

Advanced Fetal Monitoring:

An Evidence-Based Approach

Lisa A. Miller, CNM, JD



Disclosure

In the interest of full disclosure, I wish to disclose my relationship with Clinical Computer Systems, Inc., as a consultant and co-developer of their "E-Tools" software.

I have no other financial relationships with EFM-related companies at this time.

EFM & OB Liability

"No tool is more universally used to demonstrate alleged negligence in obstetrical claims than the electronic fetal monitor"

L. Greenwald, Pro Mutual Risk Management Services, 1998

Why do erroneous beliefs persist?

In short, they persist due to cognitive bias, or the fallibility of human reason.

H.L. Mencken said it best:

“What ails the truth is that it is mainly uncomfortable & dull. The human mind seeks something more amusing and more caressing.”

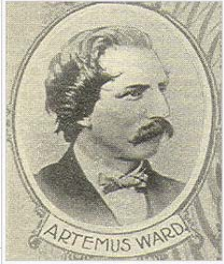
Let's test our EFM knowledge -

- These are just a few simple questions, none are trick questions.
- Some of these would be addressed in an EFM course, and many arise in depositions.
- Go with your first answer, don't over-think, and if you are not sure, guess.
- If you are a neo/peds person just take a break, we'll have some questions for you in the next session!

How did you do?

- Did the answers come easily?
- Did having to choose with your colleagues around make it easier or harder?
- Do you think these are things anyone using EFM should know?
- What do you think about clinicians who cannot answer these correctly?

To summarize...



"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."

For forty years, research in FHR interpretation has focused on forcing the technology to be a diagnostic test... to diagnose fetal injury or a nebulous, undefined condition referred to as "imminent" or "impending" fetal injury.

It is now clear that intrapartum FHR monitoring, except in the most extreme cases, is incapable of reliably diagnosing fetal injury, much less "imminent" or "impending" fetal injury.

However... intrapartum FHR monitoring is not a failed technology. It is a clear success on at least three fronts:

1. The introduction of electronic intrapartum FHR monitoring virtually eliminated intrapartum fetal death... for that reason alone, electronic FHR monitoring is here to stay
2. It is at least as effective as intensive 1-on-1 nursing with rigid auscultation protocols (the only other method of intrapartum FHR monitoring that has been studied in prospective, randomized trials)
3. Although FHR monitoring is NOT a reliable diagnostic test for fetal neurologic injury, it is an outstanding screening test... a normal FHR tracing virtually precludes fetal injury due to disrupted fetal oxygenation at the time it is observed.

The exceptional negative predictive value of intrapartum FHR monitoring can be used to construct a systematic, logical approach to standardized interpretation and management.

Intrapartum EFM Management Three Simple Questions

- What do I call it?
- What does it mean?
- What should I do about it?

Standardizing EFM for clinicians

- **What do I call it?**
Standardized terminology: NICHD
- **What does it mean?**
Standardized interpretation using the O2 pathway and differentials
- **What should we do about it?**
Standardized management using a simple series of questions and evaluating the risk of developing fetal metabolic acidemia versus safely obtaining a vaginal delivery

Terminology

Recent progress in the standardization of FHR definitions is reflected in the consensus support of the 1997 NICHD FHR definitions by:

- ACOG – May 2005
- AWHONN – May 2005
- ACNM – December 2006

The definitions may not be perfect, but they represent the first time that physicians, nurses and midwives have all agreed to use the same language... The importance of a common language cannot be overstated

Fetal Heart Rate Categories

Category I requires ALL of the following

Baseline – 110-160 bpm
Variability – Moderate
Late decelerations absent
Variable decelerations absent
Prolonged decelerations absent

Category II

Includes all FHR tracings that are not included in Category I or III

Category III requires AT LEAST ONE of the following

Absent variability with recurrent late decelerations
Absent variability with recurrent variable decelerations
Absent variability with bradycardia
Sinusoidal pattern for at least 20 minutes

So how many Categories do you need to actually KNOW?

