Delivery Room and Initial Respiratory Management of Premature Neonates Born Before 30 Weeks Gestation

Advocate System Wide Implementation
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Components

• Thermoregulation in Delivery Room
• Timed Cord Clamping (TCC)
• Oxygen Saturation Targeting
• Delivery Room CPAP and use of Surfactant
• Early use of Caffeine to Prevent Bronchopulmonary Dysplasia (BPD)
• Delivery Room Checklist
Thermoregulation in the Delivery Room
Thermoregulation

• Rationale
  • Hypothermia is an independent risk factor for mortality in the neonate

• Neonatal Resuscitation Program (NRP) recommendations
  • Delivery room temperature: 74-78 degrees
  • Plastic wrap or bag
  • Hat
  • Thermal mattress
  • Prewarmed incubator for transport

• Goal infant temperature
  • 36.5-37.5°C
Thermoregulation

• Committee recommendations
  • DR temperature minimum of 74 degrees
  • Employ a combination of:
    • Plastic wrap or bag
    • Thermal mattress
    • Hat (consider double hat if head not covered by plastic)
    • Prewarm transport isolette
Thermoregulation

• Considerations
  • Wrap infant in plastic wrap during TCC
  • Remove thermal mattress if temperature exceeds 37
  • Ensure infant remains wrapped in bag until in warm/humidified isolette

• Data collection
  • DR ambient temperature
  • Axillary temperature prior to leaving DR
  • NICU admit axillary temperature
Timed Cord Clamping
Timed Cord Clamping

• Rationale
  • Improved transitional circulation
  • Better establishment of RBC volume
  • Decreased need for blood transfusion
  • Lower incidence of necrotizing enterocolitis
  • Lower incidence of IVH
Timed Cord Clamping

• Inclusion criteria
  – All vigorous infants not requiring immediate resuscitation at birth
    • C-section or vaginal deliveries
    • Multiple gestation at discretion of obstetric provider

• Exclusion criteria
  • Maternal conditions
    • Hemorrhage
    • Hemodynamic instability
    • Abnormal placentation
      • Previa
      • Abruption
  • Fetal/Neonatal Conditions
    • Need for immediate resuscitation
    • Problems with placental circulation
      • Previa
      • Abruption
      • Cord avulsion
      • IUGR with abnormal dopplers
Timed Cord Clamping

• Process
  • Neonatal team discusses with OB provider appropriateness of TCC
  • If TCC occurs neonatal team will verbalize time in 10 sec intervals
  • Infant placed at or below level of placenta or skin-to-skin on abdomen
  • Obstetric team clamps cord after 30-60 sec of TCC

• Data collection
  • Golden Hour Data Sheet
  • Document in EHR
Oxygen Saturation Targeting
Oxygen Saturation Targeting

• Rationale
  • There is no benefit in survival, prevention of BPD, IVH, or ROP when resuscitated with high FiO2 (>65%) vs. low FiO2 (21-30%)
  • Blood oxygen levels do not reach extrauterine values until ~10 minutes of life in uncompromised infants
  • Growing evidence that adverse outcomes may result from exposure to excessive oxygen during and following resuscitation
Oxygen Saturation Targeting

- **Process**
  - Initial FiO2 set @ 21-30%
  - Preductal pulse oximeter probe place on R hand
  - Follow NRP recommendations for oxygen saturation targets, adjusting FiO2 as needed

<table>
<thead>
<tr>
<th>Time</th>
<th>Preducatal saturation</th>
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</thead>
<tbody>
<tr>
<td>1 minute</td>
<td>60-65%</td>
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<tr>
<td>2 minutes</td>
<td>65-70%</td>
</tr>
<tr>
<td>3 minutes</td>
<td>70-75%</td>
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<tr>
<td>4 minutes</td>
<td>75-80%</td>
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<tr>
<td>5 minutes</td>
<td>80-85%</td>
</tr>
<tr>
<td>10 minutes</td>
<td>85-90%</td>
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</tbody>
</table>
Delivery Room CPAP and Surfactant
Delivery Room CPAP and Surfactant

• Rationale
  • Early surfactant studies showed delaying surfactant administration in premature infants with RDS was associated with increased risk for BPD.
  • Several more recent studies show that CPAP can sufficiently maintain functional residual capacity (FRC) in some infants with RDS resulting in improved pulmonary outcomes.
  • Atelectasis is an important component in the pathophysiology of RDS resulting in inflammation and worsening short and long term pulmonary outcomes.
Delivery Room CPAP and Surfactant

• Surfactant
  • Decreases alveolar surface tension
  • Prematurity
    • 50% of infants @ 30 weeks are deficient
    • 80% of infants < 28 weeks are deficient
Effects of Surfactant Deficiency

High surface tension = loss of FRC
Effects of Surfactant Deficiency

Loss of FRC = Atelectasis
Preventing Atelectasis

• Provide distending pressure
  • Mechanical ventilation
    • Reliably delivers pressure directly to airway
    • Requires intubation in most cases (NIV NAVA)
    • Easy to maintain pressure
    • Invasive
  • CPAP
    • Noninvasive
    • Must maintain good seal
      • More difficult to maintain pressure
    • Also delivers pressure to GI tract
    • Removal of CPAP = loss of distending pressure
      • Atelectasis in short period of time (mask/prong change)
Preventing Atelectasis in Premature Lungs

• Surfactant
  • Endogenous
    • 2-5 days postnatally
    • Potential complications of waiting
      • Pneumothorax
      • High oxygen requirement (oxygen toxicity)
      • Hypercarbia
      • Atelectasis
  • Exogenous administration
    • Immediate
    • Invasive
    • Potential complications of exogenous administration
      • Barotrauma
      • Vocal cord injury
      • PDA
      • Pulmonary Hemorrhage
CPAP vs Surfactant

• All comers CPAP > Prophylactic surfactant?
  • Recent meta-analysis reveals we have not decreased BPD significantly

• Can we do better?
  • Avoid atelectasis – prevent downstream inflammation

• Is CPAP the answer?
  • SOMETIMES
    • Infant produces sufficient surfactant
    • Lung structure mature enough
    • FRC can be achieved and maintained
    • Amount of pressure does not cause barotrauma or air leak syndrome
Identifying CPAP Candidates

• Some infants with RDS can have FRC maintained safely with CPAP
  • Smaller percentage with decreasing GA

• Which ones?
  • Not immediately clear at birth

• Intubate everyone?
  • Subject those who can be maintained on CPAP to complications associated with intubation.

• CPAP for everyone?
  • Subject those who need surfactant to atelectasis, hypoxia, hypercarbia, and resulting changes leading to CLD.
Identifying CPAP Candidates

• Need a tool to **safely** differentiate which infants can maintain FRC with CPAP.
  • Safe levels of CPAP
  • No significant hypercarbia
  • No significant hypoxia
  • No administration of high FiO$_2$
    • Oxidative damage
Identifying CPAP Candidates

• Avoid atelectasis
• Improve outcomes
  • BPD rates
  • IVH rates
  • Neurodevelopment
• Don’t be misguided by aiming for these outcomes
  • Decreased intubation
  • Increased CPAP use
  • Decreased surfactant administration
Chasing Atelectasis

• Potential pitfall
  • FRC is not maintained on initial nCPAP settings
  • Settings increased to reestablish FRC
  • Inflammatory changes secondary to atelectasis decrease compliance requiring incremental need for higher settings

• Potential solution
  • Choose a safe level of nCPAP +5 to +8 cm H2O
    • Need to monitor and balance against incidence of air leaks
  • If infant shows signs of loss of FRC intubate and administer surfactant with minimal delay
Caffeine
Early Caffeine for Prevention of BPD

• Prophylactic caffeine
  • Decreases apnea of prematurity
  • Significantly reduces risk of BPD

• Early vs late?
  • Multiple studies favor early use

• Committee recommendation
  • Intubated infants <1250g should receive prophylactic caffeine
  • Caffeine should be continued until at least 32 weeks unless otherwise indicated
Delivery Room Checklist
Delivery Room Checklists

- The committee has developed checklists to assist caregivers
  - Discipline specific
    - Physician/Practitioner
    - Nurse
    - Respiratory care provider
  - Encompass care in first 60 minutes of life
<table>
<thead>
<tr>
<th>RN</th>
<th>Pre-Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In NICU: Set up supplies for line placement at bedside</td>
</tr>
<tr>
<td></td>
<td><strong>In Delivery Room:</strong></td>
</tr>
<tr>
<td></td>
<td>Assure DR/OR Room temp =74-77°F (23-25°C)</td>
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<tr>
<td></td>
<td>Check and prepare “Warming” supplies (see Neonatal Resuscitation Quick Equipment Checklist)</td>
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<tr>
<td></td>
<td>Check and prepare “Medication” supplies (see Neonatal Resuscitation Quick Equipment Checklist)</td>
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<td></td>
<td>Arrange nest for patient’s &lt;26 weeks</td>
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<tr>
<td></td>
<td>Assure transport isolette is ready and warming</td>
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</tbody>
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### Delivery 0-15 minutes

- **Press Apgar Timer**
- **Announce Apgar time in 10-second increments for TCC**
- **Apply plastic wrap without drying (when applicable)**
- **Apply hat directly over plastic wrap on head**
- **Attach pulse ox- right wrist by 2 minutes**
- **Attach temp probe and switch bed to servo control**
- **Apply precordial leads**
- **Insert PIV, if indicated (2 attempts only)**
- **Obtain weight, length (If stable)**
- **Initiate 1st Touch by family**

### NICU 15-60 minutes

- **Obtain temperature & maintain thermoregulation/humidity interventions until 60 minutes post delivery**
- **Obtain initial vital signs**
- **Weight, length if needed**
- **Set up for line placement**
- **Obtain Labs – Consider: Glucose, Blood Culture, CBC, Type & screen, blood gas**
- **Obtain PIV - if needed**
- **Prime TPN/IL/Fluids**
- **Start fluids**
- **Administer Antibiotics as ordered**

Created 7/7/2017 Updated 8/15/2017 v.2  T. Wolfe
**RCP**

**Pre-Delivery**

In NICU: Set up respiratory support at bedside

**In Delivery Room:**

Check and prepare equipment (see Neonatal Resuscitation Quick Equipment Checklist)

“Airway Clearance” supplies

“Ventilation/Oxygenation” & “Auscultation” supplies

“Intubation” supplies

“Surfactant” supplies

**Delivery 0-15 minutes**

Apply CPAP (and PPV if indicated)

Adjust FiO2 to keep within targeted range

Assure CPAP is maintained without interruption (maintains FRC)

Secure ETT if applicable

Transition infant to determined resp. support (ET or NIV)

Administer surfactant, if applicable

**NICU 15-60 minutes**

Maintain/stabilize airway

Complete set-up of respiratory devices - adjust settings,
# Golden Hour Checklist

## Provider

### Pre-Delivery
- Obtain OB history - discuss plan with team
- Discuss plan for TCC with teams
- Introduce team to family

### Delivery 0-15 minutes

- **Resuscitation lead**
  - Apply CPAP
  - Intubate (if indicated)
  - Place UVC, if indicated
  - Administer surfactant, if applicable
  - Update family

### NICU 15-60 minutes
- Complete orders
- Insert umbilical lines if needed
- Verify line placement/ET tube (Xray)
- Update mom/family

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*Created 7/7/2017  Updated 8/15/2017 v.2  T.Wolfe*
Golden Hour Data Form
Golden Hour Data Collection Sheet

Golden Hour Goals
- Family-introduce team prior to delivery,
- Present at bedside
- Timed Cord Clamping (TCC) of at least 30-60 sec for all vigorous infants
- Early CPAP and/or Timely surfactant delivery
- Admit Temp between 36.5-37.5°C (97.7-99.5°F)
- IV Fluids & Antibiotics Infusing within one hour

PRE-DELIVERY
ID: __________________________
Pre-brief done: □ Yes □ No
Communicated with family prior to delivery: □ Yes □ No □ NA
Comments: _______________________________

DELIVERY 0 – 15 Minutes
DOB: __________________________
Time: _______________
Birth Weight (grams): ___________________________
Gestational Age (week/day): _______________
L & D Room Temp: ______
Timed Cord Clamp: □ Yes □ No □ NA □ >30secs
Trial of CPAP: □ Yes □ No
If no, explain why: ___________________________
Patient axillary temp in L&D: Temp: ______°C
Family present during resuscitation: □ Yes □ No
Did first touch occur in DR?: □ Yes □ No
Debrief done: □ Yes □ No
Comments: _______________________________

NICU 15 – 60 Minutes
Family present during admit: □ Yes □ No
NICU admit axillary temp: Temp: ______°C Time: ______
Was Caffeine given within first hour: □ Yes □ No
Was Surfactant given within the first hour?: □ Yes □ No □ Not intubated
Was IV Dextrose fluids given in <1 hr?: □ Yes □ No
Was Antibiotics started within the first hour?: □ Yes □ No □ Not indicated
Comments: _______________________________
Thank you