INTRAPARTUM FETAL HEART RATE MONITORING

Definitions, Interpretation and Management

Applying Principles of Patient Safety

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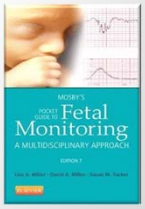

Co-author:
"Electronic Fetal Heart Rate Monitoring Interpretation and Management"
On-line, Interactive Educational Program:
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As a medical professional, there are many things on your plate, and fetal monitoring is only one of them

It might seem that a disproportionate amount of time and energy is dedicated to this one area of medicine

But that is because fetal monitoring…

1. Is the most common procedure you will perform in obstetrics
2. Involves the potential for preventable lifelong brain damage
3. Represents an overwhelmingly disproportionate share of the medicolegal risk you will face throughout your career
4. Our primary goal is to optimize outcomes…a secondary goal is to minimize risks

The most effective way to optimize outcomes AND minimize medical-legal risk is to practice according to…

"Standard of Care"

Define "Standard of Care"

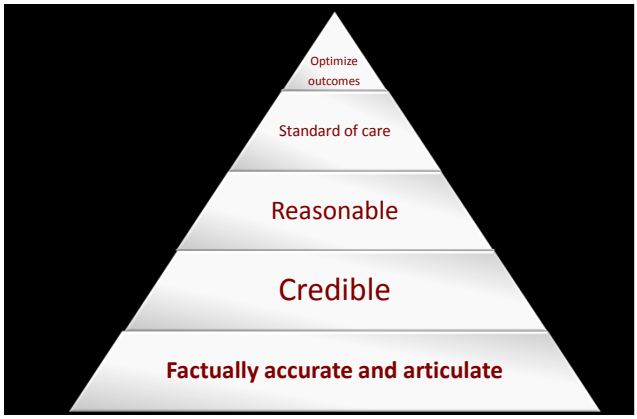
- Level of care provided by best practitioners in the community?
- Level of care provided by average practitioners in the community?
- Level of care provided by most practitioners in the community?
- Minimally acceptable level of care?
- Level of care dictated by AWHONN and ACOG?
- Level of care dictated by standard textbooks?

"Standard of Care"

Level of care expected of a ***reasonable*** practitioner

Who makes that determination?

How do they decide?



"I don't know the specific definition, but I know it when I see it."

Factual accuracy and ability to articulate are NOT optional

Even if you never encounter a legal challenge in your career, if you cannot communicate adequately to obtain appropriate informed consent, you have not met the standard of care

Intrapartum FHR monitoring is one of the most common obstetric procedures in the US, impacting the lives of almost 8 million mothers and babies every year

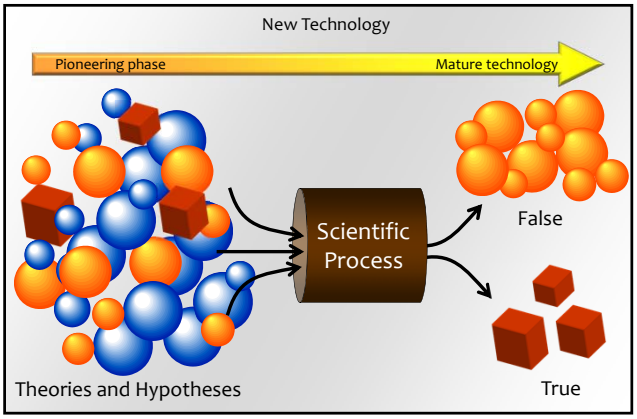
However, for 4 decades, a lack of standardized training and competency testing in intrapartum FHR monitoring has led to:

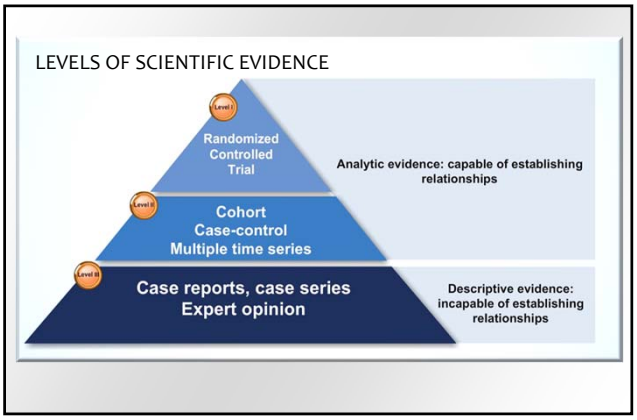
Ill-defined, confusing, controversial terms (*"perinatal asphyxia", "fetal distress"*)

Unsubstantiated theories, hypotheses… unscientific dogma

Myths, urban legends and folklore passed down from resident to resident, nurse to nurse and generation to generation

A breakdown in communication that jeopardizes patient safety challenges the credibility of our profession





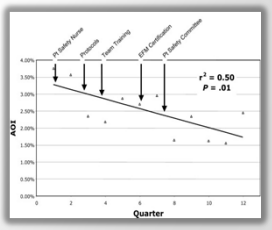
Since 1997 there have been several important consensus publications that have reshaped the fetal monitoring landscape:

- 1997 – First NICHD Consensus Statement
- 1999 – International Cerebral Palsy Task Force Consensus Statement
- 2003 – ACOG-AAP Cerebral Palsy Task Force Consensus Statement
- 2005 – ACOG/AWHONN endorsement
- 2006 – ACNM endorsement
- 2008 – Second NICHD consensus report
- 2009 – ACOG Practice Bulletin 106
- 2010 – ACOG Practice Bulletin 116

Why the need to standardize?

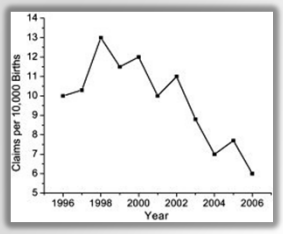
Standardization can reduce adverse outcomes and professional liability claims

Impact of a comprehensive patient safety strategy on obstetric adverse events



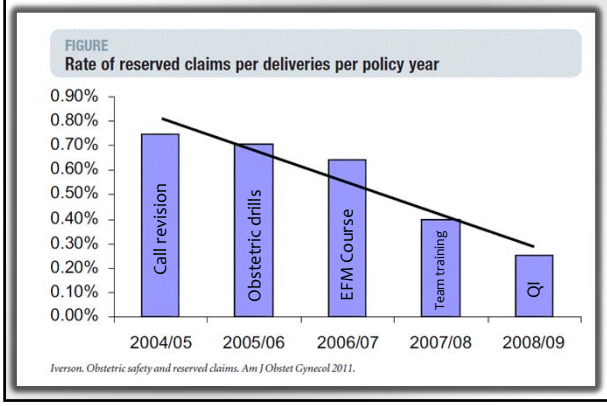
Pettker Am J Obstet Gynecol. 2009;200:492.e1-8

Reducing obstetric litigation through alterations in practice patterns



Clark SL Obstet Gynecol. 2008 Dec;112(6):1279-83.

In-house obstetric coverage
Medication protocols
VBAC protocols
Shoulder dystocia protocols

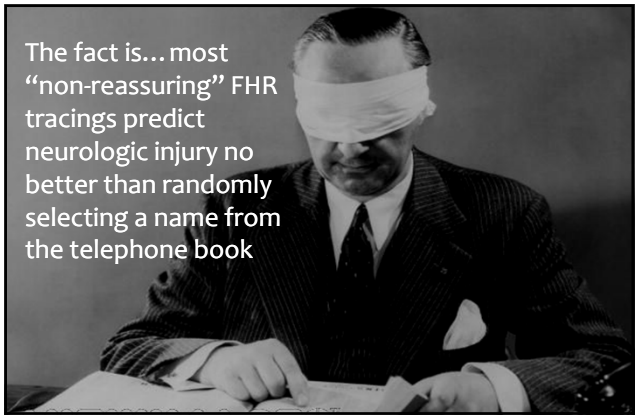


What can the technology really do?

A FHR tracing with minimal-absent variability and late decelerations accurately predicts cerebral palsy 1 time out of 500 ***(99.8% false positive rate)***

The population incidence of cerebral palsy is ~ 1 per 500

Nelson KB, Dambrosia JM, Ting TY, Grether JK. Uncertain value of electronic fetal monitoring in predicting cerebral palsy N Eng J Med 1996;334:613-8



Electronic FHR monitoring is NOT a diagnostic test

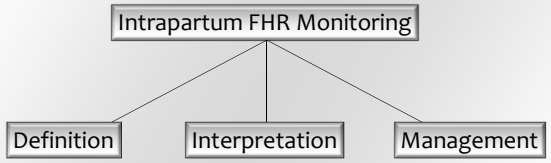
It is a screening test

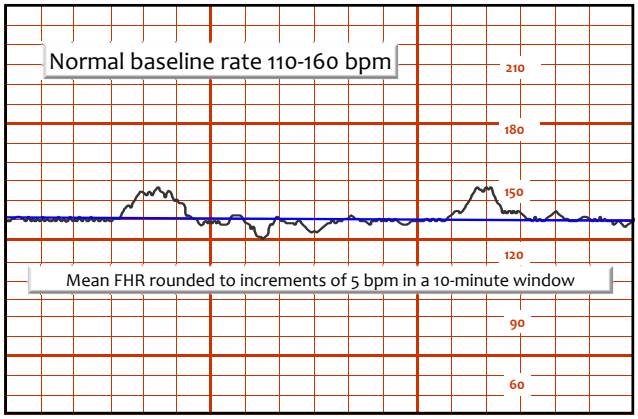
Except in the most extreme cases, it has never been capable of reliably diagnosing fetal injury or "impending injury"

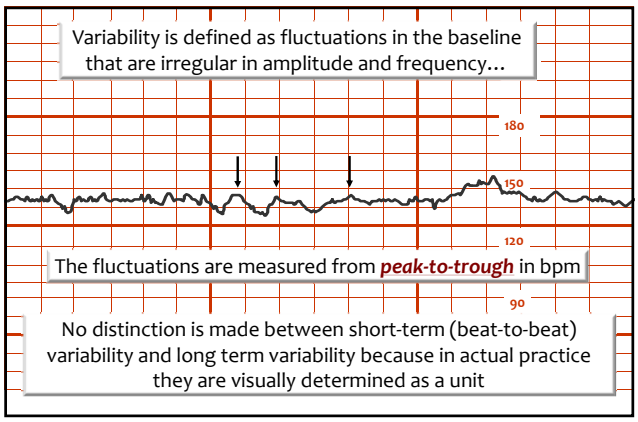
Start with the basics

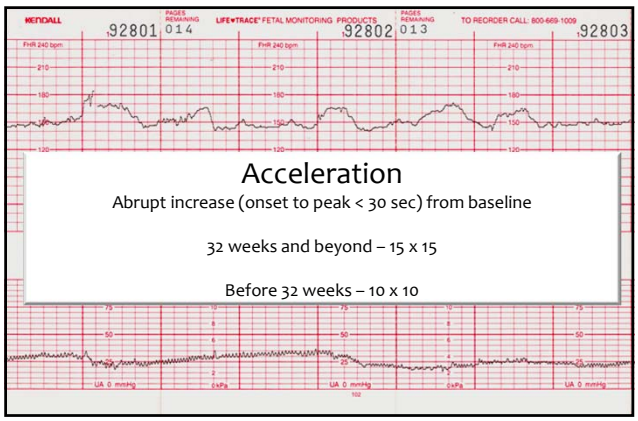
Undertake the simple exercise of deconstructing fetal heart rate monitoring into its essential components

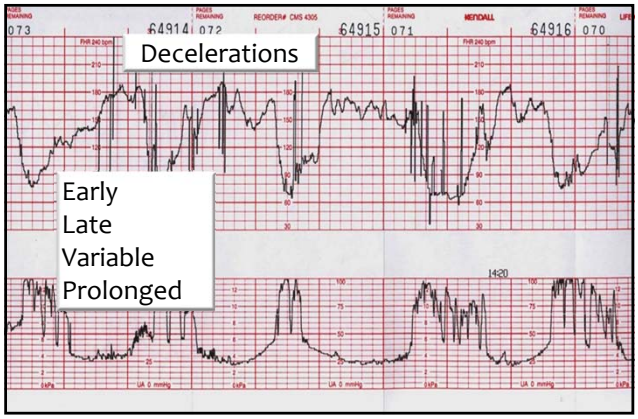
FHR monitoring consists of three components:






Variability is defined as fluctuations in the baseline that are irregular in amplitude and frequency…
180
150
120
90
The fluctuations are measured from peak-to-trough in bpm
No distinction is made between short-term (beat-to-beat) variability and long term variability because in actual practice they are visually determined as a unit


KENDALL
92801 014
LIFE•TRACE® FETAL MONITORING PRODUCTS
92802 013
TO REORDER CALL: 800-669-1009
92803
Acceleration
Abrupt increase (onset to peak < 30 sec) from baseline
32 weeks and beyond – 15 x 15
Before 32 weeks – 10 x 10