Standardizing EFM for clinicians

- ✓ **What do I call it?**
Standardized terminology: NICHD
- **What does it mean?**
Standardized interpretation using the O2 pathway and differentials
- **What should we do about it?**
Standardized management using a simple series of questions and evaluating the risk of developing fetal metabolic acidemia versus safely obtaining a vaginal delivery

**Step Two:
Standardized Interpretation**

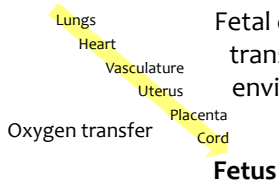
- Now that we know what to call it (standardized terminology) we need to agree on interpretation
- This requires a knowledge of the underlying physiology of FHR changes, as well as an understanding of the physiology of oxygenation, acid-base, and uterine activity

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

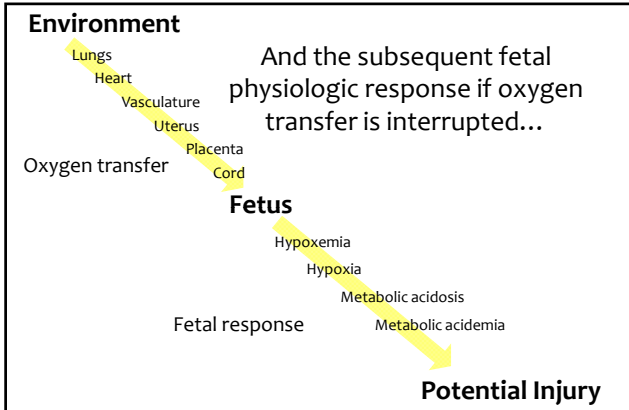
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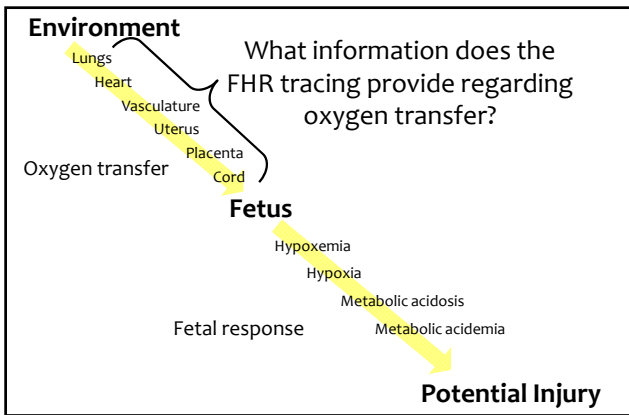
central concepts that are evidence based, reflect consensus in the literature and most importantly are practical and teachable

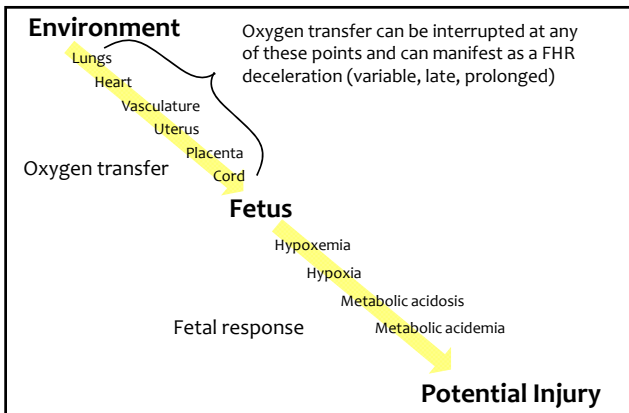
Environment

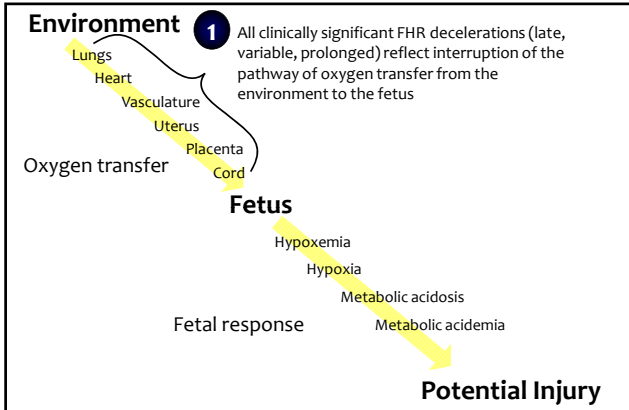


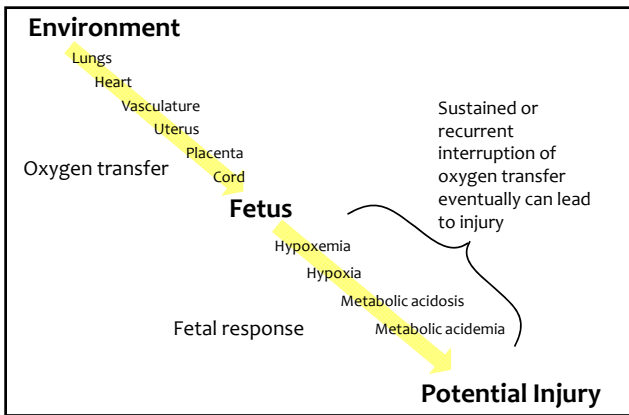
Fetal oxygenation involves the transfer of oxygen from the environment to the fetus...

