

PROCEDURE FOR: Selection of an Oxygen Delivery Device for Neonatal Patients

OBJECTIVE: The aim of oxygen therapy is to achieve adequate tissue oxygenation without creating oxygen toxicity and oxidative stress. The neonatal patient's need of oxygen is determined by measurement of inadequate oxygen tensions and saturations by invasive or noninvasive methods. Supplemental oxygen is delivered through various devices to meet this need. The nasal cannula, simple face mask, partial-rebreather mask and oxygen hood are devices that are used to provide supplemental oxygen.

RATIONALE: The administration of supplemental oxygen to the neonatal patient requires the selection of an oxygen delivery system that suits the patient's size, needs and the therapeutic goals. Certain oxygen delivery systems are categorized as low flow (variable performance) systems. Low-flow provides a fractional concentration of delivered oxygen that varies with the patient's inspiratory flow and are classified as variable-performance oxygen delivery systems. Other patient variables that impact the FiO₂ delivered are minute ventilation, respiratory rate, position of cannula to nares and nasal versus oral breathing. High flow oxygen delivery systems such as the hood provide flows that meet or exceed the patient's inspiratory flow requirement and can provide a specific FiO₂.

PERSONNEL: Respiratory Therapist

INDICATIONS: The selection of an oxygen delivery device is indicated with documented hypoxemia and a written medical order from the physician or neonatal advanced practitioner.

1. Nasal cannulas are used to provide low-level supplemental oxygen to the patient, to feed the patient without interrupting oxygen delivery and to increase mobility.
2. Simple oxygen masks are used for short periods of time (transport, emergency situations).
3. Partial-rebreathing masks are used to conserve oxygen supply and used for transport.
4. Hoods are used to control FiO₂ in the infant and/or increase heated humidity to patients who cannot tolerate other devices. Hoods delivering 100% oxygen can eliminate a small pneumothorax through nitrogen washout.

PROCEDURE FOR: LOW-FLOW SYSTEMS

1. Nasal Cannulas are two soft prongs that are inserted into the patient's anterior nares and secured to the patient's face. The internal diameter of the nasal prongs for this patient population should be 2mm.
2. Oxygen flow is set at a range of 1/8L/Min to 2L/Min with a micro-calibrated flow meter.
3. Low-flow blenders are required for flows less than 1 liter to guarantee accurate blended oxygen.
4. Nasal cannulas should be humidified with a bubble bottle.

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5. Nasal cannulas set to flows greater than 1 liter require heated humidification to minimize thickening of secretions.

PROCEDURE FOR: RESERVOIR SYSTEMS

1. Simple oxygen masks are plastic reservoirs designed to fit over the patient's nose and mouth and secured with an elastic strap.
2. An increased reservoir effect is produced by adding volume to the mask. Holes on each side of the mask provide egress for exhaled gases and serve as room-air entrainment ports. The FiO₂ varies with the patient's inspiratory flow, mask fit and respiratory pattern.
3. Oxygen flow is set at 5L/Min.

PROCEDURE FOR: PARTIAL-REBREATHING MASKS

1. Partial-rebreathing masks, similar to face masks contain a reservoir at the base of the mask. The reservoir receives fresh gas plus exhaled gas approximately equal to the volume of the patient's anatomic dead space.
2. The oxygen concentration of the exhaled gases combines with the fresh oxygen delivering a higher FiO₂ than the simple mask. Ranges of delivered FiO₂ are >40% <60%.

PROCEDURE FOR: HIGH FLOW SYSTEMS

1. Oxygen hoods are transparent enclosures designed to surround the head of the neonate. A continuous flow of humidified blended oxygen is supplied to the hood.
2. Flows > 7L/Min is required to wash out CO₂.
3. Oxygen concentration in a hood can vary from .21 to 1.0. To obtain concentrations greater than 50%, additional flow of gas is required with a double hookup system.
4. A calibrated oxygen analyzer is to be utilized when a hood is in place. The placement of the sensor needs to measure near the nose and mouth of the patient.
5. Temperature of the gases should be maintained with the aqua therm humidifier to provide a neutral thermal environment.

MONITORING: Patient:

1. Clinical assessment including but not limited to cardiac, pulmonary, and neurologic status and apparent work of breathing.
2. Supplemental oxygen flow is titrated to maintain adequate oxygen saturation as indicated by pulse oximetry, SpO₂, or appropriate arterial or venous blood gas values.
3. Refer to oxygen saturation guidelines for titration of oxygen.

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Equipment:

1. Oxygen hoods should be checked once per shift for humidity levels and appropriate oxygen analyzation.
2. Oxygen analyzers should be calibrated before each patient use and every 24 hrs.
3. Oxygen hoods should be analyzed continuously with an oxygen analyzer.

- COMPLICATIONS:**
1. Hyperoxia, Hypoxia, and fluctuations of arterial oxygen within the normal range have been implicated as an etiologic factor in retinopathy of prematurity.
 2. Direct oxygen toxicity from high concentrations of inspired oxygen is an important cause of bronchpulmonary dysplasia.
 3. Supplemental oxygen to infants with congenital heart lesions may cause an increase in alveolar oxygen tension and compromise the balance between pulmonary and systemic blood flow.
 4. Skin irritation can result from material used to secure the nasal cannula.
 5. Inadvertent CPAP may be delivered depending upon the size of the cannula, gas flow and the infant's anatomy.
 6. Displacement of nasal cannula can lead to loss of oxygen delivery.
 7. Rebreathing of CO₂ may occur with the mask if total flow is inadequate.
 8. Prolonged exposure to humidified oxygen in a hood may increase risk for cutaneous fungal infection.
 9. Inadequate or loss of gas flow in the hood may result in hyperoxia or hypercapnia.

LIMITATIONS: Nasal Cannulas:

1. Changes in minute ventilation and inspiratory flow affect air entrainment and result in fluctuations in FiO₂.
2. Prongs are sometimes difficult to keep in position.
3. Maximum flow should be limited to 2L/min in infants and newborns to reduce risk of inadvertent PEEP.
4. Care should be taken to keep cannula tubing from twisting upon itself limiting flow.

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Hoods:

1. Oxygen concentrations may vary within the hood. Opening any enclosure decreases the oxygen concentration.
2. High gas flows may produce harmful noise levels.

APPROVAL:

EFFECTIVE DATE: 4/21/08

REVISION DATES: