
به نام خدا

INTRAPARTUM FHR MONITORING

CANDIDATES FOR INTRAPARTUM FETAL MONITORING

American College of Obstetricians and Gynecologists :

- Either continuous electronic FHR monitoring or intermittent auscultation is acceptable in uncomplicated patients.

- High-risk pregnancies (eg, preeclampsia, suspected growth restriction, type 1 diabetes mellitus) should be monitored continuously during labor.

National Institute for Health and Care Excellence

- **In all birth settings, offer intermittent auscultation to low-risk women in the first stage of labor. Do not perform cardiotocography in low-risk women.**

- **•Advise continuous cardiotocography if any of the following risk factors occur during labor:**

- **-Suspected chorioamnionitis, sepsis, or temperature ≥38°C**

- **-Severe hypertension (≥160/110 mmHg)**

- **-Oxytocin use**

- **-Significant meconium**

- **-Fresh vaginal bleeding**

- **•If continuous cardiotocography was used because of concerns arising from intermittent auscultation but the tracing is normal after 20 minutes of observation, remove the cardiotocograph and return to intermittent auscultation.**

NICHD definitions of FHR characteristics and patterns

Variability

1. Fluctuations in baseline that are irregular in amplitude and frequency
2. Absent = amplitude undetectable
3. Minimal = amplitude 0 to 5 bpm
4. Moderate = amplitude 6 to 25 bpm
5. Marked = amplitude over 25 bpm
6. Measured in a 10-minute window. The amplitude is measured peak to trough. There is no distinction between short-term and long-term variability.

Baseline rate

- Bradycardia = below 110 bpm
- Normal = 110 to 160 bpm
- Tachycardia = over 160 bpm
- The baseline rate is the mean bpm (rounded to 0 or 5) over a 10-minute interval, excluding periodic changes, periods of marked variability, and segments that differ by more than 25 bpm. The baseline must be identifiable for two minutes during the interval (but not necessarily a contiguous two minutes); otherwise, it is considered indeterminate.

Acceleration

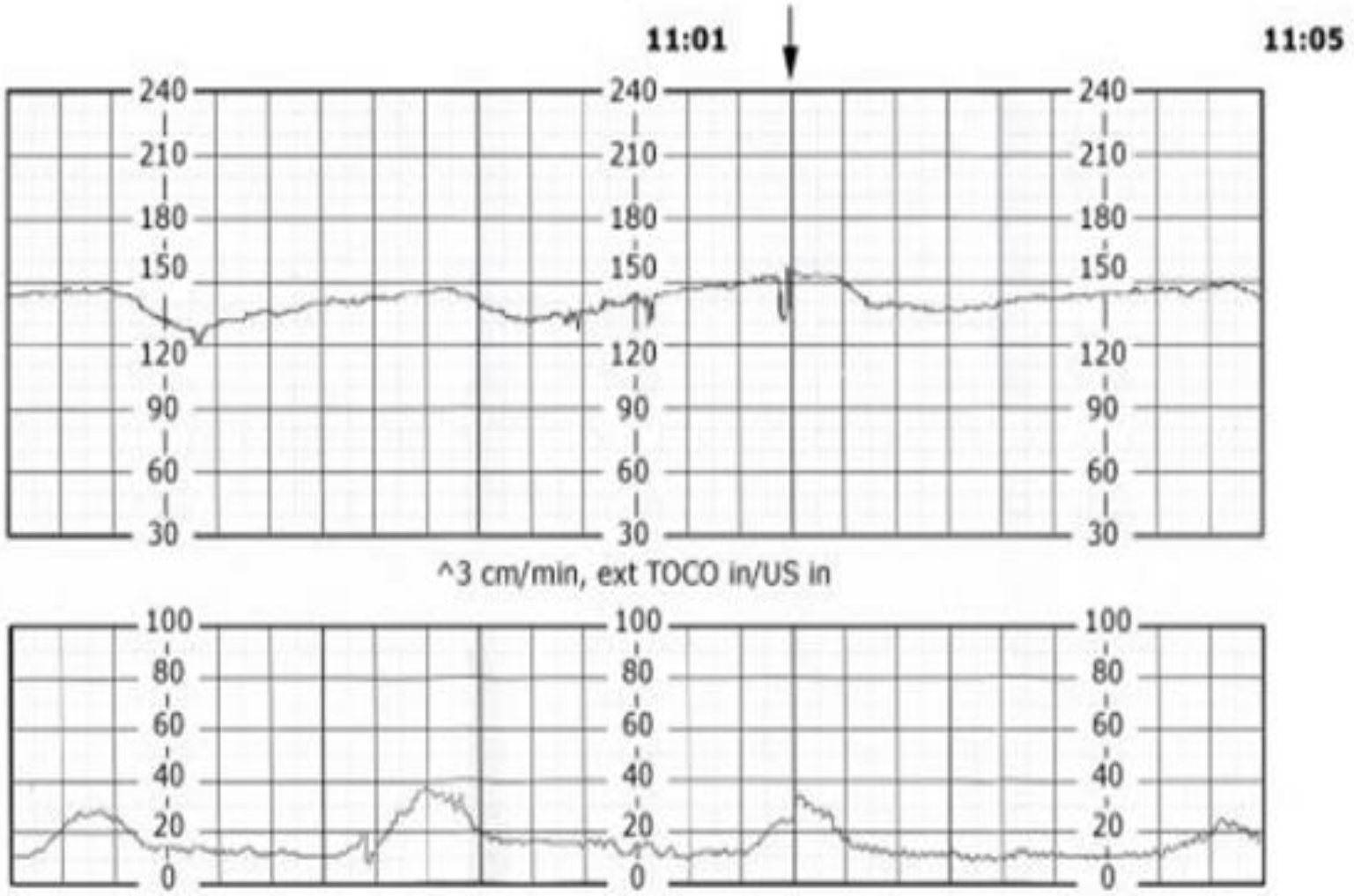
- An abrupt* increase in the FHR. Before 32 weeks of gestation, accelerations should last ≥10 sec and peak ≥10 bpm above baseline. As of 32 weeks gestation, accelerations should last ≥15 sec and peak ≥15 bpm above baseline.
- A prolonged acceleration is ≥2 minutes but less than 10 minutes. An acceleration of 10 minutes or more is considered a change in baseline.