64914 072
64915 071
KENDALL
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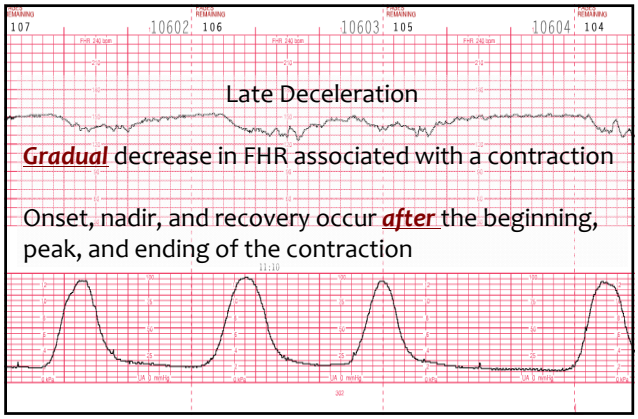
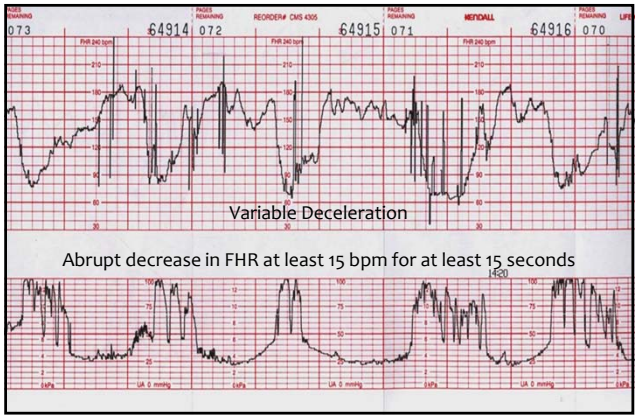
Decelerations
Early
Late
Variable
Prolonged

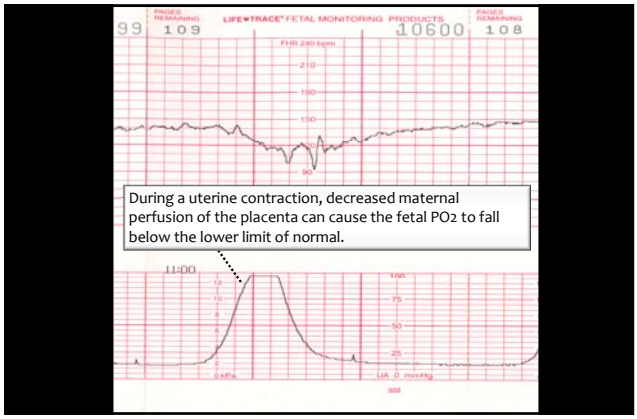
Late versus variable



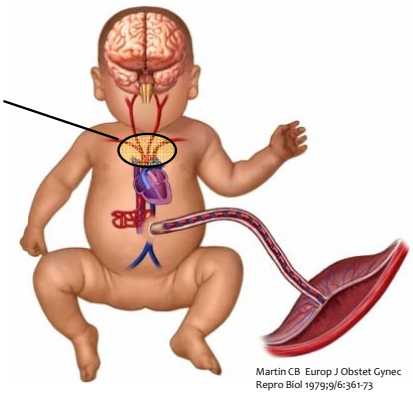


Why have we been taught to believe that late decelerations are ***"ominous"*** but variable decelerations are ***"benign"?***

As early as the 1970s, elegant research demonstrated that late decelerations reflect a protective reflex response to transient fetal hypoxemia during a uterine contraction

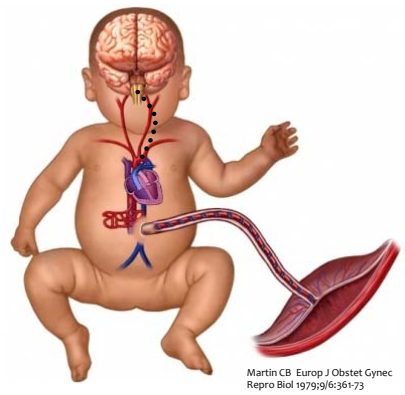


Decreased fetal PO2 ***(hypoxemia)*** during a uterine contraction is detected by… chemoreceptors



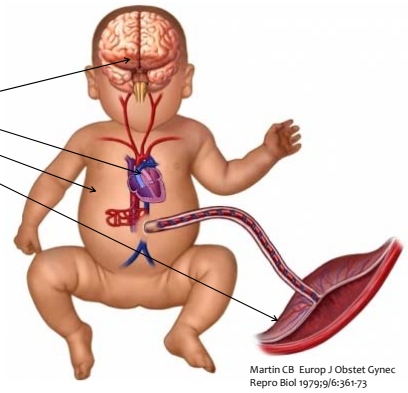
Martin CB Europ J Obstet Gynec Repro Biol 1979;9(6:361-73

Chemoreceptors signal the brain stem



Martin CB Europ J Obstet Gynec Repro Biol 1979;9(6:361-73

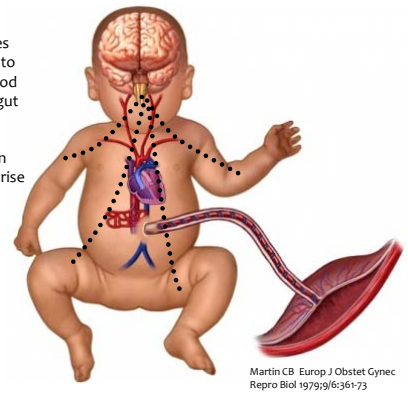
In order to shunt oxygenated blood to the vital organs of the brain, heart, adrenal glands and placenta…



Martin CB Europ J Obstet Gynec Repro Biol 1979;9(6:361-73

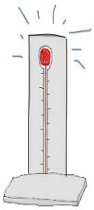
Sympathetic outflow causes peripheral vasoconstriction to redistribute oxygenated blood away from the extremities, gut and kidneys

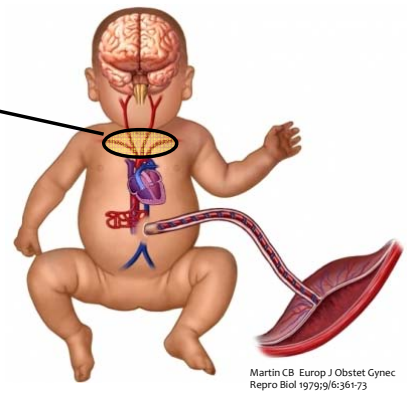
Peripheral vasoconstriction causes the blood pressure to rise



Martin CB Europ J Obstet Gynec Repro Biol 1979;9(6:361-73

Rising blood pressure is detected by… baroreceptors





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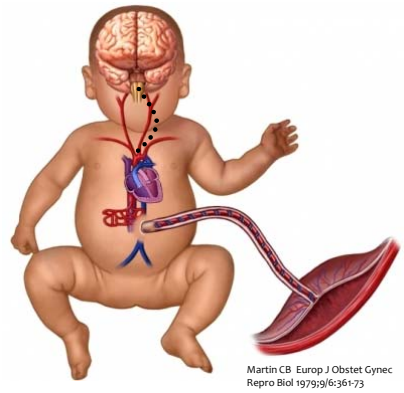
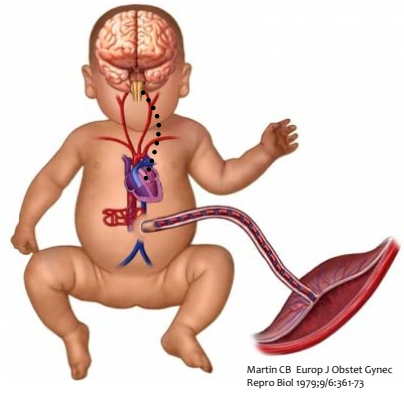


Martin CB Europ J Obstet Gynec Repro Biol 1979;9(6:361-73

Parasympathetic (vagal) outflow slows the FHR to reduce cardiac output and lower blood pressure



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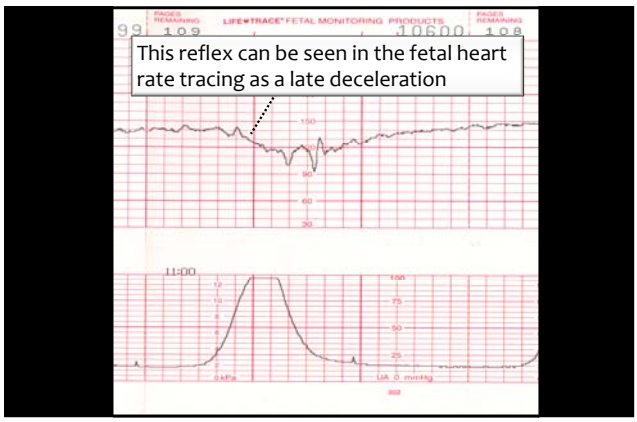
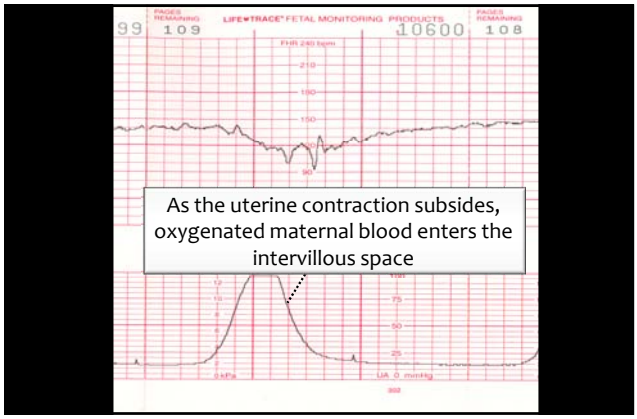
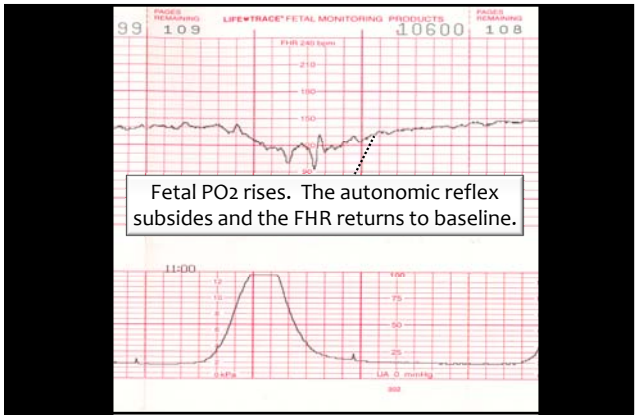

This reflex can be seen in the fetal heart rate tracing as a late deceleration


As the uterine contraction subsides, oxygenated maternal blood enters the intervillous space


Fetal PO2 rises. The autonomic reflex subsides and the FHR returns to baseline.

If this description is accurate, what would you expect to see?

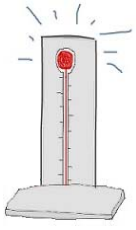
Blood Flow in Fetal Lamb in response to hypoxemia

Reference	Kidney	Body	BP	Brain	Heart	Adrenal
Cohn (1)	↓	↓	↑	↑	↑	↑
Peeters (2)	↓	↓	↑	↑	↑	↑
Richardson (3)		↓	↑	↑		
Field (4)	↓	↓	↑	↑	↑	↑
Reid (5)	↓	↓	↑	↑	↑	↑
Jensen (6)		↓	↑	↑	↑	↑
Ball (7)	↓	↓			↑	↑
Itskovitz (8)		↓	↑	↑	↑	↑
Ball (9)	↓	↓	↑	↑		↑

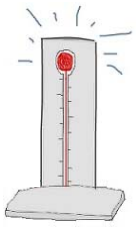
1. AJOG 1974;120:817-24
2. AJOG 1979;135:637-46
3. J Dev Physiol 1983;11:37-43
4. J Dev Physiol 1990;14:131-7
5. J Dev Physiol 1991;15:183-8
6. J Dev Physiol 1991;15:309-23
7. AJOG 1994;170:156-61
8. Am J Physiol 1987;252:H100-9
9. AJOG 1994;171:1549-55

