FETAL HEART RATE CHARACTERISTICS AND PATTERNS: NICHD (1997)

Term	Definition
Baseline Rate	Approximate mean FHR rounded to increments of 5 bpm during a 10-minute segment, excluding periodic or episodic changes, periods of marked variability, and segments of baseline that differs by >25 bpm. In any 10-minute window, the minimum baseline duration must be at least 2 minutes or the baseline for that period is indeterminate. In this case, one may need to refer to the previous 10-minute segment for determination of the baseline.
Bradycardia	Baseline rate of <110 bpm.
Tachycardia	Baseline rate of >160 bpm.
Baseline Variability	Fluctuations in the baseline FHR of 2 cycles per minute or greater. These fluctuations are irregular in amplitude and frequency and are visually quantified as the amplitude of the peak to trough in bpm.
- Absent variability	Amplitude range undetectable.
- Minimal variability	Amplitude range visually detectable (>undetectable) but ≤5 bpm.
- Moderate variability	Amplitude range 6–25 bpm.
- Marked variability	Amplitude range >25 bpm.
Acceleration	Visually apparent ***abrupt*** increase (onset to peak is < 30 seconds) in FHR above baseline. The increase is calculated from the most recently determined portion of the baseline. Acme is ≥ 15 bpm. above the baseline and lasts ≥ 15 seconds and <2 minutes from the onset to return to baseline. Before 32 weeks of gestation, an acme ≥10 bpm above the baseline and duration of ≥10 seconds is an acceleration.
Prolonged acceleration	Acceleration ≥2 minutes and <10 minutes duration.
Early deceleration	Visually apparent ***gradual*** decrease (onset to nadir is ≥ 30 seconds) of the FHR and return to baseline associated with a uterine contraction. This decrease is calculated from the most recently determined portion of the baseline. It is coincident in timing, with the nadir of deceleration occurring at the same time as the peak of the contraction. In most cases, the onset, nadir, and recovery of the deceleration are coincident with the beginning, peak, and ending of the contraction, respectively.

(*continued*)

Late deceleration	Visually apparent ***gradual*** decrease (onset to nadir is ≥ 30 seconds) of the FHR and return to baseline associated with a uterine contraction. This decrease is calculated from the most recently determined portion of the baseline. It is delayed in timing, with the nadir of deceleration occurring after the peak of the contraction. In most cases, the onset, nadir, and recovery of the deceleration occur after the onset, peak, and ending of the contraction, respectively.
Variable deceleration	Visually apparent ***abrupt*** decrease (onset to beginning of nadir is <30 seconds) in FHR below baseline. The decrease is calculated from the most recently determined portion of the baseline. Decrease is ≥ 15 bpm, lasting ≥ 15 seconds and <2 minutes from onset to return to baseline. When variable decelerations are associated with uterine contractions, their onset, depth, and duration vary with successive uterine contractions.
Prolonged deceleration	Visually apparent decrease in FHR below baseline. The decrease is calculated from the most recently determined portion of the baseline. Decrease is ≥ 15 bpm, lasting ≥ 2 minutes but <10 minutes from onset to return to baseline.

