Corrective Measures:
Taking a Proactive Approach to Category II FHR Patterns

Rebecca Cypher, MSN, PNNP
Maternal-Fetal Solutions, LLC
rlcjumper913@gmail.com

Disclosures

In addition to Cypher Maternal-Fetal Solutions LLC offering education and consulting services, I have a professional relationship with
◦ Elsevier: Co-author with royalties
◦ Clinical Computer Systems: Education

I may discuss off label medications or products
Not all examples that illustrate a concept will be in your handout
Objectives

Discuss the prevalence of intrapartum Category II FHR patterns
Identify optimal management strategies for Category II FHR patterns
Analyze research to support conservative corrective measures

One of the difficult OB challenges we face is to ensure appropriate timing of delivery before injury occurs.
Category II
“Indeterminate”
Please do NOT use Reassuring or Non-Reassuring

“...not predictive of abnormal fetal acid-base status yet we do not have adequate evidence to classify as Category I or Category III”

Frequency of Categories in Labor
20 minutes segments
48,444 patients (10 hospitals; 2007-2009)

<table>
<thead>
<tr>
<th></th>
<th>I Total</th>
<th>II</th>
<th>III</th>
<th>I 2 hours</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean minutes</td>
<td>399.6</td>
<td>113.5</td>
<td>0.02</td>
<td>73.1</td>
<td>46.9</td>
<td>0.01</td>
</tr>
<tr>
<td>% of total</td>
<td>77.9</td>
<td>22.1</td>
<td>0.004</td>
<td>60.9</td>
<td>39.1</td>
<td>0.006</td>
</tr>
<tr>
<td>Median minutes</td>
<td>339.4</td>
<td>74.8</td>
<td>0.0</td>
<td>80</td>
<td>40</td>
<td>0.0</td>
</tr>
</tbody>
</table>

## Frequency of Categories in Labor: 20 minutes segments

<table>
<thead>
<tr>
<th></th>
<th>I Total</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean minutes</td>
<td>399.6</td>
<td>113.5</td>
<td>0.02</td>
</tr>
<tr>
<td>% of total</td>
<td>77.9</td>
<td>22.1</td>
<td>0.004</td>
</tr>
<tr>
<td>Median minutes</td>
<td>339.4</td>
<td>74.8</td>
<td>0.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>2 hours</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean minutes</td>
<td>73.1</td>
<td>46.9</td>
<td>0.01</td>
</tr>
<tr>
<td>% of total</td>
<td>60.9</td>
<td>39.1</td>
<td>0.006</td>
</tr>
<tr>
<td>Median minutes</td>
<td>80</td>
<td>40</td>
<td>0.0</td>
</tr>
</tbody>
</table>

48,444 patients (10 hospitals; 2007-2009)

---

## Short Term Neonatal Outcomes: Last 2 Hours

<table>
<thead>
<tr>
<th></th>
<th>1-25%</th>
<th>26-50%</th>
<th>51-75%</th>
<th>76-100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>11,676</td>
<td>9,313</td>
<td>9,846</td>
<td>9,494</td>
</tr>
<tr>
<td>1-min Apgar &lt;7</td>
<td>451 (4.8%)</td>
<td>536 (5.4%)</td>
<td>545 (6.7%)</td>
<td>922 (9.7%)</td>
</tr>
<tr>
<td>5-min Apgar &lt;7</td>
<td>56 (0.6%)</td>
<td>61 (0.6%)</td>
<td>69 (0.9%)</td>
<td>119 (1.3%)</td>
</tr>
<tr>
<td>NICU admission</td>
<td>363 (3.9%)</td>
<td>424 (4.3%)</td>
<td>395 (4.9%)</td>
<td>691 (7.3%)</td>
</tr>
<tr>
<td>5-min Apgar &lt;7 + NICU</td>
<td>22 (0.2%)</td>
<td>27 (0.3%)</td>
<td>24 (0.3%)</td>
<td>67 (0.7%)</td>
</tr>
</tbody>
</table>

Variables lasting longer than 60 seconds with nadir more than 60 bpm below baseline
Variables lasting longer than 60 seconds with nadir less than 60 bpm regardless of baseline
Any late decelerations of any depth
Any prolonged decelerations
A Standardized Approach for Category II Fetal Heart Rate with Significant Decelerations: Maternal and Neonatal Outcomes

Laurence E. Shields, MD, Suzanne Wiesner, RN, MBA, Catherine Klein, RN, CNM, Barbara Pellestreau, RN, MPH, Herman L. Hedrana, MD

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th></th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trial Hospital (6)</strong></td>
<td></td>
<td></td>
<td><strong>Non-Trial Hospital (23)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Births</td>
<td>5,208</td>
<td>9,974</td>
<td>Total Births</td>
<td>19,363</td>
<td>46,839</td>
</tr>
<tr>
<td>Repeat CD</td>
<td>737</td>
<td>1,459</td>
<td>Repeat CD</td>
<td>2,885</td>
<td>6,933</td>
</tr>
<tr>
<td>Eligible</td>
<td>4,471</td>
<td>8,515</td>
<td>Eligible</td>
<td>16,478</td>
<td>39,906</td>
</tr>
<tr>
<td>Primary CD</td>
<td>884/4,471</td>
<td>1,562/8,515</td>
<td>Primary CD</td>
<td>3,136/16,478</td>
<td>7,259/39,906</td>
</tr>
<tr>
<td>-1.5% P &lt; 0.05</td>
<td>19.8%</td>
<td>18.3%</td>
<td>-0.8% P = 0.02</td>
<td>19%</td>
<td>18.2%</td>
</tr>
<tr>
<td>VD</td>
<td>3,334/4,471</td>
<td>6,451/8,515</td>
<td>VD</td>
<td>12,296/16,478</td>
<td>30,305/39,906</td>
</tr>
<tr>
<td>1.2% P = 0.13</td>
<td>74.6%</td>
<td>75.8%</td>
<td>1.3% P = 0.02</td>
<td>74.6%</td>
<td>75.9%</td>
</tr>
<tr>
<td>Operative VD</td>
<td>253/4,471</td>
<td>502/8,515</td>
<td>Operative VD</td>
<td>1,045/16,478</td>
<td>2,342/39,906</td>
</tr>
<tr>
<td>0.2% P = 0.6</td>
<td>5.7%</td>
<td>5.9%</td>
<td>-0.4% P = .02</td>
<td>6.3%</td>
<td>5.9%</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th></th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trial Hospital (6)</strong></td>
<td></td>
<td></td>
<td><strong>Non-Trial (23)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-min Apgar &lt;7</td>
<td>102/4,471</td>
<td>146/8,515</td>
<td>5-min Apgar &lt;7</td>
<td>2,554/16,478</td>
<td>6,545/39,906</td>
</tr>
<tr>
<td>-24.6% P &lt; 0.05</td>
<td>2.3%</td>
<td>1.7%</td>
<td>+5.8% P = 0.08</td>
<td>1.55%</td>
<td>1.6%</td>
</tr>
<tr>
<td>5-min Apgar &lt;5</td>
<td>474/4,471</td>
<td>66/8,515</td>
<td>5-min Apgar &lt;5</td>
<td>1,236/16,478</td>
<td>227/39,906</td>
</tr>
<tr>
<td>-26.4% P = 0.11</td>
<td>1.1%</td>
<td>0.78%</td>
<td>+12.0% P = 0.01</td>
<td>0.53%</td>
<td>0.57%</td>
</tr>
<tr>
<td>5-min Apgar &lt;3</td>
<td>25/4,471</td>
<td>49/8,515</td>
<td>5-min Apgar &lt;3</td>
<td>87/16,478</td>
<td>227/39,906</td>
</tr>
<tr>
<td>0% P = 0.9</td>
<td>0.57%</td>
<td>0.57%</td>
<td>+7.5% P = 0.6</td>
<td>0.53%</td>
<td>0.57%</td>
</tr>
<tr>
<td><strong>Severe UNC</strong></td>
<td>71/4,471</td>
<td>98/8,515</td>
<td><strong>Severe UNC</strong></td>
<td>247/16,478</td>
<td>559/39,906</td>
</tr>
<tr>
<td>-27.2% P &lt; 0.04</td>
<td>1.6%</td>
<td>1.2%</td>
<td>-6.7% P = 0.4</td>
<td>1.5%</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

UNC: Unexplained Newborn Complications (severe respiratory complications, sepsis, birth trauma, neonatal shock, neuro injury

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

Interruptions of oxygen transfer to the fetus can occur at one or more points along the pathway and the subsequent fetal physiologic response if oxygen transfer is interrupted... decelerations