Late deceleration

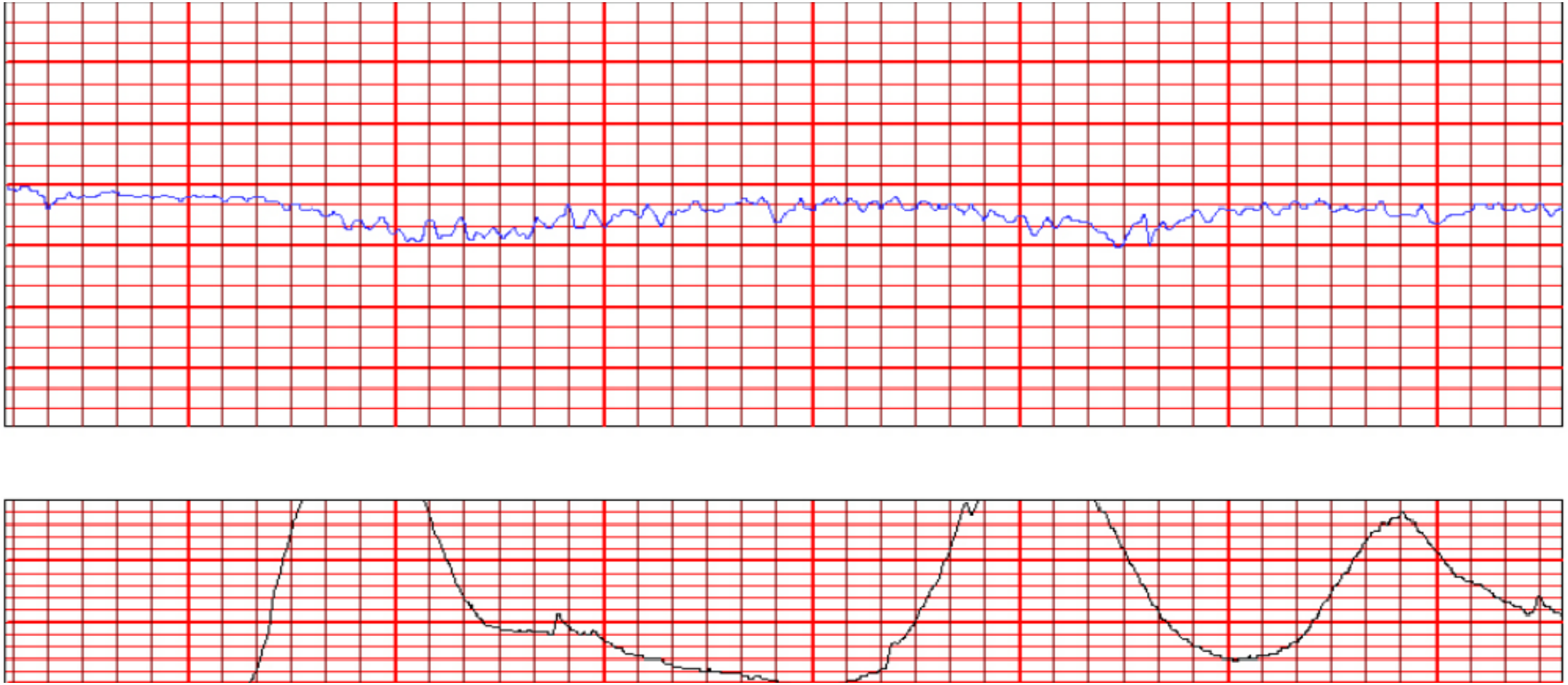
- A gradual* decrease and return to baseline of the FHR associated with a uterine contraction. The deceleration is delayed in timing, with the nadir of the deceleration occurring after the peak of the contraction.
- The onset, nadir, and recovery usually occur after the onset, peak, and termination of a contraction.