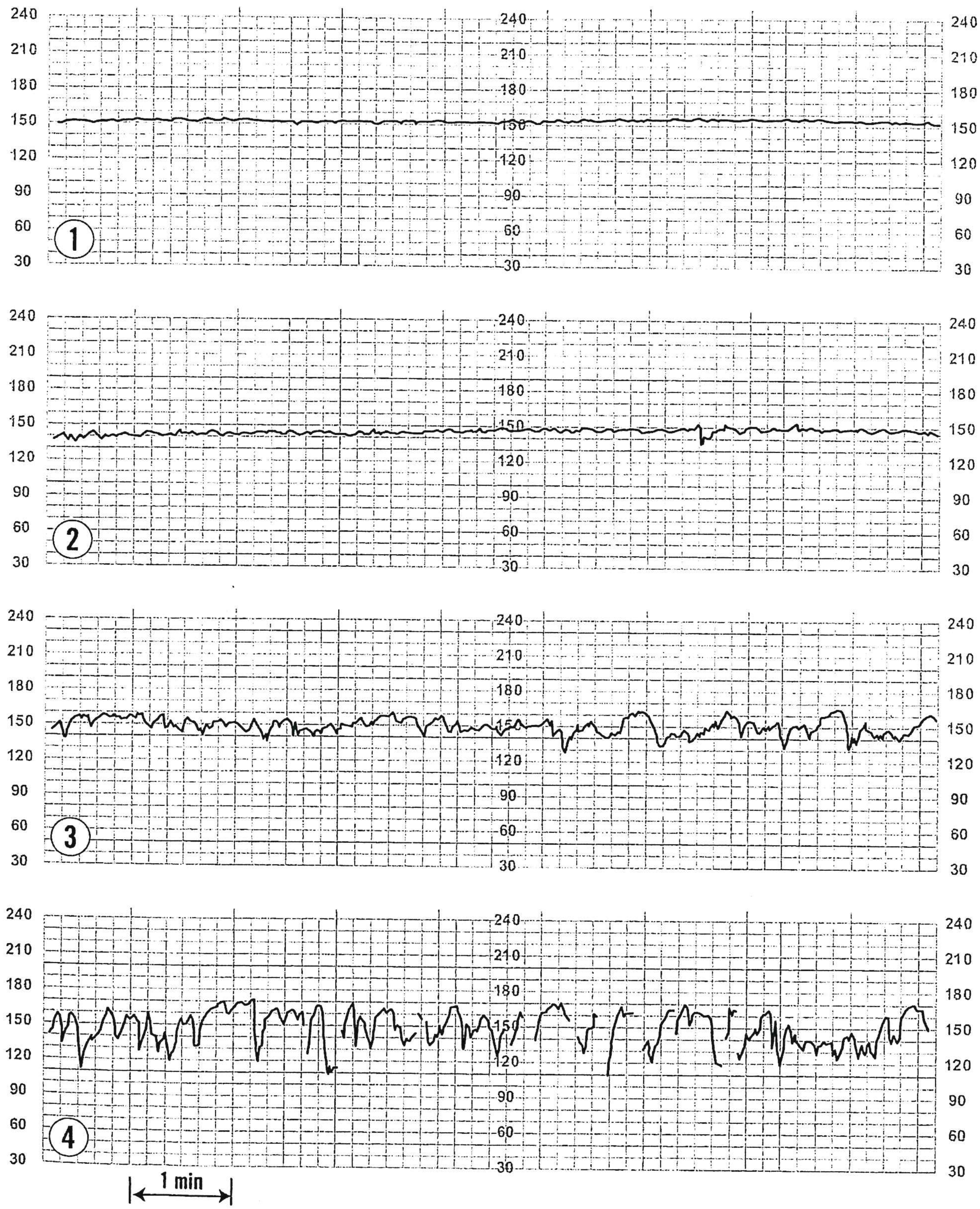
Source: From the National Institute of Child Health and Human Development Research Planning Workshop: Electronic fetal heart rate monitoring: Research guidelines for interpretation. *American Journal of Obstetrics and Gynecology* (1997) 177(6), 1,385–1,390; and *Journal of Obstetric, Gynecologic and Neonatal Nursing* (1997), 26(6) 635–640.

Pattern interpretation must also take into account influencing factors, such as fetal gestational age, maternal medications and medical conditions, and results of other tests of fetal well-being, etc. The following table summarizes each of the characteristics, each of which will then be discussed in more detail.

Table 3.2 Interpretation of Fetal Heart Rate Tracings

Baseline	• The mean fetal heart rate (FHR) rounded to increments of 5 beats per minute (bpm) during a 10-minute segment, excluding – Periodic or episodic changes – Periods of marked FHR variability – Segments of baseline that differ by more than 25 bpm • The baseline must be for a minimum of 2 minutes in any 10-minute segment, or the baseline for that time period is indeterminate. In this case, one may refer to the prior 10-minute window for determination of baseline. • Normal FHR baseline: 110 to 160 bpm • Tachycardia: FHR baseline is greater than 160 bpm • Bradycardia: FHR baseline is below 110 bpm
Baseline variability	• Fluctuations in the baseline FHR that are irregular in amplitude and frequency • Variability is visually quantitated as the amplitude of peak to trough in beats per minute. – Absent—amplitude range undetectable – Minimal—amplitude range detectable but 5 bpm or fewer – Moderate (normal)—amplitude range 6 to 25 bpm – Marked—amplitude range greater than 25 bpm
Acceleration	• A visually apparent abrupt increase (onset to peak in less than 30 seconds) in the FHR. • At 32 weeks of gestation and beyond, an acceleration has a peak of 15 bpm or more above baseline, with a duration of 15 seconds or more but less than 2 minutes from onset to return. • Before 32 weeks of gestation, an acceleration has a peak of 10 bpm or more above baseline, with a duration of 10 seconds or more, but less than 2 minutes from onset to return. • Prolonged acceleration lasts 2 minutes or more but less than 10 minutes in duration. • If an acceleration lasts 10 minutes or longer, it is a baseline change.

