
بسم الله الرحمن الرحيم

OXYGEN DELIVERY SYSTEMS

H.Moeini .MD
Anesthesiologist
Pediatric Anesthesia Fellowship

Introduction

- Oxygen therapy is critical for patient recovery in the PACU.
- Selecting the right oxygen delivery system is essential.
- Factors include type of surgery, patient condition
- Effective oxygenation reduces complications and supports healing.

Considerations for Post-Surgery Oxygen Delivery

- **The oxygen delivery system of choice :**
  - **Degree of hypoxemia**
  - **Surgical procedure**
  - **Patient compliance**
- **Oxygen should be humidified**
- **Patients who have just undergone head and neck surgery:**
  - **may not be candidates for face mask**
  - **nasal packing prohibits the use of nasal cannulas**
- **Individualized approach ensures patient safety.**

Supplemental Oxygen in the PACU

- Hypoxemia is common post-surgery due to anesthesia effects.
- Oxygen therapy tailored to patient's needs ensures proper saturation.
- Common causes: atelectasis, pain, residual anesthesia.
- Close monitoring helps adjust oxygen delivery as needed.

Importance of Humidification

- Dry oxygen can irritate nasal and oral mucosa.
- Humidification prevents discomfort, especially with prolonged use.
- Recommended for patients requiring high-flow oxygen therapy.
- Enhances patient comfort and reduces mucosal dryness.

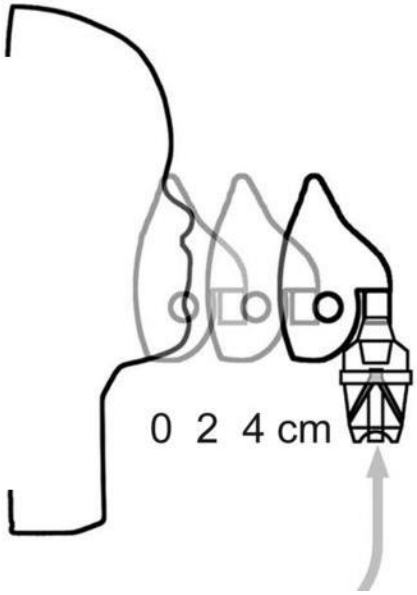
oxygen delivery devices

Alternative Oxygen Delivery Options

- Face tents: Provide oxygen without pressure on the face.
- Blow-by setups: Deliver oxygen near the face without direct contact.
- Useful for facial trauma or grafts where masks can't be used.
- Maintain adequate FiO_2 levels without discomfort.

Blow-by setups

O2% : 30% to 40%, depending on the flow rate and proximity of the oxygen source to the child's face.

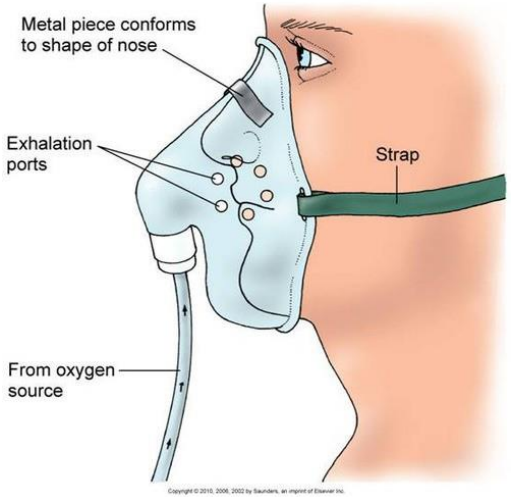


Elderly Patients & Oxygen Delivery

- In an elderly patient, or one who is at an increased risk of delirium: nasal cannula
- Nasal cannulas reduce anxiety and confusion compared to masks.
- Suitable for elderly patients with cognitive challenges.
- Ensures comfort while maintaining adequate oxygenation.
- Frequent monitoring of SpO_2 levels is necessary.