Late decerelation

e decelerations



late decelerations



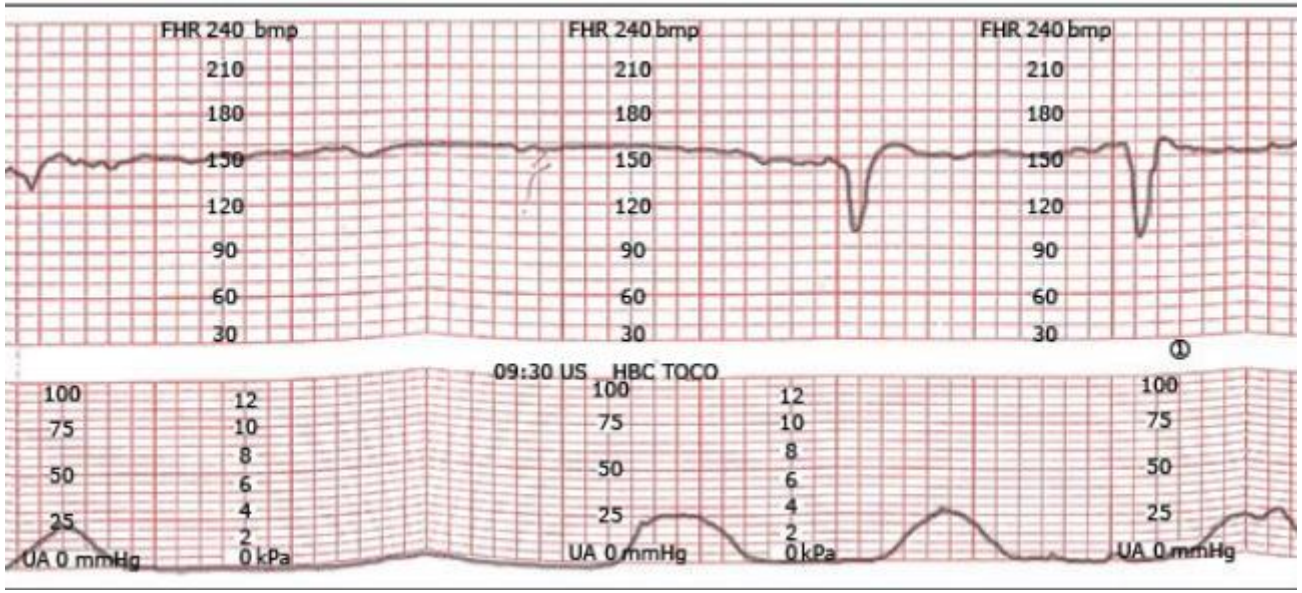
Early deceleration

- A gradual* decrease and return to baseline of the FHR associated with a uterine contraction. The nadir of the FHR and the peak of the contraction occur at the same time. The deceleration's onset, nadir, and termination are usually coincident with the onset, peak, and termination of the contraction.

Variable deceleration

- An abrupt* decrease in FHR below the baseline.
- The decrease is ≥15 bpm, lasting ≥15 secs and <2 minutes from onset to return to baseline.
- The onset, depth, and duration of variable decelerations commonly vary with successive uterine contractions.

Absent variability with recurrent variable decelerations



Prolonged deceleration

- A decrease in FHR below the baseline of 15 bpm or more, lasting at least 2 minutes but <10 minutes from onset to return to baseline.

- A prolonged deceleration of 10 minutes or more is considered a change in baseline.

NICHD CLASSIFICATION OF FHR PATTERNS

Category I

Baseline 110 to 160 beats per minute with moderate variability and no late or variable decelerations. Accelerations and early decelerations may be present or absent.	This is a normal tracing.	Intermittent or continuous fetal monitoring based on clinical status and underlying risk factors Review every 30 minutes in the first stage and every 15 minutes in the second stage of labor.

- Category II FHR patterns include all FHR patterns that are not classified as category I (normal) or category III (abnormal)
- The American College of Obstetricians and Gynecologists considers category II tracings as indeterminate as they comprise a diverse spectrum of FHR patterns that require evaluation, ongoing surveillance, initiation of appropriate corrective measures when indicated, and reevaluation
- The Society of Obstetricians and Gynaecologists of Canada classifies these tracings as "atypical" ,
- The potential for development of fetal acidosis varies widely across the different types of category II patterns

Category II

Intermittent variable decelerations (<50 percent of contractions)	Common finding usually associated with normal outcome.	No intervention required.

Recurrent variable decelerations (>50 percent of contractions)	Umbilical cord compression. May be associated with impending acidemia, especially if progressive increase in depth, duration, and frequency. Moderate variability and/or accelerations suggest fetus is not currently acidemic.	Reposition mother to left or right lateral. Amnioinfusion is an option. Adjunctive measures to promote fetal oxygenation (oxygen supplementation, intravenous fluid bolus, reduce uterine contraction frequency) may be useful. Initiate scalp stimulation to provoke fetal heart rate acceleration, which is a sign that the fetus is not acidotic. Delivery is indicated if tracing does not improve and acidemia suspected.

Category II

Recurrent late decelerations	**Transient or chronic uteroplacental insufficiency, such as from hypotension, tachystole, or maternal hypoxia.** **Accelerations and/or moderate variability suggest fetus is not currently acidemic.**	**Reposition mother to left or right lateral. Adjunctive measures to promote fetal oxygenation include oxygen supplementation, intravenous fluid bolus, reduce uterine contraction frequency. Persistent late decelerations with minimal variability and absent accelerations suggest fetal acidemia; this is even more likely if variability is absent (category III). Initiate scalp stimulation to provoke fetal heart rate acceleration, which is a sign that the fetus is not acidotic.**
		Delivery is indicated if tracing does not improve.

Category II

Bradycardia (baseline heart rate less than 110 beats per minute for at least 10 minutes)	Acute onset may be due to hypotension, umbilical cord occlusion, rapid fetal descent, tachysystole, abruption, uterine rupture. Fetal acidemic more likely when associated with minimal or absent variability and absent accelerations during baseline periods.	Treat underlying cause, if known. Initiate scalp stimulation to provoke fetal heart rate acceleration, which is a sign that the fetus is not acidotic. Delivery is indicated if tracing does not improve and acidemia suspected.
Prolonged decelerations (15 beats per minute drop below baseline for more than 2 and less than 10 minutes)		

Category II

Fetal tachycardia (baseline heart rate greater than 160 beats per minute for at least 10 minutes)	Infection, medication, maternal medical disorders, obstetric complications, fetal tachyarrhythmia (typically rate over 200 beats per minute Fetal acidemic more likely when associated with minimal or absent variability, absent accelerations, and/or recurrent decelerations.	Treat underlying cause, if known. Initiate scalp stimulation to provoke fetal heart rate acceleration, which is a sign that the fetus is not acidotic.
		Delivery is indicated if tracing does not improve and acidemia suspected.

