CLINICAL GUIDELINE	
Respiratory Distress Syndrome (RDS)	
Scope (Staff):	Nursing and Medical Staff
Scope (Area):	NICU KEMH, NICU PCH, NETS WA

This document should be read in conjunction with this DISCLAIMER

Respiratory distress syndrome is respiratory distress persisting beyond 4 hours of age, in infants with characteristic radiographic findings of bilateral air bronchograms with a ground glass or reticulogranular appearance in the lung fields.

Epidemiology

- A common neonatal respiratory disorder most frequently seen in preterm infants, however some near term infants can also be affected typically from 34-37 weeks.
- The incidence of RDS increases with decreasing gestational age.
- Risk factors include: male sex, Caucasian, maternal diabetes, elective caesarean section, multiple pregnancy, perinatal asphyxia.
- Protective factors include: antenatal corticosteroids, chronic foetal stress (maternal drug abuse, chronic congenital infections, prolonged rupture of membranes), IUGR/SGA.

Pathophysiology

RDS is primarily an indication of surfactant deficiency. Inadequate surfactant activity results in high surface tension leading to instability of the lung at end- expiration, low lung volume and decreased compliance. These changes in lung function cause hypoxemia due to mismatch between ventilation and perfusion, primarily due to collapse of large portions of the atelectetic lungs with additional contributions of ventilation/perfusion mismatch from intrapulmonary and extrapulmonary right to left shunts.

Surfactant deficiency also leads to lung inflammation and respiratory epithelial injury, which may result in pulmonary oedema and increased airway resistance. These factors further exacerbate lung injury and worsen lung function. At the same time, abnormal fluid absorption results in inefficient clearing of fluid in the injured lung, leading to lung oedema that also impedes gas exchange.

Clinical Presentation

- RDS usually presents immediately after birth or hours after birth, with grunting respirations, subcostal and sternal retractions, nasal flaring, bilateral poor air entry on auscultation and cyanosis in room air.
- The natural history of hyaline membrane disease (HMD) is one of deterioration over the first 24-48 hours of age, followed by stabilisation for about 24 hours and later continued improvement often accompanied by diuresis. Resolution of disease is often a more protracted process in less mature infants.

- Complications prior to the advent of surfactant included a high rate of air leak.

Investigations

- Baseline observations and SaO_2.
- Arterial blood gas (hypoxemia, hypercarbia and sometimes a mild metabolic acidosis).
- FBC and U&Es, glucose.
- Septic screen.
- CXR (AP and Lateral) will demonstrate increased density of both lung fields with reticulogranular (ground glass) appearance, air bronchograms and elevation of the diaphragm.
- ECG/cardiac USS if suspecting CHD.

Management

- Management should always be discussed with the on-call consultant/senior registrar. Almost all lung diseases affecting the neonate can develop within the first 4 hours of life. Sepsis and RDS may co-exist thus all infants with respiratory distress should be investigated appropriately and treatment with antibiotics should be considered.
- In those who have mild respiratory distress, commencement of CPAP should be considered.
- Provide respiratory support, Continuous Positive Airway Pressure (CPAP), with or without supplemental oxygen, to maintain normal pulse-oximetry saturations (refer to Monitoring and Observation Frequency guideline) and to prevent respiratory acidosis.
- Any non-intubated infants with clinical signs of respiratory distress or other evidence of RDS like abnormal gas (respiratory acidosis), worsening FiO_2 requirement or abnormal CXR can be considered for Intubate, Surfactant, extubate (INSURE) Procedure.
- A more intensive approach is to intubate and use surfactant early as rescue treatment. The use of exogenous surfactant has dramatically changed the natural course of the disease and is associated with a rapid decrease in oxygen and ventilation requirements, and a decrease in the incidence of air leaks. In infants < 28 weeks gestation the earlier the surfactant is given the better. This can be in the delivery ward as prophylactic treatment - but must be discussed with the consultant before the birth of the infant. Refer to Surfactant Therapy guideline.

Indications for Intubation

- A rising $PaCO_2$ > 60 mmHg or falling pH < 7.25.
- Recurrent apnoea requiring stimulation and resuscitation.
- Increased work of breathing (sternal and intercostal recession, grunting and tachypnoea) in conjunction with abnormal blood gas analysis
- Consideration should be given to hypoxia, increasing oxygen requirements, and saturation trends.
- Incipient collapse.
- Agitation that cannot be relieved and other causes eg. pneumothorax have been ruled out.

Ventilation: Starting Guidelines

- Avoidance of high tidal volumes is essential for prevention of air leak syndromes, especially in the period of rapid increase in compliance following surfactant administration. Volume guarantee (VG) should be commenced as soon as the infant is placed on a ventilator equipped with flow monitoring.
- VG should be monitored prior to and after surfactant administration. Initially 4.5ml/kg working up to 6 mL/kg tidal volume if required.
- The initial starting ventilation parameters are dependent on the size of the infant and clinical condition. Refer to Conventional Ventilation guideline for further details

Preterm Neonate

- Mode: SIPPV with Volume Guarantee (VG)
- Initial Settings:
  - PIP=18 cmH_2O, PEEP=5 cmH_2O, Inspiratory Time=0.3 seconds.
  - PIP and PEEP should be adjusted by the medical team to achieve adequate VG.
- Rate = 40 breaths/min (ventilator rate may be increased if infant does not spontaneously breathe above the backup ventilator rate).
- Pressure support ventilation (PSV) may be used as an alternative, using a lower flow (5-6 L/min), as synchronisation with both onset and end of inspiration may reduce risk of air leak, and improve patient comfort. Lower flows during PSV lengthen the duration of the spontaneous inspiratory time, and promote more even and gentle inflation of the lung. When PSV is used, a backup inspiratory time approximately 1.5 - 2 times the spontaneous inspiratory time should be set.

Term Neonate

- Mode: SIMV or SIPPV with Volume Guarantee
- Initial Settings:
  - PIP=22 cmH_2O, PEEP= 5 cmH_2O, Inspiratory Time=0.4 seconds
  - PIP and PEEP should be adjusted by the medical team to achieve adequate VG
- Rate=30 breaths/min

Related CAHS internal policies, procedures and guidelines

Neonatology Guideline

- Continuous Positive Airway Pressure (CPAP)
- Monitoring and Observation Frequency guideline
- Surfactant Therapy
- Ventilation: Conventional

References and related external legislation, policies, and guidelines

1. Sweet DG, Halliday HL et al.. European Consensus Guidelines on the Management of Respiratory Distress Syndrome. Neonatology. 2019;115(4):432-450.
2. Stoll BJ, Hansen NI, Bell EF, et al. Neonatal outcomes of extremely preterm infants from the NICHD Neonatal Research Network. Pediatrics 2010; 126:443.
3. Morley CJ, Davis PG, Doyle LW, Brion LP, Hascoet JM, Carlin JB; COIN Trial Investigators. Nasal CPAP or intubation at birth for very preterm infants. N Engl J Med. 2008;358(7):700–708.
4. Golombek SG, Truog WE. Effects of surfactant on gas exchange and clinical course in near-term newborns with RDS. J Perinat Med. 2000;28:436–442
5. Kumar A, Bhat BV. Epidemiology of respiratory distress of newborn. Indian J Pediatr. 1996;63 (1):93-8.

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