NRP 7th Edition: The Science Behind the Changes

Jessica Brunkhorst, MD
Neonatologist
3rd Annual Regional Neonatal Conference
April 7th, 2017
Audience Poll

• My LEAST favorite NRP 7\textsuperscript{th} edition change is:
  
  – A. No longer routinely performing tracheal suctioning for non-vigorous meconium
  
  – B. Use of CR monitor leads in the delivery room
  
  – C. Recommendations for intubation prior to chest compressions
  
  – D. Wait… There were changes to NRP??
  
  – E. Other
Objectives

• Review the changes in delivery room management presented in the 7th edition of NRP
  – Non-Vigorous Meconium
  – CR Monitor leads
  – ET Insertion depth
  – Delayed cord clamping
  – Intubation before compressions

• Discuss the history of and evidence behind the management of infants born with meconium stained amniotic fluid

• Describe the resuscitation science utilized in the development of the 7th edition of NRP
Meconium

- “Non-vigorous newborns with meconium-stained fluid do not require routine intubation and tracheal suctioning”
- “Meconium-stained amniotic fluid is a perinatal risk factor that requires the presence of one resuscitation team member with full resuscitation skills, including endotracheal intubation”
Audience Poll

Approximately what percentage of term infants have meconium stained amniotic fluid?

– A. 5%
– B. 12%
– C. 27%
– D. 53%
– E. All of them… They ALL have Mec!
Audience Poll

• In what year was it no longer recommended to routinely suction VIGOROUS infants with meconium stained amniotic fluid
  – A. 1990
  – B. 1995
  – C. 2000
  – D. 2006
  – E. Wait… We’re not suppose to suction vigorous meconium??
Meconium

• At term, 12% of fetuses will pass meconium during the birth process

• 1970s - Ting and Brady, Gregory et al: Tracheal suctioning of infants with Mec stained fluid improved outcomes

• 1976 - Carson et al: OB + Pediatric approach beneficial

• Based on low grade evidence, routine tracheal suctioning became standard of care

Ringer and Eichenwald. AAP NCE. 2016
Meconium

- Early 1980s: Prevent breathing, intubate and suction by mouth
- Late 1980s: Maybe “Thin Mec” is okay…

Ringer and Eichenwald. AAP NCE. 2016
Meconium

1994 -

- 4938 live births at a single institution
- 799 meconium stained fluid
- Developed “selective” tracheal suctioning protocol
- Infants who were suctioned did worse

Obstet. Gynecol 1994;83:77-84
Table 2. Frequency of Specific Pulmonary Diagnoses and Any Respiratory Complication in Infants With or Without Meconium-Stained Amniotic Fluid and With or Without Suctioning

<table>
<thead>
<tr>
<th></th>
<th>Moderate to thick MSAF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control (n = 778)</td>
</tr>
<tr>
<td>Meconium aspiration syndrome</td>
<td>0 *</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>21 (3%)</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>8 (1%)</td>
</tr>
<tr>
<td>Persistent pulmonary</td>
<td>0</td>
</tr>
<tr>
<td>hypertension</td>
<td>Transient tachypnea</td>
</tr>
<tr>
<td>Any respiratory problem</td>
<td>40 (5%) †</td>
</tr>
</tbody>
</table>

MSAF = meconium-stained amniotic fluid.
* P < .01 vs no suction.
† P < .01 vs all others.
‡ P < .01 vs control and light staining.

Table 3. Need for Ventilator and Oxygen Support Among Infants With or Without Meconium-Stained Amniotic Fluid and With or Without Suctioning

<table>
<thead>
<tr>
<th></th>
<th>Mechanical ventilation</th>
<th>Oxygen requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Any &gt;24 h</td>
<td>Any &gt;48 h</td>
</tr>
<tr>
<td>Controls (n = 778)</td>
<td>4 (0.5%) 1 (0.1%)</td>
<td>27 (3.5%) 3 (0.4%)</td>
</tr>
<tr>
<td>Light MSAF (n = 323)</td>
<td>3 (0.9%) 1 (0.3%)</td>
<td>10 (3.1%) 1 (0.3%)</td>
</tr>
<tr>
<td>No suction (n = 211)</td>
<td>1 (0.5%) 0</td>
<td>8 (3.8%) 2 (0.9%)</td>
</tr>
<tr>
<td>Suction (n = 196)</td>
<td>10 (5.1%)* 7 (3.6%)*</td>
<td>27 (13.8%)* 8 (4.1%)*</td>
</tr>
</tbody>
</table>

MSAF = meconium-stained amniotic fluid.
* P < .01 vs all others.
† P < .01 vs control and light staining.
Meconium

2000-

Delivery Room Management of the Apparently Vigorous Meconium-stained Neonate: Results of the Multicenter, International Collaborative Trial

Thomas E. Wiswell, MD*; Catherine M. Gannon, MD*; Jack Jacob, MD‡; Leonard Goldsmith, DO§; Edgardo Szyld, MD¶; Kerry Weiss, MD¶; David Schutzman, MD#; Gerard M. Cleary, DO*; Panayot Filipov, MD**; Isabel Kurlat, MD††; Carlos L. Caballero, MD¶¶; Soraya Abassi, MD¶¶; Daniel Sprague, MD¶¶; Charles Oltorf, MD##; and Michael Padula, BA*
Meconium

• But is suctioning harmful??