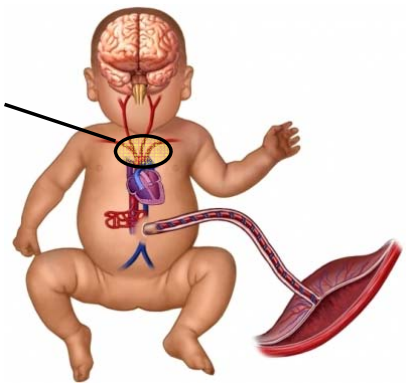
Variable Deceleration

Occlusion of the umbilical cord causes the blood pressure to…
RISE

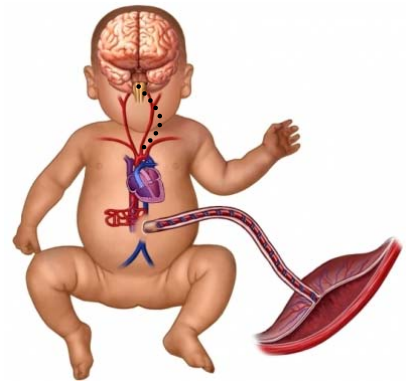


Rising blood pressure is detected by… baroreceptors

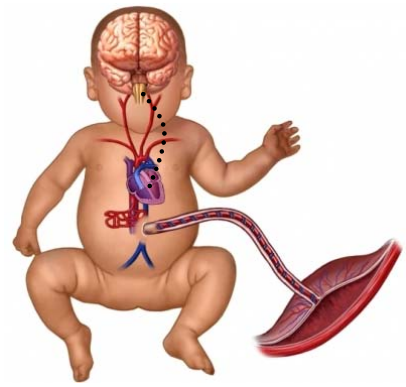




Baroreceptors signal the brain stem



Parasympathetic (vagal) outflow slows the FHR to reduce cardiac output and lower blood pressure



Late decelerations and variable decelerations are protective autonomic reflex responses

Neither is inherently "ominous"

Neither is inherently "benign"

The 2008 NICHD Workshop Report on Electronic Fetal Monitoring

A very brief update

Obstet Gynecol 2008;112:661-6

Previous classification system

"Reassuring"

"Non-reassuring"

Reassuring: (adj)

"Restoring confidence and relieving anxiety"

New "Three-Tier" Fetal Heart Rate Classification System

Category I – "Normal"

Category II – "Indeterminate"

Category III – "Abnormal"

Obstet Gynecol 2008;112:661-6

New "Three-Tier" Fetal Heart Rate Classification System

Category I – "Normal"

Baseline rate: 110-160 bpm
Variability: Moderate
Decelerations: No late, variable or prolonged

Obstet Gynecol 2008;112:661-6

New "Three-Tier" Fetal Heart Rate Classification System

Category III – "Abnormal"

1. Absent variability with recurrent late decelerations
2. Absent variability with recurrent variable decelerations
3. Absent variability with bradycardia for at least 10 min
4. Sinusoidal pattern for at least 20 min

Obstet Gynecol 2008;112:661-6

Category II?

Everything Else

Definitions:
- Baseline
- Variability
- Accelerations
- Decelerations
- Changes or trends over time
- "CATEGORY"

Factual Accuracy

Interpretation

Patient Safety

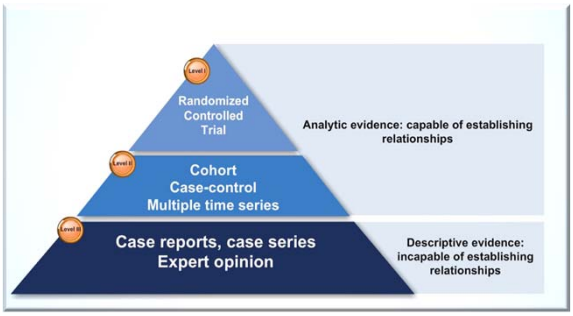
+

Standard of Care

- Standard
- Simple
- Factually Accurate
- Articulate

"Ominous overshoot pattern"
"Variable with a late component"
"Checkmark pattern"
"V-volume-variable = oligohydramnios"
"W variable = nuchal cord"
"Icicle deceleration"
"Carrot-stick deceleration"
"Uniform accelerations = umbilical vein compression"
"Atypical variables"
"Ominous Conversion Factor"
"Wandering baseline"
"Variability at the base of a late decel is reassuring"
"Classifying decelerations as mild-moderate-severe"

LEVELS OF SCIENTIFIC EVIDENCE



Level II evidence REQUIRES "appropriate control of confounding factors", including baseline rate, variability, accelerations and frequency of decelerations

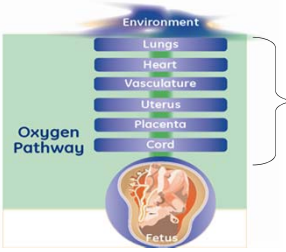
In the next few minutes, 40 years of research in intrapartum FHR interpretation will be distilled into

3

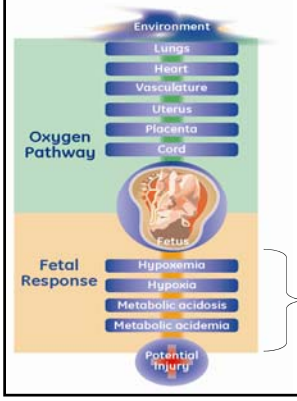
central principles that are evidence based, reflect consensus in the literature and most importantly are simple, practical and teachable

Intrapartum FHR monitoring is intended to assess

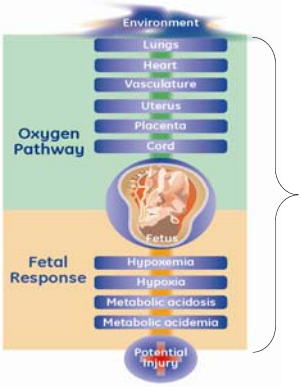
fetal oxygenation



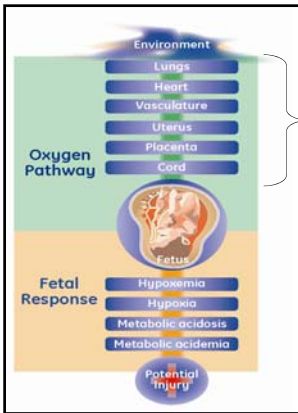
Fetal oxygenation involves the transfer of oxygen from the environment to the fetus…



And the subsequent fetal physiologic response if oxygen transfer is interrupted…

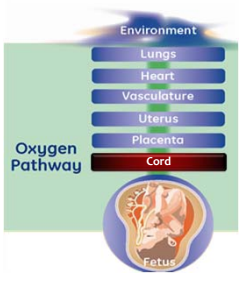


What does the fetal heart rate tracing reveal about this pathway?

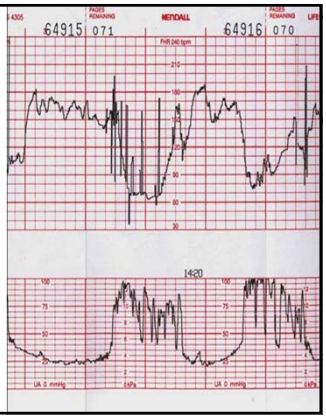


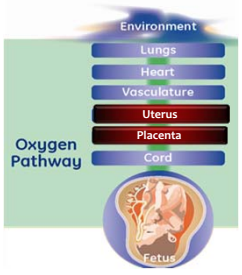
Start at the top

What information does the FHR tracing provide regarding oxygen transfer?

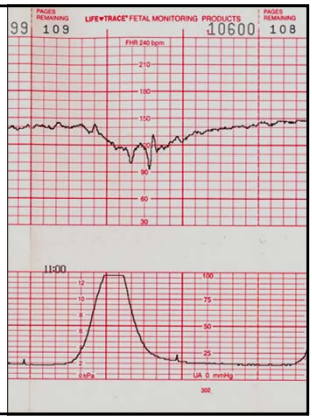


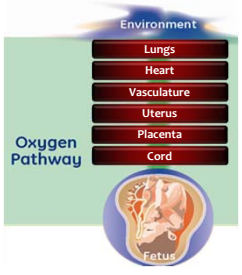
Interruption of the oxygen pathway by compression of the umbilical cord can result in a variable deceleration



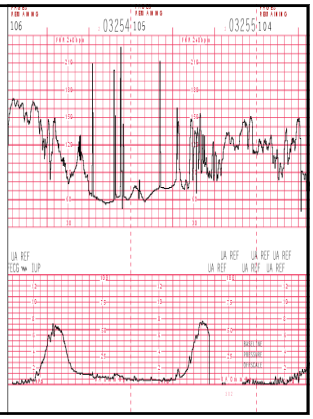


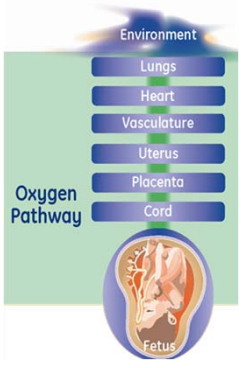
Interruption of the oxygen pathway at the level of the uterus or placenta can result in a late deceleration





Interruption of the oxygen pathway at any point can result in a prolonged deceleration

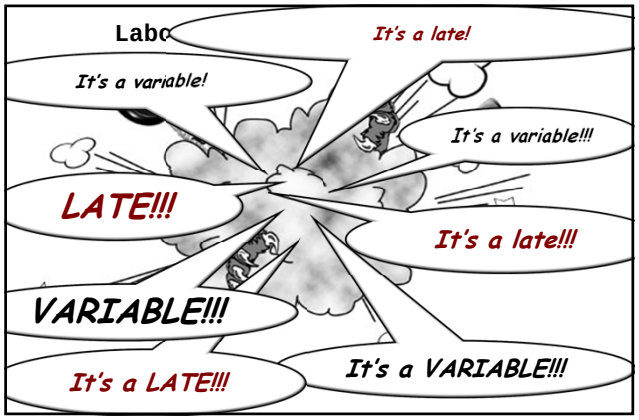


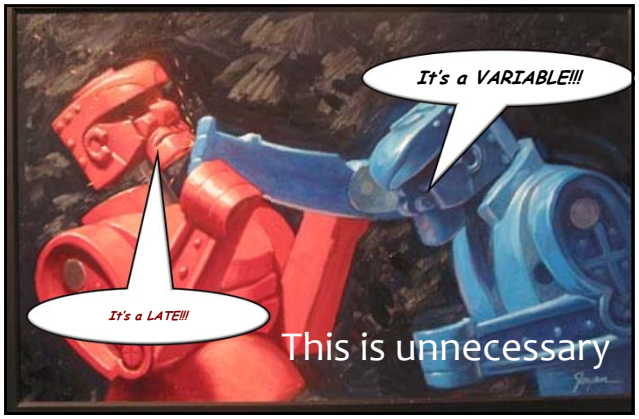


ALL clinically significant FHR decelerations (late, variable, prolonged)

HAVE EXACTLY THE SAME TRIGGER…

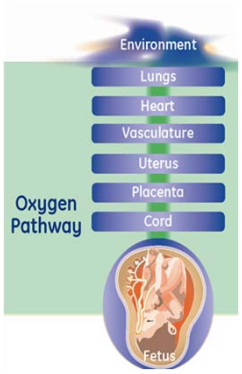
Interruption of the oxygen pathway at one or more points





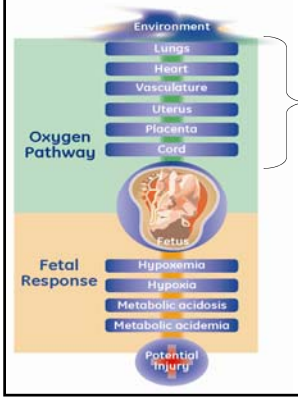
Step away from the edge…

Make it easy for yourself and your team…

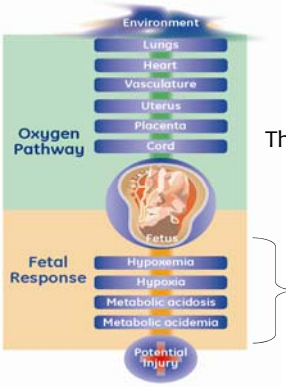


All FHR decelerations that have any potential clinical significance have the same common trigger…

Interruption of oxygen transfer from the environment to the fetus at one or more points along the oxygen pathway

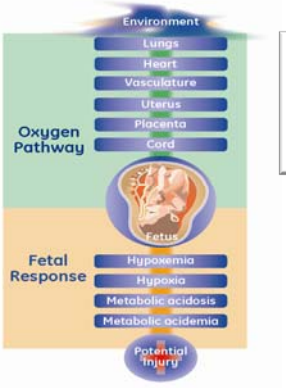


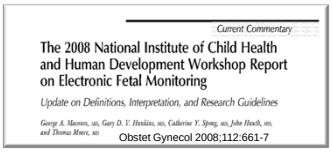
<u>Principle #1</u>
Variable, late or prolonged decelerations signal interruption of the oxygen pathway at one or more points



The second half of the pathway

What information can the FHR tracing provide regarding the fetal response to interruption of the oxygen pathway?



