HEALTH HOLDING

HAFER ALBATIN HEALTH CLUSTER
MATERNITY AND CHILDREN HOSPITAL

Department:	Neonatal Intensive Care Unit (NICU)		
Document:	Departmental Policy and Procedure		
Title:	Management of Apnea of Prematurity		
Applies To:	All NICU Staff		
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1. PURPOSE:

1.1 To identify the infants early as the repetitive exposure to hypoxemia followed by a rapid increase in oxygen, and the ventilation and perfusion disturbances could damage vital organs and tissues.

1.2 To prevent a decline in cerebral blood flow velocity. Cerebral perfusion may decrease to very low levels during prolonged apnea and potentially could exacerbate hypoxic ischemic brain injury in susceptible preterm infants.

2. DEFINITIONS:

2.1 **Apnea of Prematurity (AOP)** is a developmental condition that probably reflects physiological rather than pathological immaturity of respiratory control. The term AOP includes episodes of apnoea, or breathing pauses, bradycardia, and intermittent hypoxemia, either solely or in combination.

2.2 An **apneic spell** is a temporary cessation of breathing or airflow for 15 to 20 seconds or longer or a shorter pause accompanied by bradycardia (< 100 beats per minute) desaturation or pallor.

2.3 **Apnea** that lasts for less than l0 seconds is considered significant if it is associated with decrease in oxygen saturation (SpO_2 80-85%), whereas "significant" bradycardia has been defined as a decrease in heart rate to less than 80 beat/min or less than two thirds of base line.

2.4 Extreme events are apnea more than 30 seconds and/or heart rate < 60 beat/ min for > l0 seconds.

3. POLICY:

3.1 **Pathophysiology and classification of Apnea of Prematurity (AOP):** It results from developmental immaturity of several mechanisms involved in regulating respiratory control and in maintaining patency of the upper airways. The causes of apnea can be divided into 3 major groups based on the mechanism.

3.1.1 **Central**: There is cessation of breathing effort with absence of chest wall movement and no evidence of obstruction to airflow. Preterm infants exhibit fewer neuronal connections, poor myelination of the brain stem and immature chemoreceptors function and response.

3.1.2 **Obstructive apnea**: Presents clinically with the preservation of chest wall movement. However, airflow is extinguished secondary to lack of coordination of respiratory musculature, pharyngeal instability, neck flexion, or nasal obstruction.

3.1.3 **Mixed Apnea:** Have components of both obstructive and central apneas. In most preterm infants, the sequence observed is an initial loss of central respiratory drive, followed by recovery and delayed activation of upper airway muscles superimposed on a closed upper airway, leading to prolonged mixed apnea episodes.

3.2 **Caffeine therapy**

3.2.1 Both theophylline and caffeine are used, but caffeine citrate is preferred because of its longer half-life (once a day dose), higher therapeutic to toxic ratio, less adverse effects such as tachycardia and feeding intolerance.

3.2.2 Effects:

3.2.2.1 It improves the central respiratory drive, CO_2 sensitivity, lung compliance and airway

resistance, minute ventilation, diaphragmatic contractility, decreases periodic breathing and hypoxic depression of breathing.

3.2.2.2 It also causes mild diuresis, enhanced catecholamine activity and increases metabolic rate and oxygen consumption over the first 3-4 weeks, leading to temporary less daily weight gain and need for more caloric intake.

3.2.3 Therapeutic effects:

3.2.3.1 Treats AOP, reduces intermittent hypoxia, increases the chances of successful extubation of preterm infants within one week of age, shorter duration of intubation and non-invasive respiratory support, reduces incidence of BPD, decreases need for treatment of patent ductus arteriosus and improved neurodevelopmental outcome at 18 months. Differences in neurodevelopmental outcome were less evident at 5 years but favoured the caffeine-treated infants.

3.2.3.2 Benefits of caffeine on decreasing BPD were most significant when treatment was initiated in the first 3 days after birth.

3.2.4 Side effects:

Tachycardia emesis, feeding intolerance, cardiac dysrhythmias, jitteriness, seizures. Accidental overdose my cause tachycardia, tachypnea, metabolic abnormalities or neurologic symptoms as agitation, irritability, tremor, opisthotonus, and hypertonia, tonic-clonic movements and non-purposeful jaw and lip movements representative of seizure activity.

4. PROCEDURE:

4.1 Monitoring:

4.1.1 Monitor preterm infants born at less than 35 weeks gestation for apnea, bradycardia and desaturation events.

4.1.2 Continuously monitor all neonates admitted to NICU. Consider the following parameters as being significant and requiring continued observation and/or treatment:

4.1.2.1 Apnea for more than or equal to 15 to 20 seconds, or,

4.1.2.2 Less duration if associated with bradycardia of less than or equal to 80 to 100 beats/min and/ or oxygen desaturation to less than or equal to 80% to 85%.

4.1.3 Nursing staff will regularly document vital signs and condition of the baby in the patient's medical record every 2 hours in intensive care and every 4 hours in other neonatology units and more frequently as required.

4.1.4 Preterm infants may develop apnea and other signs of respiratory control instability with certain stresses, including general anesthesia, ophthalmology examination, immunization, and viral illnesses or readmitted for elective surgical procedures. Additional close monitoring in these situations is indicated until 44 weeks PMA

4.2 Apply Preventive Measures

4.2.1 Position: avoid extreme flexion or extension of neck to maintain patency of upper airway. Consider prone positioning

4.2.2 Ensure placing the preterm in thermal environmental temperature with appropriate humidity. Temperature fluctuations can precipitate apneic episodes.

4.2.3 Maintain nasal patency. Avoid vigorous suctioning or prolonged use of nasogastric tubes. Use heated humidified air to prevent crusting of nasal secretions, and use appropriately sized nasal cannulas

4.2.4 Maintain SpO_2 between 91% and 95%. Provide supplemental oxygen as needed to avoid hypoxia and hyperoxia. Hypoxia can lead to severe desaturation episodes. Preterm infants respond to hypoxia by ventilatory depression that can aggravate apnea and result in delayed recovery of the infant.

4.3 After the first apneic spell:

4.3.1 Take history and conduct a full clinical examination including assessment of airway patency, respiratory movement, color, heart rate, blood pressure, SpO_2, temperature, glucose to exclude other underlying causes of apnea.

4.3.2 If a cause is identified, initiate specific treatment.

4.3.3 Investigations includes, but not limited to, according to each case:
- 4.3.3.1 Complete blood count, blood gases, electrolytes, blood sugar, serum calcium, phosphorous, magnesium.
- 4.3.3.2 Complete septic work up, chest X-Ray as required,
- 4.3.3.3 Cranial ultrasound.

4.4 When the infant has apnea (monitor alarms desaturation or bradycardia):
- 4.4.1 If the infant has cyanosis, marked pallor or limpness, intervene immediately. Ensure patent airway and adequate ventilation.
- 4.4.2 If no clinical change, assess the infant for self-correction, the presence of apnea and respiratory movements over l0 seconds.
- 4.4.3 If still apneic at l0 seconds or more provide tactile stimulation.
- 4.4.4 If no response, increase the current FiO_2 in increments of 5% if infant receiving oxygen or give 25-30% if infant was in room air, not to exceed the acceptable range of SpO_2.
- 4.4.5 If the infant continues to have inadequate or no respiratory effort after 30 seconds from the beginning of the event, ventilate with bag and mask at a rate of 40-60 per minute.
- 4.4.6 Avoid hyperventilation as this may decrease the infant's PCO_2 level and suppress the stimulus to breathe. Preterm infants have a CO_2 apnoeic threshold, (which is the CO_2 level below which apnea is triggered), that is only slightly below the normal baseline PCO_2. As a result even brief periods of hyperventilation might trigger apneic episodes
- 4.4.7 If the infant has respiratory effort, may provide only Positive End Expiratory Pressure (PEEP) of 4-6 cm H_2O.
- 4.4.8 If suction is needed, be careful as vigorous suctioning may precipitate apnea and bradycardia. Laryngeal chemo-reflex is exaggerated in preterm infants.
- 4.4.9 Reassess respiratory effort, heart rate and oxygen saturation after 60-90 seconds of PPV if it is required for that length of time. Increase FiO_2 if the baby's heart rate and oxygen saturation do not show improvement.
- 4.4.10 Continue PPV until regular respiration, normal heart rate and color have returned to baseline, or other treatment modality is needed e.g. CPAP or ventilation.
- 4.4.11 Medical staff documents, their assessment and response to treatment on the multidisciplinary progress notes of the patient's medical record.

4.5 Caffeine use for apnea of prematurity:
- 4.5.1 **Indications:**
  - 4.5.1.1 Give prophylactic caffeine to infants 28 weeks gestation or less and to preterm infants with birth weight less than 1250 gram.
    - 4.5.1.1.1 A 2010 Cochrane review did not support the prophylactic use of caffeine for preterm infants at risk of apnea. . However, given the common occurrence of apnea among this group of infants, the good safety profile, and the recently reported favorable outcomes with early use of caffeine, the prophylactic use of caffeine to prevent apnea among this high-risk preterm infants who may have cardiorespiratory compromise from apnea is reasonable.
    - 4.5.1.1.2 Start it on the first day of life soon after birth.
  - 4.5.1.2 Infants 29 weeks to less than 35 weeks gestation:
    - 4.5.1.2.1 Exclude other causes. Note that apnea in a late preterm and late onset apnea would highly suggest sepsis.
    - 4.5.1.2.2 Start treatment when apnea occurs, apneic events are frequent and/or prolonged, when they are associated with bradycardia (< 100 beat/min), or oxygen desaturations (< 80%-85%), or if the events require intervention, that is, frequent tactile stimulation or bag and mask ventilation
  - 4.5.1.3 Give 12-24 hours prior to extubation of very low birth weight infants in the first week of life:

4.5.1.3.1 A significant contributing factor to failure of extubation in the preterm is the relatively poor respiratory drive and tendency to develop hypercapnia and apnea.