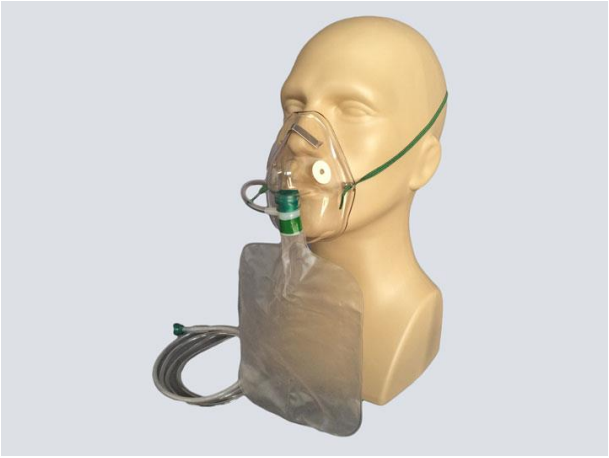
Simple Face Masks

- Used for patients needing moderate oxygen flow (5-10L/min).
- Proper fit is essential to prevent CO_2 rebreathing.
- Minimum flow rate: 5L/min to clear exhaled CO_2.
- Delivers FiO_2 up to 0.6 depending on flow rate.



Non-Rebreather Masks

- Provides nearly 100% oxygen concentration with a reservoir bag.
- Ideal for acute hypoxemia or emergencies.
- Ensure one-way valve functionality to prevent CO_2 rebreathing.
- Useful for spontaneously breathing patients needing high FiO_2.
- uncomfortable for prolonged use



Traditional Nasal Cannulas

- Comfortable and easy to use for low-to-moderate oxygen needs.
- Flow rates limited to 6L/min to prevent dryness.
- FiO_2 increases by 0.04 per liter of flow (up to 0.44 at 6L/min).
- Best for patients who are stable and require low-flow oxygen.

Venturi Oxygen Mask - Overview

Venturi Mask - Oxygen Delivery: 24%-50%

High-flow device providing precise oxygen concentrations.

Creates a high flow by mixing air and oxygen via the Venturi effect.

Use: For COPD patients needing controlled oxygen levels

Advantages & Limitations: Precise, non-invasive
may cause skin irritation with prolonged use.

Useful for adults and children; pediatric adapters available.

Head Tent - Overview

Provides 24%-80% humidified oxygen.

Surrounds head to deliver oxygen, mainly for pediatric use.

Ideal for children intolerant to masks, ensuring comfort.

Non-restrictive; potential CO_2 buildup if not monitored.

Primarily for children; limited adult use due to size.

Allows head movement, reducing claustrophobia concerns.

Face Tent - Overview

Delivers 30%-70% oxygen, mixed with ambient air.

Non-constrictive device for patients with facial injuries.

Useful for trauma, burns, or claustrophobic patients.

Comfortable, less pressure; less precise oxygen levels.

Suitable for both Adults & Children

Provides humidified oxygen for better mucosal comfort.

Nebulizer Oxygen Mask - Recovery Use

Provides 30%-50% oxygen while delivering medication.

Combines oxygen therapy with medication delivery.

for patients needing medication like bronchodilators.

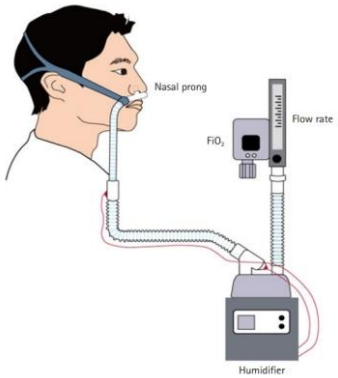
Simultaneously delivers medication and oxygen
less precise oxygen control.

Beneficial for all ages

Ensures continuous delivery of medication to improve breathing post-op.

High-Flow Nasal Cannula (HFNC) Overview

- Delivers oxygen at 40–60L/min with adjustable FiO_2
- 40%–100% O2 at 37°C and 99.9% relative humidity
- Provides 99% humidity and warmth to improve airway comfort.
- Suitable for patients with moderate hypoxemia without hypercapnia
- Can provide a mild CPAP effect, reducing work of breathing



Benefits of HFNC

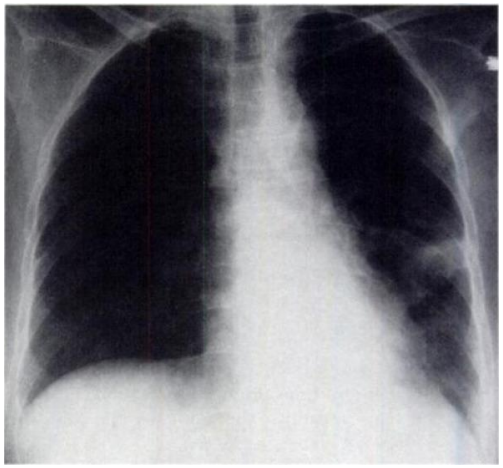
- Reduces the need for mechanical ventilation.
- Improves oxygenation in hypoxemic patients.
- Provides comfort with humidified, heated air.
- Effective for respiratory distress without intubation.
- HFNC setup in ICU.

Continuous Positive Airway Pressure (CPAP)

- CPAP improves alveolar recruitment and prevents atelectasis.
- Enhances lung compliance and functional residual capacity.
- Useful in patients with obesity or obstructive sleep apnea (OSA).
- Effective for hypoxemia post-major surgery.

CPAP and Atelectasis

- Postoperative atelectasis common due to pain and sedation.
- CPAP helps reopen collapsed alveoli, improving gas exchange.
- Reduces the risk of postoperative pneumonia.
- Beneficial for patients with restricted lung function.



CPAP Use in Bariatric Surgery

- Obese patients benefit from CPAP post-surgery to prevent hypoxemia.
- No increased risk of anastomotic leaks found with CPAP.
- Improves oxygenation without stomach inflation.
- Studies confirm CPAP safety in bariatric cases.

Noninvasive Positive-Pressure Ventilation (NIPPV)

- Provides additional support for patients not responding to CPAP.
- Effective for COPD, OSA, and pulmonary edema management.
- Can prevent the need for invasive intubation.
- Delivered via face mask or nasal interface.

Indications for NIPPV

- Ideal for COPD exacerbations, OSA, and cardiogenic pulmonary edema.
- Supports spontaneous breathing while increasing alveolar pressure.
- Enhances ventilation without invasive intubation.
- Useful post-extubation to prevent respiratory failure.

Contraindications for NIPPV

- hemodynamic instability or life-threatening arrhythmia
- Not suitable for patients with altered mental status
- High aspiration risk patients
- those unable to protect their airway.
- inability to use nasal or facial mask (head and neck procedures)
- refractory hypoxemia

Requires patient cooperation for effective use

NIPPV

Success Factors for NIPPV

- Best outcomes in patients who are alert and cooperative.
- Moderate hypercarbia ($PaCO_2$ 45-92 mmHg) improves with NIPPV.
- Quick improvement within 2 hours is a positive indicator.
- Requires continuous monitoring and adjustment.

Preventing Postoperative Respiratory Failure

- Early use of NIPPV reduces the risk of atelectasis.
- Beneficial for high-risk surgical patients, especially after thoracic surgery.
- Enhances recovery by improving oxygenation and reducing fatigue.
- Supports smooth transition from mechanical ventilation.

Prophylactic Use of NIPPV

- Useful in bariatric, thoracic, and vascular surgeries to prevent complications.
- Reduces risk of reintubation and pulmonary complications.
- Tailored protocols based on patient risk profiles.
- Enhances recovery and reduces ICU stay duration.

Post-Extubation Use of NIPPV

- **Supports patients transitioning off mechanical ventilation.**
- **Reduces the incidence of post-extubation respiratory distress.**
- **Particularly effective in patients with underlying lung disease.**
- **Can prevent the need for reintubation.**