- Blood flow to uterine muscle decreased or blocked due to spiral artery compression
- Result: Brief periods of anaerobic activity in uterine muscle (normal)
- Relaxation time: oxygenated blood flow returns = lactate cleared
Recurrent or sustained disruption of oxygenation:
Sustain metabolic requirements
Fetal Defense Mechanism
Redistribute blood to vital organs

Tissue hypoxia
Anaerobic metabolism
Lactic acidosis
Metabolic acidemia
Direct myocardial depression
Potential Injury

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
D – Decision to delivery time

“B” Begin Corrective Measures

- Maternal repositioning
- Oxygen administration
- IV fluid bolus
- Decrease uterine activity
- Correct hypotension
- Amnioinfusion
- Tocolytic administration
- Alteration in 2\textsuperscript{nd} stage pushing technique

AWHONN Physiologic Goals

- Maximize uterine blood flow
- Maximize umbilical circulation
- Maximize oxygenation
- Maintain appropriate uterine activity
- Support maternal coping and labor progress

The Classic Triad Approach

Maternal Position Change  Oxygen Supplementation  Intravenous Fluid Bolus

Lungs  □ Airway and breathing  □ Supplemental oxygen
Heart  □ Heart rate and rhythm  □ Position changes  □ Fluid bolus

Maternal Position Change

Maximize placental perfusion by avoiding aortocaval compression

Alter relationship between umbilical cord, fetus, uterus or bony pelvis

Lateral Positioning

Improves cardiac return and output
- Position off vena cava or aorta
- ↓ risk of maternal hypotension
- Maximizes blood flow to uterus

Improves fetal oxygenation
- Mean FSp02:
  - LL = 53.2%, RL – 50.5%, Supine = 46.7%


12 women: 35-38 weeks gestation
MRI: supine and left lateral
Phase-contrast images measurements
- Cardiac output
- Flow through azygos vein, abdominal aorta and IVC
- Deoxygenated blood back to superior vena cava

Cardiac Output \( \downarrow 16.4\% \)

IVC flow 
\( \downarrow 85.3\% \) (Origin) 
\( \downarrow 44.4\% \) (Renal veins)

Azygos Vein 
\( \uparrow 220\% \)

Aortic Bifurcation 
\( \downarrow 32.3\% \)

---

Let’s Talk About Oxygen

Hypoxemia
Hypoxia

Maternal Oxygen 10L/min

Anaerobic Metabolism

Metabolic Acidosis

Potential Injury
Origins of Fetal Hypoxia

**Pre-placental:** Oxygen content in maternal blood
- Hypoxic placenta and fetus
- High altitudes, cyanotic cardiac disease
- Average 102 gm per 1000 m elevation gain

**Utero-placental:** Normal oxygen content
- Restricted flow into uteroplacental tissue
- Contractions, preeclampsia, occlusions

**Post-placental:** Normal oxygen content
- Villi fail to transfer oxygen to fetus
- Abnormal placentation


Transporting Oxygen To The Fetus

**Major supplier of oxygen:** Woman
- Bulk transport and diffusion
- Via “environment”

**Maternal lungs**
- Oxygen and hemoglobin combine
- Oxyhemoglobin association

**Dependent on**
- Oxygen content, affinity, delivery, consumption
- Cardiac output
Transporting Oxygen To The Fetus

Transporting Oxygen To The Fetus

Circulated to uterus
  ◦ Pulmonary arteries
  ◦ Left atrium and left ventricles
  ◦ Aorta
  ◦ Uterine arteries

Uterine perfusion
  ◦ 700-800 mL/min at term
  ◦ 10-15% of maternal CO

Why Give Oxygen In Labor

Physiologically
  ◦ Normal oxygen supply to fetus exceeds demand
  ◦ Fetal oxygen uptake
    ◦ Not affected until oxygen delivery ↓ by half

Indeterminate and Abnormal FHR characteristics (Lates)
  ◦ Apply O2
  ◦ Intervention to ↑ fetal P02
Can Oxygen Improve Fetal Metabolic Status?

Data supporting oxygen to correct FHR decelerations only

1960's-1970's (animal and human data)

Althabe et al., Effects on fetal heart rate and fetal pO2 of oxygen administration to the mother. Am J Obstet Gynecol 1967;98:858-70

- 100% O2 via face mask (21 women in labor)
- Corrected fetal tachycardia and late decels
- Correlated with fetal muscle PO2 levels

Can Oxygen Improve Fetal Metabolic Status?

Data supporting oxygen to correct FHR decelerations only

1960's-1970's (animal and human data)

Althabe et al., Effects on fetal heart rate and fetal pO2 of oxygen administration to the mother. Am J Obstet Gynecol 1967;98:858-70

- 100% O2 via face mask (21 women in labor)
- Corrected fetal tachycardia and late decels
- Correlated with fetal muscle PO2 levels
Can Oxygen Improve Fetal Metabolic Status?

**Maybe**

Limited mixed results data
- Mostly nonrandomized trials
- Not exclusive to laboring women
- Animal data
  - Oxygen $\uparrow$ maternal-fetal oxygen levels
  - $\downarrow$ Frequency of late decelerations
  - No improvement in fetal pH


- Room air versus 10 L/min face mask
- **No difference in umbilical artery pH**
- **Oxygen group:** $\uparrow$ number of pH values $<7.20$

- Similar results
Limited Data of Oxygen and Fetal Acid-Base Status

↑ Need for neonatal resuscitation
Maternal hyperoxia = ↑ free radical activity
3 markers of free radical activity
◦ Malondialdehyde (MDA), isoprostane, organic hydroperoxides


Aerobic to anaerobic

- ATP depleted

ATP breakdown product accumulate

- Increases cell permeability

Reoxygenation

- Calcium flows into cells
- Disrupted ATP production
- Cellular molecules breakdown

Oxygen Free Radicals

- Unstable molecules that damage cell membrane.
- Potential edema and hemorrhage to fetal brain and heart

Neonatal Resuscitation

100% oxygen no longer recommended
◦ Oxygen induced cellular damage
◦ Bronchopulmonary dysplasia
◦ Neurodevelopmental complications
◦ Retinopathy

Room air: decreased neonatal mortality
No difference in HIE or changes in neurodevelopmental outcomes

Impact of Hyperoxgenation

Adult (AVOID trial)
◦ Supplemental oxygen with ST-elevation–myocardial infarction without hypoxia
◦ ↑ early myocardial injury = larger myocardial infarct size at 6 months

Adult
◦ 02 to maintain PaO2 and SpO2 values
◦ Conservative oxygen therapy vs conventional therapy resulted in lower ICU mortality
◦ Maintain Pao2 between 70 and 100 mm Hg or Spo2 94% - 98%


Hemodynamics of Hyperoxygenation

46 pregnant women and 20 nonpregnant women
- Median EGA: 35 weeks (33 to 37 weeks)

Continuous hemodynamic monitoring
Hyperoxygenation: O2 100% at 12L/min by partial non-breather mask
Measurements before, immediately after completion, 10 minutes after
- Cardiac index, SVR, stroke volume, HR, BL
- Significant ↓ cardiac index and ↑ SVR without return to BL
- ? Impact on oxygen delivery


<table>
<thead>
<tr>
<th>Study</th>
<th>Population</th>
<th>N</th>
<th>Groups</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawes et al, 1988 RCT</td>
<td>Elective CD</td>
<td>35</td>
<td>O2 50% vs 33%</td>
<td>ND: Cord gases Apgars</td>
</tr>
<tr>
<td>Perreault et al, 1992 RCT</td>
<td>Elective CD</td>
<td>20</td>
<td>O2 50% vs 100%</td>
<td>ND: Cord gases 5 minute Apgars</td>
</tr>
<tr>
<td>Thorp et al, 1995 RCT</td>
<td>2nd stage labor</td>
<td>86</td>
<td>O2 10L face mask vs no O2</td>
<td>⬆ abnormal cord gases prolonged O2</td>
</tr>
<tr>
<td>Sirimai et al, 1997 RCT</td>
<td>2nd stage labor</td>
<td>80</td>
<td>O2 vs no O2</td>
<td>ND: cord gases</td>
</tr>
<tr>
<td>Jozwik et al, 2000 Prospective Cohort</td>
<td>Elective CD</td>
<td>41</td>
<td>O2 60% at 15L x15 min vs 02 via face mask</td>
<td>ND: Fetal acid base status</td>
</tr>
<tr>
<td>Qian et al, 2017 RCT</td>
<td>2nd stage labor No EFM abnormalities</td>
<td>443</td>
<td>O2 2L/min nasal cannula vs placebo</td>
<td>ND: Cord gases FHR changes</td>
</tr>
<tr>
<td>Raghuraman et al, 2017 Retrospective Cohort</td>
<td>1st and 2nd stage</td>
<td>7,789</td>
<td>O2 vs no O2</td>
<td>O2: ⬆ neo morbidity in acidemic neonates</td>
</tr>
</tbody>
</table>

Among patients with category II fetal heart tracings, intrauterine resuscitation with room air is noninferior to oxygen in improving umbilical artery lactate. The results of this trial challenge the efficacy of a ubiquitous obstetric practice and suggest that room air may be an acceptable alternative.

### 60 Minutes Prior to Randomization

<table>
<thead>
<tr>
<th>FHR Pattern</th>
<th>Oxygen (N=57)</th>
<th>Room Air (N=57)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ever variable deceleration</td>
<td>34 (59.7%)</td>
<td>29 (50.9%)</td>
<td>0.35</td>
</tr>
<tr>
<td>Recurrent variable deceleration</td>
<td>4 (7%)</td>
<td>2 (3.5%)</td>
<td>0.40</td>
</tr>
<tr>
<td>Ever late deceleration</td>
<td>40 (70.2%)</td>
<td>41 (71.9%)</td>
<td>0.84</td>
</tr>
<tr>
<td>Recurrent late deceleration</td>
<td>2 (3.5%)</td>
<td>5 (8.8%)</td>
<td>0.24</td>
</tr>
<tr>
<td>Ever tachycardia</td>
<td>0</td>
<td>2 (3.3%)</td>
<td>0.50</td>
</tr>
<tr>
<td>Ever minimal variability</td>
<td>5 (8.3%)</td>
<td>11 (8.3%)</td>
<td>0.18</td>
</tr>
<tr>
<td>Ever prolonged deceleration</td>
<td>18 (31.6%)</td>
<td>17 (29.8%)</td>
<td>0.56</td>
</tr>
</tbody>
</table>

*Ever: present at any point within 60 minutes as analyzed in 10 minute segments*
*Recurrent: present with more than 50% of contractions within 60 minutes as analyzed in 10 minute segments*

<table>
<thead>
<tr>
<th>Umbilical Artery Gas</th>
<th>Oxygen (N=48)</th>
<th>Room Air (n=51)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.26 (7.24-7.28)</td>
<td>7.25 (7.23-7.27)</td>
<td>0.55</td>
</tr>
<tr>
<td>Base Excess</td>
<td>-3.62 (-4.3-2.9)</td>
<td>-3.6 (4.3-2.9)</td>
<td>0.99</td>
</tr>
<tr>
<td>pCO₂</td>
<td>55.9 (53.5-58.2)</td>
<td>57.4 (54.2-60.6)</td>
<td>0.44</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode of Birth</th>
<th>Oxygen (N=48)</th>
<th>Room Air (n=51)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cesarean</td>
<td>2 (3.9%)</td>
<td>6 (12.5%)</td>
<td>0.14</td>
</tr>
<tr>
<td>Cesarean for FHR</td>
<td>0</td>
<td>2 (4.2%)</td>
<td>N/A</td>
</tr>
<tr>
<td>Operative Vaginal Birth</td>
<td>6 (11.8%)</td>
<td>1 (2.1%)</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Mean Umbilical Artery Lactate

Blue line: non-inferiority margin
Black dot: mean and error for 95% CI
Mean lactate difference: 0.9 mg/dL


Today’s Take Home Points

Ask yourself if oxygen is necessary as a first line response
Try other corrective measures initially
  ◦ Moderate variability
Discontinue as soon as fetal response warrants
Keep reading the journals
Question: Is maternal oxygen supplementation at the time of birth associated with improved umbilical artery gas measures and neonatal outcomes?

Key Point:
- Maternal oxygen supplementation was associated with improved UA PaO2 but no significant difference in UA pH compared with room air.
- Similar UA gas measures, NICU admissions, and Apgar scores between the oxygen and room air groups.