VISUAL ASSESSMENT OF VARIABILITY SCALE



Source: Adapted from Electronic fetal heart monitoring: Research guidelines for interpretation, National Institutes of Child Health and Human Development Research Planning Workshop, 1997, Journal of Obstetric, Gynecologic and Neonatal Nursing, 26(6), 635–640. Copyright © AWHONN.

Table 3.2. Interpretation of Fetal Heart Rate Tracings *(continued)*	
Early deceleration	• Visually apparent, usually symmetrical gradual decrease and return of the FHR associated with a uterine contraction. • A gradual FHR decrease is defined as from the onset to the FHR nadir of 30 seconds or more. • The decrease in FHR is calculated from the onset to the nadir of the deceleration. • The nadir (low point) of the deceleration occurs at the same time as the peak of the contraction. • In most cases, the onset, nadir, and recovery of the deceleration coincide with the beginning, peak, and ending of the contraction, respectively.
Late deceleration	• Visually apparent, usually symmetrical gradual decrease and return of the FHR associated with a uterine contraction. • A gradual FHR decrease is defined as from the onset to the FHR nadir of 30 seconds or more. • The decrease in FHR is calculated from the onset to the nadir of the deceleration. • The deceleration is delayed in timing, with the nadir of the deceleration occurring after the peak of the contraction. • In most cases, the onset, nadir, and recovery of the deceleration occur after the beginning, peak, and ending of the contraction, respectively.
Variable deceleration	• Visually apparent abrupt decrease in FHR. • An abrupt FHR decrease is defined as from the onset of the deceleration to the beginning of the FHR nadir of less than 30 seconds. • The decrease in FHR is calculated from the onset to the nadir of the deceleration. • The decrease in FHR is 15 beats per minute or greater, lasting 15 seconds or greater, and less than 2 minutes in duration. • When variable decelerations are associated with uterine contractions, their onset, depth, and duration commonly vary with successive uterine contractions.
Prolonged deceleration	• Visually apparent decrease in the FHR below the baseline. • Decrease in FHR from the baseline that is 15 bpm or more, lasting 2 minutes or more but less than 10 minutes in duration. • If a deceleration lasts 10 minutes or longer, it is a baseline change.
Sinusoidal pattern	• Visually apparent, smooth, sine wave-like undulating pattern in FHR baseline with a cycle frequency of 3 to 5 per minute that persists for 20 minutes or more.

Used with permission from Macones GA, Hankins GD, Spong CY, Hauth J, Moore T. The 2008 National Institute of Child Health and Human Development workshop report on electronic fetal monitoring: update on definitions, interpretation, and research guidelines. *Obstet Gynecol.* 2008;112:661-666.

Table 3.3. Fetal Heart Rate Variability: Beats per Minute Ranges	
Baseline Fetal Heart Rate Variability	**Peak-to-Trough Beats per Minute (bpm) Range**
Absent	Undetectable
Minimal	Detectable, but ≤5 bpm
Moderate	6 to 25 bpm
Marked	>25 bpm

a. Significance
- *Absent variability:* Amplitude range visually undetectable. Absent variability always required prompt evaluation. It may reflect a central nervous system impairment of the fetus and/or fetal acidemia.
- *Minimal variability:* Amplitude range visually detectable but ≤5 bpm. Minimal variability may be due to fetal sleep or, possibly, to low gestational age of the fetus. It also may be due to drugs given to the woman, including barbiturates, tranquilizers, certain narcotics, and magnesium sulfate. By itself, minimal variability may be a benign finding.