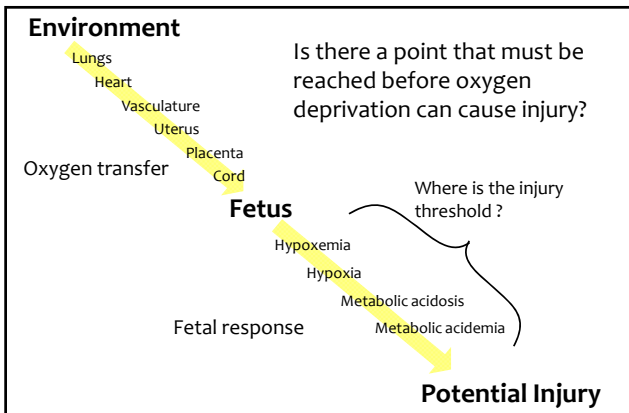












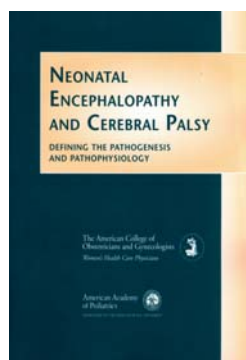
In 1999, the International Cerebral Palsy Task Force published a consensus statement defining the relationship between intrapartum events and neurologic injury

MacLennan A. A template for defining a causal relation between acute intrapartum events and cerebral palsy: International consensus statement. *BMJ* 1999;319:1054-9.

Supporters included:

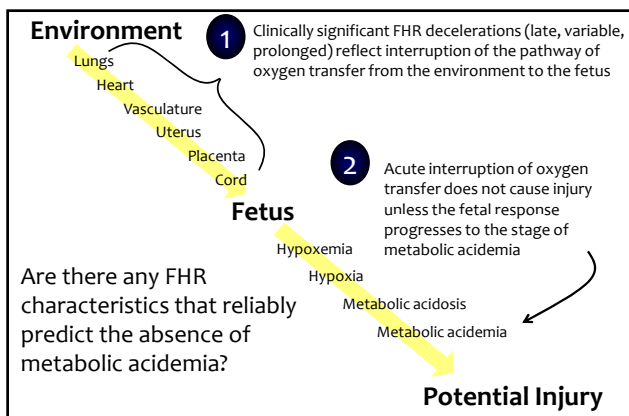
American College of Obstetricians and Gynecologists
American Gynecological and Obstetrical Society
Australian College of Midwives
Hong Kong Society of Neonatal Medicine
Institute of Obstetrics and Gynaecology of the Royal College of Physicians of Ireland
International Society of Perinatal Obstetricians
New Zealand College of Midwives
Paediatric Society of New Zealand
Perinatal Society of Australia and New Zealand
Royal Australasian College of Physicians, Paediatric Division
Royal Australian College of General Practitioners
Royal Australian College of Obstetricians and Gynaecologists
Royal College of Obstetricians and Gynaecologists
Royal College of Pathologists of Australasia
Royal New Zealand College of Obstetricians and Gynaecologists
Society of Obstetricians and Gynaecologists of Canada

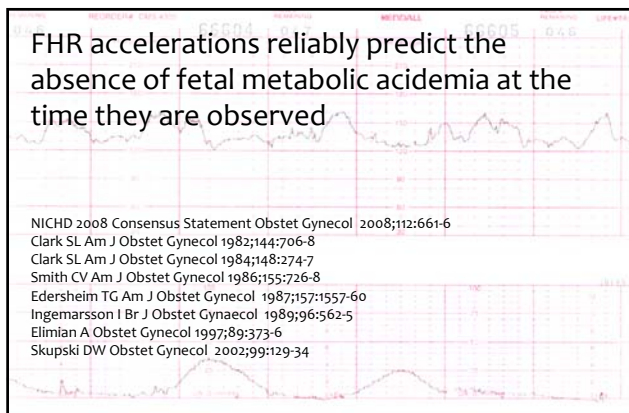
In 2003, ACOG and the American Academy of Pediatrics (AAP) jointly published a monograph summarizing the medical literature regarding the relationship between neonatal encephalopathy and cerebral palsy.

