



## **Chapter 33**

### **OXYGEN THERAPY**

The Respiratory Sequence is the first area of concern in the ACoRN Primary Survey. This reflects the critical importance of establishing and maintaining adequate ventilation and oxygenation in the stabilization of the sick and at-risk newborn. The baby must receive enough oxygen to maintain tissue oxygenation and prevent development of acidosis or pulmonary vasoconstriction.

ACoRN Manual 2005

### **Hypoxia / Cyanosis / Hyperoxia**

#### **Important Points to Consider:**

1. "The clinical diagnosis of hypoxia is unreliable. Cyanosis may be absent in hypoxic babies, and it may be present in those who are well oxygenated. Its presence over different parts of the body is variable, and there is little consistency among observers in the ability to recognize it."<sup>2</sup>

The fetal oxyhemoglobin dissociation curve demonstrates that cyanosis becomes visible in newborns with saturations of 75-85% that corresponds with arterial oxygen values of 32-42 mmHg.

"The ideal oxygen saturation range for babies is controversial, but values between 88-95% are generally considered acceptable."<sup>1</sup>

2. Clinical recognition of cyanosis in the newborn is unreliable as it is influenced by many factors including:
  - Differences in perception of the observer
  - Type and intensity of light
  - Hemoglobin / hematocrit (the severely anemic infant will not appear cyanosed even with severely low PO<sub>2</sub> values)
  - Colour and thickness of skin
  - Number of capillaries
  - Skin blood flow - state of the circulation
3. Hyperoxia is impossible to recognize, as there is little change in skin colour with hemoglobin saturations over 90%.

### **Monitoring and Documentation**

1. Oxygen should be regarded as a drug, and requires a physician order that includes the mode of delivery (eg. Hoodbox) and the "dosage" expressed in percent (%), as a Fraction of Inspired Oxygen ( $FiO_2$ ), or when providing oxygen by low flow in litres/minute (L/min.). Once ordered, it should be adjusted to maintain  $O_2$  saturation between 88-95%.
2. Dry gases are irritating to the airways and increase insensible water losses. **It is preferable to humidify the oxygen being delivered.**
3. **Oxygen should be warmed.** Blowing cold oxygen on a newborn's face increases oxygen consumption resulting from cold stress. The recommended temperature varies with the mode of oxygen delivery.
  - Bag/mask/endotracheal tube/free flow/ventilator: 37°C
  - Hoodbox: the same temperature as required in the isolette for thermoregulation

**The temperature of the humidified oxygen should be recorded hourly or when changes are made.**

4. During acute illness, blood gas samples should be drawn intermittently to assess adequacy of ventilation. Oxygenation is best assessed by  $O_2$  saturation monitoring, or arterial blood gases.
5. **An oxygen saturation monitor is utilized to ensure that the oxygen saturation is maintained between 88-95%.** Continuous monitoring is recommended in the acute stage of illness. Strong lights (phototherapy/procedure) interfere with the saturation monitor's accuracy; an occlusive cover of aluminum foil or Mylar should be used over the sensor. Poor peripheral circulation decreases the accuracy of saturation monitoring. Select the best site for the probe; this may be on the thumb of the infant.
6. To help maintain a stable concentration of oxygen, an anaesthesia bag and mask, oxygen mask or oxygen tubing inserted through a styrofoam cup is useful when removal of infant's hoodbox is required. (eg. access for procedures, being held by parents), when the isolette doors are opened (if tight fitting sleeves are not in use), or when supplemental oxygen is required and a hoodbox is not available for prolonged use.
7. Clinical observations of the infant's response to oxygen therapy include: colour, respiratory rate, respiratory effort, and state (eg. hypoxic infants are often restless). **These observations should be recorded hourly until the infant's condition is stabilized, then**

- every 2-4 hours as required.** More frequent recording and reporting may be necessary.
8. **Personnel need to be familiar with the operation and use of their equipment,** including storage location, assembly, basic trouble shooting, battery changing, and cleaning.
  9. To ensure accuracy, **analyzers should be calibrated to both the high and low settings.** Alarm limits are set 5-10% above and below the ordered concentration of oxygen. The sensor should be placed close to the infant's face.

## **Methods of Administration**

### **1. Flow inflating bag, mask or oxygen tubing**

- placed close to the baby's face
- used with blended oxygen at a minimum flow rate of 5L/min to keep saturations in target range

disadvantage of this method is the inability to measure the amount of oxygen the baby is receiving

### **2. Nasal prongs (newborn size)**

- this is not a preferred method of oxygen delivery during initial stabilization because of the inability to determine the precise concentration of supplemental oxygen.
- oxygen flow is adjusted between 0.5 to 2 L/minute
- flow should never exceed 2 L/minute because flow rates above this level can irritate and dry the nasal mucosa.
- provide varying amounts of oxygen depending on the baby's rate and depth of respiration
- changing requirements should be assessed over time
- high flow rates generally indicate high oxygen requirements and the potential need for further respiratory support.
- high flow rates can also cause inadvertent positive end expiratory pressure (PEEP).

### **3. Oxygen hood**

- a Plexiglas<sup>R</sup> "hood" placed over the baby's head with blended, humidified oxygen administered to it at 5-10 L/min
- the exact amount of oxygen delivered can be determined by an oxygen analyzer placed close to the baby's mouth.

#### **4. Incubator**

- older-style incubators may only provide approximately 30% oxygen when flooded with 100% oxygen and the oxygen level drops precipitously when the incubator door is opened; therefore, these incubators should be used concomitantly with an oxygen hood.
- newer incubators provide consistently high  $\text{FiO}_2$  and humidity with built-in oxygen analyzers that continuously adjust the  $\text{FiO}_2$  to the preset concentration.

#### **References**

1. *ACoRN: Acute Care of at-Risk Newborns*, The ACoRN Editorial Board, Vancouver, British Columbia, Canada, 2005.
2. Jean Lancaster, Sheldon Korones, *High-Risk Newborn Infants: The Basis of Intensive Care Nursing*, 4th ed., The CV Mosby Company, Toronto, 1986.