Minimal variability	Fetal sleep, medication, fetal acidemia. If due to fetal sleep, should recover in 20 to 60 minutes. If due to maternal medication, should recover as medication wears off.	**If decreased fetal oxygenation suspected, reposition mother to left or right lateral. Adjunctive measures to promote fetal oxygenation include oxygen supplementation, intravenous fluid bolus, reduce uterine contraction frequency. Initiate scalp stimulation to provoke fetal heart rate acceleration, which is a sign that the fetus is not acidotic.** **If no improvement and no accelerations, delivery is indicated if acidemia suspected or confirmed by scalp pH.**

Tachysystole (more than 5 contractions in 10 minutes, averaged over 30 minutes) with fetal heart rate changes . Tachysystole that is spontaneous and associated with a normal fetal heart rate pattern does not require treatment, but the possibility of placental abruption as the underlying etiology should be considered.	Spontaneous labor: Tachysystole may be associated with fetal acidemia if accompanied by recurrent fetal heart rate decelerations.	Reposition mother to left or right lateral, oxygen supplementation, intravenous fluid bolus. If ineffective, reduce uterine contraction frequency with a tocolytic. Initiate scalp stimulation to provoke fetal heart rate acceleration, which is a sign that the fetus is not acidotic.
	Induction or augmentation·	Decrease or stop uterotonic medications. Reposition mother to left or right lateral, oxygen supplementation, intravenous fluid bolus. If ineffective, reduce uterine contraction frequency with a tocolytic. Initiate scalp stimulation to provoke fetal heart rate acceleration, which is a sign that the fetus is not acidotic.

conservative measures based on an assessment of the most likely cause(s):

- encourage the woman to mobilise or adopt an alternative position (and to avoid being supine)
- offer intravenous fluids if the woman is hypotensive
- reduce contraction frequency by reducing or stopping oxytocin if it is being used and/or offering a tocolytic drug (a suggested regimen is subcutaneous terbutaline 0.25 mg).

Ancillary tests

- Ancillary tests can be performed to gain more information, but there is no standard for evaluation of these fetuses.
- In general, FHR accelerations are highly predictive of normal fetal acid-base status and provide reassurance that expeditious delivery is unnecessary

1. Scalp stimulation
2. Fetal electrocardiogram
3. Fetal scalp blood sampling
4. Fetal pulse oximetry

Management

- Because of the wide spectrum and significance of category II patterns, various decision aids have been created to help with their identification, interpretation, and management, but these systems have not been well-validated.

- Patients with category II patterns are evaluated for factors that may reduce fetal oxygenation, taking into account associated clinical circumstances (eg, abruption, trial of labor after a previous cesarean delivery, intrauterine growth restriction), and the stage and progress of labor.

- Resuscitative measures can be initiated with frequent reassessment to determine whether to perform an operative intervention and the urgency of the intervention.

- Continued surveillance and frequent reassessment are indicated until the pattern resolves to category I or progresses to category III.
- However, there are virtually no data to inform decision-making as to how long to monitor a fetus with a persistent category II tracing despite use of standard interventions

Category III

Absent baseline variability and recurrent late decelerations, recurrent variable decelerations, or bradycardia	Increased risk of fetal acidemia.	Prepare for delivery and reposition mother to left or right lateral, oxygen supplementation, intravenous fluid bolus. Initiate scalp stimulation to provoke fetal heart rate acceleration, which is a sign that the fetus is not acidotic. If no improvement after conservative measures and scalp stimulation does not result in acceleration, delivery is advisable.

Category III

Sinusoidal	Increased risk of hypoxemia. Risk of acidemia increased if prolonged or amplitude of 15 beats per minute or more.	Prepare for delivery and reposition mother to left or right lateral, oxygen supplementation, intravenous fluid bolus. Initiate scalp stimulation to provoke fetal heart rate acceleration, which is a sign that the fetus is not acidotic. If no improvement after conservative measures and scalp stimulation does not result in acceleration, delivery is advisable.

The following are examples of some decision/interpretation aids:

- A five-tier FHR classification system has been proposed to identify fetuses at risk of developing acidosis .
- The system focuses on baseline FHR, variability, and decelerations to stratify the risk of evolution to acidemia.
- Depending on risk level, the system suggests different interventions, such as conservative measures or delivery.
- The five-tier has not been validated in a large prospective or randomized trial and no data are available to indicate that it improves neonatal outcome or reduces operative intervention.

- An online risk assessment calculator is available for management of category II tracings .
- It takes into account factors such as labor stage (latent or active first stage or second stage), labor progress (normal or abnormal), assessment of variability (presence/absence of moderate variability or accelerations), and assessment of decelerations (frequency and duration of recurrent decelerations).
- Based on information entered by the clinician, the calculator suggests observation or delivery.
- The algorithm on which the calculator is based has been reported to facilitate earlier recognition of some, but not all, FHR tracings associated with metabolic acidemia without increasing the rate of operative intervention
- . The performance of the calculator has not been assessed in a clinical trial.

- Artificial intelligence has also been used for interpretation of FHR tracings, but meta-analyses have concluded that it did not improve neonatal outcomes compared with usual clinical assessment of FHR tracings, and inter-rater reliability between experts and computer systems was moderate at best .

A Standardized Approach for Category II Fetal Heart Rate with Significant Decelerations: Maternal and Neonatal Outcomes

Laurence E Shields [1 2], Suzanne Wiesner [2], Catherine Klein [2], Barbara Pelletreau [2], Herman L Hedriana [3]

Affiliations + expand

PMID: 29895077 DOI: 10.1055/s-0038-1660459

- n 2018, one group described a standardized algorithm for the management of category II FHR tracings with recurrent "significant" FHR decelerations, defined as late decelerations, prolonged decelerations, or variable decelerations lasting at least 60 seconds and reaching a nadir of ≤60 bpm or at least 60 bpm below baseline . Six hospitals in a large health system participated in a cohort study comparing maternal and neonatal outcomes before and after the introduction of the algorithm. Fetal monitor tracings that demonstrated moderate (or marked) variability and significant decelerations with >50 percent of contractions for 30 minutes were managed as follows:

- •If cervical dilation was <4 cm and recurrent decelerations did not resolve with conservative corrective measures, delivery was accomplished.

