Intrapartum Fetal Resuscitation, A Misnomer?

Brian L Shaffer, MD
Clinical Instructor, Maternal Fetal Medicine
University of California, San Francisco
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Intrapartum Fetal Monitoring

- Intermittent auscultation
- Electronic fetal monitoring (EFM)
  - Intermittent
  - Continuous
    • 85% of live births in US

Benefits of EFM

- Normal FHR pattern → “reassuring”
- Neonatal vigor (98-99%)

Benefits of EFM

- “Non reassuring” FHR → timely delivery
**EFM less helpful**

- FHR of uncertain significance
  - Abnormal FHR → acidic fetus
    - Positive predictive value – 1%
  - CNM, MD, RN obligated to act
    - “Fix” FHR tracing
      - “Intrapartum or Intrauterine Resuscitation”

**“Intrauterine Resuscitation” Goals**

- Safe delivery (vaginal)?
- Specific options?
- Data for each option?
  - Improve perinatal outcomes?
    - Fetal acidemia, cesarean section
    - Surrogate outcomes?
- Scenarios
  - Which intervention is best
  - Contraindications & Caution

**“Decel in room 3”**

- “Fix” the FHT
  - Safe vaginal delivery
  - In preparation for CD, operative vag del, team preparation (OB, anes, etc)
  - Prevent evolution
- Etiology
  - Cord prolapse, cord compression, etc
- Clinical Judgment
  - FHR – how “concerning”

**“Resuscitation” - Options**

- Maternal Position
- Oxygen administration
- Intravenous (IV) fluid bolus
- Treatment of maternal hypotension
- Reduction in uterine activity
- Amnioinfusion
- Pushing - 2nd stage
Maternal Position

Theory:
Uterus and fetus
→ IVC compression
→ decreases venous return
→ decreases CO
→ decreases uterine perfusion
→ unhappy fetus

Maternal Position - Data

Simpson et. al, 2005 Obstet Gynecol
- Term, normal labor & FHR (n=60)
- Few “hard” outcomes
  - Many, many patients
- Surrogate outcomes
  • Fetal oxygen saturation (FSpO₂)
  - Supine, Left, or Right lateral (15 min)

Maternal Position - Data

Simpson et. al, 2005 Obstet Gynecol
- Outcomes
  • No comparison group
- Fetal FSpO₂
- Left or right lateral decubitus position
  - Increases
  - 48% vs. 38%

Maternal Position - Data

Carbonne et al, 1996
- Normal labor (n=15)
- 10 minutes of lateral or supine
- One with FHR abnormalities
  - Supine hypotension syndrome
Conclusion
- Left lateral vs. supine
  - significantly higher FSpO₂
Maternal Position - Conclusions

• Lateral position
  - Likely ideal
  - ↑ FSpo2 normal FHR
• Helpful in nonreassuring FHR?
  - Cord compression
  - Utero-placental insufficiency
• No evidence of harm
  - Position and evaluate for etiology

Oxygen administration

Theory
↑ maternal O₂ →
↑ fetal O₂ delivery

Cochrane Review (Fawole et. al, 2003)
- Prophylactic O₂ during labor
- Meta-analysis of 2 studies (n=166)
- Increased rates of UA pH<7.2
  - [RR 3.51 (1.3-9.2)]
• Harmful?

Oxygen administration - Data
Thorp et. al, 1995
• RCT (n=86)
• Prophylactic oxygen, stage 2
• Fewer side effects, more compliance

Results
• More fetuses with CUA pH <7.2
  - One fetus with pH of 7.09
    • Reasonable measure of harm?
    • Clinical significance

Simpson et. al, 2005
• Term, Labor, Oxytocin
• Normal FHR
• 10L/min for 15 minutes (FiO2 0.8-1)
• Outcomes - FSpo2
  • ↑ FSpo2 (8.7%)
  • Increase greater if lower baseline (<40%)
  • Continued 30 min after O₂ discontinued
Oxygen administration

