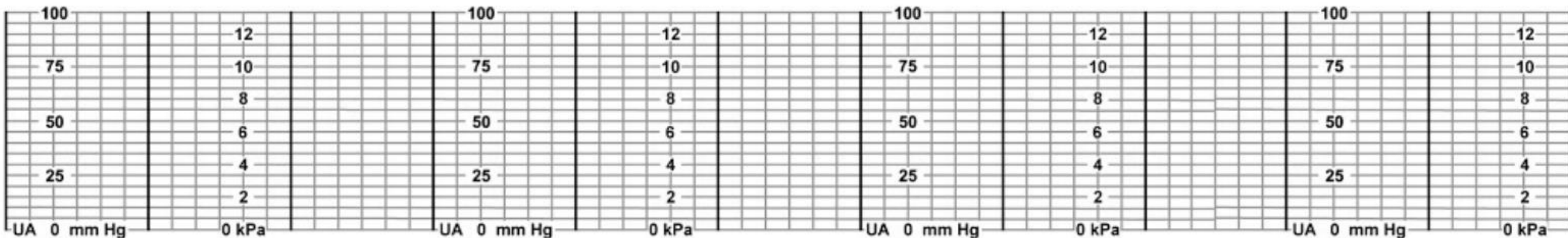
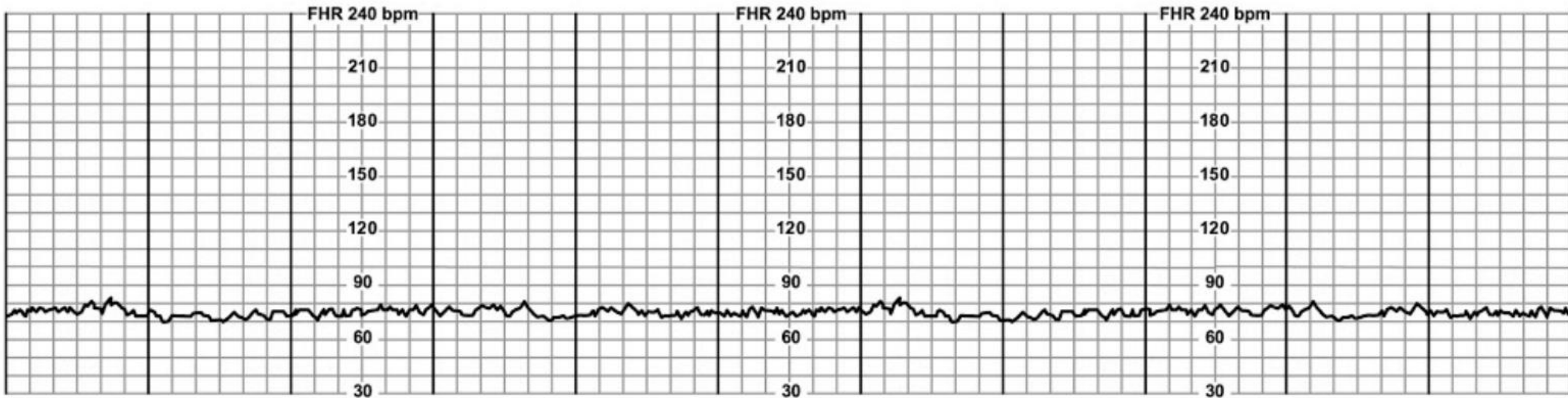
- Excluding accelerations and deceleration and periods of marked FHR variability
- Must be ≥ 2 min period (not necessarily contiguous)

Normal range is **110-160 bpm**

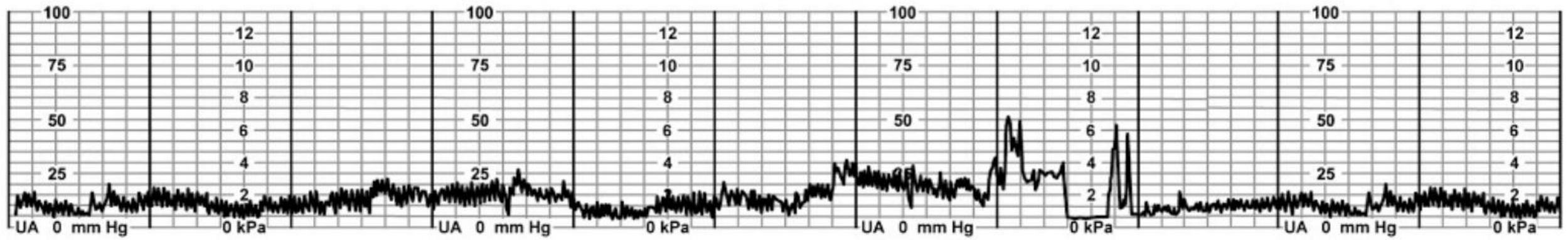
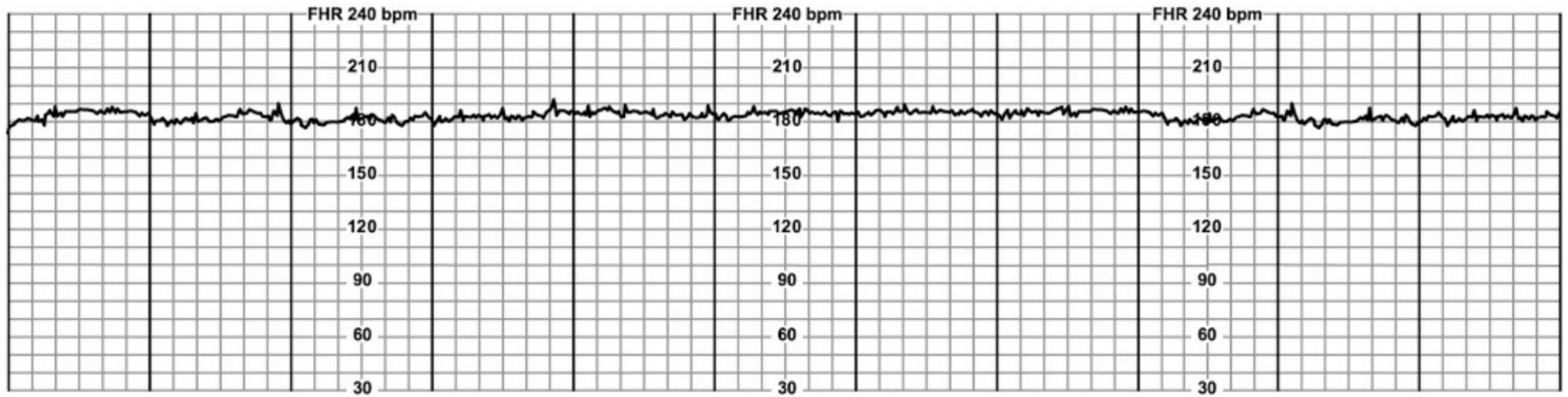
Bradycardia < 110 bpm for ≥ 10 min

Tachycardia > 160 bpm for ≥ 10 min





What causes fetal bradycardia?



What causes fetal tachycardia?

2

Baseline Variability

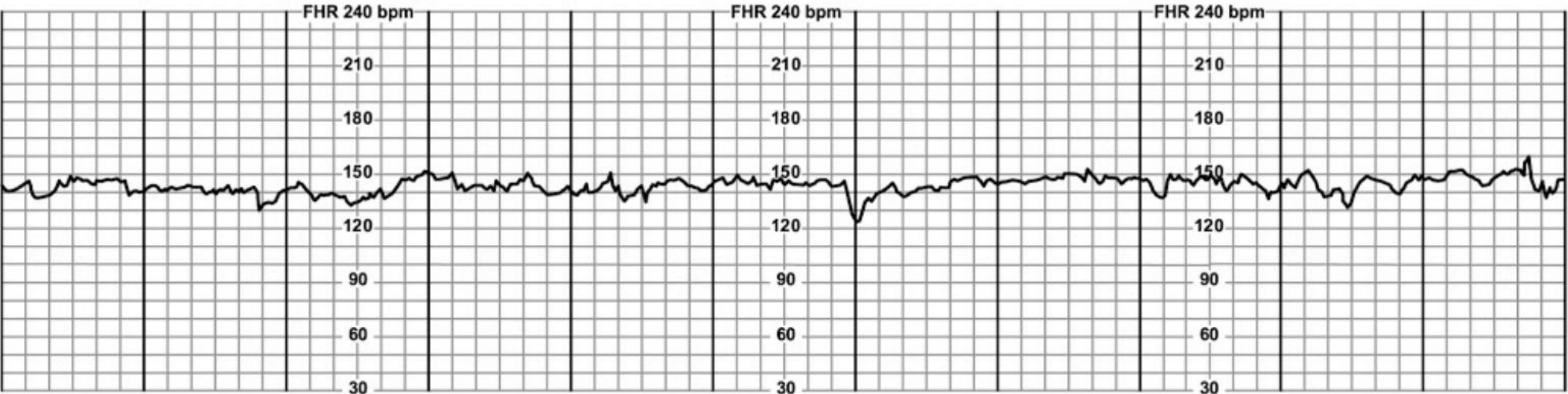
Fluctuation in the baseline FHR that are irregular in amplitude and frequency

Determined in a 10-min window, excluding accelerations and decelerations

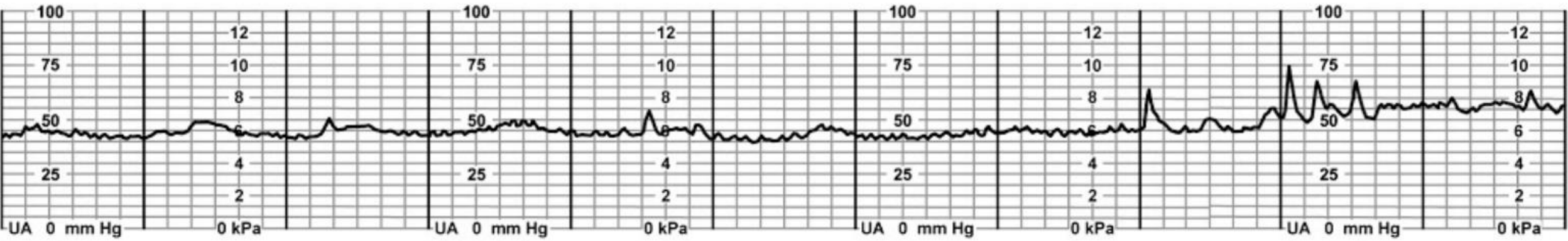
Amplitude range is visually quantified as follows:

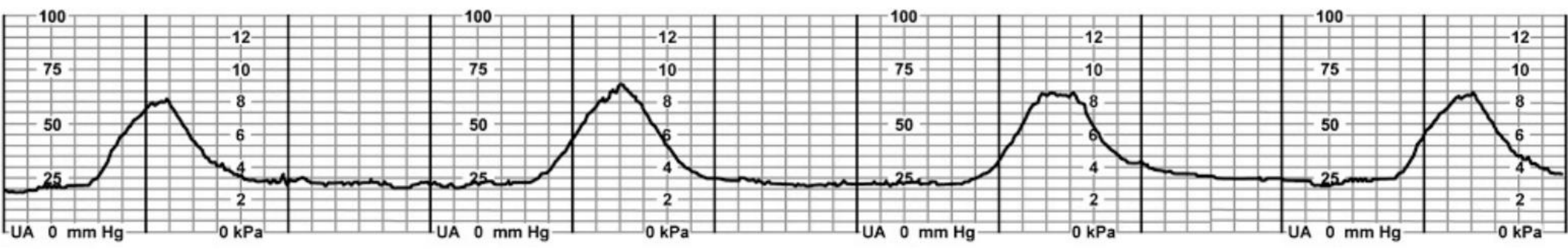
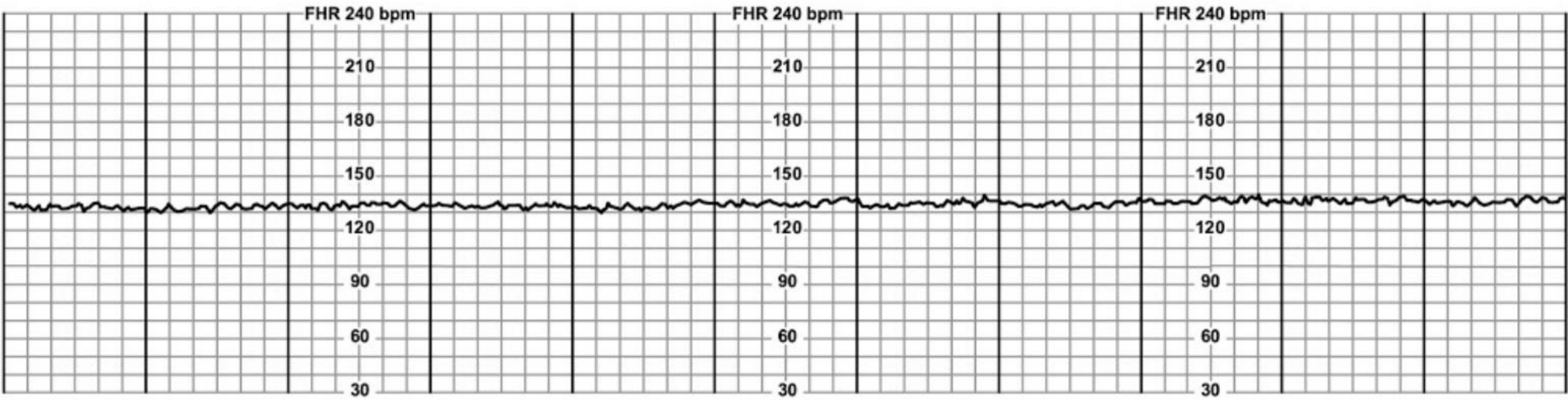
- **Absent** : amplitude range undetectable
- **Minimal** : amplitude $>$ undetectable but ≤ 5 bpm
- **Moderate** : amplitude range 6-25 bpm
- **Marked** : amplitude range >25 bpm

Variability is a reflection of current oxygen reserve.



Moderate variability = rules out fetal acidemia at current time!!



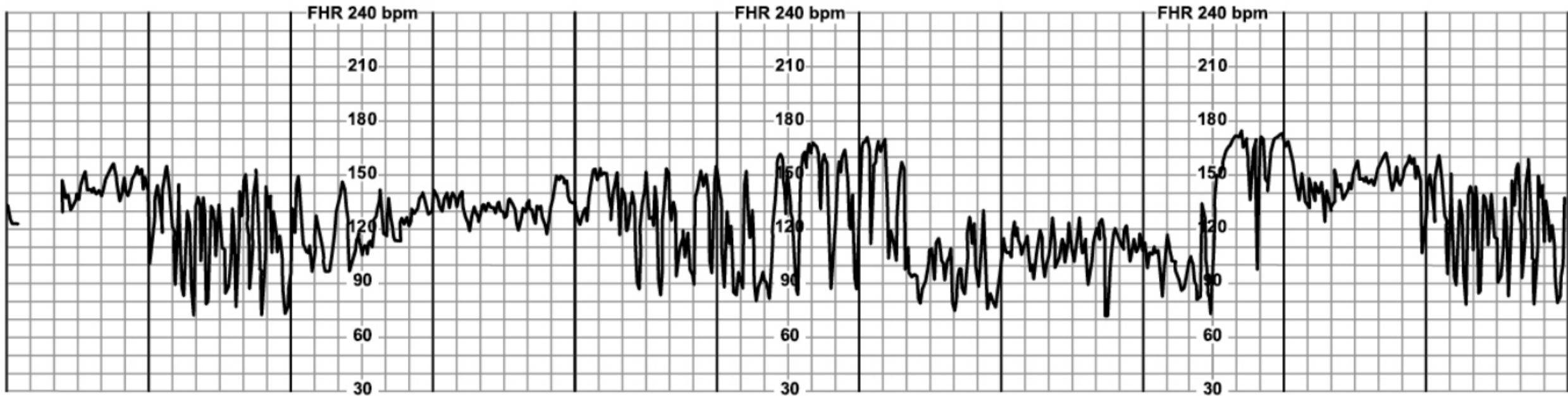


The image shows a fetal heart rate monitoring strip with a central text box. The strip has a grid background and a line representing the fetal heart rate. The line starts with a regular, rhythmic pattern, then becomes flat for a period, and then resumes its regular pattern. The text box is dark blue with a red border and contains white text. The text is as follows:

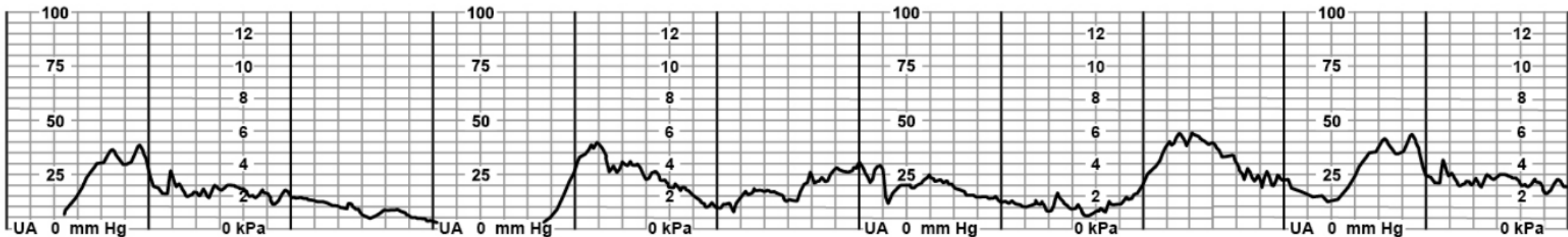
Decrease in variability associated with:

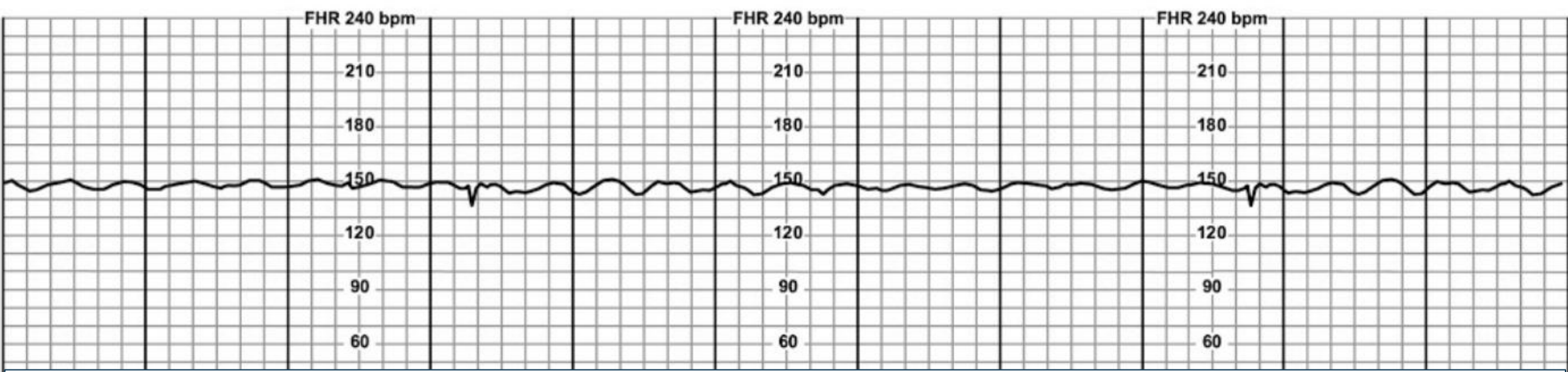
- *Interrupted Fetal Oxygenation*
 - *Fetal sleep cycle*
 - *Fetal tachycardia*
 - *Medications*
 - *Narcotics*
 - *General anesthetics*
 - *Prematurity*
 - *Congenital anomalies*
 - *Fetal anemia*
 - *Infection*
- *Preexisting neurologic injury*
- *Fetal metabolic acidosis*

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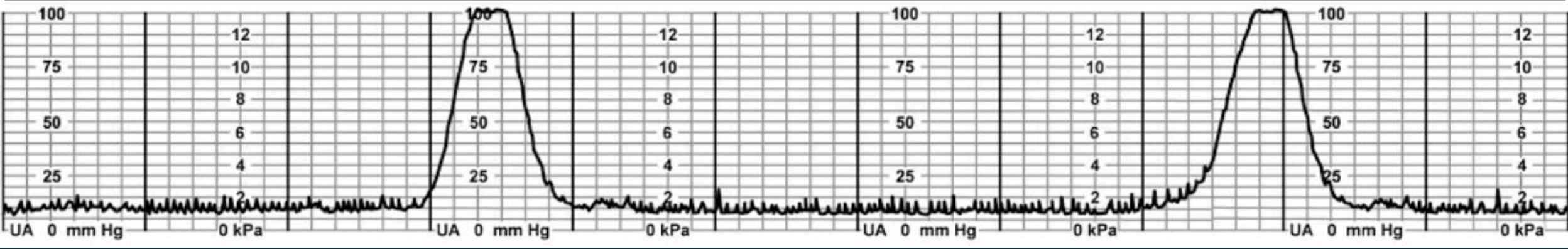


Marked variability = indeterminant baseline





Sinusoidal Pattern: Visually apparent, smooth, sine wave-like undulating pattern in FHR baseline with cycle frequency of 3-5min that persists for ≥ 20 min



! Category 3!

3

Accelerations

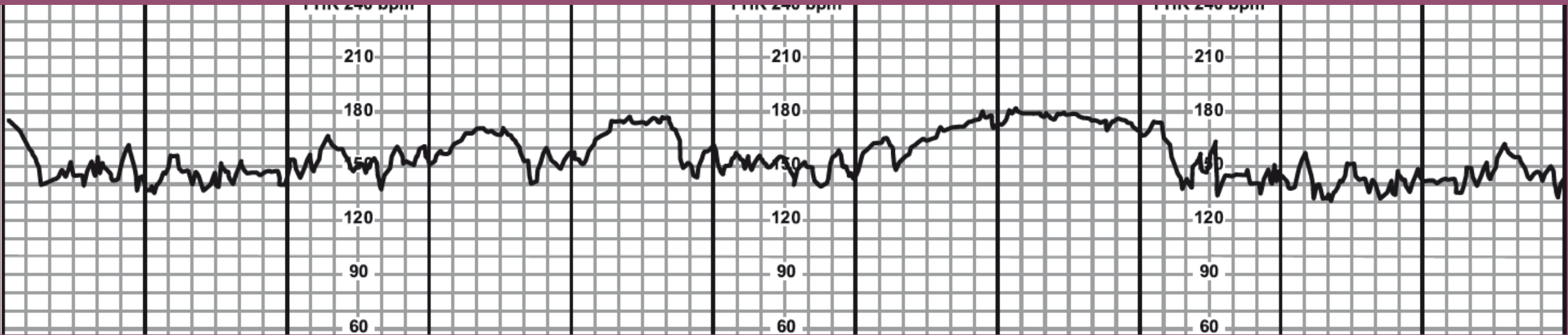
Abrupt increases in FHR above the baseline

- Onset to peak in <30 sec
- Can be with or without a contraction
- Indicate a well-oxygenated fetus with an intact CNS (*at that moment in time*)

In fetus ≥ 32 weeks should be at least 15 beats above the baseline and last for at least 15 seconds (15X15 rule)

In fetus < 32 weeks, can be acceptable if 10X10

Accelerations



4

Decelerations

Decrease from the baseline FHR

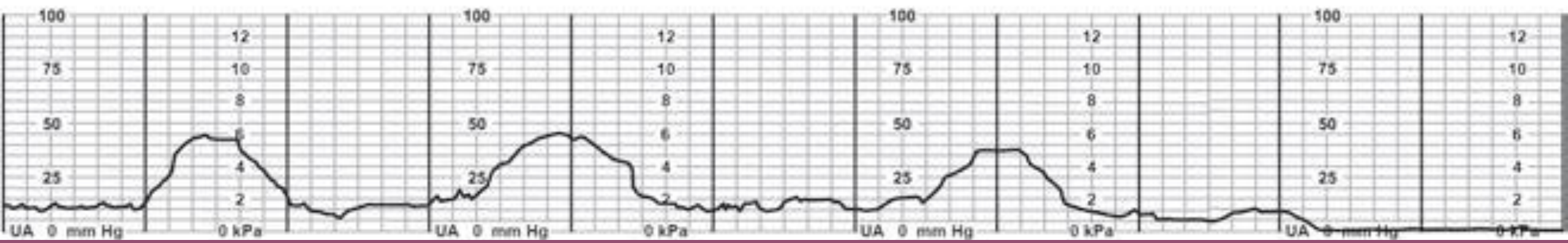
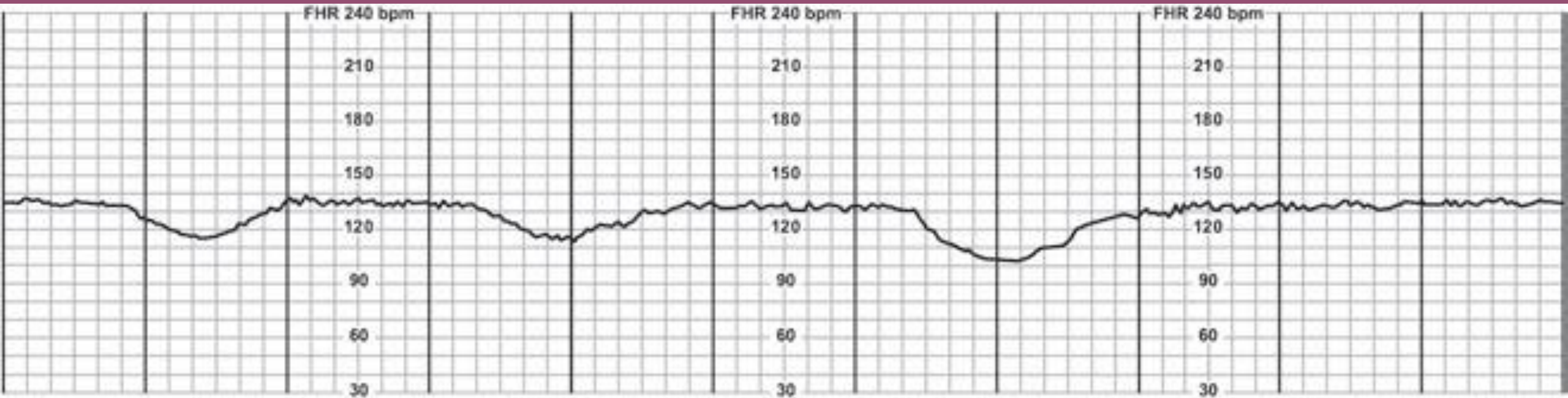
- Gradual or abrupt decline
- 4 types
 - **Early**
 - **Late**
 - **Variable**
 - **Prolonged**

Recurrent : occur with $\geq 50\%$ of uterine contractions within a 20-min period

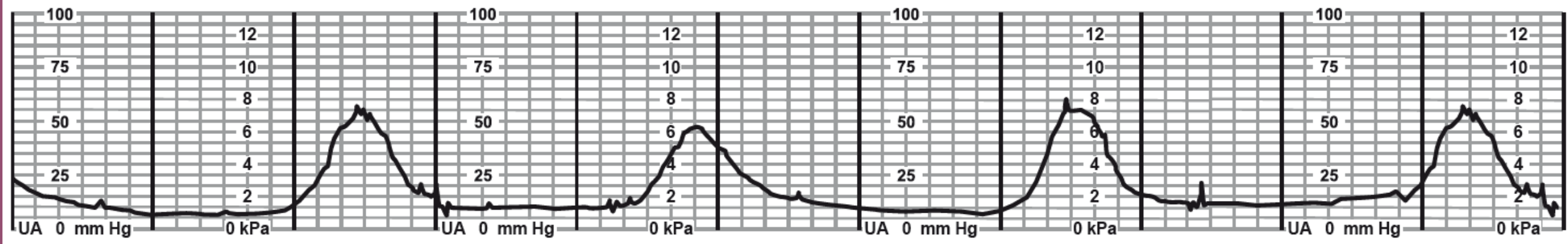
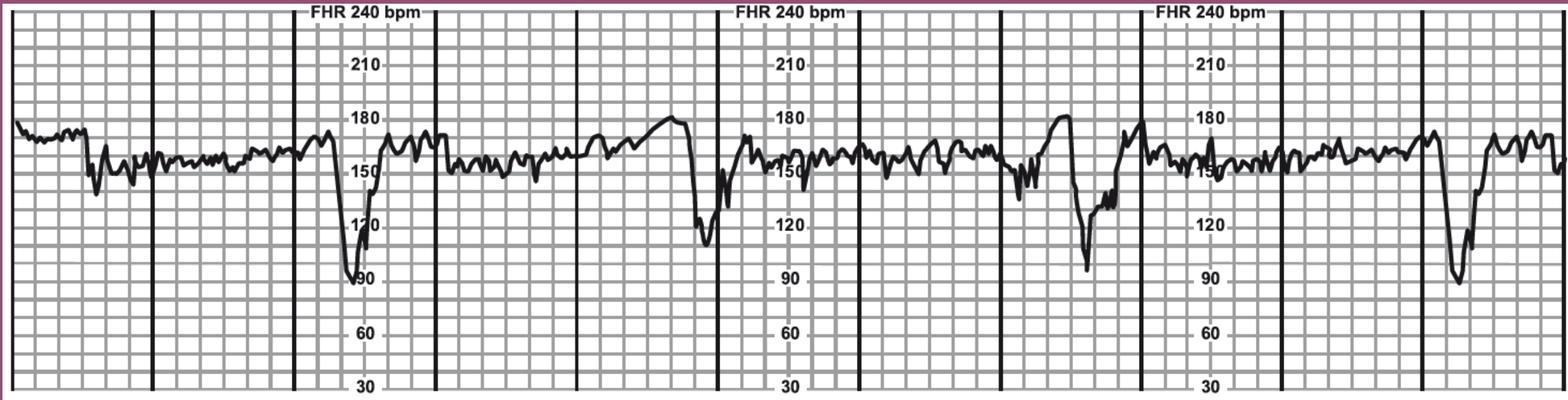
Intermittent : occur with $< 50\%$ of uterine contractions within a 20-min period

Decelerations

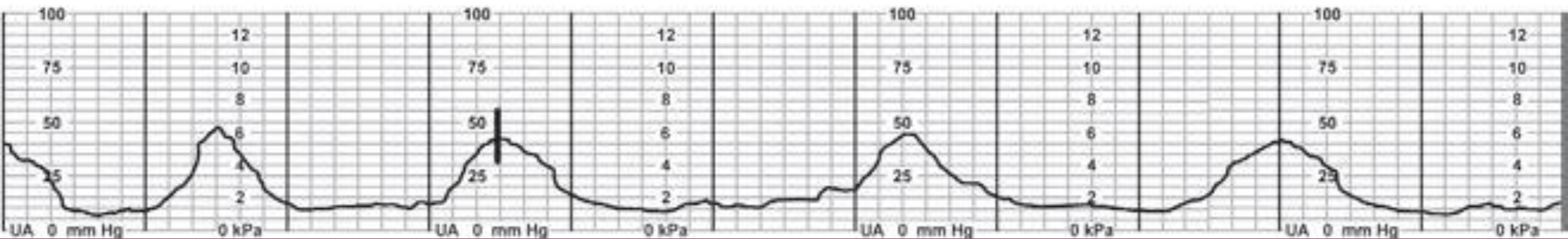
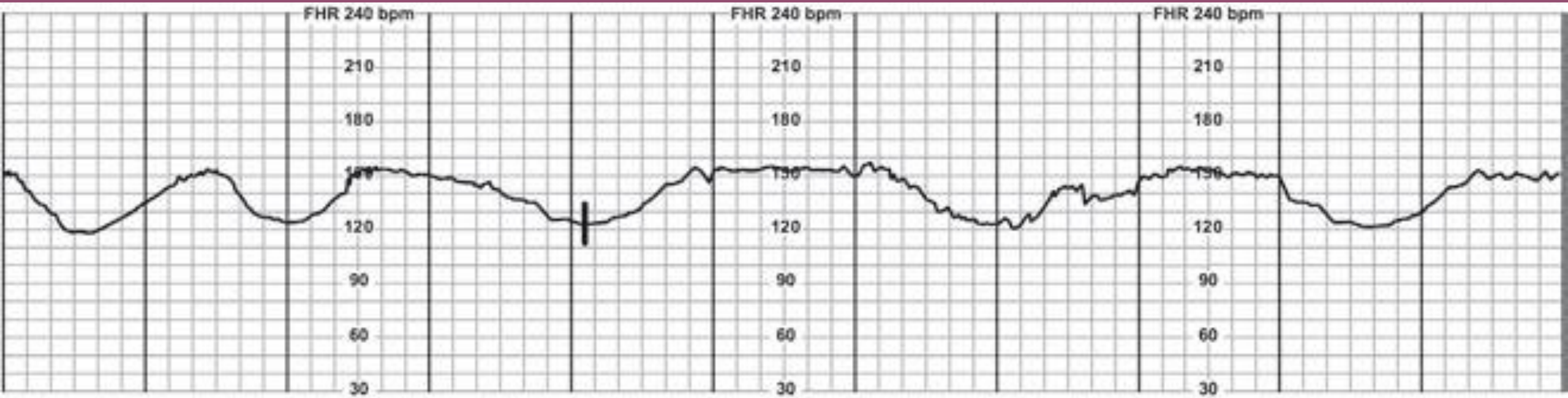
Type	Definition	Associated with
Early	Gradual onset ≥ 30 sec from onset to nadir; nadir simultaneous with peak of contraction	Head compression
Late	Gradual onset ≥ 30 sec from onset to nadir; delayed in timing – nadir after peak of contraction	Utero-placental insufficiency
Variable	Abrupt onset < 30 sec from onset to beginning of nadir, lasting ≥ 15 sec but < 2 min; depth ≥ 15 bpm	Cord compression
Prolonged	Decrease of ≥ 15 bpm lasting ≥ 2 min but less than 10 min	Disrupted oxygen transfer



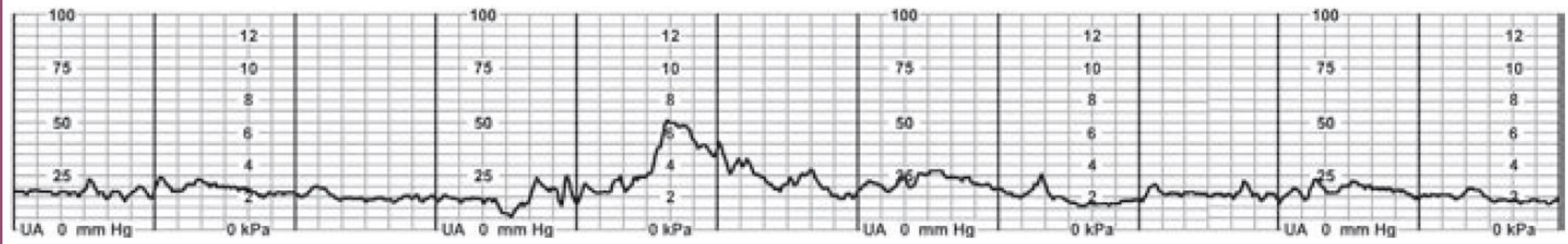
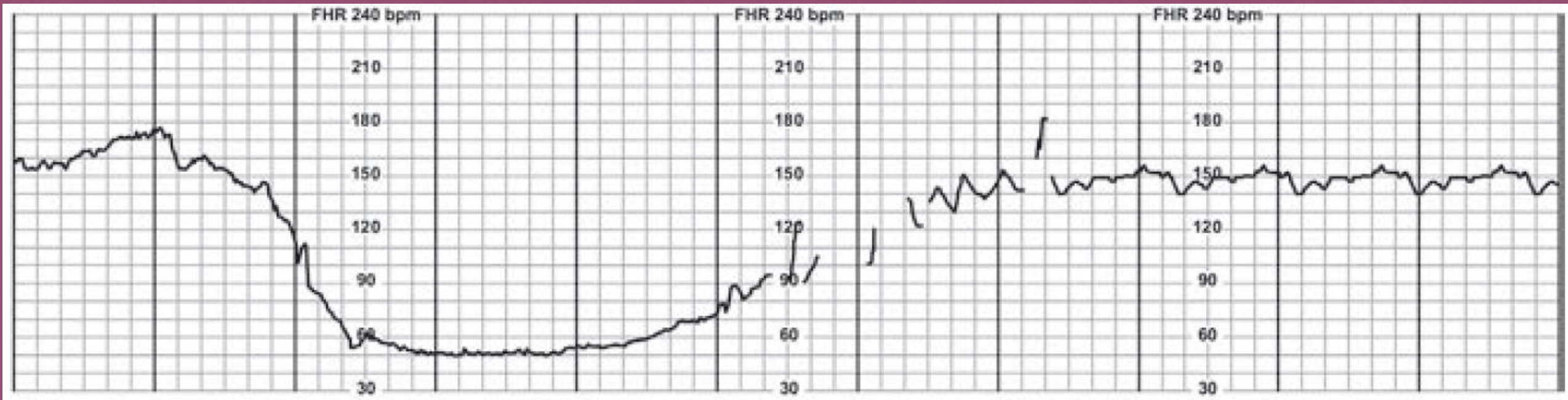
EARLY = Gradual onset ≥ 30 sec from onset to nadir; nadir simultaneous with peak of contraction



VARIABLE = Abrupt onset < 30sec from onset to beginning of nadir, lasting ≥ 15 sec, depth ≥ 15 bpm



LATE = Gradual onset ≥ 30 sec from onset to nadir; nadir after peak of contraction



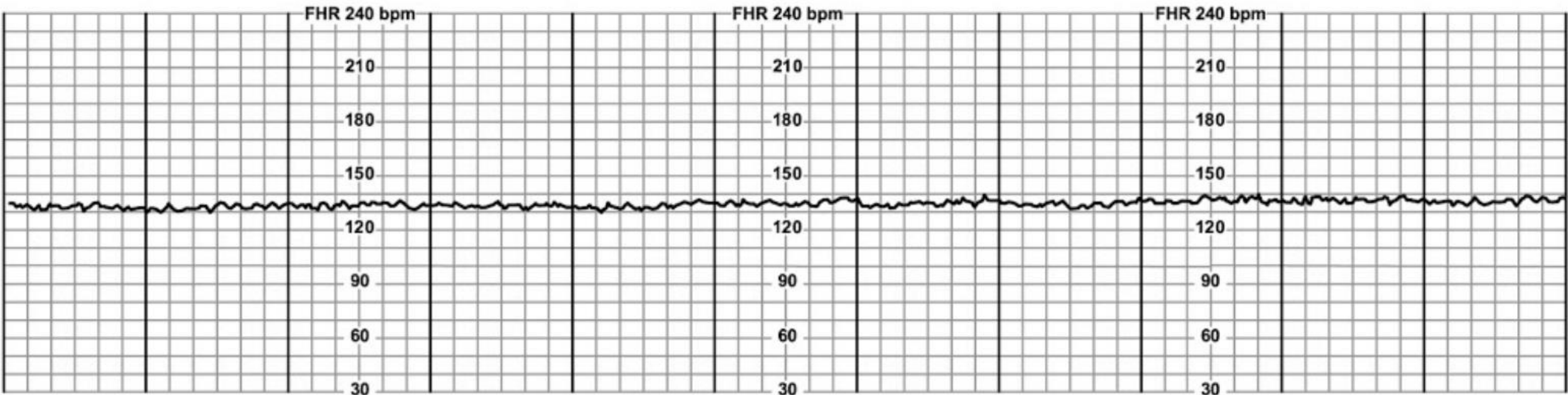
PROLONGED = Decrease of ≥ 15 bpm lasting ≥ 2 min but less than 10 min

5

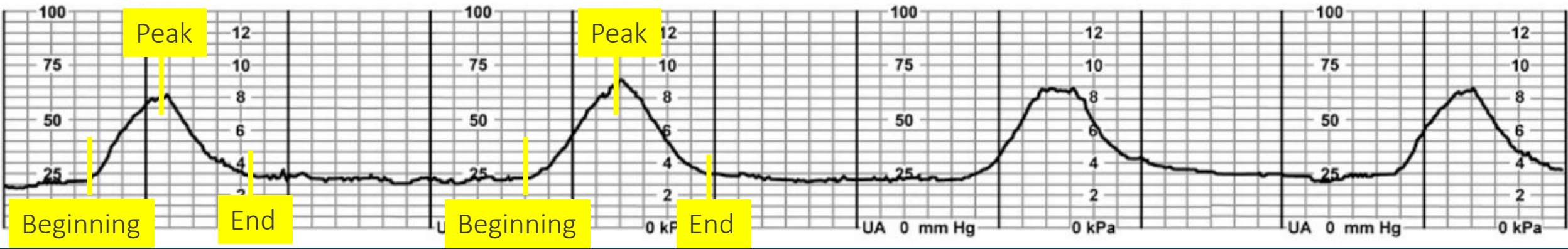
Uterine Activity

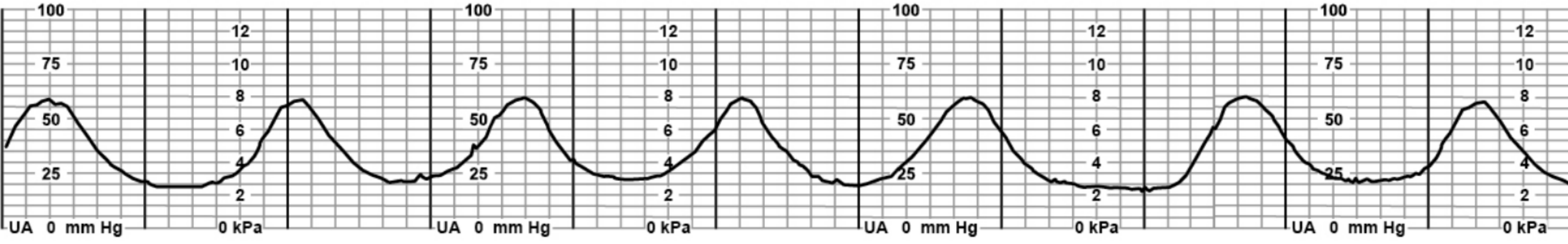
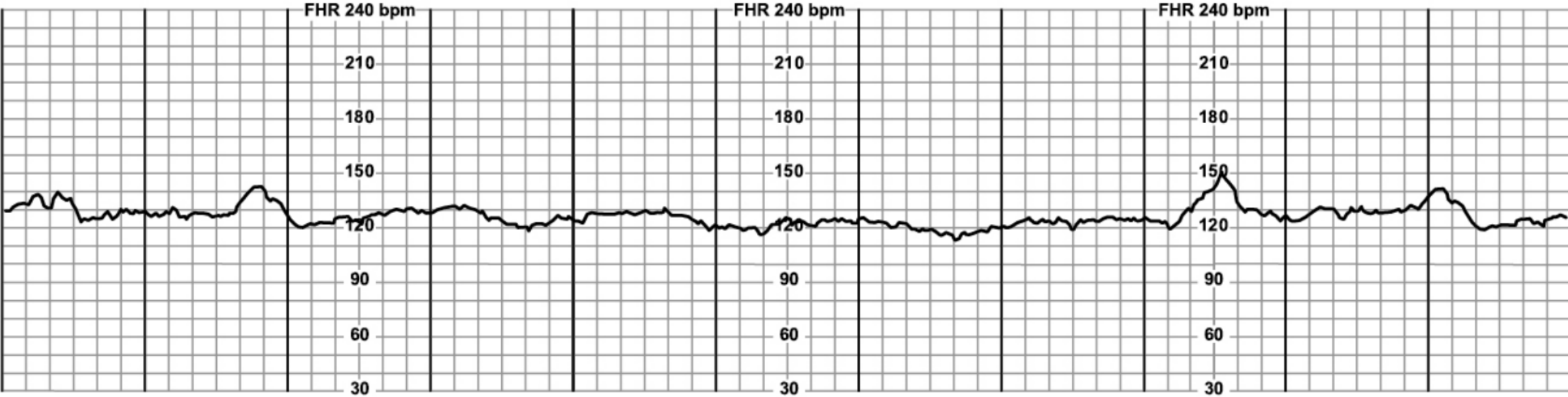
Assessed based on the number of contractions that are occurring in a 10min segment, averaged over a 30 min period.

- **Frequency**
 - **Normal** : ≤ 5 contractions in 10min, averaged over 30min
 - **Tachysystole** : >5 contractions in 10min, averaged over 30min
- **Duration**
- **Intensity**
- **Resting Tone**



Frequency and Duration







Intensity & Resting Tone

Intensity

- Assessed by palpation or IUPC
- With palpation, document as mild, moderate or strong
- With IUPC, document in mmHg or MVUs

Resting Tone

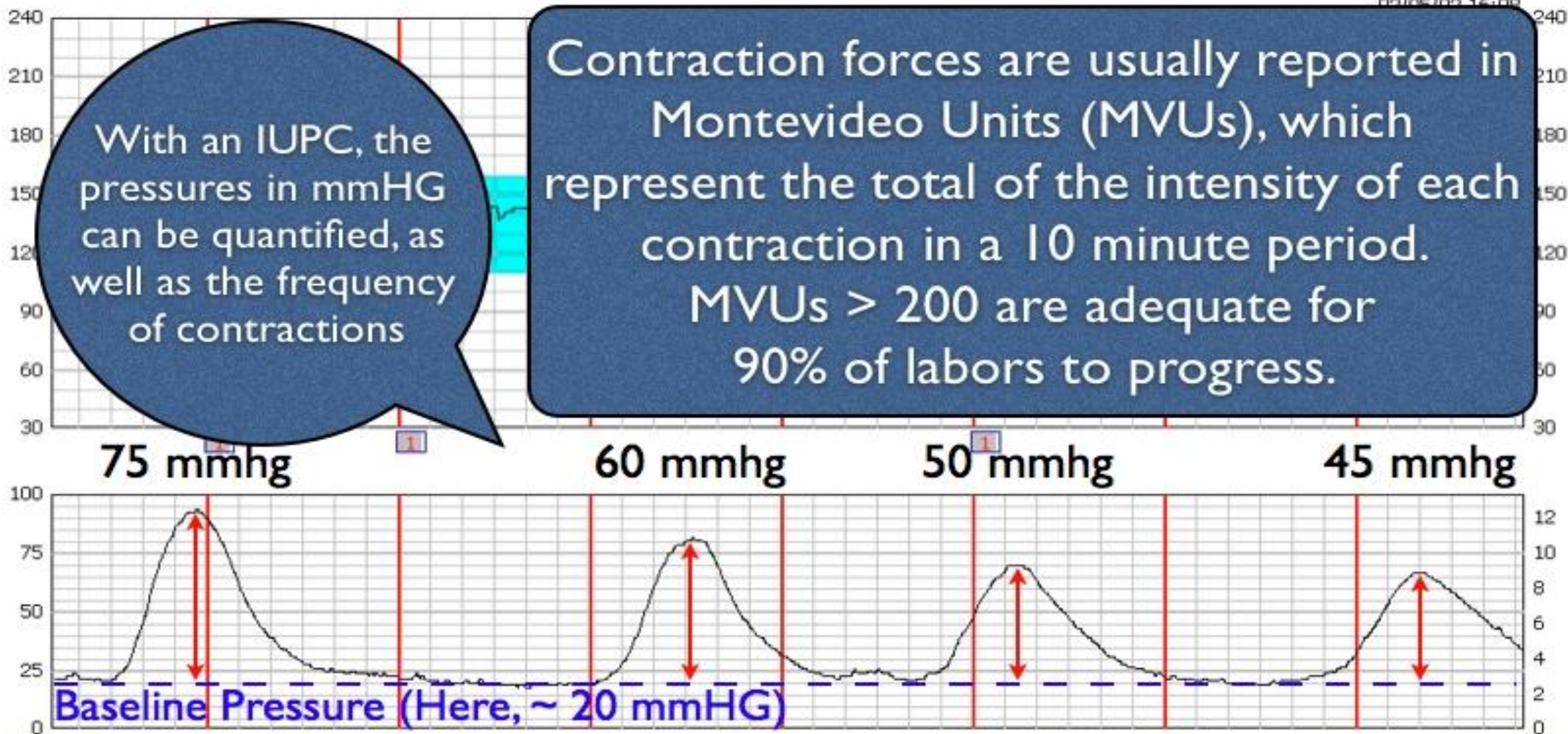
- Uterine tone between contractions
- With palpation, document soft or firm
- With IUPC, usually ≤ 20 mmHg

Calculating MVUs

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With an IUPC, the pressures in mmHG can be quantified, as well as the frequency of contractions

Contraction forces are usually reported in Montevideo Units (MVUs), which represent the total of the intensity of each contraction in a 10 minute period. MVUs > 200 are adequate for 90% of labors to progress.



6

Category of Tracing

Three-Tier fetal heart rate interpretation system for predicting acid base status at the time of observation

- Category 1
- Category 2
- Category 3

Category I

All of the Following:

- ❖ **Baseline 110-160**
- ❖ **Variability: Moderate**
- ❖ **Late or Variable Decels: Absent**
- ❖ **Early Decelerations: Present or Absent**
- ❖ **Accelerations: Present or Absent**

Category II

Examples:

- ❖ Moderate Variability with recurrent late or variable decelerations
- ❖ Minimal Variability with recurrent variable decelerations
- ❖ Absent Variability **WITHOUT** recurrent decelerations
- ❖ Bradycardia with Moderate Variability
- ❖ Prolonged Decelerations

Category III

Either:

- ❖ **Absent Variability with:**
 - ❖ Recurrent late decels **OR**
 - ❖ Recurrent variable decels **OR**
 - ❖ Bradycardia
- ❖ **OR:**
- ❖ **Sinusoidal Pattern**

Category Interpretation

Category I: predictive of *normal acid-base status*

- Follow in routine manner
- No action required

Category II: *indeterminate of fetal acid-base status*

- Require heightened surveillance
- Clinical interventions vary to circumstances
- Consider birth options in context of labor progress & evolution of pattern

Category III: predictive of *abnormal fetal acid-base status*

- Clinical interventions vary to circumstances
- If not quickly resolved, expedite delivery



Fetal assessment is an ongoing indirect assessment of the adequacy of fetal oxygenation.



A normal FHR pattern reflects an intact, oxygenated brainstem, autonomic nervous system and heart.

It is a good predictor of normal outcome. It is not a good predictor of poor outcome.



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Let's Practice

Everything EFM by NCC



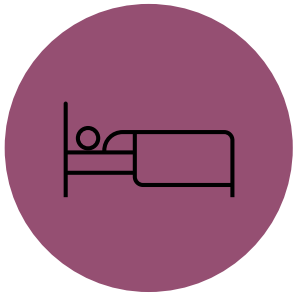
Interventions

The objective of fetal heart rate monitoring is to assess fetal oxygenation during labor.

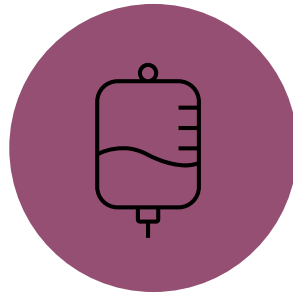
The goal is to limit interruption of fetal oxygenation to prevent fetal injury.

How do we limit interruption of fetal oxygenation?

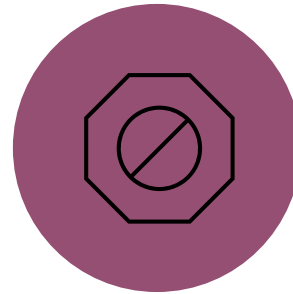
Interventions



Maternal
Lateral
Repositioning



Intravenous
Fluid Bolus



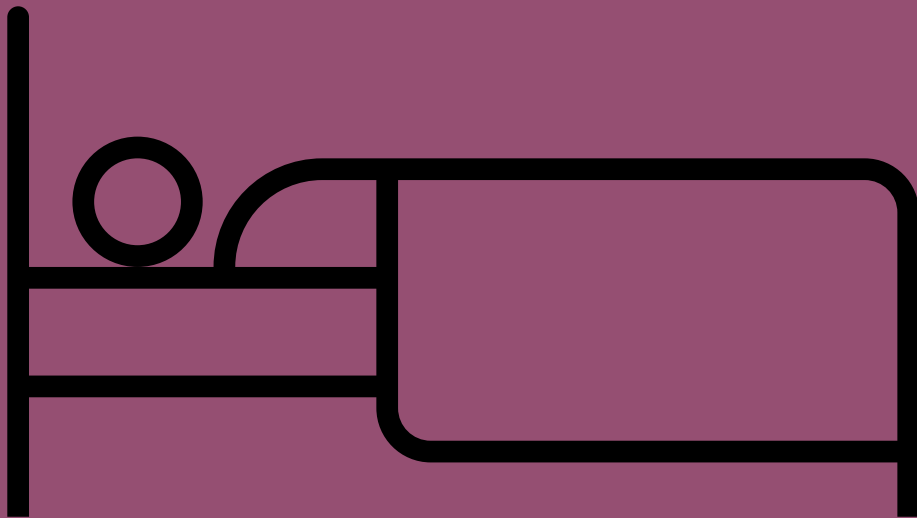
Reduction or
Discontinuation
of Oxytocin



Maternal
Oxygen
Administration

Maternal lateral repositioning

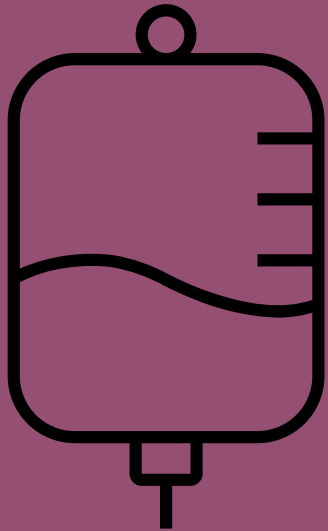
- Avoids compression of maternal great vessels
- Improves uteroplacental perfusion
- Alleviate umbilical cord compression



Position	Mean Cardiac Output (liters per minute)
Left lateral	6.6
Right lateral	6.8
Supine	6.0
Sitting	6.2
Standing	5.4
Knee Chest	6.9

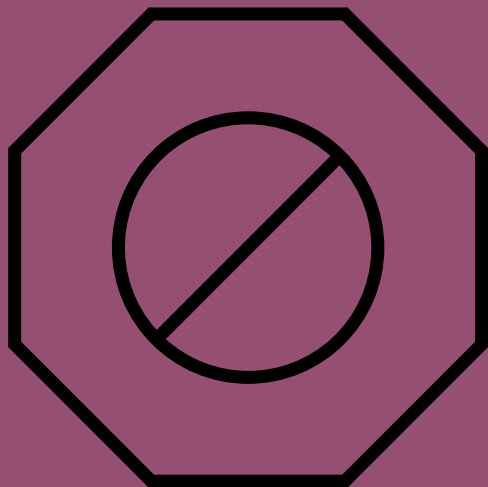
Intravenous Fluid Bolus

- Improves maternal hypovolemia
- Increases uteroplacental perfusion



500mL-1000mL fluid bolus can improve cardiac output and stroke volume

Reduction or Discontinuation of Oxytocin



- Reduces uterine tachysystole and subsequent fetal hypo oxygenation

Normal FHR	Abnormal FHR
Assist to lateral position	Discontinue oxytocin
IV bolus	Assist to lateral position
If uterine activity does not return to normal after 10–15 min, decrease oxytocin rate by at least ½.	IV bolus
If uterine activity does not return to normal after additional 10-15 min, discontinue oxytocin until uterine activity is normal.	Consider oxygen and 0.25mg terbutaline
To resume after resolution of tachysystole; if infusion off for <20-30 min, resume at no more than ½ rate infusing when tachysystole occurred. If infusion off for > 30–40-min, resume oxytocin at initial dose of administration.	

Maternal Oxygen Administration

- Increase oxygen transfer to fetal umbilical vein

Given at 10 L per minute via nonrebreather mask

Apply oxygen with maternal hypoxia and/or other interventions do not resolve the clinical presentation

Discontinue as soon as possible



Five Goals of Interventions

Support maternal coping & progress

- Provide a comforting presence
- Review plans and expectations
- Maintain calm environment
- Include family members when appropriate

Maximize uterine blood flow

- Reduce anxiety/pain
- Lateral positioning
- Intravenous hydration
- Reduce uterine activity

Maximize umbilical circulation

- Maternal positioning
- Amnioinfusion
- Elevation of presenting part

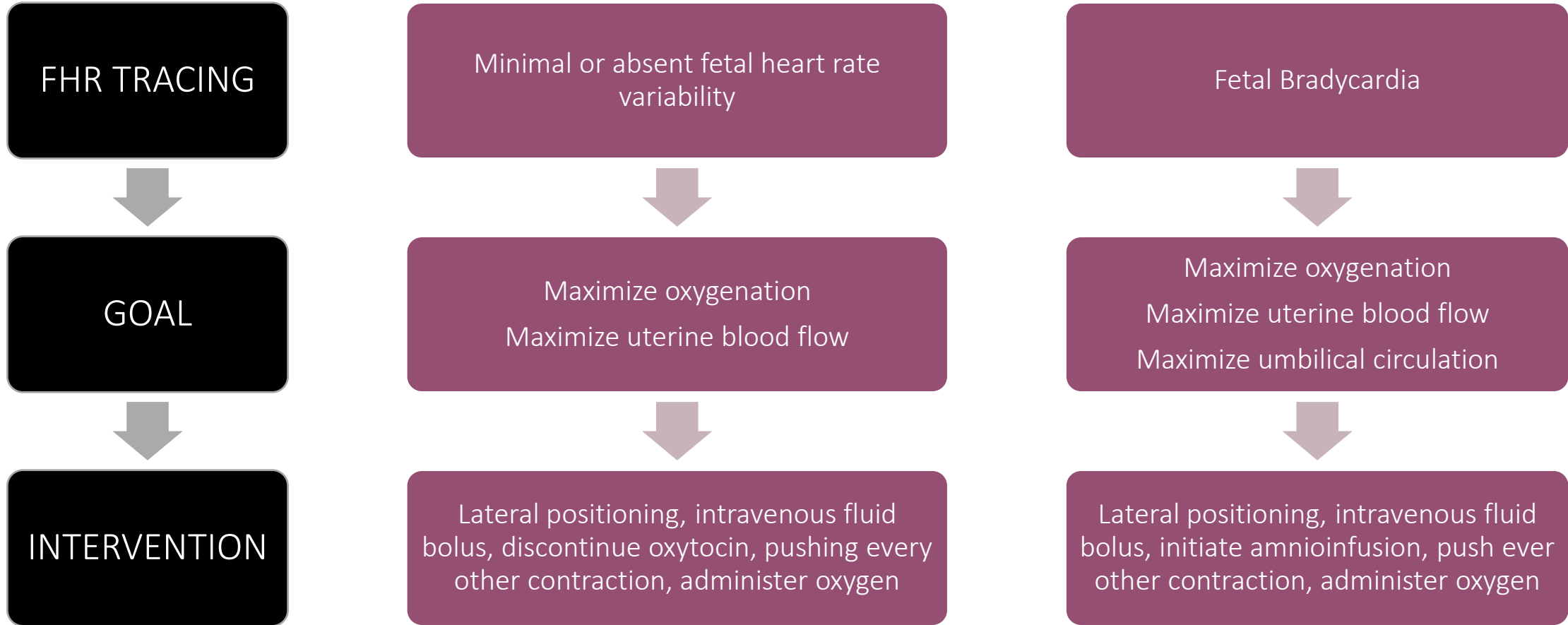
Maximize oxygenation

- Lateral positioning
- Give maternal oxygen
- Guide maternal breathing
- Correct or treat underlying disease

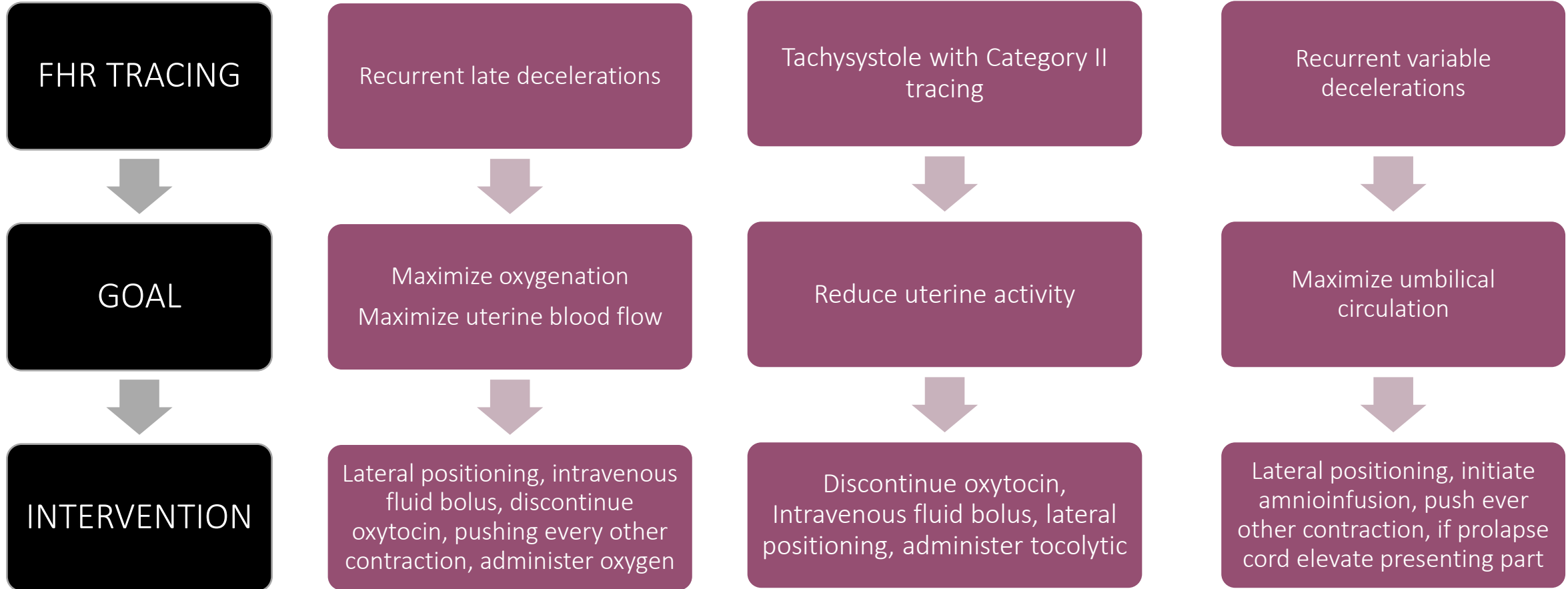
Maintain appropriate uterine activity

- Maternal lateral position
- Reduce/discontinue oxytocin
- IV fluid bolus
- Administer tocolytics

Intrauterine Resuscitation



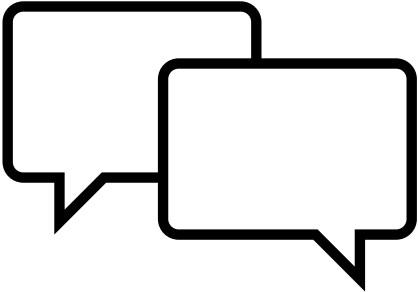
Intrauterine Resuscitation



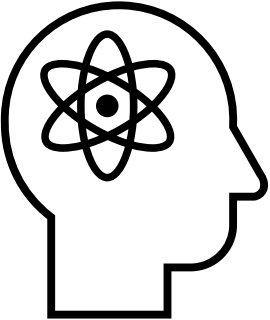
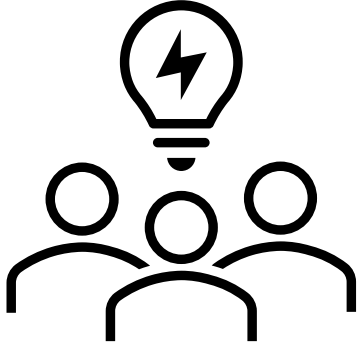
GROUP ACTIVITIES

Group 1

HEADS UP GAME

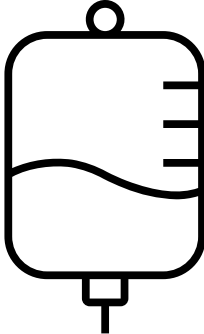


Group 3
INDUCTION –
AUGMENTATION
OF LABOR



Group 2

COMMUNICATIO
N TO PROVIDER



Group 4

CASE STUDY

References

AWHONN Fetal Heart Monitoring Principles and Practices 6th Edition, 2021

Mosyb's Pocket Guide to Fetal Monitoring 9th Edition, 2022

AWHONN Perinatal Nursing 5th Edition, 2020

2008 NICHD Report on Electronic Fetal Monitoring

National Certification Corporation Website, EFM Tracing Game