Transport of the Neonate with Respiratory Distress Syndrome and Air Leak

Decision-Making for Optimal Care and Outcomes
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Disclosures

• The speakers do not have anything to disclose.
Objectives

• Discuss the presentation and pathology of Neonatal Respiratory Distress Syndrome (RDS) and Air Leak Syndrome (ALS)

• Discuss neonatal RDS and ALS in the pre-transport setting

• Discuss the unique variables and challenges in caring for neonatal RDS and ALS during transport

• Discuss how to optimize the care of the neonate with RDS and/or ALS in the transport setting
Respiratory Distress Syndrome
Pathophysiology

- Etiology: Surfactant deficiency
Respiratory Distress Syndrome – Incidence

- Incidence inversely proportional to gestation
  - 95-98% of neonates 22-24 weeks

- 5% at 34 weeks
- 1% at 37 weeks
Respiratory Distress – Other Risk Factors

- Slight male predominance (and of European descent)
- Elective delivery without labor, especially late preterm 34-36 weeks
- Maternal Diabetes
- Perinatal acidosis or HIE
Respiratory Distress Syndrome – Clinical Course

- Increased work of breathing, retractions, tachypnea, supplemental O2 requirement and grunting typically **shortly after delivery**. Those with severe hypoxia or <28 weeks may have intermittent apnea.

- Symptoms and therapy needs tend to **peak at 48 to 72 hours** of life then endogenous surfactant production starts.

- At risk of developing **Chronic Lung Disease** if RDS is severe and prolonged ventilation is required.
Respiratory Distress Syndrome - Treatment

• Positive Pressure Ventilation
  – High Flow Nasal Cannula
  – CPAP
  – Non-invasive positive pressure ventilation
  – Synchronized Intermittent Mechanical Ventilation
  – High Frequency ventilation

• Surfactant Therapy
  – Curosurf administered by CMCCT
Respiratory Distress Syndrome – Transport Considerations

– What is the Medical Control Physician thinking about?

• **To intubate or not to intubate? That is the question**
  
  • Not all preemies have RDS and not all RDS requires intubation (Banc 2012, Laugh 2009)
  
  • Avoiding intubation in some neonates may prevent BPD (Hendrik 2013)
  
  • There are inherent risks to intubation (Colm 2006)

• **To Surf or not to Surf? That is another question.** (AAP Surf replacement, 2014)
  
  – Surfactant administration can be associated with air leak and pulmonary hemorrhage
  
  – Early surfactant may be more beneficial than late surfactant administration
  
  – What about the INSURE (Intubation, surfactant administration, extubation to CPAP) Strategy?
What is the transport team thinking about? (AAP air/ground 2007)

- Safety, Safety, Safety, Safety, Safety
- Accurate Communication with MCP
- Will my equipment work
- Will my equipment fit
- Weather
- Intubation Experience
- Distance
- Mode of Ventilation
- Referral comfort with ground time
- Mode
- Tank reserves
- Need for central lines
- Trajectory of illness
- Referral resources
- Time constraints
- Blood Product Availability
- Temperature
- Referral Support
- Safe
- Effective
- Transport
- APNEA
- pCO₂ > 70
- paO₂ <50% on >50% FiO₂
- <28 weeks gestation
- Severe SaO₂ lability
- Severe distress

- Intubate
- Administer Surfactant
- SIMV or High Frequency Ventilation

- pCO₂ <60
- pCO₂ stabilizes or improves on CPAP
- paO₂ >50 on <30% FiO₂
- Breathing comfortably
- No SaO₂ lability

- Continue non-invasive support

- pCO₂ 60-70
- FiO₂ Needs 30-50%
- Long transport
- Air Mode
- Several hours old
- Moderate distress

- May need intubation, surfactant and MV
Air Leak Syndrome

- **Etiology:**
  - Overdistension and rupture of alveoli

- Air dissects via the perivascular bundles and collect as:
  - Pneumomediastinum
  - Pneumothorax
  - Pneumopericardium
  - Pulmonary Interstitial Emphysema
  - Pneumoperitoneum
  - Subcutaneous emphysema
Air Leak Syndrome – Incidence

• Estimated to occur in 1-2% of term neonates
• Incidence increases with decreasing gestational age
• Up to 15% with BW of 501-750gm
• Other Risk factors:
  – Early, aggressive CPAP
  – Long I-times
  – High PIP with lower PEEP
  – Frequent suctioning
  – Respiratory Distress Syndrome
  – Elective c-section prior to 39 weeks gestation
Air Leak Syndrome - Diagnosis

• Suspect in acute respiratory decompensation, followed by tachycardia, hypotension, hypoxia

• Asymmetric auscultation, chest wall, shift of PMI

• Transillumination or Chest x-ray depending on stability of patient
Air Leak Syndrome - Treatment

- Titrate FiO₂ to support adequate oxygen saturations
- Needle Thoracotomy
  - Can be temporizing or definitive
- Chest Tube placement
  - For recurrent pneumothorax
- High Frequency Ventilation
- Supportive care
  - Blood pressure cardiac output
Air Leak Syndrome – Transport Considerations

• What is the Medical Control Physician thinking about?
  – Not all pneumothoraces require invasive treatment including needle thoracotomy or chest tube placement.
  – 100% FiO$_2$ or “nitrogen wash out” does not hasten resolution of pneumothoraces (Clark 2014)
  – Is the pneumothorax spontaneous in otherwise healthy lungs or associated with another pathology (RDS, MEC, PPHN, or anything requiring mechanical ventilation)?
  – By what mode is the patient being transported?
What is the Transport Team thinking about? (Ruskin 2008, Kaczala 2008, Parsons 1982)

• Fixed wing flights are pressurized to 4000 feet
• Rotor wing flights are flown at 5000 feet but can be as high as 8000 Feet and without pressurization
• Increased complications with air leak syndromes occur greater than 3000 feet
• BOYLES LAW – volume of a gas in an ENCLOSED space is inversely related to the pressure exerted
• What resources are available at the Referral?
- **“Small” leak**
  - No atelectasis or anatomic abnormality
  - <30% FiO$_2$
  - High Flow Nasal Cannula
  - “Comfortable”
  - No SaO$_2$ lability

- **“Large” leak**
  - Atelectasis, mediastinal shifts
  - RDS or other pathology
  - >50% FiO$_2$ and SaO$_2$ lability
  - CPAP or invasive MV

- **“Moderate” leak**
  - No atelectasis or abnormality
  - FiO$_2$ Needs 30-50%
  - Long transport
  - Air Mode
  - Moderate distress

- **“Comfortable”**
  - Supplemental oxygen and current supportive care
- **Needle thoracotomy**
  - Keeping catheter in place with drainage system
  - May need definitive chest tube

- **May opt for needle thoracotomy considering transport variables**
References


8) SD Clark, F Saker, MT Schneeberger, E Park, DW Sutton, Y Littner. Administration of 100% oxygen does not hasten resolution of symptomatic spontaneous pneumothorax in neonates. J Perinatology. 2014. 34:528-531

9) Children’s Mercy Critical Care Transport Policy: Altitude Restrictions # SA.01. Last review 11/16

