M10: Neonatal Respiratory

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Introduction

This practice guideline contains changes related to COVID-19.

Respiratory distress in the neonate is defined as an impairment of the lungs to exchange gas at the alveolar level. Multiple pathophysiologic processes can produce respiratory distress in the neonatal period and careful monitoring of the trend of disease progression can assist in identifying the cause.

Paramedic and EMR/FR management of the neonate in respiratory distress should focus on maintaining appropriate oxygenation and ventilation based on gestational age and days/hours of life. Differential diagnoses to consider in the newly born neonate differ than the differential diagnoses for a neonate on day of life 2 or more.

In neonates, the differential diagnoses can be:

- Respiratory distress syndrome (RDS): Primarily a surfactant deficiency that will progressively worsen until 72 hours of life and then slowly get better if no treatment is initiated. Normal in the preterm infant and higher risk in the neonate born to a mother with poorly controlled diabetes.
- Transient tachypnea of the newborn (TTN): Fluid retention in the lungs that will gradually resolve over 24-72 hours. Common in caesarean section and precipitous deliveries.
- Congenital pneumonia/sepsis: Similar physical presentation to RDS but with differing radiological evidence and can progress to sepsis quickly if not recognized.
- Pneumothorax: The neonate requires an opening pressure of up to 50 cmH_2O to push out the fluid filling the lung and can cause spontaneous pneumothoraxes.

The term neonate with an uncomplicated antenatal history that develops respiratory complications is unlikely to be RDS and is most likely to have an infection or undiagnosed congenital problems.

Essentials

- The Neonatal respiratory assessment consists of lung auscultation, evidence of nasal flaring, grunting of the neonate, accessory muscle use (begins in the subcostal and works up the chest as severity increases), and symmetry of the chest. A chest x-ray and blood gas analysis should be performed to gauge severity and initiate a baseline for trend monitoring.
- Establish ABCs and support ventilations if required.
- Support of the neonate's respirations follows a staged approach. The FiO_2 is titrated to maintain a pre-ductal SpO_2 of 88-95% in the preterm neonate and 92-95% in the term neonate. Escalation along the respiratory treatment pathway is based on clinical assessment, radiological evidence, and blood gas analysis.
- Pre-ductal SpO_2 is performed on the right hand and post-ductal on a lower appendage (right or left foot). A pre-ductal < 90% or a difference > 3% should prompt further investigations.
- Increased work of breathing with associated decreased air entry should be investigated for pneumothorax.

Additional Treatment Information

- Options for supporting neonatal respirations include:
  - Blow by oxygen: titrate to patient's SpO_2 if no increased work of breathing
  - High flow O_2: 2-3 lpm/kg of heated humidified gas; titrate FiO_2 to appropriate SpO_2
  - nCPAP: 5 cmH_2O - 8 cmH_2O; titrate FiO_2 to appropriate SpO_2
  - Intubation and mechanical ventilation
- Once a neonate is intubated, bLES should be considered. If the FiO_2 is > 30% and there is radiological evidence of surfactant deficiency, bLES is administered (5 ml/kg administered via a 6 fr OG tube down the ET tube).

- If patient is showing signs of tension pneumothorax – tracheal deviation, increased work of breathing, absent air entry, hemodynamic compromise – needle decompression should be performed while equipment is gathered for a chest tube insertion.
  - In a neonate a 26-gauge butterfly needle attached to a 3-way stop cock and 10 cc syringe is used to access the 2nd intercostal space mid-clavicular line, to aspirate air; in an older neonate, a 20-gauge needle connected to a 3-way stop cock and 10 cc syringe may be required
- Due to the rapid progression of sepsis in the neonatal period, all neonates with signs of respiratory distress will have a blood culture done and be started on antibiotics: Ampicillin (50 mg/Kg) and Gentamycin
  - Gentamycin:
    - DOL 0-7: < 30 weeks gestation 5 mg/kg
    - 30-34 weeks gestation 4 mg/kg q 36 hrs
    - > 35 weeks gestation 4 mg/kg q 24 hrs
    - DOL > 7: < 30 weeks gestation 5 mg/kg
    - > 30 weeks gestation 4 mg/kg q 24 hrs
- Common initial ventilation settings are: RR 50 Ti 0.4 TV 4-5.5 ml/kg FiO_2 as required, PEEP 5 cmH_2O. Neonates require I:E ratios approaching 1:1. The normal range of Ti is 0.35-0.5 with most patients requiring 0.35-0.4. If a large tube leak is detected, then PCV ventilation should be considered (starting settings may be 20/5 and then are titrated to effect).
- Neonates require an uncuffed ET tube due to the possibility of subglottic damage from an ET cuff and prolonged intubation, resulting in subglottic stenosis as the neonate grows.
- Sedation in the neonate should only be initiated if there are signs of pain or discomfort based on the BIIP scale as there is evidence of increased morbidity and mortality when sedation is given to neonates with no signs of pain or discomfort. If sedation is to be initiated, the preferred analgesics are:
  - Morphine: 50 mcg/kg bolus with an infusion of 10-20 mcg/kg/hr
  - Fentanyl: 1-2 mcg/kg bolus with an infusion of 0.5-2 mcg/kg/hr
  - Midazolam: 50 mcg/kg as a bolus for the labile neonate.
- Maintenance fluids for the first 24 hours should be D10W, and after 24 hours, D10W with NaCl (20 mmol/L)
  - DOL 0 – 60-80 ml/kg/day
  - DOL 1 – 80-100 ml/kg/day
  - DOL 2 – 100-120 ml/kg/day
  - DOL 3 – 120-140 ml/kg/day
  - DOL 4 – 140-150 ml/kg/day
  - DOL 5 – 150 ml/kg/day

General Information

- Neonates that have been in the community are at an increased risk of an infective origin to their increased work of breathing; these need to be considered during the differential diagnosis:
  - Bronchiolitis
  - Pneumonia
  - Croup
  - Pertussis

Interventions

First Responder

- Maintain thermal stability
- Provide supplemental oxygen as required. The maximum flow of a nasal cannula should be 5 L/min. The maximum flow of a partial or non-rebreathing mask should be 15 L/min. A nasal cannula may be placed under an NRB or BVM when flow rates above 5 L/min are required.
  - → A07: Oxygen Administration
- Positive pressure ventilation via bag-valve-mask. Provide a tight seal with the BVM using a 2-person technique where

possible. An inline viral filter should be used between the mask and the bag-valve device.

- → B01: Airway Management
- Most pediatric airways can be effectively managed with proper positioning and an OPA/NPA (as per license level) and BVM without any requirements for further airway interventions. The gold standard for airway management is a self-maintained airway. Bag-valve mask is the preferred technique for airway management in pediatric resuscitation and is reasonable compared with advanced airway interventions (endotracheal intubation or supraglottic airway).

Emergency Medical Responder – All FR interventions, plus:

- Provide supplemental oxygen to maintain $SpO_2 \geq 90\%$. The maximum flow of a nasal cannula should be 5 L/min. The maximum flow of a partial or non-rebreathing mask should be 15 L/min. A nasal cannula may be placed under an NRB or BVM when flow rates above 5 L/min are required.
  - → A07: Oxygen Administration
- Convey to closest facility with notification
- Consider intercept with additional resources