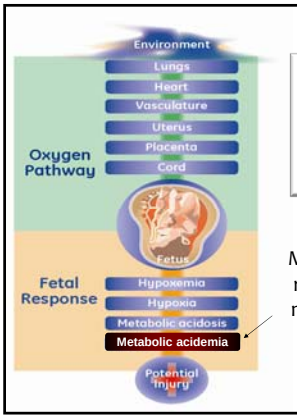

Current Commentary

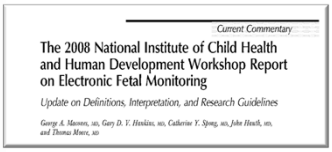
The 2008 National Institute of Child Health and Human Development Workshop Report on Electronic Fetal Monitoring

Update on Definitions, Interpretation, and Research Guidelines

Obstet Gynecol 2008;112:661-7

The 2008 NICHD consensus statement identified two fetal heart rate characteristics that reliably predict the absence of fetal metabolic acidemia at the time they are observed



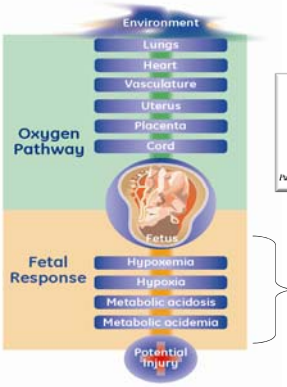

Current Commentary

The 2008 National Institute of Child Health and Human Development Workshop Report on Electronic Fetal Monitoring

Update on Definitions, Interpretation, and Research Guidelines

<u>Principle # 2</u>

Moderate variability or accelerations reliably predict the absence of fetal metabolic acidemia at the time they are observed



CONSENSUS STATEMENT

A template for defining a causal relationship between acute intrapartum events and cerebral palsy: international consensus statement

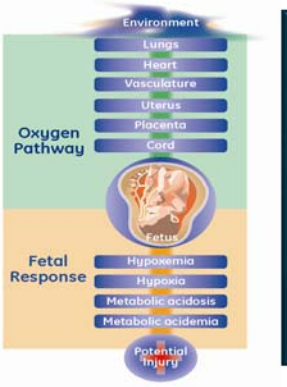
Alastair MacLennan for the International Cerebral Palsy Task Force*

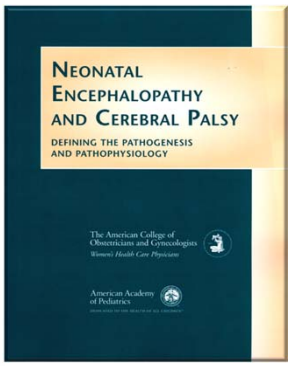
Published in the British Medical Journal 16 October 1999; 319: pages 1054-1059 and reprinted with permission

What is the physiologic significance of excluding metabolic acidemia?

Supporters included:

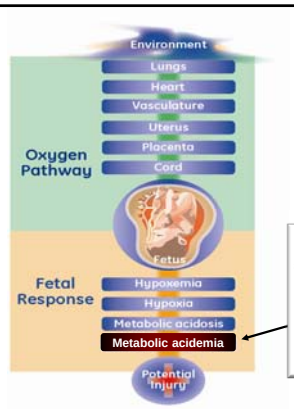
1. *American College of Obstetricians and Gynecologists*
2. *American Gynecological and Obstetrical Society*
3. *Australian College of Midwives*
4. *Hong Kong Society of Neonatal Medicine*
5. *Institute of Obstetrics and Gynaecology of the Royal College of Physicians of Ireland*
6. *International Society of Perinatal Obstetricians*
7. *New Zealand College of Midwives*
8. *Paediatric Society of New Zealand*
9. *Perinatal Society of Australia and New Zealand*
10. *Royal Australasian College of Physicians, Paediatric Division*
11. *Royal Australian College of General Practitioners*
12. *Royal Australian College of Obstetricians and Gynaecologists*
13. *Royal College of Obstetricians and Gynaecologists*
14. *Royal College of Pathologists of Australasia*
15. *Royal New Zealand College of Obstetricians and Gynaecologists*
16. *Society of Obstetricians and Gynaecologists of Canada*



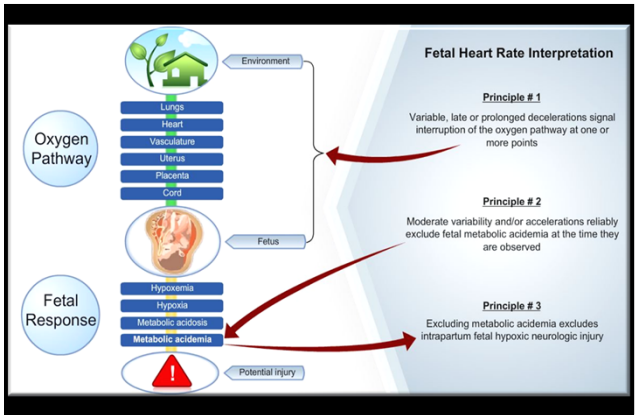


The publication was endorsed by:

1. *American College of Obstetricians and Gynecologists*
2. *American Academy of Pediatrics*
3. *Centers for Disease Control and Prevention*
4. *Child Neurology Society*
5. *March of Dimes Birth Defects Foundation*
6. *National Institute of Child Health and Human Development*
7. *Royal Australian and New Zealand College of Obstetricians and Gynecologists*
8. *Society for Maternal-Fetal Medicine*
9. *Society of Obstetricians and Gynaecologists of Canada*



Metabolic acidemia
is an essential prerequisite to intrapartum hypoxic neurologic injury
(pH < 7, BD ≥ 12 mmol/L)



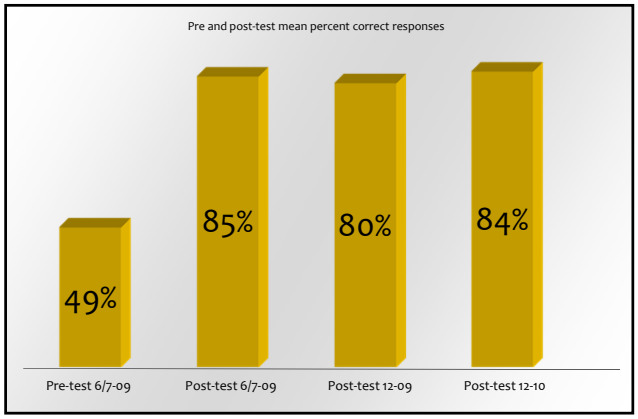
Is this simple enough to be taught and retained?

In 2009, the Los Angeles County Department of Health mandated FHR competency testing (OVMC, HUCLA, LAC+USC)

After a series of training sessions on standard NICHD FHR definitions, NICHD categories and 3 simplified principles of interpretation, a formal written test was administered to all care providers at all levels

A two-year quality improvement initiative to standardize the methods by which obstetric team members interpret, communicate, document and manage fetal heart rate tracings

400 representatives from 90 of New York's 140 hospitals



Interobserver Reliability of Fetal Heart Rate Pattern Interpretation Using NICHD Definitions

Reviewers demonstrated agreement on:

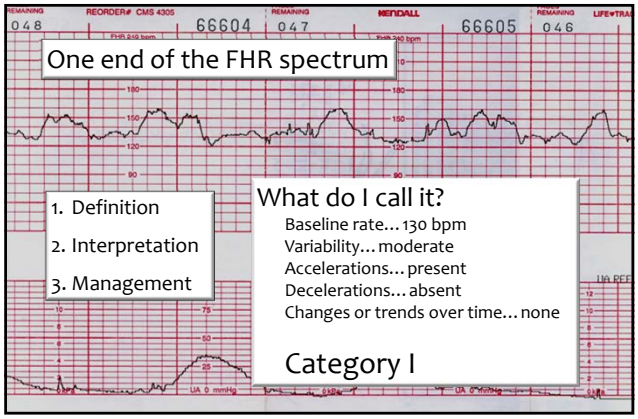
Baseline rate	0.97
Moderate variability	0.80
Accelerations	0.62
Decelerations	0.63
Category	0.68
Exclude fetal metabolic acidemia	0.82

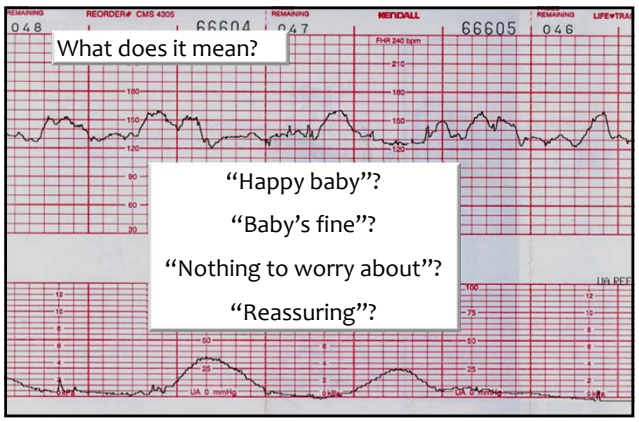
Substantial to Excellent agreement on all components

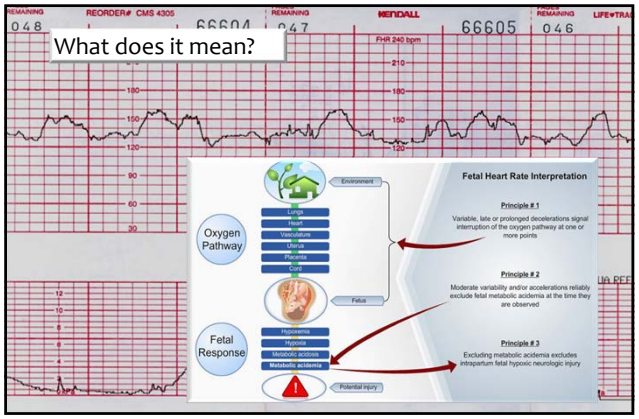
Kappa value	Agreement
< 0.40	Poor
.41 – .60	Moderate
.61 – .80	Substantial
.81 – 1.0	Excellent

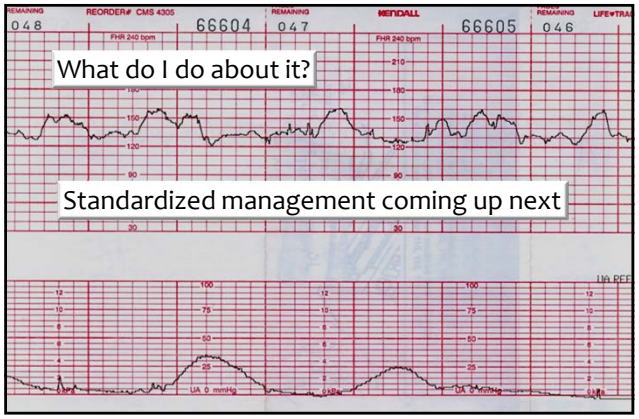
Epstein A, et al. Am J Perinatol 2012 – in press

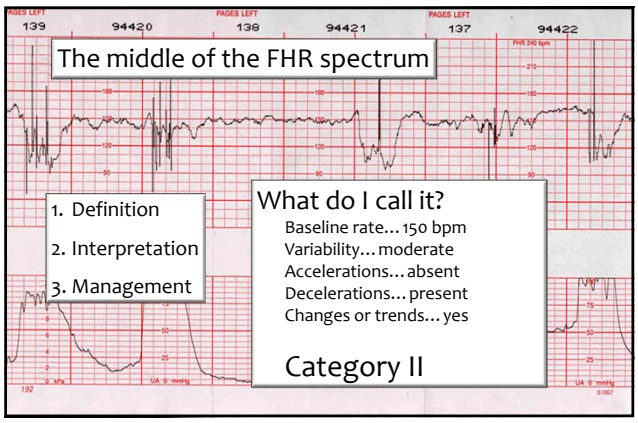
Does it have a practical application?

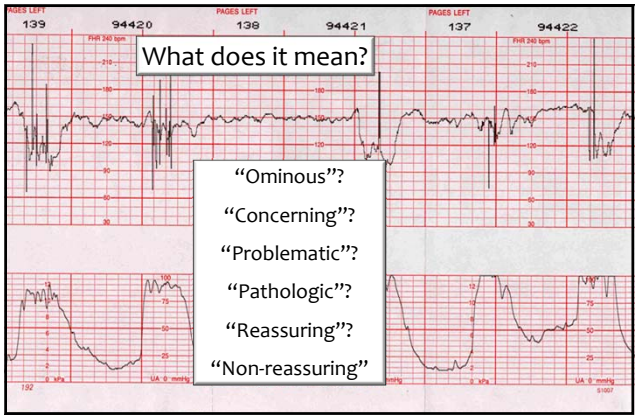


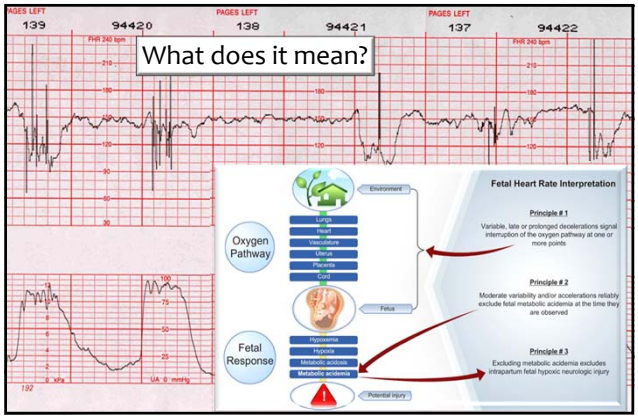

What does it mean?
"Happy baby"?
"Baby's fine"?
"Nothing to worry about"?
"Reassuring"?

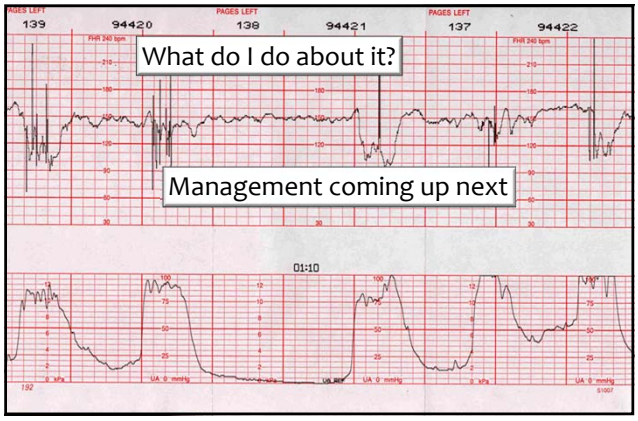

What does it mean?
Fetal Heart Rate Interpretation
Oxygen Pathway
Fetal Response
Principle # 1
Principle # 2
Principle # 3

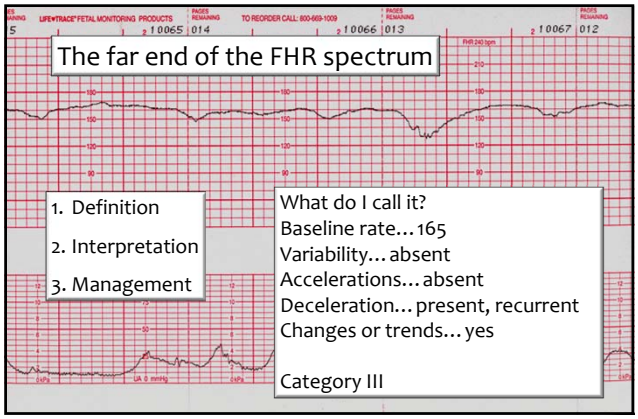

What do I do about it?
Standardized management coming up next

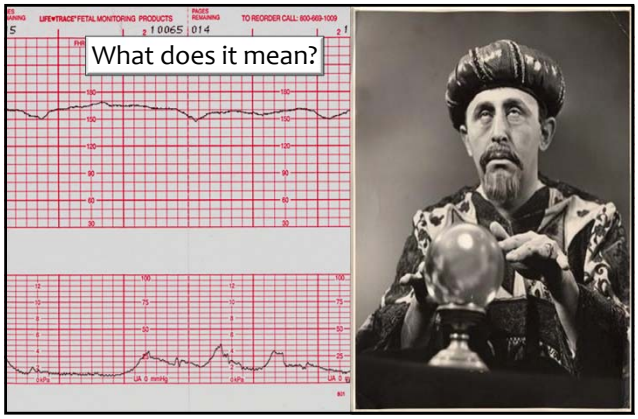

The middle of the FHR spectrum
1. Definition
2. Interpretation
3. Management
What do I call it?
Baseline rate… 150 bpm
Variability… moderate
Accelerations… absent
Decelerations… present
Changes or trends… yes
Category II

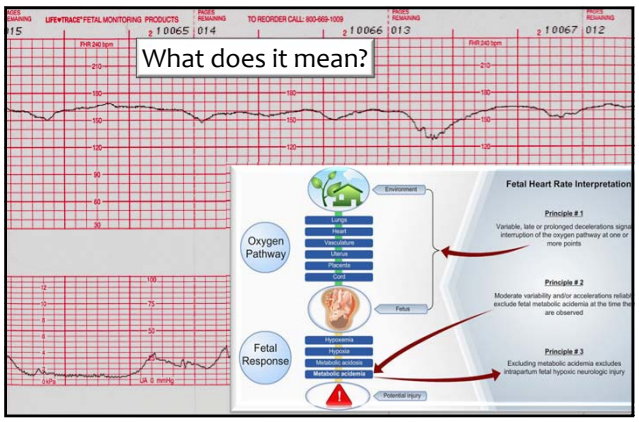

What does it mean?
"Ominous"?
"Concerning"?
"Problematic"?
"Pathologic"?
"Reassuring"?
"Non-reassuring"

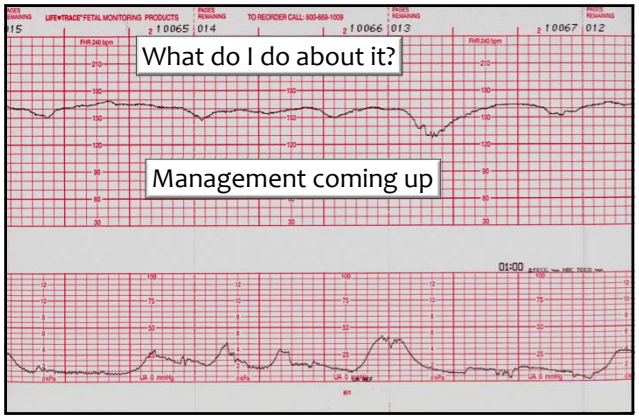

What does it mean?
Oxygen Pathway
Fetal Response
Fetal Heart Rate Interpretation
Principle # 1
Principle # 2
Principle # 3


What do I do about it?
Management coming up next


The far end of the FHR spectrum
1. Definition
2. Interpretation
3. Management
What do I call it?
Baseline rate…165
Variability… absent
Accelerations… absent
Deceleration… present, recurrent
Changes or trends… yes
Category III


What does it mean?





Factual Accuracy

Standard Definitions
- We have achieved consensus in the United States on the terminology used to describe the five components of a FHR tracing

Standard interpretation
- Three central concepts of FHR interpretation are evidence-based and reflect consensus in the literature

Ability to Articulate

Standardized management is the next challenge

This will be the topic of the breakout sessions

Standardized management is NOT intended to replace individual clinical judgment

On the contrary…

Standardized management is intended to ***encourage the systematic application of individual clinical judgment***

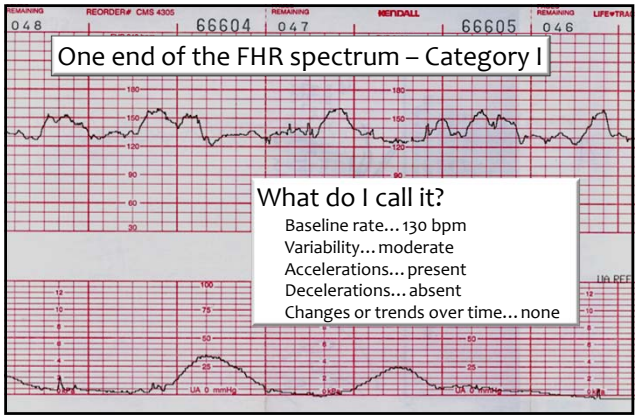
Risk factors for error

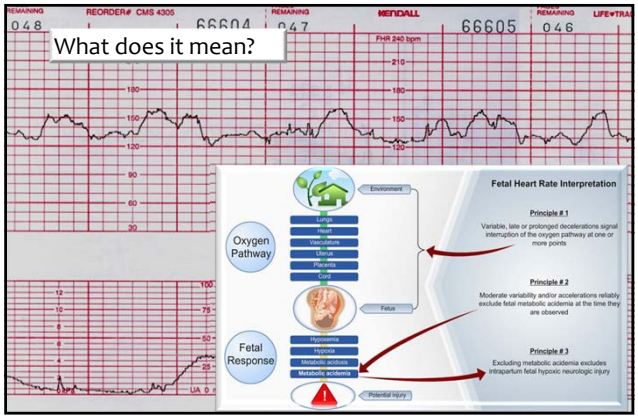
Random recall

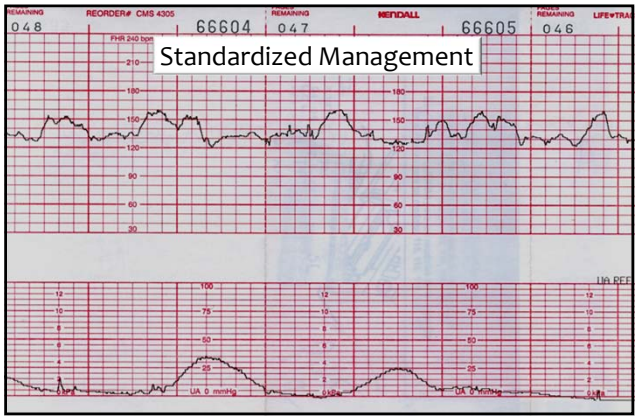
Lack of a checklist

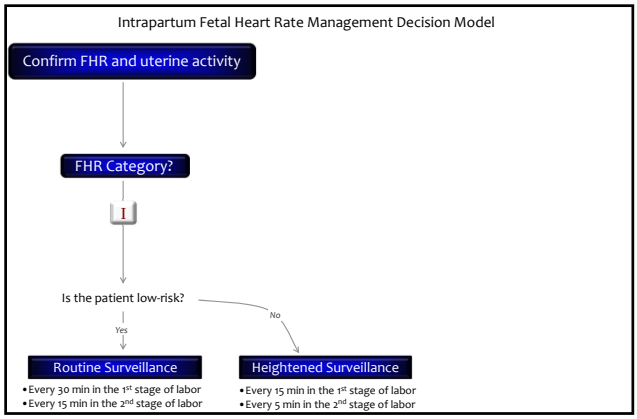
Unnecessary complexity

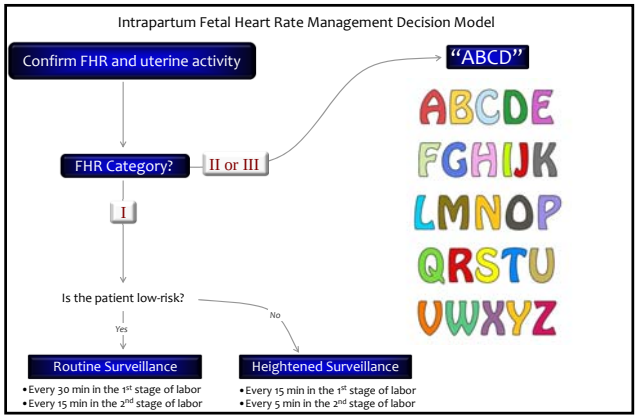
Random recall






Standardized Management


Intrapartum Fetal Heart Rate Management Decision Model
Confirm FHR and uterine activity
FHR Category?
I
Is the patient low-risk?
Yes
No
Routine Surveillance
•Every 30 min in the 1st stage of labor
•Every 15 min in the 2nd stage of labor
Heightened Surveillance
•Every 15 min in the 1st stage of labor
•Every 5 min in the 2nd stage of labor

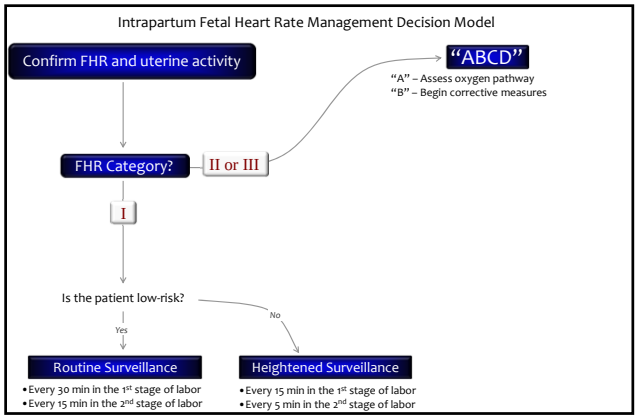

Intrapartum Fetal Heart Rate Management Decision Model
Confirm FHR and uterine activity
"ABCD"
ABCDE
FGHIJK
LMNOP
QRSTU
VWXYZ
FHR Category?
II or III
I
Is the patient low-risk?
Yes
No
Routine Surveillance
•Every 30 min in the 1st stage of labor
•Every 15 min in the 2nd stage of labor
Heightened Surveillance
•Every 15 min in the 1st stage of labor
•Every 5 min in the 2nd stage of labor

Standardized Intrapartum FHR Management

Four Elements

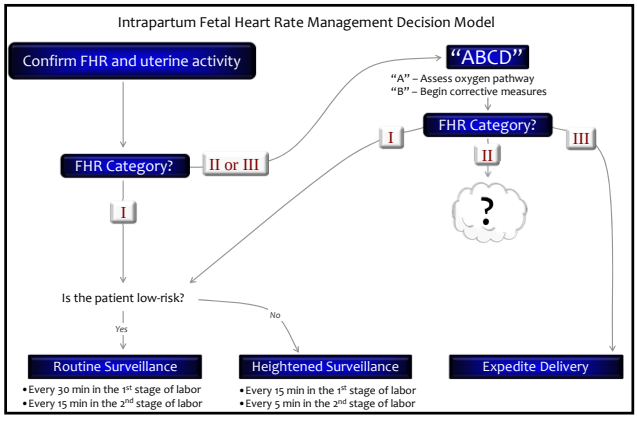
"ABCD"

A – Assess the oxygen pathway
B – Begin corrective measures



	"A" Assess Oxygen Pathway
Lungs	Airway and breathing
Heart	Heart rate and rhythm
Vasculature	Blood pressure Volume status
Uterus	Contraction strength Contraction frequency Baseline uterine tone Exclude uterine rupture
Placenta	Placental separation Bleeding vasa previa
Cord	Vaginal exam Exclude cord prolapse

	"A" Assess Oxygen Pathway	"B" Begin Corrective Measures *if Indicated*
Lungs	Airway and breathing	Supplemental oxygen
Heart	Heart rate and rhythm	Position change Fluid bolus Correct hypotension
Vasculature	Blood pressure Volume status	
Uterus	Contraction strength Contraction frequency Baseline uterine tone Exclude uterine rupture	Stop or reduce stimulant Consider uterine relaxant
Placenta	Placental separation Bleeding vasa previa	
Cord	Vaginal exam Exclude cord prolapse	Consider amnioinfusion



What fetal heart rate characteristics tell you it is safe to continue surveillance?

Step away from the edge…

Make it easy for yourself and your team…

If you have ***any question***…

…the safest approach is to proceed to the next step

"C"

Cesarean Section

NO

"C"

Cesarean?
Call for Cesarean?
Crash Cesarean?
Call for the vacuum?
Commit to cesarean?
Commit to delivery?
Cancel clinic?

Standardized Intrapartum Management

"ABCD"

A – Assess the oxygen pathway
B – Begin corrective measures
C – Clear obstacles to rapid delivery

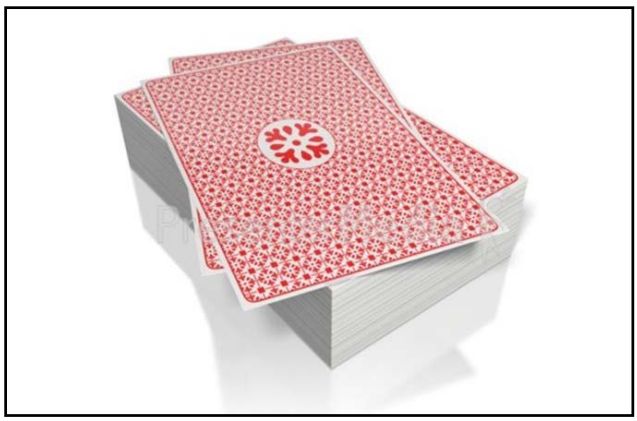
Clear obstacles to rapid delivery

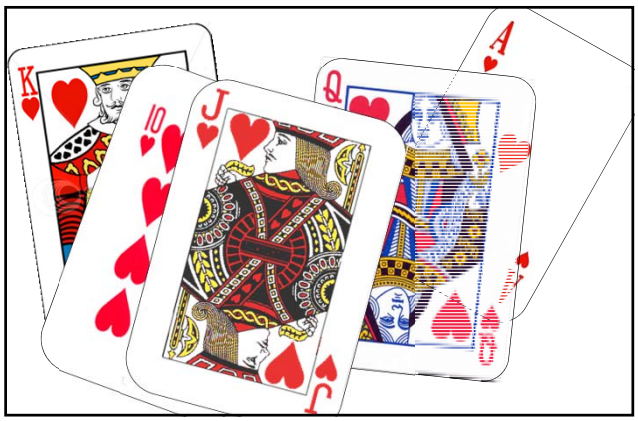
If conservative measures do not correct the FHR tracing, it is prudent to plan ahead for the possible need for rapid delivery

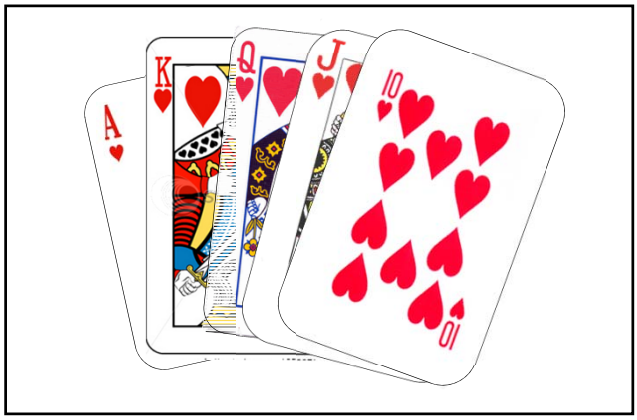
This does NOT commit the patient to delivery

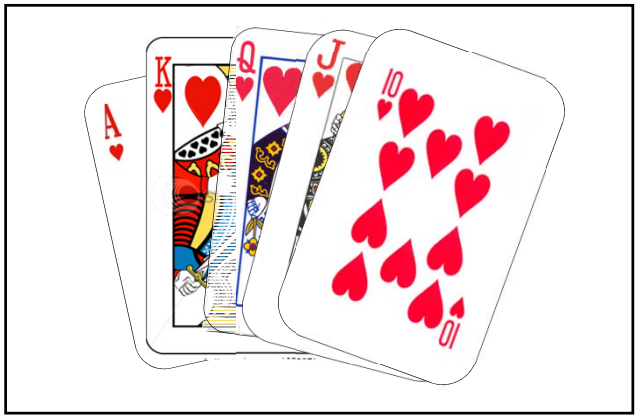
It simply identifies common sources of unnecessary delay in a systematic way so they can be addressed in timely fashion

By doing this, it demonstrates reasonableness and prudence… two elements that define the standard of care



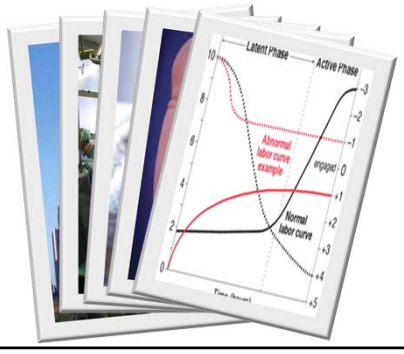



A
K
Q
J
10


A
K
Q
J
10

Consider individual characteristics of

Facility
Staff
Mother
Fetus
Labor

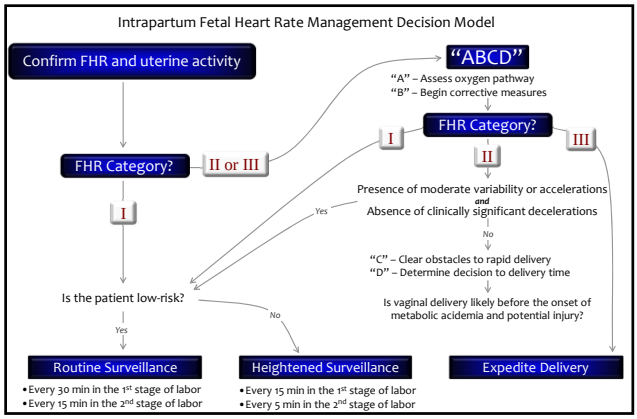


	"A" Assess Oxygen Pathway	"B" Begin Corrective Measures *if Indicated*		"C" Clear Obstacles to Rapid Delivery
Lungs	Airway and breathing	Supplemental oxygen	Facility	
Heart	Heart rate and rhythm	Position changes Fluid bolus Correct hypotension	Staff	
Vasculature	Blood pressure Volume status		Mother	
Uterus	Contraction strength Contraction frequency Baseline uterine tone Exclude uterine rupture	Stop or reduce stimulant Consider uterine relaxant	Fetus	
Placenta	Placental separation Bleeding vasa previa			
Cord	Vaginal exam Exclude cord prolapse	Consider amnioinfusion	Labor	

	"A" Assess Oxygen Pathway	"B" Begin Corrective Measures *if Indicated*		"C" Clear Obstacles to Rapid Delivery
Lungs	Airway and breathing	Supplemental oxygen	Facility	OR availability Equipment
Heart	Heart rate and rhythm	Position changes Fluid bolus Correct hypotension	Staff	Notify *Obstetrician* *Surgical assistant* *Anesthesiologist* *Neonatologist* *Pediatrician* *Nursing staff*
Vasculature	Blood pressure Volume status		Mother	Informed consent Anesthesia options Laboratory tests Blood products Intravenous access Urinary catheter Abdominal prep Transfer to OR
Uterus	Contraction strength Contraction frequency Baseline uterine tone Exclude uterine rupture	Stop or reduce stimulant Consider uterine relaxant	Fetus	Confirm *Estimated fetal weight* *Gestational age* *Presentation* *Position*
Placenta	Placental separation Bleeding vasa previa			
Cord	Vaginal exam Exclude cord prolapse	Consider amnioinfusion	Labor	Consider IUPC

	"A" Assess Oxygen Pathway	"B" Begin Corrective Measures *if Indicated*
Lungs	Airway and breathing	Supplemental oxygen
Heart	Heart rate and rhythm	Position changes Fluid bolus Correct hypotension
Vasculature	Blood pressure Volume status	
Uterus	Contraction strength Contraction frequency Baseline uterine tone Exclude uterine rupture	Stop or reduce stimulant Consider uterine relaxant
Placenta	Placental separation Bleeding vasa previa	
Cord	Vaginal exam Exclude cord prolapse	Consider amnioinfusion

	"C" Clear Obstacles to Rapid Delivery	"D" Determine Decision to Delivery Time
Facility	OR availability Equipment	Facility response time
Staff	Notify *Obstetrician* *Surgical assistant* *Anesthesiologist* *Neonatologist* *Pediatrician* *Nursing staff*	Consider staff: Availability Training Experience
Mother	Informed consent Anesthesia options Laboratory tests Blood products Intravenous access Urinary catheter Abdominal prep Transfer to OR	Surgical considerations *(prior abdominal or uterine surgery)* Medical considerations *(obesity, hypertension, diabetes, SLE)* Obstetric considerations *(parity, pelvimetry, placental location)*
Fetus	Confirm *Estimated fetal weight* *Gestational age* *Presentation* *Position*	Consider factors such as: *Estimated fetal weight* *Gestational age* *Presentation* *Position*
Labor	Consider IUPC	Consider factors such as: *Arrest disorder* *Protracted labor* *Remote from delivery* *Poor expulsive efforts*



This is sometimes a very tough decision to make

No matter what our decision is, we'll never be able to guarantee a good outcome

Having a bad outcome despite a well-thought out plan is not necessarily unreasonable

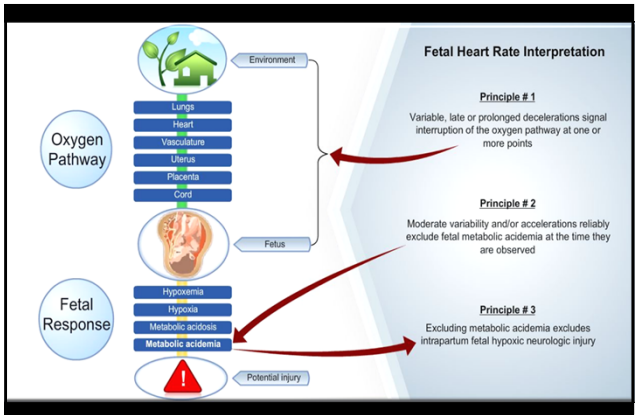
It is much more difficult to convince someone that our actions were reasonable if we neglect to make a plan… fail to make a decision at a critical point

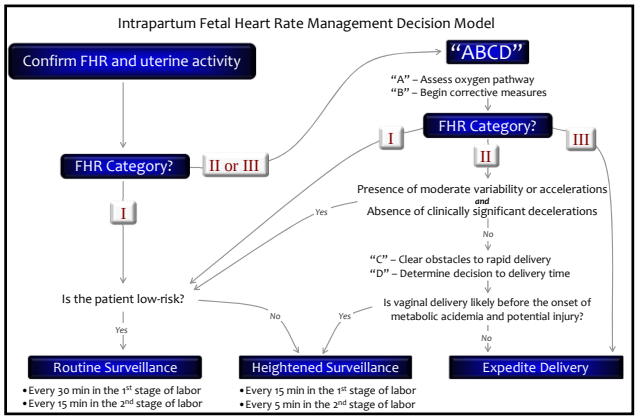
Deciding to wait

is distinctly different from

Waiting to decide

Kickin' the can down the road





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Staff	Notify *Obstetrician* *Surgical assistant* *Anesthesiologist* *Neonatologist* *Pediatrician* *Nursing staff*	Consider staff: Availability Training Experience
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Fetus	Confirm *Estimated fetal weight* *Gestational age* *Presentation* *Position*	Consider factors such as: *Estimated fetal weight* *Gestational age* *Presentation* *Position*
Labor	Consider IUPC	Consider factors such as: *Arrest disorder* *Protracted labor* *Remote from delivery* *Poor expulsive efforts*

How do you document this?

If the "Objective" section of your SOAP note indicates:

"145 bpm, mod var, occ accels, occ late decels"

Does the "Assessment" section need to read:

"Late decelerations indicate interruption of the oxygen pathway, however moderate variability and accelerations reliably exclude metabolic acidemia, therefore reliably exclude hypoxic neurologic injury at this time"

Of course not

How about this?

If the "Objective" section of your SOAP note indicates:

"145 bpm, mod var, occ accels, occ late decels"

Why not write:

"Occasional late decelerations. Moderate variability and accelerations confirm adequate oxygenation"

Or even simpler

"Adequate oxygenation"

What would be your indication for cesarean?

"Fetal distress"?

"Fetal intolerance to labor"?

"Non-reassuring fetal status"?

Why not…

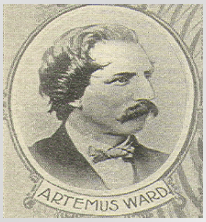
"Recurrent decelerations, minimal variability, remote from delivery"?

Myth Busting 101
Separating Fact from Fiction

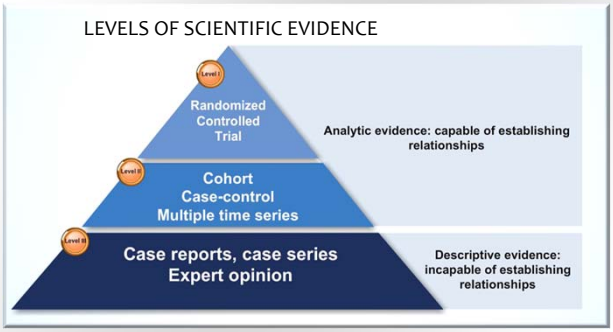
David A. Miller, M.D.
Professor of Obstetrics, Gynecology and Pediatrics
University of Southern California
Childrens Hospital Los Angeles

"It ain't so much the things we don't know that get us into trouble.

It's the things we know that just ain't so,"

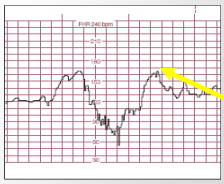


LEVELS OF SCIENTIFIC EVIDENCE



"Atypical variable decelerations"

"Overshoot"



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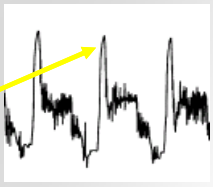


"Overshoot"
No consensus regarding:

- Definition
- Clinical significance
- Management

"Overshoot"

The term "overshoot" has been used to describe a FHR pattern characterized by persistently absent variability, absent accelerations and a variable deceleration followed by a smooth, prolonged rise in the FHR above the previous baseline with gradual return.

As with the "wandering baseline", essential elements of this uncommon pattern include the persistent absence of variability and the absence of accelerations.

"Overshoot"

The "overshoot" pattern has been attributed to a range of conditions, including

"mild fetal hypoxia above the deceleration threshold"

"chronic fetal distress"

"repetitive transient central nervous system ischemia"

"Overshoot"

However, all of these associations are speculative and none has been substantiated by available scientific evidence

"Overshoot"

The physiologic mechanisms responsible for the "overshoot" pattern are not known

However, the pattern has been described in association with abnormal neurologic outcome with or without metabolic acidemia, suggesting that it might indicate preexisting neurologic injury

"Overshoot"

Because of the wide variation in reported associations and the total lack of agreement regarding the definition and clinical significance of "overshoot", it is best to avoid the use of this term in favor of specific terminology

All evidence regarding the "overshoot" pattern in humans is Level III.

"Atypical variable decelerations"

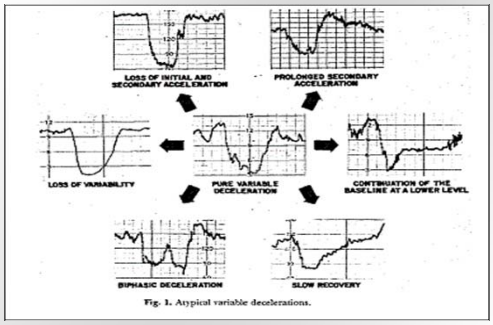
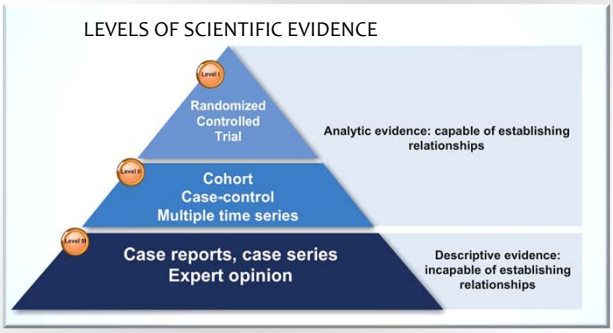


Fig. 1. Atypical variable decelerations.

Krebs HB, Petres RE, Dunn LJ. Intrapartum fetal heart rate monitoring VIII. Atypical variable decels. Obstet Obset Gynecol 1983;145:297-305.

LEVELS OF SCIENTIFIC EVIDENCE



Level II evidence requires "appropriate control of confounding factors". Evidence that does not rise to this level does not satisfy criteria for Level II

Known confounding factors in fetal monitoring

- *Presence or absence of normal baseline rate*
- *Presence or absence of moderate variability*
- *Presence or absence of accelerations*
- *Presence or absence of antecedent decelerations*

Studies that do not control for these known sources of confounding bias do not meet criteria for inclusion in Level II. - US Preventive Services Taskforce

U.S. Preventive Services Task Force Procedure Manual. AHRQ Publication No. 08-05118-EF, July 2008. http://www.uspreventiveservicestaskforce.org/uspstf08/methods/procmanual.htm

"Atypical variable decelerations"

"Variable deceleration with a late component"

"Atypical variable decelerations"

"Variable deceleration with a late component"

The specific physiologic mechanism has not been studied systematically.

There is no Level I supporting evidence

There is no Level II evidence with appropriate control of confounding factors

In the absence of a standard definition of this pattern, its use is best avoided in favor of standard terminology. For example: "variable deceleration with gradual return to baseline"

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 (variable with a late component).…

"Atypical variable decelerations"

"Mild", "Moderate" and "Severe" variable decelerations

The depth and duration of variable decelerations have been suggested as predictors of newborn outcome

Kubli and colleagues proposed three categories of variable decelerations based upon these characteristics

"Atypical variable decelerations"

"Mild", "Moderate" and "Severe" variable decelerations

According to this classification system, a mild variable deceleration was defined by a duration < 30 seconds regardless of depth, a depth no lower than 80 bpm or a depth of 70-80 bpm lasting < 60 seconds

A moderate variable deceleration was defined by a depth < 70 bpm lasting 30-60 seconds or a depth of 70-80 bpm lasting more than 60 seconds.

A severe deceleration was defined as a deceleration below 70 bpm lasting more than 60 seconds

"Atypical variable decelerations"

"Mild", "Moderate" and "Severe" variable decelerations

There is no level I or level II evidence in the literature that the depth of any type of deceleration (early, variable, late or prolonged) is predictive of fetal metabolic acidemia or newborn outcome independent of other important FHR characteristics such as baseline rate, variability, accelerations and frequency of decelerations

"Atypical variable decelerations"

"Mild", "Moderate" and "Severe" variable decelerations

Therefore, "mild", "moderate" and "severe" categories are not included in standard NICHD definitions of FHR decelerations

Consistent with NICHD terminology, all decelerations are quantitated by depth in beats per minute and duration in minutes and seconds

2008 NICHD

"Some authors have suggested grading of decelerations (mild, moderate, severe) based on the depth of the deceleration or absolute nadir in beats per minute and duration."

"These grading systems require further investigation as to their predictive value."

This categorization system was specifically addressed by the 2008 NICHD consensus panel and specifically rejected for lack of evidence

"Atypical variable decelerations"

"V-shaped variables" and "W-shaped variables"

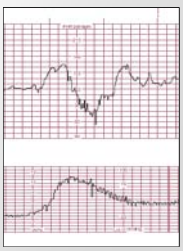
The visual appearance of a variable deceleration has been suggested to predict the underlying cause

For example, a "V-shaped" variable deceleration has been suggested to indicate umbilical cord compression due to oligohydramnios

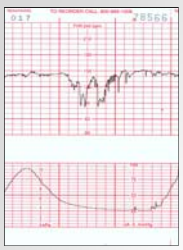
A "W-shaped" variable deceleration has been suggested to reflect umbilical cord compression due to a nuchal cord

"Atypical variable decelerations"

"V-shaped variables" and "W-shaped variables"



Oligohydramnios?



Nuchal cord?

"Atypical variable decelerations"

"V-shaped variables" and "W-shaped variables"

Although such claims likely have little impact on patient care, there is no supporting evidence in the literature

These terms are not included in standardized NICHD terminology

2008 NICHD

"Variable decelerations may be accompanied by other characteristics, the clinical significance of which requires further research investigation."

"Some examples include biphasic decelerations"

(W-shaped)

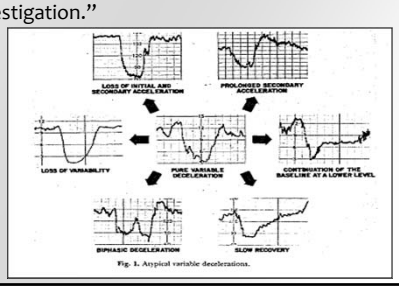


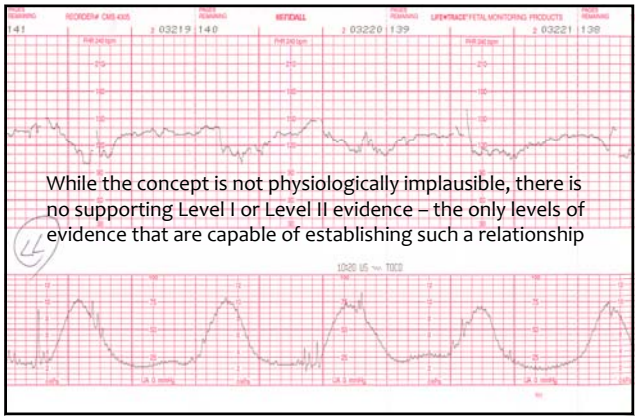
Fig. 1. Atypical variable decelerations.

Other myths…

"Good variability within the deceleration"

At the nadir of a variable or late deceleration, the FHR frequently appears irregular, similar to the appearance of moderate variability

The visual similarity has led some to suggest that "variability" during a deceleration has the same clinical significance as baseline variability



Other myths…

"Good variability within the deceleration"

In addition, it is inconsistent with standard terminology.

Variability is a characteristic of the FHR baseline

The term "variability" is not used to qualify periodic or episodic decelerations that interrupt the baseline

In the absence of evidence, the safest approach is to avoid assigning undue significance to this observation

Other myths…

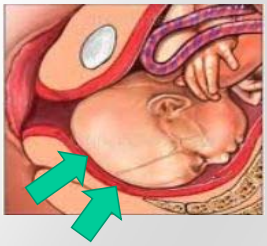
"The constant pounding of the fetal head on the maternal pelvis causes local cerebral ischemia and brain damage WITHOUT systemic metabolic acidemia and WITHOUT the necessity of neonatal encephalopathy"

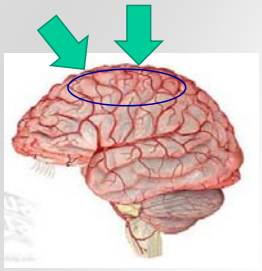
Scenario

- Term labor
- Uncomplicated vaginal delivery
- Normal Apgar scores
- Normal umbilical artery blood gas results
- Normal newborn course
- Home with mother on PPD 2
- Neurologic symptoms noted at 18 months

Claim

"Silent" cerebral ischemia…
Not global hypoxia





Mechanical head compression

There are no analytic studies in the literature to support this hypothetical mechanism of injury

Analytic (case-control) studies evaluating risk factors for cerebral palsy have never identified any degree of uterine activity as a risk factor

Case-control Studies Failing to Identify Uterine Activity as a Risk Factor

Kułak W, Okurowska-Zawada B, Sienkiewicz D, Paszko-Patej G, Krajewska-Kułak E Risk factors for cerebral palsy in term birth infants. Adv Med Sci. 2010;55(2):216-21.

Walstab J, Bell R, Reddihough D, et al. Antenatal and intrapartum antecedents of cerebral palsy: a case-control study. Aust N Z J Obstet Gynaecol. 2002 May;42(2):138-46.

Nelson KB, Ellenberg JH. Antecedents of cerebral palsy. Univariate analysis of risks. Am J Dis Child. 1985;139(10):1031-1038.

Nelson KB, Ellenberg JH Antecedents of cerebral palsy. Multivariate analysis of risk. N Engl J Med. 1986 Jul 10;315(2):81-6.

Badawi N, Kurinczuk JJ, Keogh JM, et al. Intrapartum risk factors for newborn encephalopathy: the Western Australian case-control study. BMJ 1998; 317:1554–1558.

Suvanand S, Kapoor SK, Reddaiah VP, Singh U, Sundaram KR. Risk Factors for Cerebral Palsy. Indian J Pediatr 1997; 64:677-685.

Towner D, NEJM 1999;341:1709-14

TABLE 1. SINGLETON INFANTS BORN TO NULLIPAROUS WOMEN IN CALIFORNIA BETWEEN 1992 AND 1994, ACCORDING TO THE MODE OF DELIVERY.*

YEAR	SPONTANEOUS DELIVERY	VACUUM EXTRACTION	CESAREAN SECTION	FORCEPS DELIVERY	VACUUM EXTRACTION AND FORCEPS DELIVERY	TOTAL
	number of infants (percent)					
1992	133,486 (66.3)	18,667 (9.3)	41,502 (20.6)	6,519 (3.2)	1105 (0.5)	201,279
1993	128,737 (66.6)	19,499 (10.1)	39,235 (20.3)	4,948 (2.6)	920 (0.5)	193,339
1994	125,576 (66.5)	21,188 (11.2)	36,688 (19.4)	4,478 (2.4)	792 (0.4)	188,722
Total	387,799 (66.5)	59,354 (10.2)	117,425 (20.1)	15,945 (2.7)	2817 (0.5)	583,340

*Data are restricted to live-born infants weighing 2500 to 4000 g.

	TOTAL (N=117,425)		DURING LABOR (N=84,417)		CESAREAN: DURING LABOR, FAILED VAGINAL DELIVERY (N=2342)†		CESAREAN: DURING LABOR, NO ATTEMPT AT VAGINAL DELIVERY (N=82,075)†		NO LABOR (N=33,008)	
	Incidence	Odds Ratio	Incidence	Odds Ratio	Incidence	Odds Ratio	Incidence	Odds Ratio	Incidence	Odds Ratio
Subdural or cerebral hemorrhage	6.7	2.3 (1.7–3.1)	7.4	2.5 (1.8–3.4)	25.7	8.8 (3.9–19.9)	6.8	2.3 (1.7–3.2)	4.1	1.4 (0.8–2.6)
Intraventricular hemorrhage	2.1	2.0 (1.2–3.3)	2.5	2.3 (1.4–4.0)	0.0	0.0 (0.0–1.1)	2.6	2.4 (1.4–4.1)	0.8	0.6 (0.1–2.5)
Subarachnoid hemorrhage	0.9	0.7 (0.4–1.4)	1.2	0.9 (0.4–1.9)	4.3	3.3 (0.5–23.9)	1.1	0.9 (0.4–1.7)	0.0	0.0 (0.0–19.7)
Facial-nerve injury	3.5	1.1 (0.7–1.5)	3.1	0.9 (0.6–1.4)	12.8	3.8 (1.2–12.1)	2.8	0.8 (0.5–1.3)	4.9	1.5 (0.8–2.6)
Brachial plexus injury	3.0	0.4 (0.3–0.5)	1.8	0.2 (0.1–0.4)	8.6	1.1 (0.3–4.4)	1.6	0.2 (0.1–0.4)	4.1	0.5 (0.3–1.0)
Convulsions	18.7	2.9 (2.4–3.6)	21.3	3.3 (2.8–4.1)	68.8	10.8 (6.5–17.8)	19.9	3.1 (2.6–3.8)	8.6	1.4 (0.9–2.1)
CNS depression	8.9	2.9 (2.2–3.7)	9.6	3.1 (2.3–4.1)	17.1	5.5 (1.7–15.5)	9.4	3.0 (2.3–4.0)	6.7	2.2 (1.3–3.6)
Feeding difficulty	114.7	1.7 (1.6–1.8)	117.2	1.7 (1.6–1.8)	94.8	1.4 (0.9–2.1)	117.9	1.7 (1.6–1.8)	106.3	1.6 (1.4–1.8)
Mechanical ventilation	96.0	3.7 (3.4–4.1)	103.2	4.0 (3.6–4.3)	156.1	6.0 (4.3–8.3)	101.7	2.6 (2.2–3.0)	71.3	2.8 (2.4–3.3)

*The incidence is expressed as the number of cases per 10,000 infants. Numbers in parentheses are 95 percent confidence intervals. CNS denotes central nervous system.

†Vaginal delivery refers to delivery with the use of vacuum extraction, forceps, or both.

Spontaneous vaginal deliveries = 387,799

One of the latest myths…

MORE CATEGORIES ARE BETTER

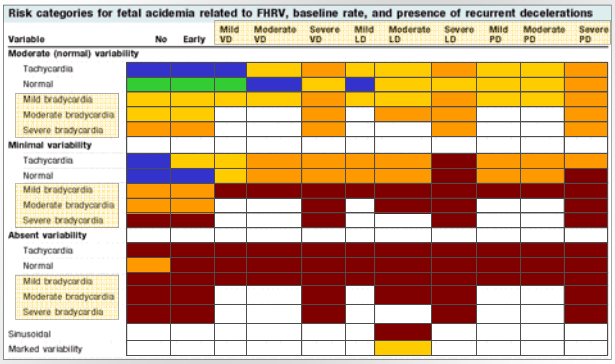


TABLE 2

Risk of acidemia, evolution of FHR patterns to more serious risk, and recommended action

Variable	Risk of acidemia	Risk of evolution	Action
Green	0	Very low	
Blue	0	Low	
Yellow	0	Moderate	
Orange	Borderline/acceptably low	High	
Red	Unacceptably high	Not a consideration	

"5-tier system"

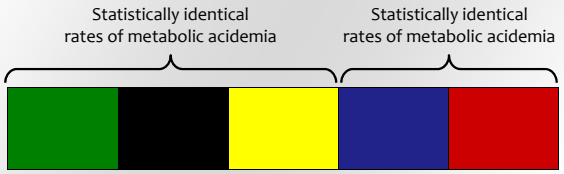
Most studies have ignored the difference between respiratory and metabolic acidemia

Respiratory Acidemia	Metabolic/mixed Acidemia
• Common	• Uncommon (< 2 %)
• Low pH	• Low pH
• PCO_2 > 50 mmHg	• Normal or high PCO_2
• Base deficit < 12	• Base deficit ≥ 12
• ***Clinically benign***	• ***Prerequisite to injury***

If a study does not differentiate between benign respiratory acidemia and potentially-pathologic metabolic acidemia, no meaningful conclusions can be made regarding a relationship between "5-tiers" and adverse outcome

"5-tier system"

The studies that have assessed metabolic acidemia have never demonstrated more than 2-3 separate categories of risk

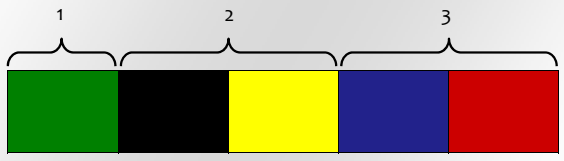


"5 tiers" = Only 2 distinct categories of risk for metabolic acidemia

Coletta, et al. Am J Obstet Gynecol 2012;206:226.e1-5.

"5-tier system"

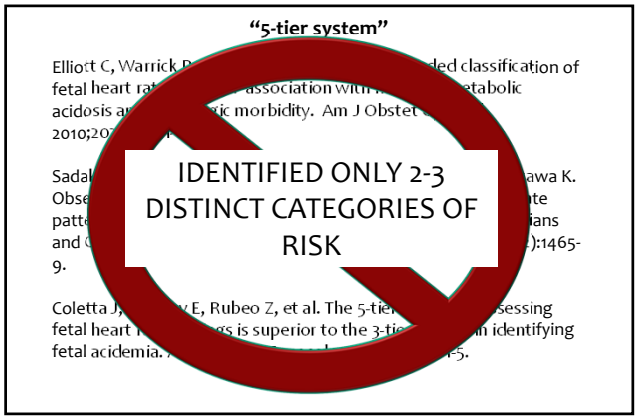
The studies that have assessed metabolic acidemia have never demonstrated more than 2-3 separate categories of risk



"5 tiers" = Only 3 distinct categories of risk for metabolic acidemia

Elliott C, Warrick PA, Graham E, Hamilton EF. Am J Obstet Gynecol 2010;202:258.e1-8.

"5-tier system"



"5-tier system"

The system does not include management recommendations not already published in the model presented here, by AWHONN and in ACOG Practice Bulletin 116 using the much simpler 3-tier system

"3-tier" versus "5-tier system"

The current 3-tier system is not perfect, but it is simple and practical. Minor refinements are certainly worth considering

However, the solution to the imperfections of a simple, standard 3-tier system is NOT to replace it with a cumbersome, highly complex 5-tier system that does not identify 5 tiers of risk and offers no new recommendations for management

SIX FATAL FLAWS OF A "5-TIER SYSTEM"

Patient Safety
- Not standard *(rejected by 2008 NICHD)*
- Not simple *(134 combinations?)*

Standard of Care
- Factually inaccurate *("mild, moderate, severe")*
- Cannot be articulated

Common Sense
- Does not identify 5 risk tiers
- Offers no new management recs

WHY IS THIS SO IMPORTANT?

After multiple highly-publicized broad-based consensus reports, we are finally making meaningful headway in fetal monitoring standardization and simplification, factual accuracy and ability to articulate a rational plan

WHY IS THIS SO IMPORTANT?

Continued refusal to accept and adopt standard fetal monitoring principles endorsed by our professional societies not only arrests this forward progress…

…it sends us back to the past when EFM was dominated by unproven myths, lacked standardization and consensus, was unnecessarily complex and inconsistent to the point of threatening patient safety

Fetal Heart Rate Monitoring

The days are over when individual practitioners, individual hospitals or individual hospital systems can make up their own approaches to fetal monitoring that directly contradict the standard, evidence-based consensus of all major organizations representing providers of obstetric care in the United States

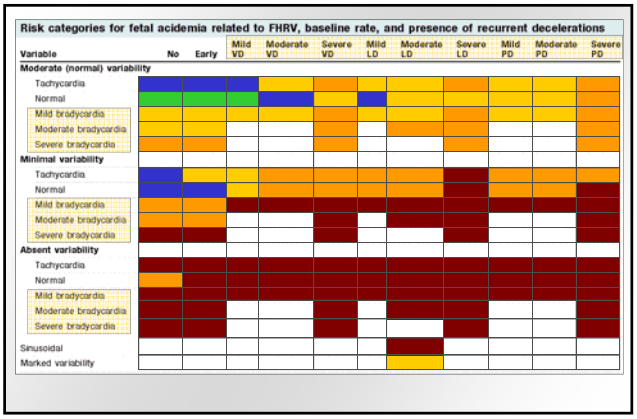
Cowboy

These days are over

Maverick

Lone Wolf

Hot Dog



Summary

Fetal monitoring is a SCREENING TEST

Fetal monitoring CANNOT diagnose cerebral palsy

Use standard definitions and interpretation

Summary

Develop and maintain a "shared mental model"

KEEP IT SIMPLE

Unnecessary complexity predisposes to error

Don't hesitate to use flow charts and checklists

Summary

A standardized approach to intrapartum FHR definition, interpretation and management demonstrates ***reasonableness***

The essential element that defines the standard of care

Cord gas?

"Physicians should attempt to obtain venous and arterial cord blood samples in the following situations:

- Cesarean delivery for fetal compromise
- Low 5-minute Apgar score
- Severe growth restriction
- Abnormal fetal heart rate tracing
- Maternal thyroid disease
- Intrapartum fever
- Multifetal gestations"

Umbilical Cord Blood Gas Acid-Base Analysis
Committee Opinion Number 348
Reaffirmed 2010

Other myths…

Intrapartum asphyxia is a leading cause of cerebral palsy

Intrapartum hypoxia is a leading cause of mental retardation

Intrapartum events are responsible for autism and ADD

The FHR tracing can define the timing of fetal stroke

The "30-minute rule" defines the standard of care

Other myths…

Minimal-absent variability diagnoses fetal metabolic acidemia and asphyxia

Late decelerations are caused by fetal asphyxia

Late decelerations are always "ominous"

Meconium is a sign of asphyxia

Checklists on L&D just get you into trouble

Standardized training in intrapartum FHR monitoring is part of residency training

Amnioinfusion causes amniotic fluid embolism