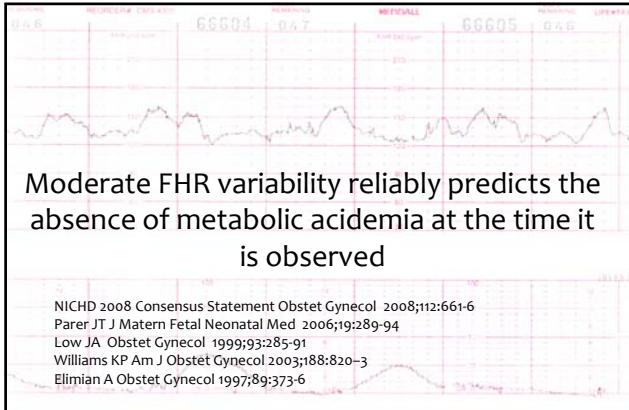


STANDARDIZED FHR INTERPRETATION CONSENSUS

Intrapartum interruption of fetal oxygenation does not result in neurologic injury (cerebral palsy) unless it progresses to the stage of significant metabolic acidemia (umbilical artery pH < 7.0 and base deficit ≥ 12 mmol/L)

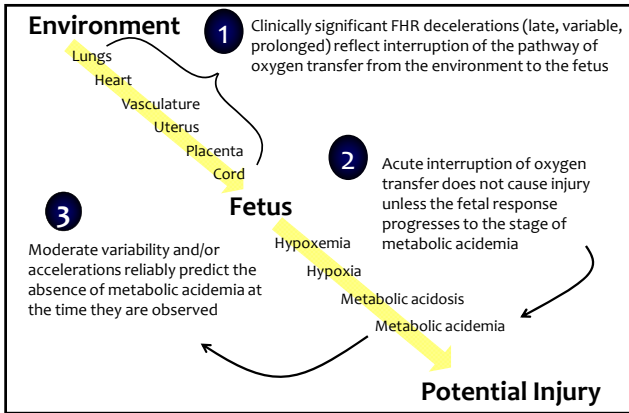


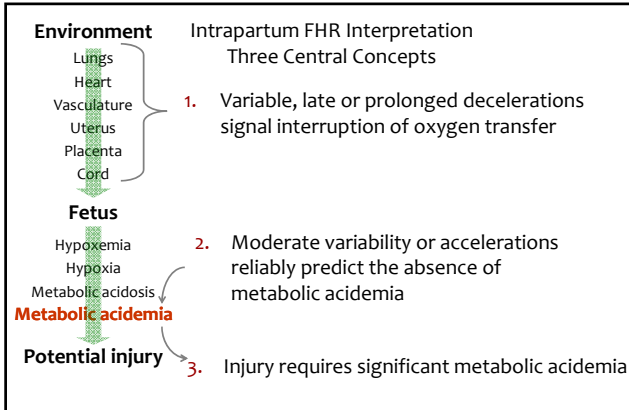




Distilling 40 years of research in FHR interpretation into three central concepts:

With respect to interrupted oxygenation, FHR interpretation can be summarized as...





Standard terminology
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

Standardized management is the next challenge

Management (n.) The act of handling or controlling something successfully

Success = safe delivery

Birth free from injury caused by interrupted oxygenation

The objective of a “standardized management” protocol is to minimize all potential sources of preventable error

Potential sources of preventable error from admission

- Confirm FHR and uterine activity
- Define FHR tracing accurately (terminology)
- Interpret FHR tracing accurately
- Consider other factors that might be responsible for the FHR changes
- Communicate accurately and effectively
- Apply appropriate corrective measures
- Address common obstacles to rapid delivery
- Realistically assess the decision to delivery time

~~Determine the need for immediate operative intervention~~

To delivery

If we can approach FHR management in a systematic fashion, applying it to tracings in all 3 NICHD categories (like we did with terminology and interpretation), maybe we can complete the standardized fetal monitoring instruction manual

A Standardized Intrapartum FHR Management Model

Four Central Concepts

“ABCD”

- A – Assess the oxygen pathway/review differentials
- B – Begin conservative corrective measures
- C – Clear for delivery (the 5 “p”s)
- D – Decision to delivery time

Do “conservative measures” improve fetal oxygenation?