  Loss of variability may also be a warning sign for fetal acidosis or chronic fetal hypoxia. When it occurs with late or variable decelerations it is concerning, requiring prompt investigation and possible intervention.
- *Moderate variability:* Amplitude range of 6 to 25 bpm. It is the usual, and normal, finding. The presence of moderate variability is usually associated with a normal fetal acid-base status.
- *Marked variability:* Amplitude range >25 bpm. This pattern is very uncommon and the significance of marked variability is unclear.

If findings are worrisome, be sure to assess all components of the fetal heart rate pattern, as well as other indicators of fetal well-being.

b. Treatment: If minimal or absent variability occurs in association with recurrent late or variable decelerations, consider prompt cesarean delivery.

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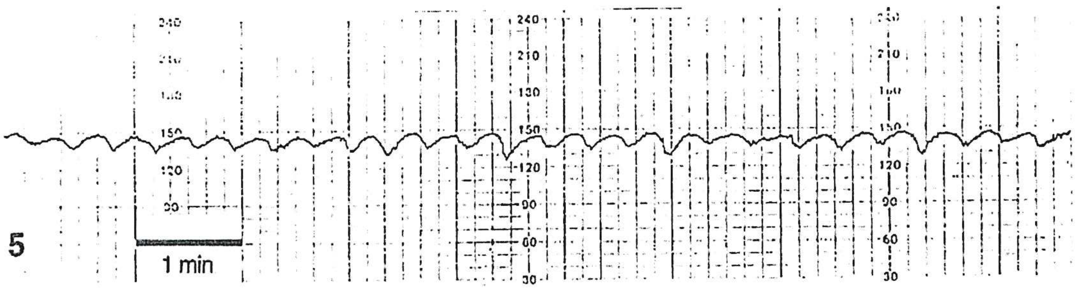

Figure 3.4. Sinusoidal Pattern.
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b. Significance
- Sometimes occurs as a transient pattern with no significance, or may be due to certain narcotics given to the laboring woman.
- Sinusoidal pattern also may be associated with
  – Severe fetal anemia
  – Fetal acidosis
  – Fetal hydrops

c. Treatment
- Stop oxytocin, if used.
- Position the woman in lateral decubitus to promote uterine blood flow. Avoid supine positioning.
- Give 100% oxygen by mask (not nasal cannula).
- Hydrate the woman with normal saline or Ringer's lactate solution.
- If spontaneous contractions are present, consider using a beta-agonist to decrease uterine contractions.
- If the pattern continues after these measures, obtain a scalp or auditory stimulation test. Consider consultation with maternal-fetal medicine specialists.
- A Kleihauer-Betke test of fetal cells in maternal circulation may identify a feto-maternal transfusion. If that is the case, the fetus may be severely anemic.
- Determine if the woman is Rh-positive or Rh-negative and if she is sensitized to any other antigen.
- If the sinusoidal pattern still persists and cannot be attributed to maternal narcotic medication, consider prompt delivery. Cesarean delivery is usually performed. The longer the pattern goes on, the more likely there is to be fetal hypoxia and acidosis.

Persistent sinusoidal fetal heart rate pattern requires prompt investigation and possible intervention.

C. Rate Changes

Fetal heart rate changes that are related to the timing of uterine contractions are called **periodic** heart rate changes. **Episodic** changes are not associated with uterine contractions.

- Drop below baseline is at least 15 bpm and lasting at least 15 seconds
  2 minutes before returning to baseline.
- Shape of the fetal heart rate decrease and recovery pattern is frequently irregular.

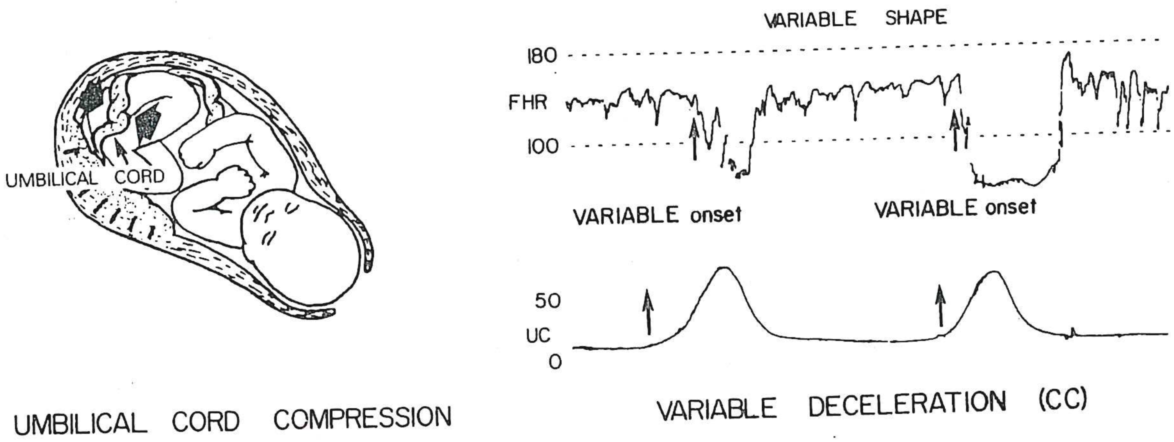

Figure 3.7. Variable Deceleration Pattern.
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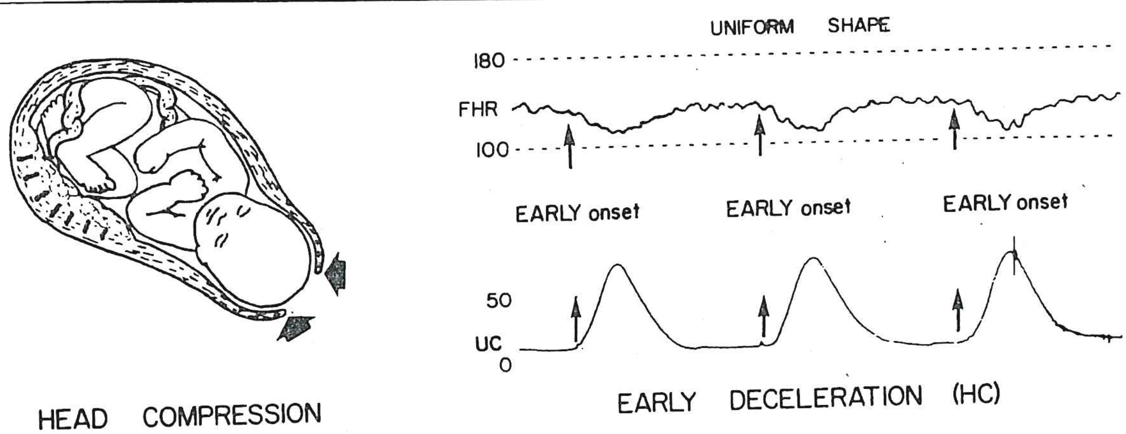

Figure 3.5. Early Deceleration Pattern.
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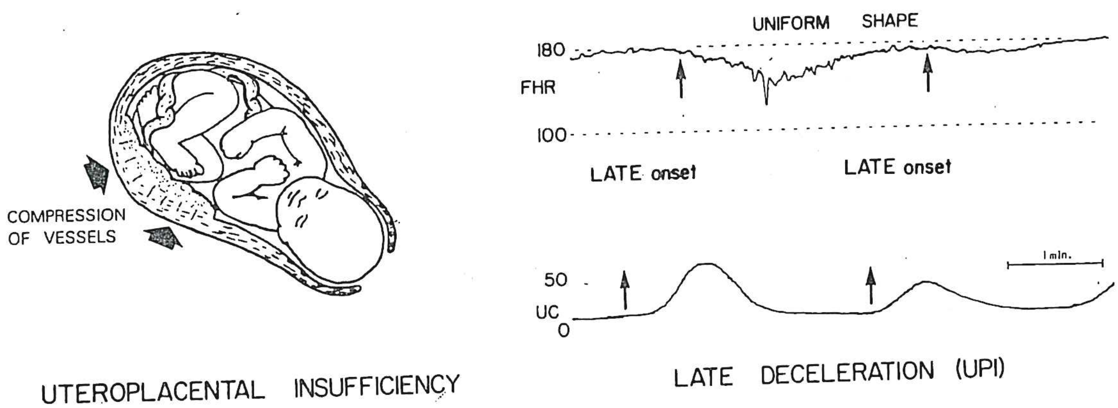