• 2012-

Each 30 second delay of BVM ventilation increased mortality and morbidity by 16%!
Meconium

• 2015-

Endotracheal Suction for Nonvigorouse Neonates Born through Meconium Stained Amniotic Fluid: A Randomized Controlled Trial

Subhash Chettri, MBBS, Bethou Adhisivam, DNB (Ped), and B. Vishnu Bhat, MD, MD

• First randomized study comparing suctioning vs no suctioning in non-vigorous infants
• Single institution in India, 2013-2014
• 16111 births, 1115 born with MSF, 963 vigorous
• 121 infants randomized
Meconium

- No difference in MAS, asphyxia or PPHN
- No difference in mortality or NDI

<table>
<thead>
<tr>
<th>Table III. Comparing outcomes in the 2 groups</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td><strong>During NICU stay</strong></td>
</tr>
<tr>
<td>MAS</td>
</tr>
<tr>
<td>Perinatal asphyxia</td>
</tr>
<tr>
<td>pH (mean ± SD)</td>
</tr>
<tr>
<td>Base deficit (mean ± SD)</td>
</tr>
<tr>
<td>Convulsions</td>
</tr>
<tr>
<td>Shock</td>
</tr>
<tr>
<td>Secondary pneumonia</td>
</tr>
<tr>
<td>Blood culture positive</td>
</tr>
<tr>
<td>Sepsis</td>
</tr>
<tr>
<td><strong>At 9-month follow-up</strong></td>
</tr>
<tr>
<td>Survival</td>
</tr>
<tr>
<td>Mortality</td>
</tr>
<tr>
<td>Lost in follow-up</td>
</tr>
<tr>
<td>Mental development by DASII</td>
</tr>
<tr>
<td>Normal (DQ ≥85%)</td>
</tr>
<tr>
<td>Mild delay (DQ 70%-84.9%)</td>
</tr>
<tr>
<td>Severe delay (DQ ≤69.9%)</td>
</tr>
<tr>
<td>Motor development by DASII</td>
</tr>
<tr>
<td>Normal (DQ ≥85%)</td>
</tr>
<tr>
<td>Mild delay (DQ 70%-84.9%)</td>
</tr>
<tr>
<td>Severe delay (DQ ≤69.9%)</td>
</tr>
</tbody>
</table>
Meconium

• Take Home Message:
  – Little or no evidence suggesting a benefit to suctioning and at least some evidence of potential harm
  – Therefore, ROUTINE suctioning is no longer recommended
  – If the infant requires respiratory support this should begin as soon after birth as feasibly possible
  – Suctioning may still be warranted in certain circumstances

Ringer and Eichenwald. AAP NCE. 2016
CR Monitor Leads

• “If you cannot determine the heart rate by auscultation and the baby is not vigorous, quickly connect a pulse oximetry sensor or ECG leads and use a pulse oximeter or cardiac monitor to assess the HR”

• “When PPV begins, consider using a cardiac monitor for accurate assessment of the HR”

• “An electronic cardiac monitor is the preferred method for assessing HR during chest compressions”

Eichenwald and Strand. _NRP Instructor Update_. 2015
Audience Poll

• How long does it take for the pulse ox to pick up in the delivery room?
  – A. 5 sec
  – B. 30 sec
  – C. 1 min
  – D. 2 min
  – E. An Eternity!!
CR Monitor Leads

- 4 studies: 3-lead ECG displayed a reliable heart rate faster than pulse oximetry
- 2 studies: ECG was more likely to detect the newborn’s heart rate during the first minute of life
- Mean differences between HR measured by ECG and pulse oximetry were small, pulse oximetry tended to underestimate
- Majority of the studies did not report any difficulties applying the leads

CR Monitor Leads

Electrocardiogram Provides a Continuous Heart Rate Faster Than Oximetry During Neonatal Resuscitation

• 46 infant had both ECG and pulse ox placed
  • 33 were VLBW
• Median time to place the ECG was 26 sec, 38 sec for PO
• Median time to acquire a signal: ECG 2 sec, PO 20 sec
• During the first minutes of resuscitation, 93% of infant had an ECG HR compared with only 56% for PO
  • First minute >1500g, 100% ECG, 50% PO
Audience Poll

- You have a 3kg infant. How far should you insert the ET tube?
  - A. Wt in Kg + 6 = 9
  - B. Other
Endotracheal Tube Insertion Depth

