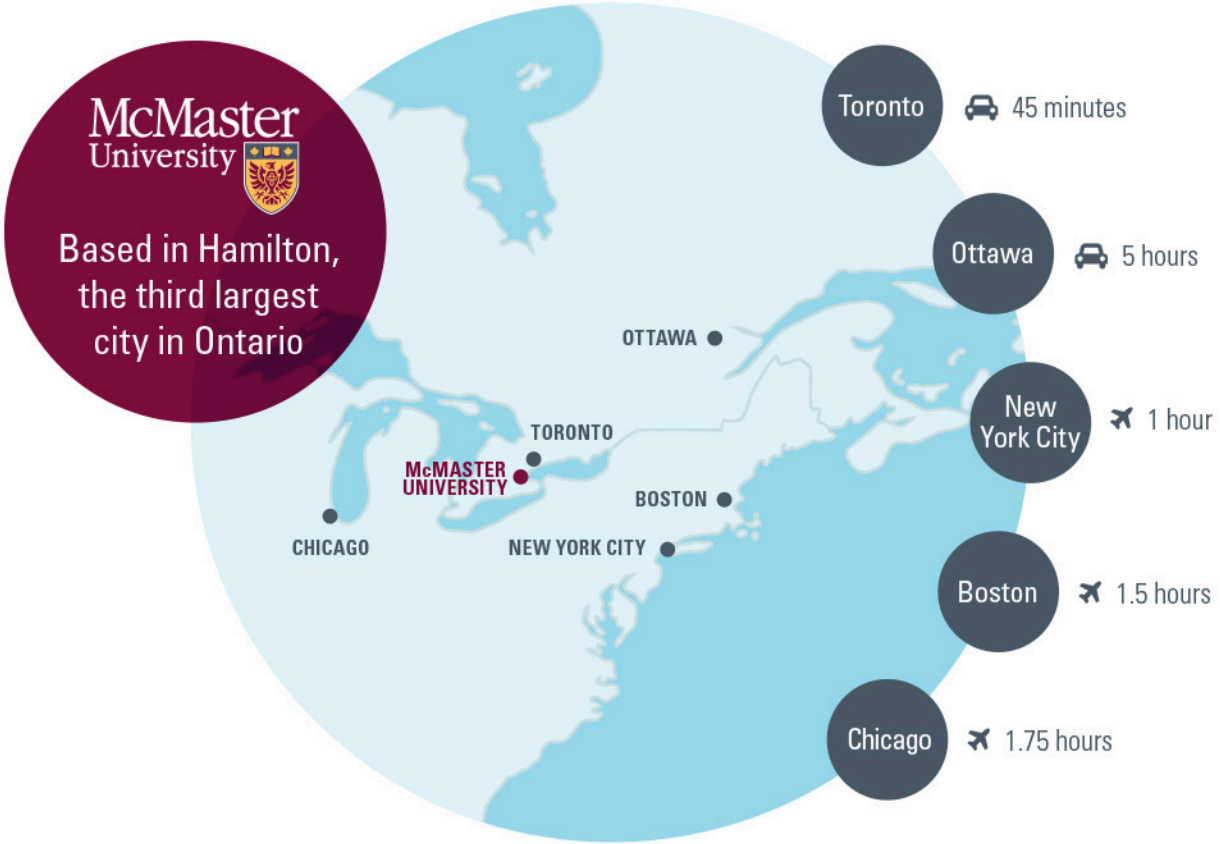
The Physiology of Fetal Asphyxia as reflected in International Classification of EFM patterns

April 25 2023

Professor Jon Barrett
Chair Dept OBGYN
McMaster University
Canada


350 acres
Between the Niagara Escarpment and the Royal Botanical Gardens


McMaster University
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45 minutes
Ottawa
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New York City
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BOSTON
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Boston
1.5 hours
Chicago
1.75 hours

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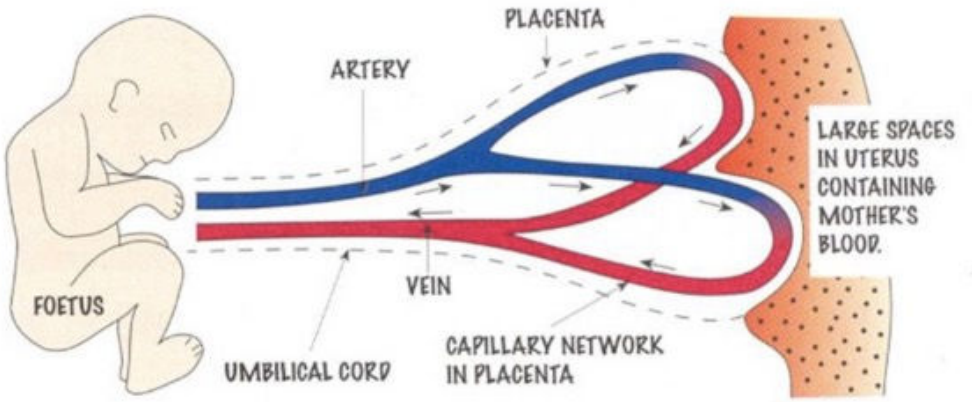
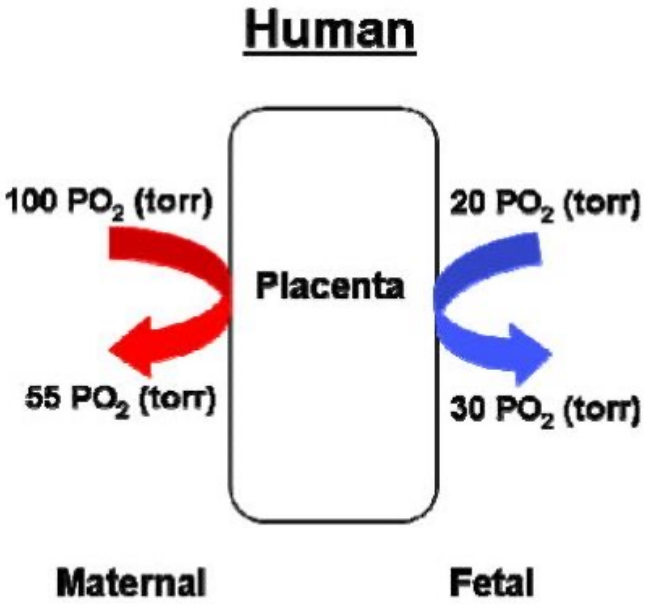
***Times Higher Education in partnership with Vertigo Ventures based on United Nations Sustainable Development Goals

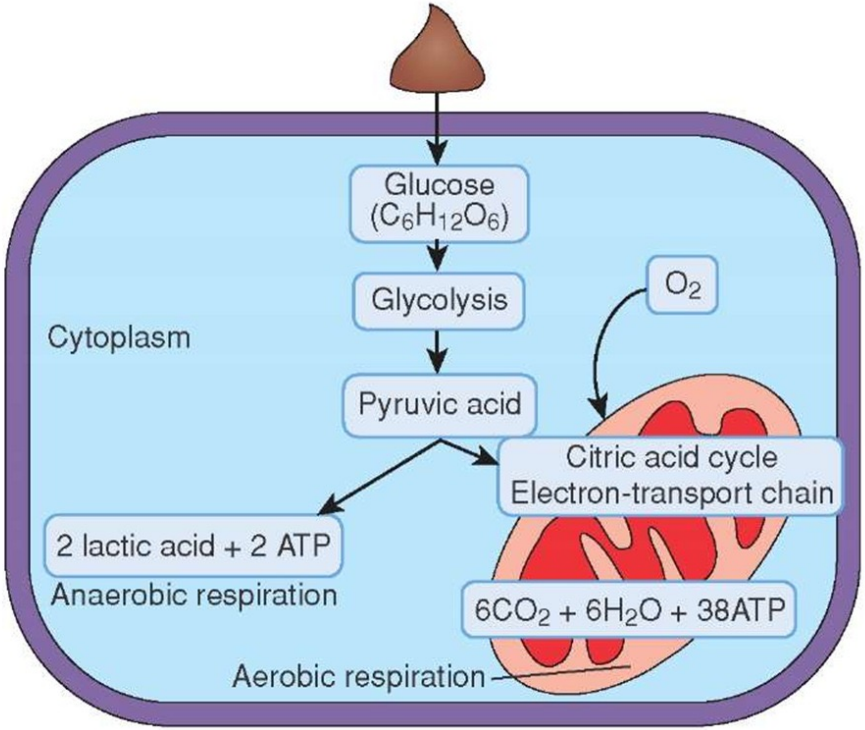
Starts with OXYGEN



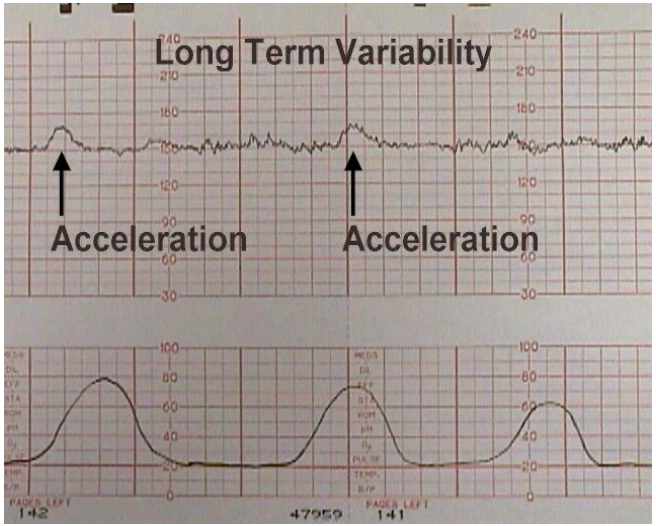
At the Placenta cell



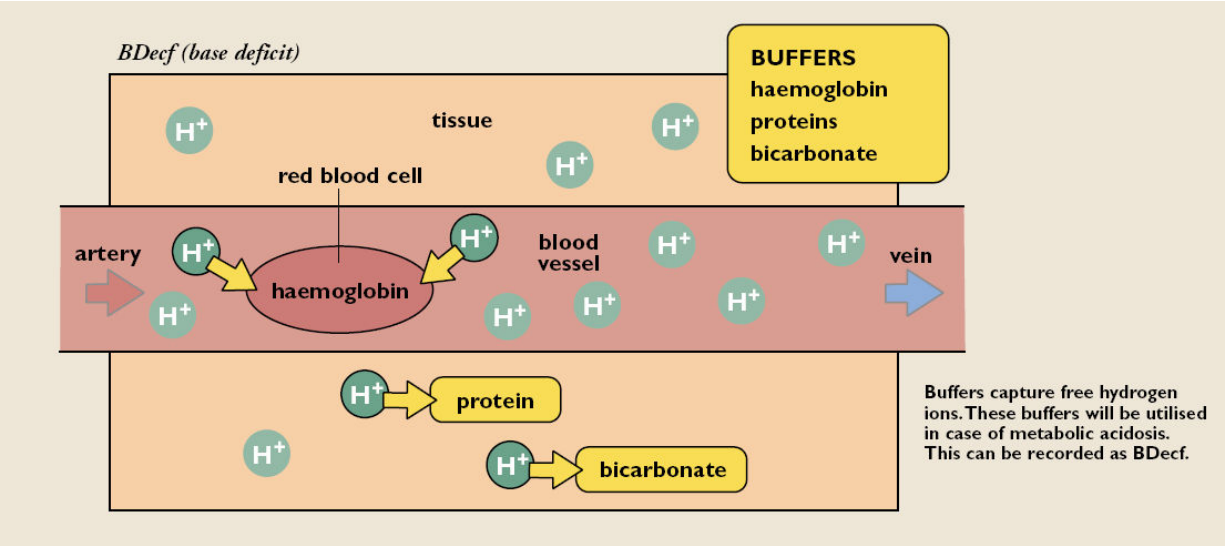
Metabolism -Aerobic and Anaerobic



Normal Metabolism - Category 1



What happens to the Acid



Whats happens to the CO2

Transporting CO_2 in blood

- Dissolved in blood plasma as bicarbonate ion

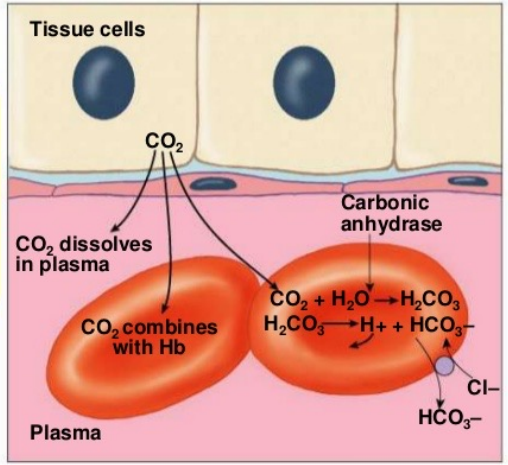
carbonic acid

$CO_2 + H_2O \rightarrow H_2CO_3$

carbonic anhydrase

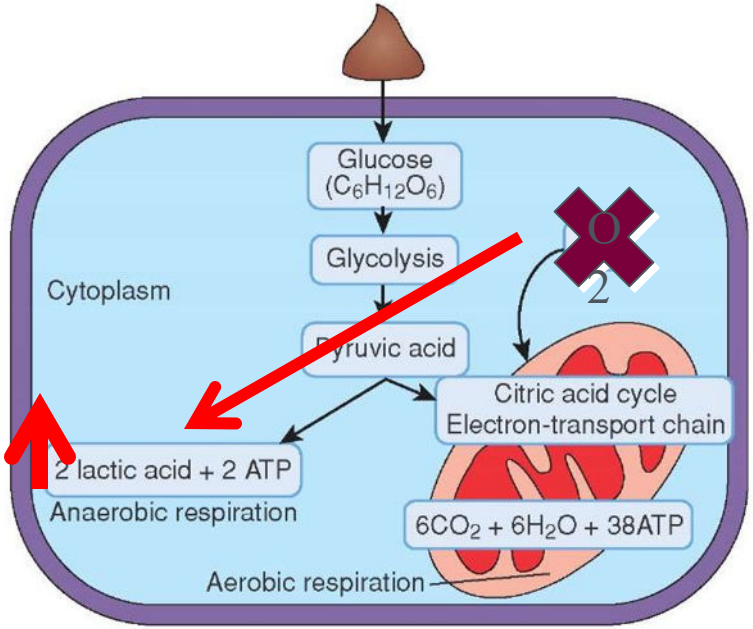
bicarbonate

$H_2CO_3 \rightarrow H^+ + HCO_3^-$

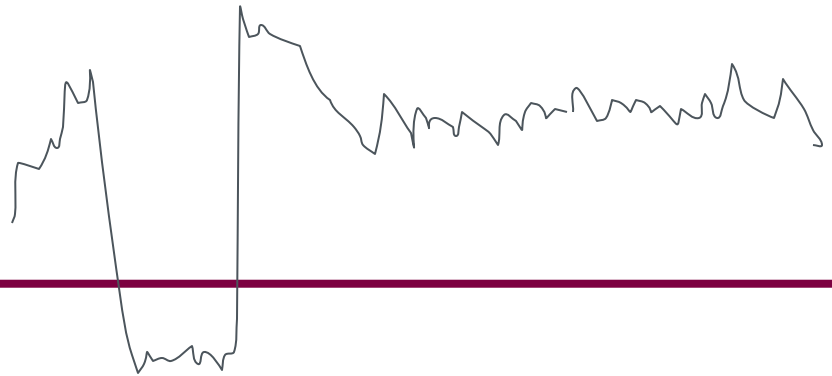


AP Biology

Late Decels = Lactic Acid



Variable Deceleration



Late Deceleration

Predictive Value of Electronic Fetal Monitoring for Intrapartum Fetal Asphyxia With Metabolic Acidosis

JAMES A. LOW, MD, RAHI VICTORY, MD, AND E. JANE DERRICK, BA

- *Objective*: To determine the predictive value of each fetal heart rate (FHR) variable and of patterns of FHR variables for fetal asphyxia during labor.

- *Methods*: Case-control study included an asphyxia group of 71 term infants with umbilical artery base deficit greater than 16 mmol/L and a control group of 71 term infants with umbilical artery base deficit less than 8 mmol/L.

- The FHR variables associated with fetal asphyxia included absent and minimal baseline variability and late and prolonged decelerations. Fetal heart rate patterns with absent baseline variability wer ethe most specific but identified only 17% of the asphyxia group. The sensitivity of this test increased to 93% with the addition of less specific patterns. The estimated positive predictive value ranged from 18.1% to 2.6%, and the negative predictive value ranged from 98.3% to 99.5%.

Predictive Value of Electronic Fetal Monitoring for Intrapartum Fetal Asphyxia With Metabolic Acidosis

Table 4. Sensitivity, Specificity, and Estimated Positive and Negative Predictive Values for the Fetal Heart Rate Patterns for Asphyxia

			Predictive value	
Pattern*	Sensitivity	Specificity	Positive	Negative
1	17	98	18	98.3
1,2	46	89	8	98.7
1,2,3	75	57	3.5	99.1
1,2,3,4	93	29	2.6	99.5

Data are presented as percentages.

* The criteria for the fetal heart rate patterns are 1 = absent baseline variability (≥1 cycle) usually with late and/or prolonged decelerations, 2 = minimal baseline variability (≥2 cycles) and late and/or prolonged decelerations (≥2 cycles), 3 = minimal baseline variability (≥2 cycles) or late and/or prolonged decelerations (≥2 cycles), and 4 = minimal baseline variability (1 cycle) and/or late and/or prolonged decelerations (1 cycle).

- The **sensitivity** of our test (the probability of detecting a real problem (ACIDOSIS) if there is one and its **specificity** (the probability that we *won't* detect a problem if there *isn't* one).

- Let's Smoke Alarm is functional 99.9% of the time. If we assume the service just fails randomly the other 0.1% of the time, we can calculate the true-positive rate – would you respond to a page

$$\begin{aligned} \text{FPR} &= \text{(prob. of service non-failure)} * \text{(prob. of detecting failure anyway)} \\ &= (1 - 0.001) * (1 - 0.99) \\ &= 0.0099 \\ &= 0.99\% \end{aligned}$$

$$\begin{aligned} \text{TPR} &= \text{(prob. of service failure)} * \text{(prob. of detecting a failure)} \\ &= (0.001) * (0.99) \\ &= 0.00099 \\ &= 0.099\% \end{aligned}$$

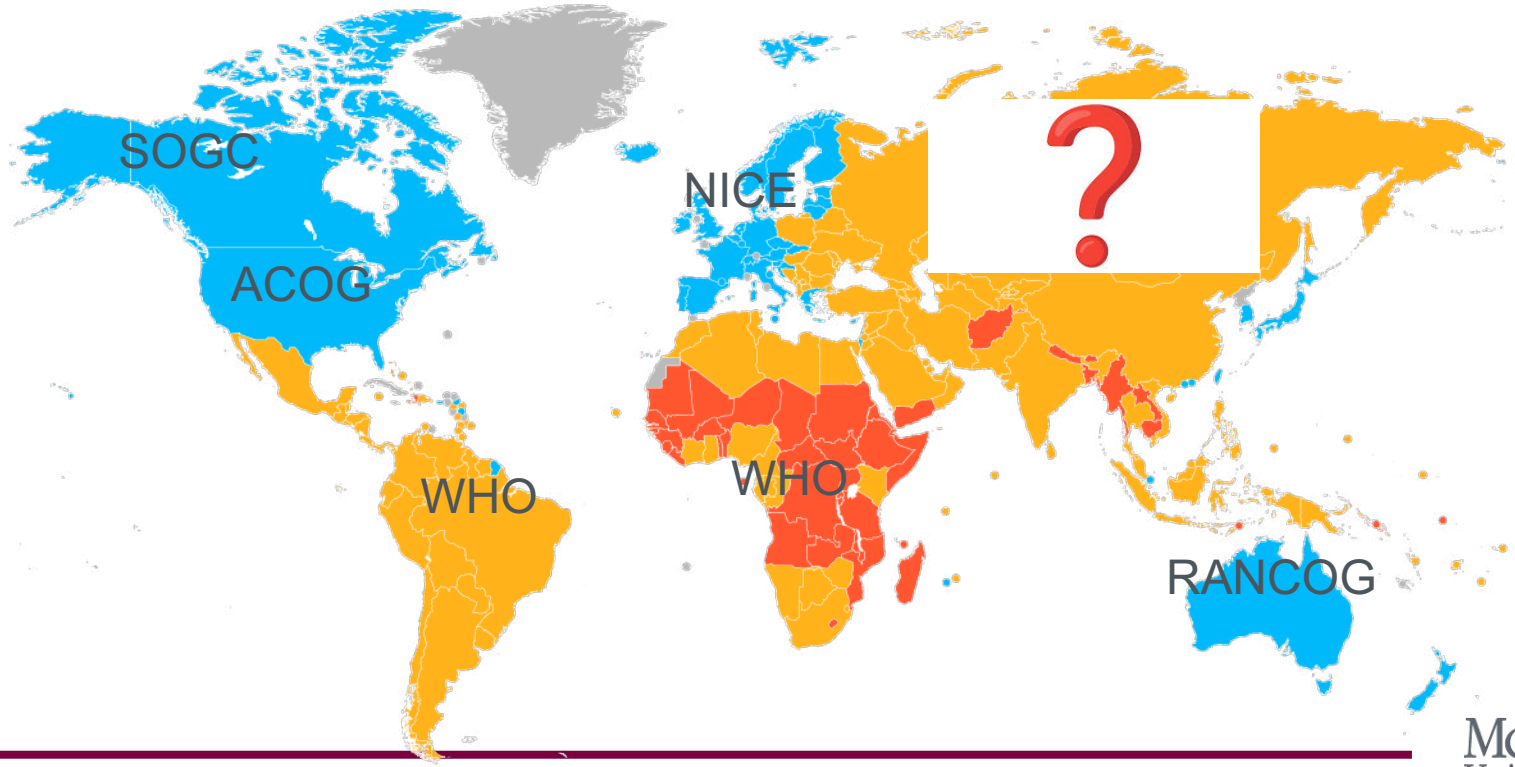
$$\begin{aligned} \text{(Positive predictive value)} &= \frac{\text{TPR}}{\text{TPR}+\text{FPR}} \\ &= \frac{0.00099}{0.00099+0.0099} \\ &= 0.091 \\ &= 9.1\% \end{aligned}$$

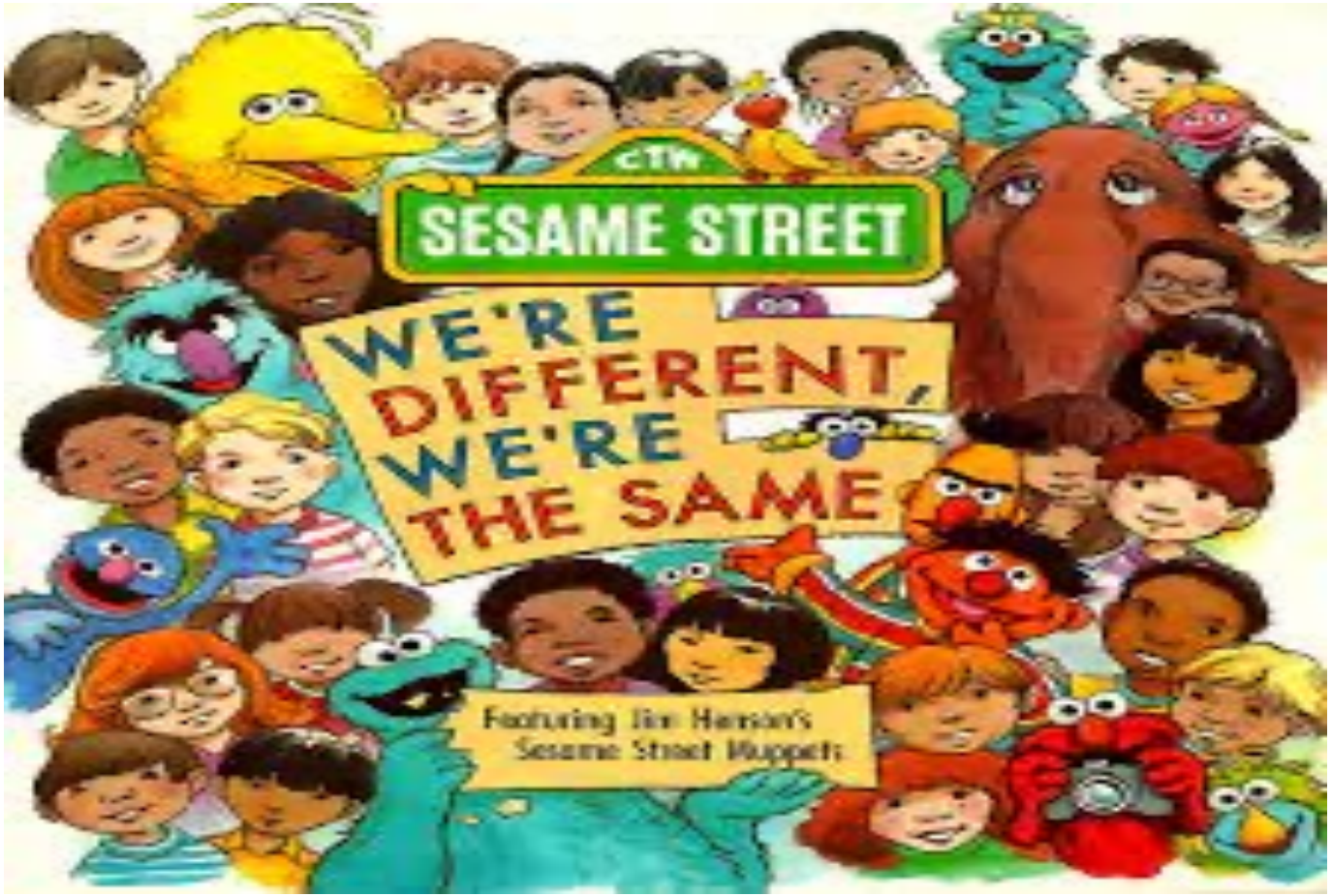
Predictive Value of Electronic Fetal Monitoring for Intrapartum Fetal Asphyxia With Metabolic Acidosis

- If the goal is to predict fetal asphyxial exposure before decompensation, one cannot wait for evidence of absent baseline variability. At this stage, the asphyxial exposure is moderate or severe, with substantial newborn morbidity. Asphyxial exposure must be considered if two or more cycles of minimal baseline variability and late or prolonged decelerations are observed in the record

- The identification of predictive FHR patterns requires continuous scoring of FHR records because of the narrow 1-hour window of these patterns with developing metabolic acidosis. Predictive FHR patterns require supplementary tests such as fetal blood gas and acid-base assessment to confirm the diagnosis of fetal asphyxia and to identify the false-positive results to avoid unnecessary intervention

International Classifications





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ACOG
The American College of Obstetricians and Gynecologists

TABLE 2. Category Definitions

Category I: Normal or "Good" 	*Present:* – Baseline FHR 110 to 160 bpm – Moderate baseline variability (6-25 bpm)
	Absent: – Variable decelerations – Late decelerations
	Present or Absent: – Accelerations – Early decelerations
 **Category II: Indeterminate or "Atypical"**	FHR patterns that are not category I or III
	Absence of induced accelerations after fetal stimulation
	*Present (either):* – Sinusoidal FHR pattern **OR** – Absent baseline FHR variability **AND ANY**: – Recurrent late decelerations – Bradycardia – Recurrent variable decelerations

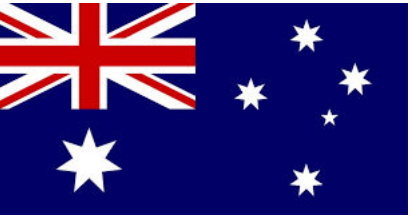

Table 15.

	Normal Tracing Previously "Reassuring"	Atypical Tracing Previously "Non-reassuring"	Abnormal Tracing Previously "Non-reassuring"
Baseline	110–160 bpm	Bradycardia 100–110 bpm Tachycardia > 160 for > 30 min to < 80 min. Rising baseline	Bradycardia < 100 bpm Tachycardia > 160 for > 80 min. Erratic baseline
Variability	6–25 bpm < 5 bpm for < 40 min.	≤ 5 bpm for 40–80 min.	≤ 5 bpm for > 80 min. ≥ 25 bpm for > 10 min. Sinusoidal
Decelerations	None or occasional uncomplicated variables or early decelerations	Repetitive (> 3) uncomplicated variable decelerations Occasional late decelerations Single prolonged deceleration > 2 min. but < 3 min.	Repetitive (> 3) complicated variables: deceleration to < 70 bpm for > 60 secs. loss of variability in trough or in baseline biphasic decelerations overshoots slow return to baseline baseline lower after deceleration baseline tachycardia or bradycardia Late decelerations > 50% of contractions Single prolonged deceleration > 3 min. but < 10 min.
Accelerations	Spontaneous accelerations present (FHR increases >15 bpm lasting > 15 seconds (< 32 weeks' gestation increase in the FHR > 10 bpm lasting >10 seconds) Accelerations present with fetal scalp stimulation	Absence of acceleration with fetal scalp stimulation	Usually absent*
ACTION	EFM may be interrupted for periods up to 30 min. if maternal-fetal condition stable and/or oxytocin infusion rate stable.	Further vigilant assessment required, especially when combined features present.	ACTION REQUIRED Review overall clinical situation, obtain scalp pH if appropriate/prepare for delivery.

*Usually absent, but if accelerations are present, this does not change the classification of tracing.

World Health Organization

McMaster University

ACOG Management - Category 1

- Category I FHR tracings are normal
- Not associated with fetal acidemia
- Routine manner with either continuous or intermittent monitoring.
- During the first stage of labor the FHR tracing should be reviewed every 30 minutes and every 15 minutes during the second stage
- Change in man- agreement may need to occur only if Category II or Category III features develop .

Rest of the Word

- Normal EFM tracings
- When a normal tracing is identified, it may be appropriate to interrupt the EFM tracing for up to 30 minutes to facilitate periods of ambulation, bathing, or position change, providing that (1) the maternal-fetal condition is stable and (2) if oxytocin is being administered, the infusion rate is not increased.
- A least every 1 hour if admission to hospital.
- Active First Q 15 min
- Second stage: At least every 15 minutes if there is a continuous presence of a caregiver and a continuous tracing

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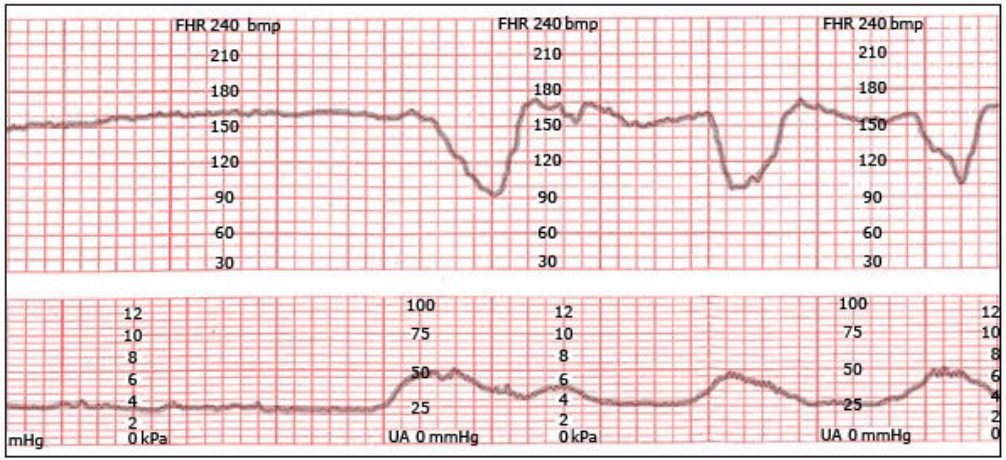
	Absence of induced accelerations after fetal stimulation
Category III: Abnormal or "Bad"	*Present (either):* – Sinusoidal FHR pattern **OR** – Absent baseline FHR variability **AND ANY**: – Recurrent late decelerations – Bradycardia – Recurrent variable decelerations

Category 3

Variable decelerations with minimal to absent variability

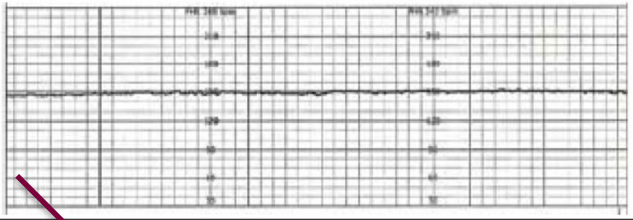
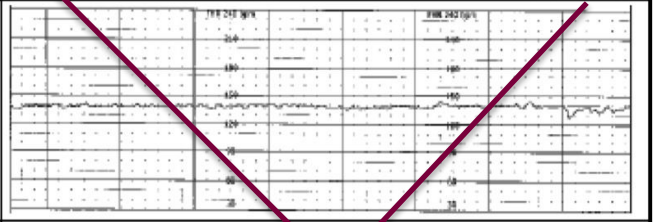
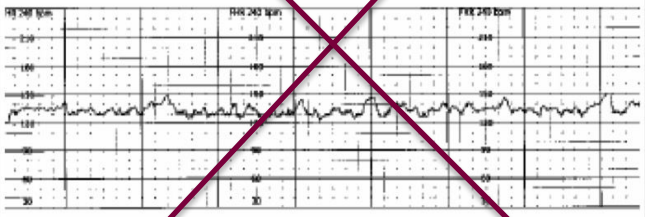
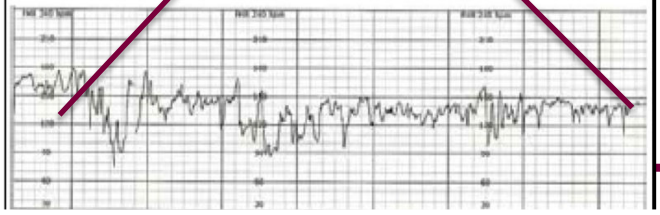


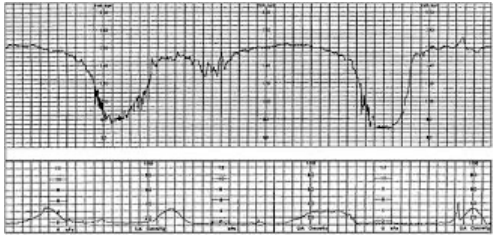
Variability is minimal to absent.

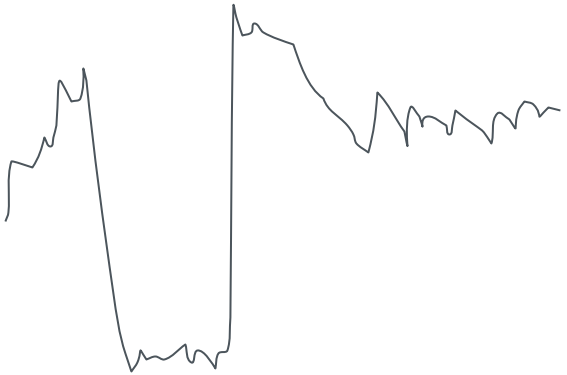
Courtesy of Bruce K Young, MD.

UpToDate®

Variability

Undetectable from baseline Absent	
> Undetectable from baseline, ≤ 5 bpm Minimal	
6 – 25 bpm Moderate	
>25 bpm Marked	





ACOG Management - Category 3

- A Category III FHR tracing is abnormal and conveys **an increased risk** for fetal acidemia at the time of observation.
- Category III tracings have been associated with an **increased risk** for neonatal encephalopathy, cerebral palsy, and neonatal acidosis.
- Nevertheless, the predictive value of Category III tracings for abnormal neurologic outcome is **poor.**
- If **unresolved**, Category III FHR tracings most often require prompt delivery.
- **Intrauterine resuscitation** measures are used, preparations for delivery should be considered and
- Time frame for proceeding to **delivery should be determined** if the FHR does not improve
- The acceptable time frame to accomplish delivery in the setting of a Category III FHR tracing **has not been established.**

ACOG Management - Category 3

- Historically, a 30-minute rule from decision- to-incision time for emergent cesarean delivery in the setting of abnormal FHR pattern has existed however, the **scientific evidence to support this threshold is lacking**
- It also should be recognized that in some cases immediate delivery in a woman with an unknown duration of a Category III tracing **may not improve outcome if the fetus** has already experienced hypoxic ischemic injury
- Nevertheless, when a decision for operative delivery in the setting of a Category III EFM tracing is made, it should be accomplished as **expeditiously as feasible.**
- The decision-to-incision interval and mode of delivery should be based on the timing that best incorporates **maternal and fetal risks and benefits.**
- May require **maternal stabilization** or additional surgical preparation before performance of emergent cesarean delivery.
- . Preparation for impending delivery of a woman with a Category III tracing often requires assessment of several logistical issues depending on the setting and clinical circumstances

ACOG TRANSLATED – CAT # 3 –

1. The predictive value of Category III tracings for abnormal neurologic outcome is poor – so what!

2. If Unresolved …… ie can watch it

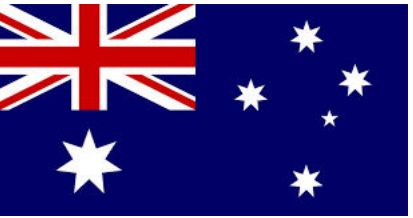
3. Consider Intra uterine resuscitation

3. No Time Limit

4. Patient factors may limit

Rest of the Word

- In the presence of an abnormal fetal heart rate pattern, usually operative delivery should be undertaken promptly unless (1) there is clear indication of normal fetal oxygenation by means of scalp pH assessment or (2) spontaneous delivery is imminent.
- Usual action in the presence of an abnormal tracing includes preparing for operative delivery (operative vaginal delivery or Caesarean section), and notifying pediatric and anesthetic services.
- While this is happening, attempts at intrauterine resuscitation should be made. In facilities where operating room capability does not exist, transfer to an appropriate facility should be initiated



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All Is not Lost – There is Hope !

IS IT MINIMAL OR ABSENT - IT DOES NOT MATTER

- Most of the literature regarding decreased variability does not differentiate between absent variability (amplitude range undetectable) and minimal variability (amplitude range detectable but ≤5 bpm). Therefore, it is not possible to make definitive conclusions about the clinical significance of absent versus minimal variability. – Up to Date 2023

- "Indeed, even among recognized experts there is significant interobserver variation in the differentiation of FHR patterns with minimal vs absent variability". – Clark et al 2013

Up To Date 2023 – Not OUT OF DATE NICHD 2008

- 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, 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.

OBSTETRICS

Intrapartum management of category II fetal heart rate tracings: towards standardization of care

Steven L. Clark, MD; Michael P. Nageotte, MD; Thomas J. Garite, MD; Roger K. Freeman, MD; David A. Miller, MD; Kathleen R. Simpson, RN, PhD; Michael A. Belfort, MD, PhD; Gary A. Dildy, MD; Julian T. Parer, MD; Richard L. Berkowitz, MD; Mary D'Alton, MD; Dwight J. Rouse, MD; Larry C. Gilstrap, MD; Anthony M. Vintzileos, MD; J. Peter van Dorsten, MD; Frank H. Boehm, MD; Lisa A. Miller, CNM, JD; Gary D. V. Hankins, MD

There is currently no standard national approach to the management of category II fetal heart rate (FHR) patterns, yet such patterns occur in the majority of fetuses in labor. Under such circumstances, it would be difficult to demonstrate the clinical efficacy of FHR monitoring even if this technique had immense intrinsic value, since there has never been a standard hypothesis to test dealing with interpretation and management of these abnormal patterns. We present an algorithm for the management of category II FHR patterns that reflects a synthesis of available evidence and current scientific thought. Use of this algorithm represents one way for the clinician to comply with the standard of care, and may enhance our overall ability to realize the benefits of intrapartum FHR monitoring.

Key words: fetal heart rate monitoring, neonatal encephalopathy, patient safety

Interpretation and management of fetal heart rate (FHR) patterns during labor remains one of the most problematic issues in obstetrics. Multiple basic science investigations and clinical trials have been published since the introduction of this technique in the late 1950s.[1-7] Unfortunately, this body of work has primarily served to raise more questions than it has answered—as a medical community, we seem to know less than we thought we did 30 years ago regarding the utility of this ubiquitous technique.

In recent years, several specific issues relating to the interpretation and management of FHR patterns have received considerable attention in the medical literature. These include the lack of agreement in interpretation even among recognized experts, the role of FHR patterns as a primary driver of a rising cesarean rate, and the explosion of litigation involving FHR patterns, despite the consistent absence of scientific evidence to support the contention that intervention based on any single FHR pattern or combination of FHR patterns in fact prevents cerebral palsy or other types of neurologic impairment.[8-12]

Against this background, however, there remains a nearly instinctive suspicion (albeit based primarily upon anecdotal experience and the original basic science investigations) that at least a portion of these conflicting evidence regarding the clinical utility of intrapartum FHR monitoring results from ad hoc interpretation of terminology, and the lack of standardized protocols for management and intervention based on what are often challenging patterns. In a very real sense, the FHR monitor is a medical device that was introduced into clinical practice without an instruction manual, without the now common premarket testing to support the unrealistic expectations of efficacy, and without clearly defined parameters for use. Under such circumstances, it would be difficult to demonstrate clinical efficacy even of a device with immense intrinsic value, since there has never been a standard hypothesis to test dealing with interpretation and management of abnormal patterns. With respect to the assessment of the clinical value of FHR monitoring, an evolving consensus exists in the maternal-fetal medicine community that it is time to start over and establish some common language, standard interpretation, and reasonable management principles and guidelines.[13-19]

A *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD) consensus panel in 2008 proposed a uniform system of terminology in which any FHR pattern is classified as category I, II, or III, based on the presence or absence of well-defined aspects of the FHR.[20] Once universally adopted in clinical practice, these

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The ACOG 18

- Tracing that show both variable decelerations secondary to cord compression and late decelerations due to hypoxia during contractions based on uteroplacental insufficiency.
- This may give rise to a less well-defined, hybrid pattern of decelerations for example, **late decelerations superimposed upon variable decelerations**. Because relatively benign variable decelerations are visually more dramatic than the subtle, yet more concerning, late decelerations. Such hybrid deceleration patterns differ from the more commonly seen “atypical” variable decelerations that have no correlation with fetal acidemia.[35]

Atypical Deceleration - Why is ACOG SO RESISTANT

1. 2008 NICHD " Variable decelerations may be accompanied by other characteristics, the clinical significance of which **requires further research investigation**. Some examples include a slow return of the FHR after the end of the contraction, biphasic decelera-tions, tachycardia after variable deceleration(s), accelerations preceding and/or following, some- times called "shoulders" or "overshoots Fuctuations in the FHR in the trough of the deceleration.
2. ACOG 116 - Silent Apart from Placing in Cat 2 quoting above

3. Single Paper *Association of Atypical Decelerations With Acidemia Alison G. Cahill, MD, et al*- VOL. 120, NO. 6, DECEMBER 2012

" These data support the absence of these specific atypical deceleration characteristics from the recognized definitions of decelerations stipulated by the College and the Eunice Kennedy Shriver National Institute of Child Health and Human Development in 2008 given their lack of association with acidemia or neonatal depression"

Atypical Deceleration - ACOG 116

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KREBS et all AJOG 145 # 3 1982

- A total of 1,996 fetal heart rate
- Nineteen percent 1) loss of initial acceleration, (2) slow return to the baseline FHA, (3) loss of secondary acceleration, (4) prolonged secondary acceleration, (5) biphasic deceleration, (6) loss of variability during
- Variable decelerations with one or more of these features were called atypical variable decelerations and predicted a high incidence of fetal acidosis and low Apgar scores.
- Particularly unfavorable combination with decreased FHR variability and tachycardia or bradycardia predicted the highest incidence of low Apgar scores, It is concluded that atypical features aid greatly in the identification of distress in fetuses with variable decelerations.

Variable decelerations: do size and shape matter?

Emily Hamilton [1], Philip Warrick, Daniel O'Keeff

- **Objective:** To determine the ability of variable decelerations and 8 subtypes, defined by size and shape, to discriminate tracings between babies with normal umbilical artery gases (N) and those with metabolic acidemia (MA).
- **Methods:** Tracings from the last 4 hours from N-3320 babies with base deficit levels under 8 mmol/L, and from MA-316 babies with base deficits over 12 mmol/L were analyzed using computerized pattern recognition. We created receiver operating characteristic curves and area under the curves (AUCs) for each deceleration subtype.
- **Results:** 3 subtypes showed significant discrimination: those with a prolonged duration (AUC 0.6109 $P < 0.0001$), loss of internal variability (AUC 0.5694 $P < 0.0001$) or with "sixties" criteria (AUC 0.5997 $P < 0.0001$).
- **Conclusions:** Finer gradation within the middle category of electronic fetal monitoring classification is needed because most tracings, including those from babies with MA, will be located in the Category II. This analysis identifies which variable decelerations have a significant association with MA and which do not.

Other Evidence + ALL OTHER GUIDELINES

- **Atypical decelerations: do they matter? Sabina Martí Gamboa - The Journal of Maternal-Fetal & Neonatal Medicine** Volume 30, 2017 - Issue 2

- Prediction of Hypoxic Acidemia in Last 2 Hours of Labour in Low-Risk Women RSS Download PDF Patricia C. Toomey MD, MScmand Lawrence Oppenheimer MD Journal of Obstetrics and Gynaecology Canada (JOGC)
- Association of Atypical Decelerations With Acidemia Ross, Michael G. MD, MPHAmaya, Kevin DORichardson, Bryan MDFrasch, Martin G. MD, PhD

- Spong CY, Rasul C, Collea JV, Eglinton GS, Ghidini A. Characterization and prognostic significance of variable decelerations in the second stage of labor. Am J Perinatol 1998;15:369–74.[Context Link]
- 3. Krebs HB, Petres RE, Dunn LJ. Intrapartum fetal heart rate monitoring. VIII. Atypical variable decelerations. Am J Obstet Gynecol 1983;145:297–305.[Context Link]
- 5. Ross MG, Jessie M, Amaya K, Matushewski B, Durosier LD, Frasch MG, et al.. Correlation of arterial fetal base deficit and lactate changes with severity of variable heart rate decelerations in the near-term ovine fetus. Am J Obstet Gynecol 2012 Oct 26 [Epub ahead of print].[Context Link]

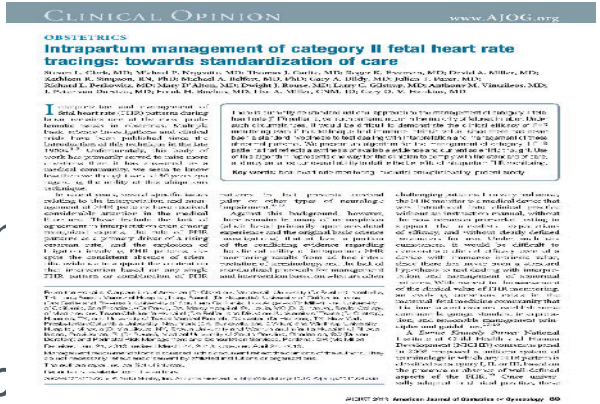
TABLE 2. Category Definitions

Category I: Normal or "Good" 	*Present:* – Baseline FHR 110 to 160 bpm – Moderate baseline variability (6-25 bpm)
	Absent: – Variable decelerations – Late decelerations
	Present or Absent: – Accelerations – Early decelerations
Category II: Indeterminate or "Atypical"	FHR patterns that are not category I or III
	Absence of induced accelerations after fetal stimulation
	*Present (either):* – Sinusoidal FHR pattern **OR** – Absent baseline FHR variability **AND ANY**: – Recurrent late decelerations – Bradycardia – Recurrent variable decelerations

CATEGORY TWO - ACOG

- Category II FHR tracings include all FHR patterns that are not classified as Category I or Category III
- Category II tracings require evaluation, continued surveillance, initiation of appropriate corrective measures when indicated, and reevaluation.
- Once identified, these tracings may require more frequent evaluation, documentation, and continued surveillance, unless they revert to Category I.

ACOG - Cat 2


CLINICAL OPINION www.AJOG.org

OBSTETRICS

Intrapartum management of category II fetal heart rate tracings: towards standardization of care

- *Although useful, these recommendations remain insufficient since 80% of fetuses ir strate FHR patterns that fall into category which no specific ACOG management rec exist. – admits that recommendations flawed*
- *However, we believe one important goal of intrapartum care is delivery of the fetus, when possible, prior to the development of damaging degrees of hypoxia/acidemia.* - admits that must intervene before Cat 3

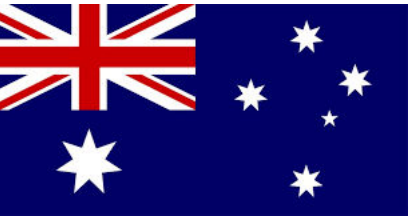


Table 15.

	Normal Tracing Previously "Reassuring"	Atypical Tracing Previously "Non-reassuring"	Abnormal Tracing Previously "Non-reassuring"
Baseline	110–160 bpm	Bradycardia 100–110 bpm Tachycardia > 160 for > 30 min to < 80 min. Rising baseline	Bradycardia < 100 bpm Tachycardia > 160 for > 80 min. Erratic baseline
Variability	6–25 bpm < 5 bpm for < 40 min.	≤ 5 bpm for 40–80 min.	≤ 5 bpm for > 80 min. ≥ 25 bpm for > 10 min. Sinusoidal
Decelerations	None or occasional uncomplicated variables or early decelerations	Repetitive (> 3) uncomplicated variable decelerations Occasional late decelerations Single prolonged deceleration > 2 min. but < 3 min.	Repetitive (> 3) complicated variables: deceleration to < 70 bpm for > 60 secs. loss of variability in trough or in baseline biphasic decelerations overshoots slow return to baseline baseline lower after deceleration baseline tachycardia or bradycardia Late decelerations > 50% of contractions Single prolonged deceleration > 3 min. but < 10 min.
Accelerations	Spontaneous accelerations present (FHR increases >15 bpm lasting > 15 seconds (< 32 weeks' gestation increase in the FHR > 10 bpm lasting >10 seconds) Accelerations present with fetal scalp stimulation	Absence of acceleration with fetal scalp stimulation	Usually absent*
ACTION	EFM may be interrupted for periods up to 30 min. if maternal-fetal condition stable and/or oxytocin infusion rate stable.	Further vigilant assessment required, especially when combined features present.	ACTION REQUIRED Review overall clinical situation, obtain scalp pH if appropriate/prepare for delivery.

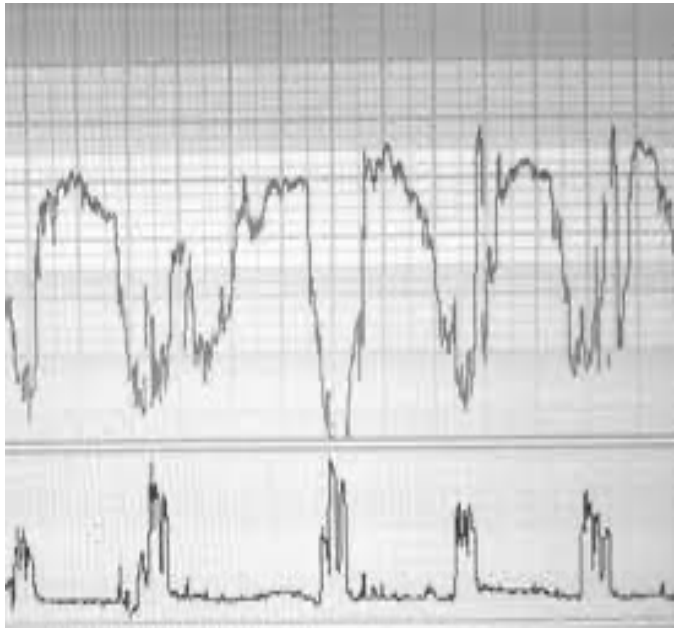
*Usually absent, but if accelerations are present, this does not change the classification of tracing.

Rest of the Word – Atypical Category

Any reversible cause of compromise should be identified and modified (correction of maternal hypotension, treatment of excessive uterine contractility).
Further fetal evaluation by means of scalp stimulation (> 34 weeks) is recommended, and fetal scalp blood testing may be considered, if available.

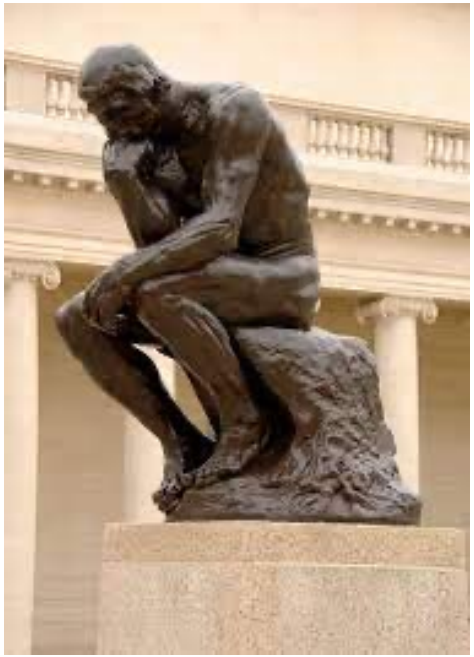
- Stop or decrease oxytocin
- Change maternal position of left or right lateral
- Improve hydration with IV fluid bolus196
- Perform vaginal examination to relieve pressure of presenting part off cord
- Administer oxygen by mask
- Consider amnioinfusion if variable decelerations present

CATEGORY TWO – ACOG - Translated



Maybe All OBGYN across the world Practice similarly

Despite Guidelines.



Most LSCS are Done for CAT 2 Tracing - After Barrett

- Cesarian delivery (CD) for non-reassuring, abnormal or intermediate fetal heart rate (FHR) tracing occurs in up to 5% of all deliveries
- Cesarian for abnormal or intermediate it accounts for almost one in four primary cesarian deliveries in the US
- Second, the frequency of cesarian deliveries for abnormal heart rate tracings has increased, and contributes to the rising overall rate of cesarian delivery.
- IF **Only 0.1 % of traces are Cat 3**
- THIS MEANS THAT MOST LSCS FOR NRFH for CAT 2 as STD of Care

Most LSCS are Done for CAT 2 Tracing – SKUPSKI et al Cesarean Delivery for Intrapartum Fetal Heart Rate Abnormalities: Incorporating Survey Data Into Clinical Judgment - **VOL 88, NO. 1, JULY 1996**

- Four hundred thirty one of questionnaires were returned.
- Consensus was identified for deciding on cesarean delivery (after intrauterine resuscitation)
  - 1) after 30 minutes for cases of repetitive late and severe variable decelerations,
  - 2) after 10 minutes in cases of fetal bradycardia,
  - 3) in all scenarios with decreased beat#to-beat variability of the FHR.

Intrapartum electronic fetal monitoring features associated with a clinical diagnosis of nonreassuring fetal status

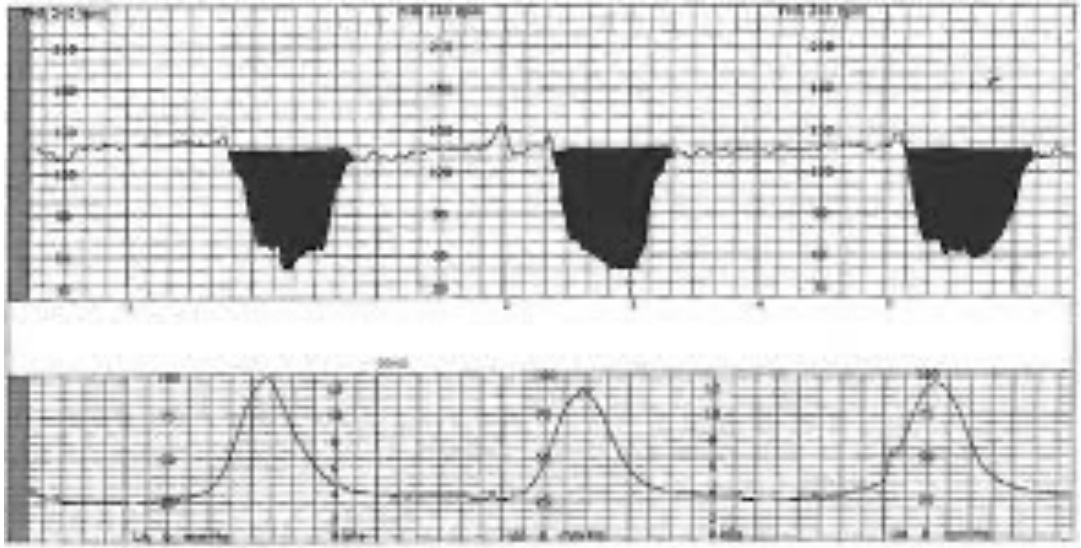
Rebecca R. Rimsza, MD; Antonina I. Frolova, MD, PhD; Jeannie C. Kelly, MD, MS; Ebony B. Carter, MD, MPH; Alison G. Cahill, MD, MSCI; Nandini Raghuraman, MD, MSCI

CONCLUSION: Although multiple category II electronic fetal monitoring features have been traditionally linked to acidemia, the presence of recurrent late decelerations, recurrent variable decelerations, and prolonged decelerations seemed to concern obstetricians enough to surgically intervene for nonreassuring fetal status. A clinical intrapartum diagnosis of nonreassuring fetal status in the setting of these electronic fetal monitoring features is also associated with increased risk of acidemia, suggesting clinical validity to the diagnosis of nonreassuring fetal status.

Cahill et all . AJOG, May 2018

- Prospective Cohort 8580
- Singletons > 37 weeks
- Pattern of Last 120 mins analyzed and Total Decelerative Area Calculated
- ACOG Criteria and Novel Pattern related to outcome
- PH < 7.1 and Neonatal Morbidity

Total Decelerative Area



*Deceleration area was estimated by width of widest aspect of deceleration (below the baseline) measured in seconds, multiplied by the maximum depth below the baseline, divided by two

Cahill et all . AJOG, May 2018

- 1.7% acidosis and 8% Neonatal Morbidity
- Persistent Category 1 = Normal pH
- Category 3 for 10 min = Acidosis
- Total Declarative Area 76 – 80 % predictive ability of Acidosis
- Tachycardia + TDA 80% predictive of Neonatal Morbidity

The Truth Behind ACOG – Cahill et all . AJOG, May 2018

- Deceleration area Valid EVEN if Moderate Variability Present
- If use this will perform 5 LSCS to prevent one asphyxia

THANK YOU

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