4.5.1.3.2 Methylxanthine stimulates breathing. It increase the chances of successful extubation of preterm infants within one week of commencing treatment, principally in infants of extremely low birth weight extubated in the first week.

4.5.1.4 After general anesthesia, caffeine can be used to prevent postoperative apnea or bradycardia and episodes of oxygen desaturation in growing preterm infants if this is seemed clinically necessary.

4.5.2 Dose:

4.5.2.1 Loading dose of caffeine citrate 20 mg/kg (10 mg/ kg of caffeine base) followed by daily maintenance dose of 5 mg/kg per day, which could be increased to l0 mg/kg per day for persistent apnea.

4.5.2.2 Consider checking blood level only if toxicity suspected or persistently not responding to high dose in the absence of precipitating causes.

4.6 **If apnea persists**:

4.6.1 Re-evaluate to exclude other precipitating causes.

4.6.2 If apnea frequency is not improved 48 hours after the caffeine loading dose, consider increasing the maintenance dose to 7.5mg/kg/day and then to l0 mg/kg/day and or a further loading dose of 10-20/mg/kg caffeine citrate.

4.6.3 Non-invasive ventilator support or intubation and ventilation, especially if frequent bag and mask ventilation is required.

4.6.4 In intubated very low birth weight infants with frequent occurrence of O_2 desaturation and bradycardia, hypoventilation is probably the initiating event. Review ventilator settings to optimize ventilation.

4.7 Nasal continuous positive airway pressure (CPAP) at pressures of 4 to 6 cm H2O, usually in conjunction with treatment with a xanthine:

4.8 Intubation and mechanical ventilation for preterm infants who do not respond to caffeine and CPAP.

4.9 Blood transfusion

4.9.1 Blood transfusions may result in a short-term but not long-term reduction in apnea.

4.9.2 Transfusions should not be used to address apnea of prematurity when hemoglobin levels are already in excess of recommended levels for maintenance (for preterm with respiratory support: during first week 11.5 mg/dl, second week; 10 mg/dl and 8.5 mg/ dl thereafter. For preterm without respiratory support: during first week l0 mg/dl, second week 8.5 mg/ dl and 7.5 mg/ dl thereafter).

4.10 Age of resolution of apneic spells:

4.10.1 It generally resolves by 36 to 37 weeks PMA in infants born at > 28 weeks.

4.10.2 Infants born at < 28 weeks may have apnea that persists to or beyond term gestation.

4.10.3 Infants with BPD may have delayed maturation of respiratory control, which can prolong apnea for as long as 2 to 4 weeks beyond term PMA.

4.11 Discontinuation of caffeine: Consider a trial off caffeine when:

4.11.1 An infant has been free of clinically significant apnea/bradycardia events, off positive pressure for 5 to 7 days.

4.11.2 At 33 to 34 weeks PMA, whichever comes first.

4.12 **Discharge:**

4.12.1 Give a clinically significant apnea event free period of 5 to 7 days before discharge. Individualize the event free period for some infants depending on their gestational age at birth and the nature and severity of apnea events e.g. 2 weeks may be suitable for infants born at less than 26 weeks gestation.

4.12.2 Initiate this countdown period a few days after discontinuation of caffeine therapy, because of its long half-life (50-100 hours), caffeine may persist in the infant's plasma for some days after cessation of therapy.

4.12.3 Include only spontaneously occurring i.e. not feeding-related events; however, severe events during feeding may suggest lack of discharge readiness.

4.12.4 Strict isolated bradycardic episodes that spontaneously resolve and feeding-related events that resolve with interruption of feeding are common in convalescent preterm infants and generally need not delay discharge.

5. MATERIAL AND EQUIPMENT:

5.1 Apnea monitor

5.2 Apnea monitoring leads

6. RESPONSIBILITIES:

6.1 Physician

6.2 Nurse

7. APPENDICES:

N/A

8. REFERENCES:

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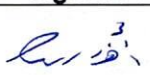
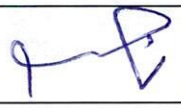
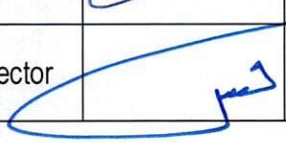
9. APPROVALS:

	Name	Title	Signature	Date
Prepared by:	Ms. Afrah Saud Al Shammari	NICU Head Nurse		January 05, 2025
Prepared by:	Dr. Falah Nabhan Al Shammari	NICU Quality Coordinator		January 05, 2025
Reviewed by:	Mr. Sabah Turayhib Al - Harbi	Director of Nursing		January 07, 2025
Reviewed by:	Dr. Sarhan Hamdan Al Shammari	NICU Head of the Department		January 08, 2025
Reviewed by:	Mr. Abdulellah Ayed Al Mutairi	QM&PS Director		January 09, 2025
Reviewed by:	Dr. Tamer Mohamed Naguib	Medical Director		January 12, 2025
Approved by:	Mr. Fahad Hazam Al - Shammari	Hospital Director		January 19, 2025