Figure 3.6. Late Deceleration Pattern.
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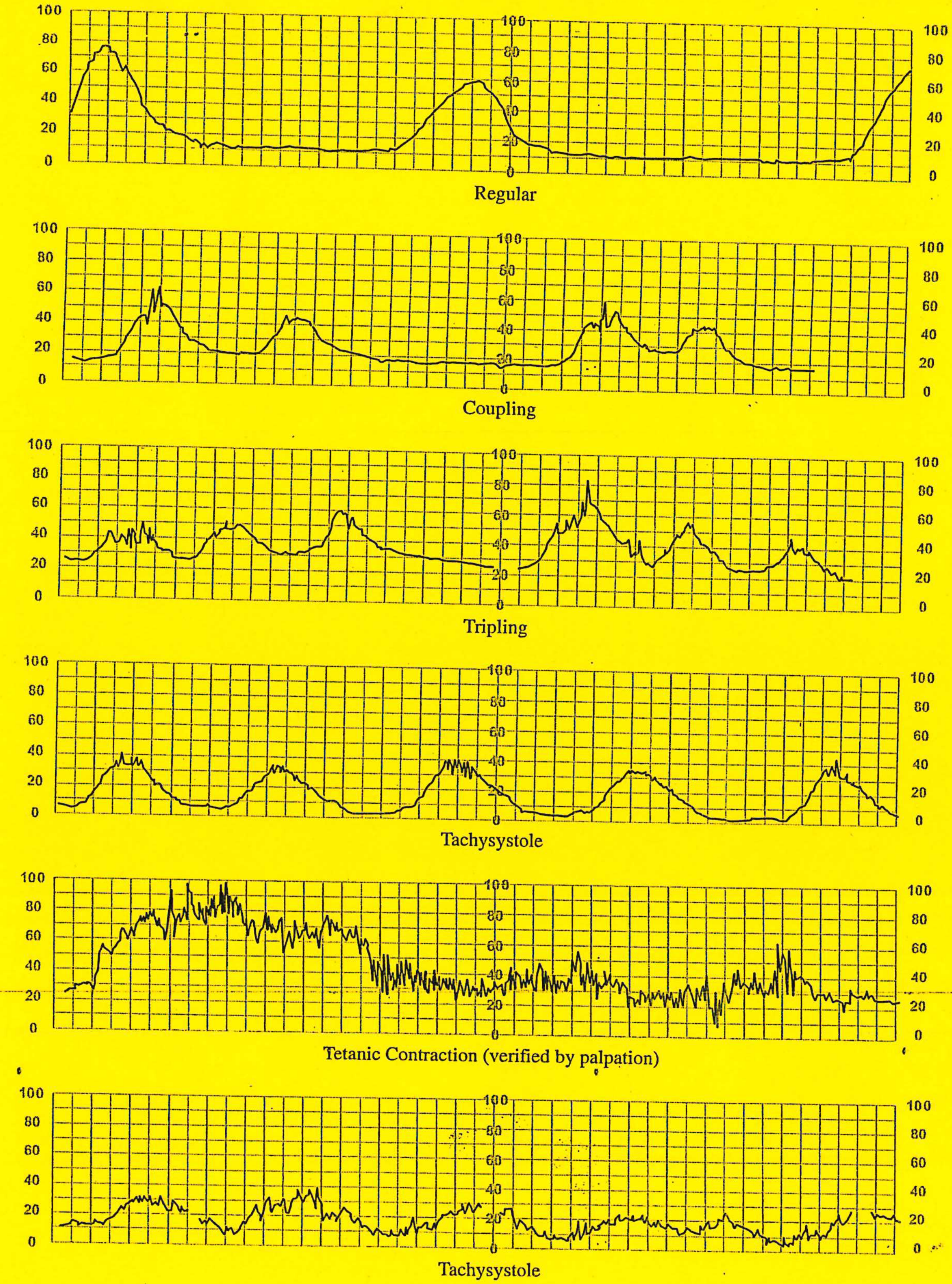

FIGURE 6-20

Samples of Uterine Activity That Represents a Regular Uterine Contraction Pattern and Variations (Tocodynamometer)