- •If cervical dilation was ≥4 cm, labor was permitted to continue only if progress was normal (first stage: cervical dilation ≥1 cm/hour; second stage: descent with pushing, total duration ≤90 minutes).

- •Delivery was indicated if criteria for normal labor progress were not met or if the FHR tracing demonstrated a persistent pattern of minimal-absent variability.

- Nearly 98 percent of screened patients were managed according to the algorithm. After its introduction, the rate of primary cesarean birth fell from 19.8 to 18.3 percent, low 5-minute Apgar scores fell from 2.3 to 1.7 percent, and a composite of severe newborn complications fell from 1.6 to 1.2 percent (all statistically significant differences).

Am J Obstet Gynecol. 2020 May;222(5):401-414. doi: 10.1016/j.ajog.2020.01.025. Epub 2020 Jan 21.

Safety and efficacy of sildenafil citrate to reduce operative birth for intrapartum fetal compromise at term: a phase 2 randomized controlled trial

Jessica Turner [1], Liam Dunn [2], William Tarnow-Mordi [3], Christopher Flatley [2], Vicki Flenady [2], Sailesh Kumar [4]

Affiliations + expand

PMID: 31978434 DOI: 10.1016/j.ajog.2020.01.025

Abstract

Background and objective: Sildenafil citrate is a vasodilator used in erectile dysfunction and pulmonary hypertension. We tested whether it reduces emergency operative births for fetal compromise and improves fetal or uteroplacental perfusion in labor in a phase 2 double-blind randomized controlled trial.

INVESTIGATIONAL PREVENTIVE THERAPY

- Sildenafil citrate has marked vasodilatory effects on the pelvic and pulmonary circulations
- It has been hypothesized that, if given prophylactically in early labor, its favorable effects on uteroplacental and fetal blood flow may reduce the frequency of intrapartum fetal distress and, in turn, emergency cesarean or operative vaginal delivery for this indication.

- In a trial that randomly assigned 300 pregnant women at term in early labor to receive sildenafil (50 mg orally every eight hours to a maximum of three doses) or placebo, sildenafil reduced the frequency of strictly defined pathologic FHR patterns by 43 percent (25.3 versus 44.7 percent, relative risk [RR] 0.57, 95% CI 0.41-0.79) .
- Importantly, sildenafil was associated with a 51 percent reduction in emergency operative deliveries (18 versus 36.7 percent, RR 0.49, 95% CI 0.33-0.73), without an increase in adverse neonatal outcomes (20.7 versus 21.3 percent, RR 0.97, 95% CI 0.62-1.50).
- Maternal side effects were mild and self-limited, and there was no increase in postpartum bleeding.

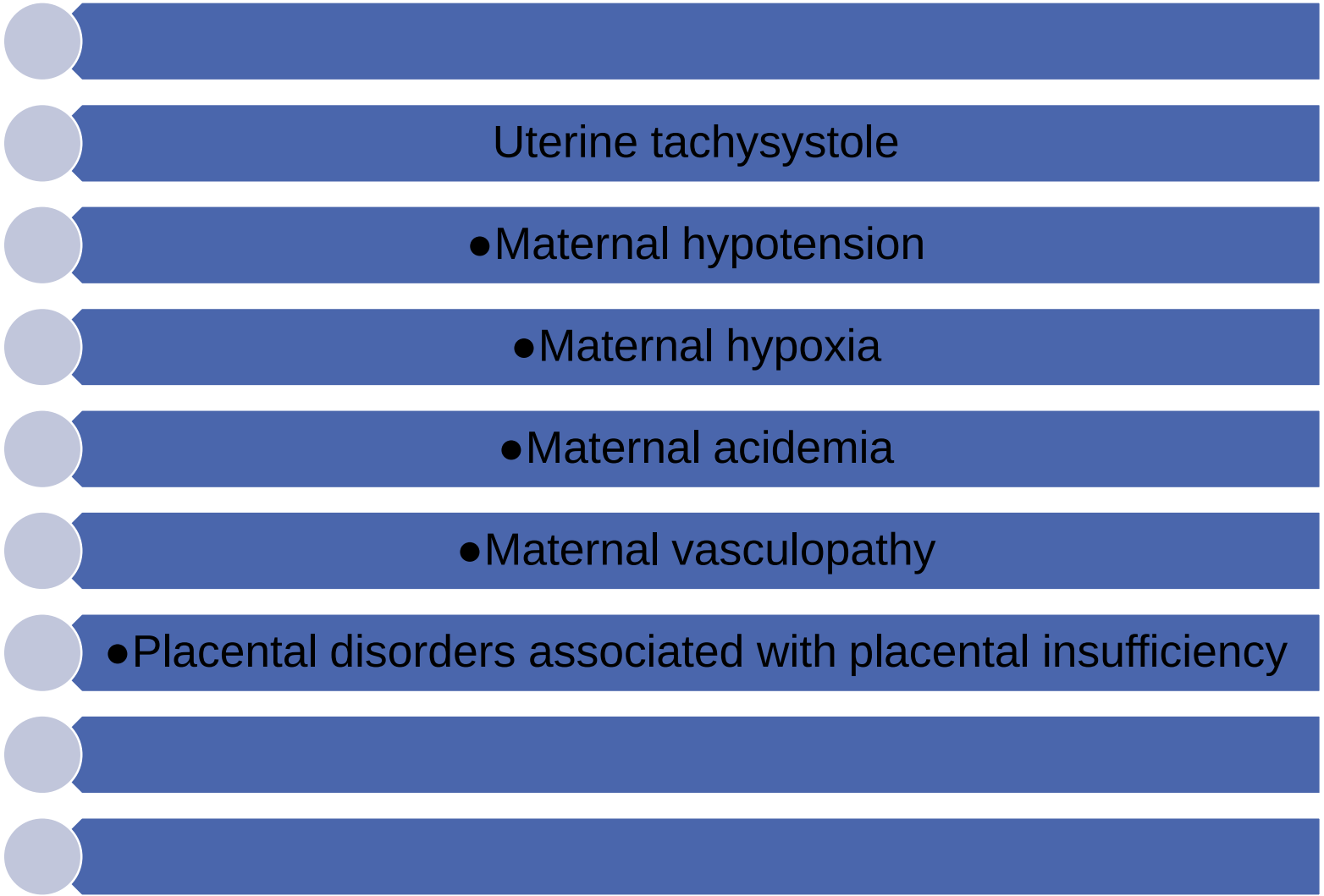
FIGO cardiotocography classification

	Normal	Suspicious	Pathological
Baseline	110 to 160 bpm	Lacking at least one characteristic of normality, but with no pathological features	<100 bpm
Variability	5 to 25 bpm	Lacking at least one characteristic of normality, but with no pathological features	Reduced variability, increased variability, or sinusoidal pattern
Decelerations	No repetitive[¶] decelerations	Lacking at least one characteristic of normality, but with no pathological features	Repetitive[¶] late or prolonged decelerations during >30 minutes or 20 minutes if reduced variability, or one prolonged deceleration with >5 minutes
Interpretation	Fetus with no hypoxia/acidosis	Fetus with a low probability of having hypoxia/acidosis	Fetus with a high probability of having hypoxia/acidosis
Clinical management	No intervention necessary to improve fetal oxygenation state	Action to correct reversible causes if identified, close monitoring or additional methods to evaluate fetal oxygenation[1]	Immediate action to correct reversible causes, additional methods to evaluate fetal oxygenation[1], or if this is not possible expedite delivery In acute situations (cord prolapse, uterine rupture, or placental abruption) immediate delivery should be accomplished

Late decelerations without loss of variability or accelerations

- recurrent late decelerations are caused by a reflex central nervous system (CNS) response to fetal hypoxia and acidemia, as well as direct myocardial depression and humoral factors

Fetal hypoxia leading to late decelerations may occur in the following settings



- Assessment of FHR variability and accelerations should be part of the evaluation of recurrent late decelerations, given the low predictive value of late decelerations alone for fetal acidosis and poor neonatal outcome .
- Moderate variability is strongly associated (98 percent) with an umbilical pH >7.15
- and spontaneous or elicited FHR accelerations are strongly associated with pH>7.10
- Category II patterns that become category I do not require any intervention.
- Patients with persistent category II patterns are closely monitored for progression to category III pattern, which develops when fetal compensatory mechanisms fail to maintain adequate cerebral and tissue oxygenation, leading to fetal acidosis.
- Expeditious delivery of these fetuses is indicated.

- The duration of time for which it is safe to closely monitor a category II tracing with late decelerations without loss of either variability or accelerations depends on the specific clinical setting.

Assessment of FHR variability and accelerations should be part of the evaluation of recurrent late decelerations, given the low predictive value of late decelerations alone for fetal acidosis and poor neonatal outcome . Moderate variability is strongly associated (98 percent) with an umbilical pH >7.15

The duration of time for which it is safe to closely monitor a category II tracing with late decelerations without loss of either variability or accelerations depends on the specific clinical setting.

category II patterns that become category I do not require any intervention.

Patients with persistent category II patterns are closely monitored for progression to category III pattern, which develops when fetal compensatory mechanisms fail to maintain adequate cerebral and tissue oxygenation, leading to fetal acidosis. Expeditious delivery of these fetuses is indicated.

and spontaneous or elicited FHR accelerations are strongly associated with pH>7.10

Fetal tachycardia

- **fetal tachycardia is defined as a baseline FHR greater than 160 bpm for at least 10 minutes**
- **Causes of fetal tachycardia include:**

1. **Maternal-fetal infection**
2. **●Medications (eg, beta-agonists, atropine, cocaine)**
3. **●Maternal hyperthyroidism**
4. **●Placental abruption**
5. **●Fetal hypoxia**
6. **●Elevated maternal catecholamine levels**

- Rarely, fetal tachycardia can be due to a fetal tachyarrhythmia, such as atrial flutter or supraventricular tachycardia.
- These tachyarrhythmias are characterized by a very high FHR, often in excess of 200 bpm.
- Fetal tachycardia less than 200 bpm alone has not been strongly associated with fetal acidemia, unless associated with recurrent decelerations, absent accelerations, or minimal/absent variability
- assessment for maternal infection or abruption and a review of maternal medications.

Appropriate treatment

- should be initiated if the underlying cause can be identified and treated (eg, acetaminophen for reduction of fever and antibiotics for treatment of intra-amniotic infection).
- In addition, fetal scalp stimulation should be performed to provoke FHR acceleration, which is a sign that the fetus is not acidotic.
- Delivery is indicated if acidemia or placental abruption is suspected.
- Tachycardia due to chorioamnionitis is generally not an indication for delivery unless decelerations or category III pattern is present, or if the patient is remote from delivery and the tachycardia does not resolve with maternal hydration

Variable decelerations without loss of variability or accelerations

- Variable decelerations occur when the umbilical cord is compressed. Intermittent variable decelerations (associated with <50 percent of contractions) are frequently observed intrapartum and usually associated with moderate variability and/or accelerations.
- They do not typically result in adverse consequences, presumably because transient cord compression is well tolerated by the fetus
- . Thus, they do not require intervention.