Haydon et. al, 2006

- O₂ given during non-reassuring FHR
- Outcome: Fetal SpO₂
- FHR deemed non-reassuring
  - 6L/min for 30 min
  - 10L/min for 30 min
- Significant increase in FSpO₂
  - 0.4 FiO₂ – 4.9%
  - 1.0 FiO₂ – 6.5%

O₂ Administration - Conclusions

- 10L/min
  - Increased fetal oxygen saturation
    - Normal labor
    - Normal FHR
    - Non-reassuring FHR
  - ? Lower pH
  - Did not change FHR
- Questions remain
  - Does O₂ change outcomes?
- Little or no harm

Oxygen administration

Haydon et. al, 2006

- Greater increases with lower initial FSpO₂
- Improved FSpO₂ overall
  - Regardless of FHR description
- FHR – no change
- Few delivery outcomes
  - No cord gas values, neonatal complications
  - 33% CD delivery
  - No report on indications

Intravenous (IV) Fluid Bolus

Theory

- Rapid volume expansion
  - Treat hypotension & hypovolemia
  - Improve perfusion
- Improve non-reassuring FHR?
- Few data on perinatal morbidity & CD
- Surrogate Outcomes
IV Bolus - Data
Simpson et. al, 2005 Obstet Gynecol
- Normal labor, normal FHR, no hypovolemia
- Outcome: FSpO2
- 500 & 1000cc bolus – prior to epidural
- 5% increase in FSpO2
- Risks – Maternal co-morbidity
  - Fluid overload: Pre-E, PTL, oxytocin
  - Fluid choice: isotonic
  - Maternal hyperglycemia with fetal effects

IV Bolus - Conclusions
- Few data on IV bolus for FHR abnormalities
- Limited evidence of benefit
- With inappropriate fluid, multiple boluses
  - Risk of harm
- Approach
  - Rule out medical contraindications
  - Limit risks - know your patient!
  - 500cc to 1L bolus
  - Limit repeated boluses

Maternal Hypotension
Theory
Hypotension
  → ↓ uterine perfusion
  → ↓ Fetal O2

Setting
- Epidural / Spinal
  ↓ peripheral resistance, uterine blood flow
- Hypotension / Acute blood loss
  IV fluid, pressors, delivery?

Maternal Hypotension - Data
Cochrane Review (Hofmeyr GJ) 2004
- Preloading prior to epidural – Fluid bolus
  - Decreases hypotension; RR 0.07  (0.01-0.53)
  - Fewer abnormal FHR; RR 0.36  (0.16-0.83)
  - Low dose epidural – less beneficial
Decrease Uterine Activity

Theory
- Frequent UCs
  - ↓ Flow to intervillous space
  - ↓ Fetal O₂
- Hyperstimulation, hypertonus, prolonged UCs
  - Umbilical cord compression
  - Uteroplacental insufficiency

Management
- Discontinue / Reduce Uterotonics
  - oxytocin, prostaglandin
- Tocolytics
  - Terbutaline, Magnesium, Nitroglycerine
  - Which drug? Route?
  - Maternal risks

Tocolysis vs. Placebo - Data
Cochrane Review (Kulier R) 1998
β mimetic vs. placebo
- Fewer FHR abnormalities; RR 0.26 (0.13-0.53)
- Fewer fetuses
  - UA pH < 7.2
  - BE < -10
- Transient maternal tachycardia
- Authors used tocolysis to "buy time"
  - most patients had cesarean

Tocolytic agents: Head to Head
Magann, et al 1993
Terbutaline vs. Magnesium
- Heterogeneous population
- Most awaiting CD
- Terbutaline
  - Decreased mean uterine activity
  - Fewer neonates with pH < 7.2
**Tocolytic agents: Head to Head**

Ascher et. al, 2004
- Atosiban vs. Hexoprenaline
- Prospective RCT (n=26)

Results
- Similar tocolytic effect
- β-mimetic - ↑ maternal HR, palpitations
- UCs resumed sooner with β-mimetic
  - 8 vs 14 minutes
- Atosiban not available in US

**Tocolytic agents: Head to Head**

Pullen et. al, SMFM 2007
- Prospective RCT (n=110)
- Terbutaline vs. Nitroglycerine

Outcome: "Resuscitation"
- Resolution of NRFHT, no operative delivery
- Similar rates of "Resuscitation"
  - Terbutaline (72%) vs. Nitro (64%)
- Terbutaline
  - Fewer UCs
  - Fewer variables (67 vs. 17%)
- Operative delivery rates: 47%

**Tocolysis - Conclusions**

- β-mimetics beat placebo
  - Neonatal outcomes
- β-mimetics
  - Effective with UCs, NRFHT
  - Side effects: Tachy, Palps, Diabetes
- Nitroglycerine
  - Effective with NRFHT
  - Side effects: slight ↓ MAP
Amnioinfusion (AI)

Theory
- → ↑ Fluid
  - → ↓ Pressure on cord during UCs
  - → ↓ Fewer variables
- Setting: Moderate/severe variable decels
- Amnioinfusion
  - Abdominal vs. cervical
  - Continuous vs. bolus
- Risks
  - Maternal – infection, perforation, AFE
  - Neonatal – cord prolapse

Transcervical AI - Data

Cochrane (Hofmeyr GJ) 1998
- Reduction in:
  - FHR decelerations; RR 0.54 (0.4-0.7)
  - Cesarean; RR 0.52 (0.4-0.7)
  - Apgar <7 @ 5min; RR 0.54 (0.3-0.9)
  - CUA pH < 7.2; RR 0.45 (0.3-0.6)
- Unclear
  - Cord prolapse, long term neonatal morbidity
  - Maternal outcomes
    - AFE, uterine rupture, perforation, etc.

AI - Bolus vs. Continuous

Rinehart et. al, 2000
- RCT (n=65)
- Outcome – Variables
- 500cc bolus vs. Bolus + 3cc/min infusion
- Outcomes
  - Increased volume with continuous (500 vs 905cc)
  - No other differences
    - Mode of delivery
    - Perinatal morbidity
- Power

Amnioinfusion - Variables

Conclusions
- Reduction:
  - FHR decelerations
  - Cesarean
  - Apgar <7 @ 5min
  - CUA pH < 7.2
- Remaining Questions
  - Rare maternal outcomes
  - Long term neonatal outcomes
**Modification of Pushing**

**Theory**
- “Typical” – closed glottis, 10 sec
  - Decreased BP → Decreased O₂ in maternal blood → decreases in fetal O₂
- Alternative
  - Wait until urge → “labor down”
  - Open glottis
  - 6 seconds of pushing
  - Increased fetal oxygen delivery

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**Modified Pushing - Data**

Simpson et. al, 2005, RCT
- “Typical” vs Alternative
- Outcomes: FSpO₂, MOD, perinatal morbidity
- Alternative
  - Increased FSpO₂, fewer variables
- No differences
  - Length of labor
  - MOD
  - Apgar
  - CUA

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**Modified Pushing**

- Potentially helpful
  - Surrogate outcome
  - FSpO₂ not endorsed by ACOG
  - Theory
- No evidence of harm
- Further study

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**Intrapartum Resuscitation**

- FHR little assistance
- Can we improve on the false positives?
  - Evaluate for etiology
  - Choose method with greatest potential benefit
    - Supine with hypotension → Position, IV fluid
    - Hypotension / Epidural → IV fluid
    - Variable decelerations → Amnioinfusion
    - 5 UCs in 10 minutes → tocolytic
Intrapartum Resuscitation

- Limit harms
  - Position change, $O_2$
  - Risk for pulmonary edema?
  - Risk for hypotension – terb vs. nitro
  - Medical contraindications – heart, diabetes

- Clinical Judgment

- “Fetal Heart Rate amelioration”? 