What does this mean to you? No association between maternal oxygen supplementation and a clinically relevant improvement in UA pH or other neonatal outcomes.
Maximize Maternal Intravascular Volume

- Improved cardiac output by
  - Increasing circulatory volume
  - Increasing venous return
  - Increasing left ventricular end-diastolic pressure
  - Increasing ventricular preload
  - Increased stroke volume

Intravascular Volume Improves Uteroplacental Perfusion

Maternal pulse pressure at admission is a risk factor for fetal heart rate changes after initial dosing of a labor epidural: a retrospective cohort study

Nathaniel R. Miller, MD; Rebecca L. Cypher, MSN; Peter E. Nielsen, MD; Lisa M. Foglia, MD

**Objective**

Is decreased maternal pulse pressure a risk factor for new onset post-epidural FHR abnormalities

- <45 mmHg
- FHR abnormalities in first 60 minutes after dosing
- Recurrent late decelerations and/or prolonged decelerations
<table>
<thead>
<tr>
<th>Admission PP ≥45 mmHg N=95</th>
<th>Admission PP &lt;45 mmHg N=95</th>
<th>OR (95% CI) P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FHR Abnormalities</td>
<td>6 (6)</td>
<td>26 (27)</td>
</tr>
</tbody>
</table>

After initial labor epidural dosing, new onset FHR abnormalities occur more frequently in women with low admission PP compared to those with normal admission PP.

Contraction Associated Maternal Heart Rate Decelerations

Contraction Associated Decelerations

Hypovolemic (<45 mmHg) vs euvoelic (≥ 50 mmHg)
- 41.1% vs 13.6%

CAHRD
- Post-epidural FHR abnormalities (43.5% vs 31.1%)
- Diastolic hypotension (63.7% vs 50.0%)
- Need for resuscitative interventions (33.9% vs 23.1%)

Our goal: Intrapartum maternal heart rate assessment
Intrapartum fluid management


The “So What” Factor

Evaluate for intravascular volume reduction
Bleeding or dehydration

Co-load versus pre-load for regional anesthesia

Consider pretreatment with vasoconstricting agent
IV Fluid Maintenance Rate

Increase IV fluid maintenance rate
- 125 cc/hr designed to replace loss in resting patient
- Labor = active metabolically and physiologically
- Consider 200-250 cc/hr in healthy patient

Intravenous fluid rate for reduction of cesarean delivery rate in nulliparous women: a systematic review and meta-analysis

ROBERT M. EHSANIPOR, GABRIELE SACCONET, NEIL S. SELIGMAN, REBECCA A.M. PIERCE-WILLIAM, ANDREA CIARDULLI & VINCENZO BERGHELLA

Five studies: LR
One study: D5NS
One study: Not defined
IV Fluid: 250 cc/hr vs 125 cc/hr
7 clinical trials

Lower incidence of cesarean for any indication: 12.5 vs 18.1%
Lower incidence of cesarean for labor dystocia: 4.9 vs 7.7%
Shorter mean duration of labor: mean difference 64 minutes
“Shorter” mean length 2\textsuperscript{nd} stage: ~ 3 minutes

**OBSTETRICS**

A randomized, double-blinded, controlled trial comparing parenteral normal saline with and without dextrose on the course of labor in nulliparas

Vineet K. Shrivastava, MD; Thomas J. Garite, MD; Sheri M. Jenkins, MD; Lisa Saul, MD;
Pamela Rumney, RNC; Christine Preslicka, RN; Kenneth Chan, MD

Normal saline versus D5NS versus D10NS
125 mL/hr
## Labor Outcomes

<table>
<thead>
<tr>
<th></th>
<th>NS N=84</th>
<th>D5NS N=76</th>
<th>D10NS N=72</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVF start to 10 cm</td>
<td>360 min (95-1203)</td>
<td>299 minutes (82-1091)</td>
<td>328 minutes (61-672)</td>
<td>.10</td>
</tr>
<tr>
<td>2nd stage</td>
<td>106 minutes (24-266)</td>
<td>69 minutes (17-227)</td>
<td>62 minutes (14-191)</td>
<td>.01</td>
</tr>
<tr>
<td>IVF start to birth</td>
<td>464 minutes (185-1336)</td>
<td>392 minutes (100-1157)</td>
<td>393 minutes (97-827)</td>
<td>.02</td>
</tr>
<tr>
<td>Prolonged labor &gt;12 hours</td>
<td>18 (22%)</td>
<td>7 (9.3%)</td>
<td>5 (6.8%)</td>
<td>.01</td>
</tr>
</tbody>
</table>


---

Thank You