Measures	Evidence
Supplemental oxygen	Direct – Pulse oximetry
Maternal position changes	Direct – Pulse oximetry
IV fluid bolus	Direct – Pulse oximetry
Correcting hypotension	Indirect – FHR
Amnioinfusion	Indirect – FHR
Reducing uterine activity	Indirect – FHR, pulse oximetry
Altered pushing technique	Indirect – FHR, pulse oximetry
Altered breathing technique	Indirect - FHR

KR Simpson J Midwifery Womens Health. 2007 May-Jun;52(3):229-37

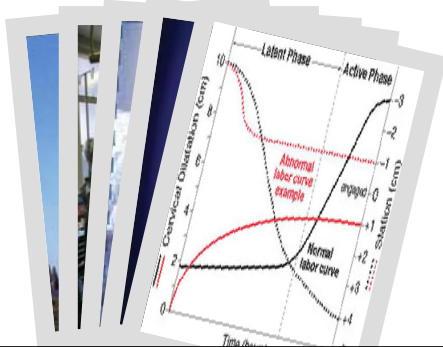
Clear obstacles to rapid delivery

These simple precautions are not often emphasized in a systematic way, but failing to address them can be a major source of criticism in the event of an untoward outcome

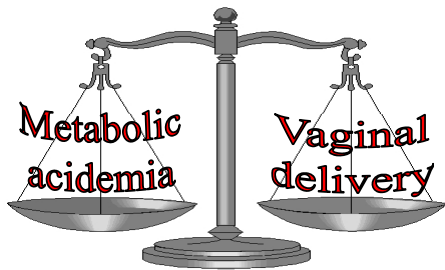


Consider individual characteristics of

Facility
Staff
Mother
Fetus
Labor



Is vaginal delivery likely to occur before the onset of metabolic acidemia?



This is ALWAYS a prediction of unknown future events

It ALWAYS involves multiple interacting factors

It ALWAYS relies on clinical judgment

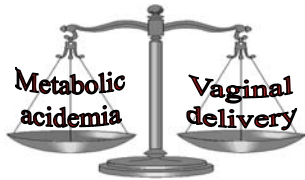
There will NEVER be a “cookbook” answer

If you’re looking for the art of medicine... here it is

USE INDIVIDUAL CLINICAL JUDGMENT TO ESTIMATE:

Time to vaginal delivery

Consider cervical dilatation, effacement, station, adequacy of uterine activity, past rate of progress and expected rate of progress in the future

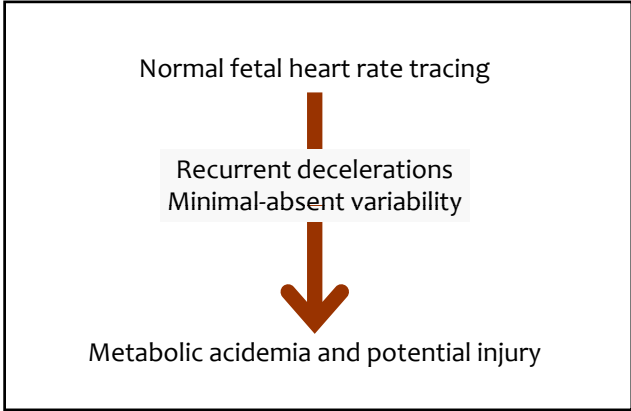


USE INDIVIDUAL CLINICAL JUDGMENT TO ESTIMATE:

Time to onset of metabolic acidemia

How in the world do you do that?





Information is limited

Parer JT, King T, Flanders S, Fox M, Kilpatrick SJ: Fetal acidemia and electronic fetal heart rate patterns. Is there evidence of an association? *J Matern Fetal Neonatal Med* 2006;19(2):289-294.

Low JA, Galbraith RS, Muir DW, Killen HL, Pater EA, Karchmar EJ: Factors associated with motor and cognitive deficits in children after intrapartum fetal hypoxia, *Am J Obstet Gynecol* 1982;148:533-539.

Low JA, Victory R, Derrick EJ. Predictive value of electronic fetal monitoring for intrapartum fetal asphyxia with metabolic acidosis. *Obstet Gynecol* 1999;93:285-91.

Fleischer A, Schulman H, Jagani N, Mitchell J, Randolph G: The development of fetal acidosis in the presence of an abnormal fetal heart rate tracing. I. The average for gestational age fetus, *Am J Obstet Gynecol* 1982;144(1):55-60.

Ingemarsson I, Herbst A, Thorgren-Jerneck K: Long-term outcome after umbilical artery acidemia at term birth: Influence of gender and fetal heart rate abnormalities, *Br J Obstet Gynaecol* 1997;104(10):1123-1127.