• “To determine tip-to-lip depth of the endotracheal tube after insertion, use the endotracheal tube initial insertion depth table or measure the nasal-tragus length”
Endotracheal Tube Insertion Depth

<table>
<thead>
<tr>
<th>Gestational Age</th>
<th>Depth of Insertion</th>
<th>Weight</th>
<th>ET Tube Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>36–37 weeks</td>
<td>8.0</td>
<td>2,000–3,000</td>
<td>3.0–3.5</td>
</tr>
<tr>
<td>38–40 weeks</td>
<td>8.5</td>
<td>2,000–3,000</td>
<td>3.5–4.0</td>
</tr>
<tr>
<td>41–43 weeks</td>
<td>9.0</td>
<td>3,200–4,200</td>
<td>3.5–4.0</td>
</tr>
</tbody>
</table>

WHY??
Endotracheal Tube Insertion Depth

- 24 hospitals in the UK
- Education drive to encourage use of standardized guidelines for ETT length based on gestation
- Decreased need for repositioning from 53% to 8%
Endotracheal Tube Insertion Depth

24 hospitals in the UK
Education drive to encourage use of standardized guidelines for ETT length based on gestation
Decreased need for repositioning from 53% to 8%
Endotracheal Tube Insertion Depth

- The relationship b/w satisfactory ETT depth and gestation age is linear.
- Relationship with weight is logarithmic.
- Based on satisfactory ETT depth and actual weight at the time of intubation, chart was derived.

Resuscitation (2008) 77, 369-373
In deliveries you attend, when is the umbilical cord typically clamped?

- A. Immediately
- B. 30 sec
- C. 60 sec
- D. 2 min
- E. We believe in Lotus births
Cord Clamping

• “Current evidence suggests that cord clamping should be delayed for at least 30 to 60 seconds for most vigorous term and preterm newborns”

• “If the placental circulation is not intact, such as after a placental abruption, bleeding placenta previa, bleeding vasa previa or cord avulsion, the cord should be clamped immediately after birth”

• “There is insufficient evidence to recommend an approach to cord clamping for newborns who require resuscitation at birth”
Cord Clamping

- Benefits of delayed cord clamping: Less IVH, higher blood pressure and blood volume, less need for transfusion, less NEC
- No evidence of decreased mortality or decreased severe IVH
- Slightly increased level of bilirubin associated with more need for phototherapy
- In majority of studies, infants thought to require resuscitation were withdrawn from randomization or not enrolled
- Insufficient evidence on the safety or utility of cord “milking”
Cord Clamping

Original Paper

Neonatology 2008;93:138–144
DOI: 10.1159/000108764

Received: December 28, 2006
Accepted after revision: July 17, 2007
Published online: September 31, 2007

A System of Brief Cord Clamping

Heike Rabe

aDepartment of Neonatology, Women’s and Children’s Health, Pan American Health Organization

Effect of timing of umbilical cord clamping of term infants on maternal and neonatal outcomes (Review)

McDonald SJ, Middleton P, Dowswell T, Morris PS
Chest Compressions

• “Intubation is strongly recommended prior to beginning chest compressions”

• “If intubation is not successful or not feasible, a laryngeal mask may be used”

• “Chest compressions are administered with the two-thumb technique”
Chest Compressions

• Ventilation is the most effective action in neonatal resuscitation

• Chest compressions are likely to compete with effective ventilation

• Rescuers should ensure that assisted ventilation is being delivered optimally before starting chest compressions
Chest Compressions

- Wyckoff, Perlman and Laptook *Pediatrics* 2005
- Parkland Memorial Hospital in Dallas, Texas
- 37,972 infants >34 weeks over a 30mo period

<table>
<thead>
<tr>
<th>Type of Resuscitation Required in DR</th>
<th>No. of Infants (% of all NICU Admissions ≥34 Weeks’ GA; N = 1456)</th>
<th>% of Entire Delivery (Population ≥34 Weeks’ GA; N = 37,972)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMV only</td>
<td>149 (10)</td>
<td>0.39</td>
</tr>
<tr>
<td>BMV + intubation</td>
<td>31 (2)</td>
<td>0.08</td>
</tr>
<tr>
<td>CPR &lt;1 min</td>
<td>9 (1)</td>
<td>0.02</td>
</tr>
<tr>
<td>Intensive CPR</td>
<td>23 (2)</td>
<td>0.06</td>
</tr>
</tbody>
</table>
Chest Compressions

- The 2-thumb technique generates higher BP and coronary perfusion pressure with less rescuer fatigue
  - 14 studies. Manikin and Animal model based
    - 209 health care providers performed compression x 2min on an infant manikin
    - Randomized to two-finger vs two-thumb for 1st min
    - Only 40/209 (19%) participants performed adequate compressions
    - Overall, more compressions were measured as shallow with two-finger
Audience Poll

What is your most favorite recent NICU name?

– A. Baybee
– B. JKMN
– C. SSSS
– D. J-a
– E. Other
References


References