Metabolic acidosis or mixed metabolic and respiratory acidosis

- can develop, however, with increasing duration, depth, and frequency of variable decelerations
- Therefore, recurrent variable decelerations (>50 percent of contractions) require close surveillance for loss of variability and accelerations, which signify a category III pattern
- In utero resuscitation measures are indicated, with the major focus to resolve cord compression. Change of maternal position is a reasonable first treatment option .
- A vaginal examination may be appropriate to assess for cord prolapse
- Delivery is indicated if a category III pattern develops.

Loss of variability without decelerations

- FHR variability results from oscillatory input by the parasympathetic nervous system. The new onset of minimal variability (amplitude 0 to 5 bpm) may occur for several reasons, including
- **Fetal sleep cycle** – These cycles generally last approximately 20 minutes, but may persist for as long as one hour. When the fetal sleep cycles are over, moderate variability should return.
- **Central nervous system (CNS) depressants** – The most common medications that decrease variability are opioids and magnesium sulfate. The effect of maternal opioids on FHR variability generally lasts no more than two hours.
- **Fetal hypoxemia**.

- If the FHR pattern had been normal and there are no decelerations, a reasonable approach to the assessment and management of new onset minimal fetal variability is to make a presumptive diagnosis of a fetal sleep cycle or the effect of recently administered maternal medications.

- Both of these causes warrant expectant management. It is also prudent to attempt to induce accelerations with scalp stimulation, as the presence of accelerations is strong evidence of the absence of fetal acidemia at that time .
- A maternal fluid bolus, repositioning, and/or maternal oxygen administration are appropriate adjunctive measures , especially in settings in which a benign etiology is less certain, such as coexistent pregnancy complications associated with uteroplacental insufficiency.
- Long-standing loss of variability can be related to congenital or acquired anomalies of the CNS or heart, or to very preterm gestation

Fetal bradycardia/prolonged deceleration without loss of variability

- Fetal bradycardia (below 110 bpm) or a prolonged deceleration is approached in a similar way clinically, since the distinction between these two entities is based primarily on the number of minutes of the decrease in FHR. The causes of prolonged deceleration or fetal bradycardia include:

- Rapid fetal descent
- Cord prolapse
- Placental abruption
- Maternal hypotension
- Uterine rupture
- Tachysystole

If variability and accelerations are present when the FHR returns to a normal baseline rate, fetal acidemia is unlikely.

Treatment of fetal bradycardia or prolonged deceleration is aimed at the cause.

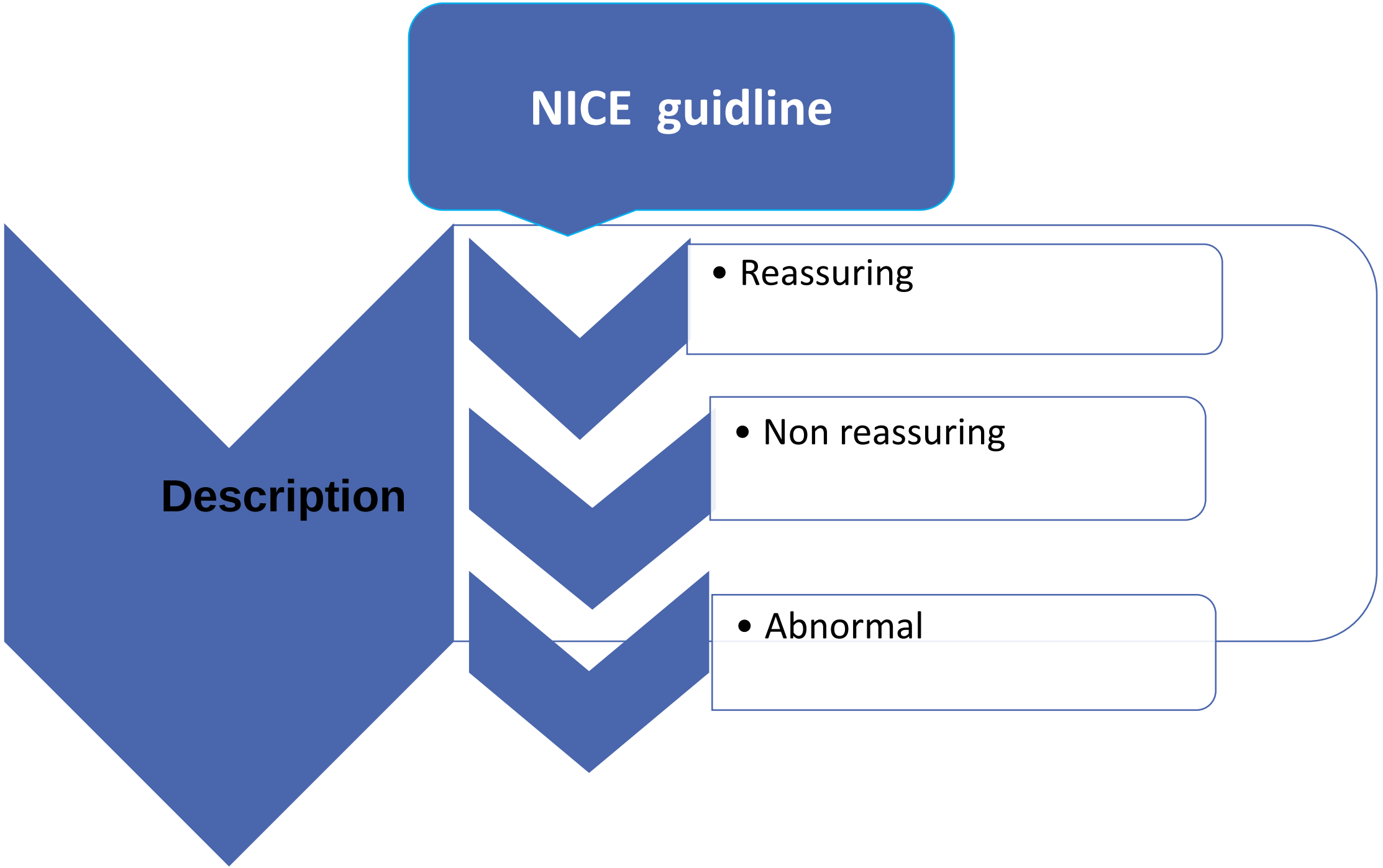
- Evaluation should include
- assessment of maternal blood pressure and
- contraction frequency and strength, and
- physical examination for evidence of rapid fetal descent, cord prolapse, placental abruption, or uterine rupture.

Delivery

- Delivery is indicated if resuscitative measures to correct the underlying cause are not possible or fail to resolve the bradycardia.
- In one study of 5388 term, singleton pregnancies at full dilation with a nonanomalous fetus in cephalic presentation, a terminal deceleration occurred in 951 (17.7 percent) and only 12 (1.3 percent) had umbilical cord gas arterial pH <7.10 .
- Of the 31 who had terminal bradycardia (FHR <110 bpm for ≥10 minutes before delivery), 4 had an umbilical cord gas arterial pH ≤7.10. Although infants with terminal bradycardia were at increased risk of acidemia, the positive predictive value was only 12.9 percent.
- The authors also noted a positive association between increasing duration of a terminal deceleration beyond two minutes and decreasing pH (pH decreased by 0.042 for every additional two minutes after the first two minutes).

In utero resuscitation

- Reposition mother to left or right lateral position
- Administer oxygen
- Administer an intravenous fluid bolus
- Discontinue uterotonic drugs
- Administer a tocolytic
- Consult the anesthesia team in patients who were recently given neuraxial drugs
- Consider hands and knees position and amnioinfusion in patients with recurrent variable decelerations, prolonged decelerations, or bradycardia
- If umbilical cord prolapse is noted, elevate the presenting part while preparing for operative delivery


NICE guidline
Description
• Reassuring
• Non reassuring
• Abnormal

Description	Feature		
	Baseline (beats/ minute)	**Baseline variability (beats/ minute)**	**Decelerations**
Reassuring	110 to 160	5 to 25	None or early Variable decelerations with no concerning characteristics* for less than 90 minutes
Non-reassuring	100 to 109† OR 161 to 180	Less than 5 for 30 to 50 minutes OR More than 25 for 15 to 25 minutes	Variable decelerations with no concerning characteristics* for 90 minutes or more OR Variable decelerations with any concerning characteristics* in up to 50% of contractions for 30 minutes or more OR Variable decelerations with any concerning characteristics* in over 50% of contractions for less than 30 minutes OR Late decelerations in over 50% of contractions for less than 30 minutes with no maternal or fetal clinical risk factors such as vaginal bleeding or significant meconium
Abnormal	Below 100 OR Above 180	Less than 5 for more than 50 minutes OR More than 25 for more than 25 minutes	Variable decelerations with any concerning characteristics* in over 50% of contractions for 30 minutes (or less if any maternal or fetal clinical risk factors [see above]) OR Late decelerations for 30 minutes (or less if any maternal or fetal clinical risk factors) OR Acute bradycardia, or a single prolonged deceleration lasting 3 minutes or more

Category	Definition	Management
Normal	All features are reassuring	• **Continue CTG (unless it was started because of concerns arising from intermittent auscultation and there are no ongoing risk factors** • **Talk to the woman and her birth companion(s) about what is happening**
Suspicious	1. **non-reassuring feature** **AND** ٢ **reassuring features**	• **Correct any underlying causes, such as hypotension or uterine hyperstimulation** • **Perform a full set of maternal observations** • **Start 1 or more conservative measures*** • **Inform an obstetrician or a senior midwife** • **Document a plan for reviewing the whole clinical picture and the CTG findings** • **Talk to the woman and her birth companion(s) about what is happening and take her preferences into account**
Pathological	1. **abnormal feature** **OR** ٢ **non-reassuring features**	• **Obtain a review by an obstetrician and a senior midwife** • **Exclude acute events (for example, cord prolapse, suspected placental abruption or suspected uterine rupture)** • **Correct any underlying causes, such as hypotension or uterine hyperstimulation** • **Start 1 or more conservative measures*** • **Talk to the woman and her birth companion(s) about what is happening and take her preferences into account** • **If the cardiotocograph trace is still pathological after implementing conservative measures:** – **obtain a further review by an obstetrician and a senior midwife** – **offer digital fetal scalp stimulation** – **and document the outcome** • **If the cardiotocograph trace is still pathological after fetal scalp stimulation:** – **consider fetal blood sampling** – **consider expediting the birth** – **take the woman's preferences into account**

- Regard the following as concerning characteristics of variable decelerations:
- lasting more than 60 seconds
- reduced baseline variability within the deceleration;
- failure to return to baseline; biphasic (W) shape; no shouldering. Although a baseline fetal heart rate between 100 and 109 beats/minute is a non-reassuring feature, continue usual care if there is normal baseline variability and no variable or late decelerations

Need for urgent intervention	Acute bradycardia, or a single prolonged deceleration for 3 minutes or more	• Urgently seek obstetric help • If there has been an acute event (for example, cord prolapse, suspected placental abruption or suspected uterine rupture), expedite the birth • Correct any underlying causes, such as hypotension or uterine hyperstimulation • Start 1 or more conservative measures* • Make preparations for an urgent birth • Talk to the woman and her birth companion(s) about what is happening and take her preferences into account • Expedite the birth if the acute bradycardia persists for 9 minutes • If the fetal heart rate recovers at any time up to 9 minutes, reassess any decision to expedite the birth,