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Oxygen Administration and the Vital Role of Nurses: A Comprehensive Review

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Abstract

Oxygen administration is a crucial intervention in managing conditions associated with hypoxemia, such as COPD, pneumonia, and heart failure. It improves oxygen saturation, supports organ function, and enhances overall quality of life by alleviating symptoms like shortness of breath and fatigue. Nurses play a pivotal role in the safe and effective delivery of oxygen therapy, selecting appropriate methods, adjusting flow rates, and ensuring continuous patient monitoring. Nurses' expertise is integral to adjusting oxygen therapy, mitigating risks, and improving patient well-being.

Keywords: Oxygen Therapy, Nurses' Role in Invasive Oxygen Administration, Non-invasive Ventilation, Extracorporeal Membrane Oxygenation (ECMO).

INTRODUCTION

Oxygen administration is a critical aspect of healthcare that plays a fundamental role in treating various medical conditions.(1) It is an essential and life-saving therapy used in emergencies, as well as in the management of chronic diseases. Nurses, as the backbone of healthcare, play a pivotal role in ensuring that patients receive the right amount of oxygen and that their oxygen therapy is effectively managed.(2) This review article explores the various aspects of oxygen administration and underscores the indispensable role of nurses in this process.(3)

Importance of Oxygen Therapy

Oxygen therapy is a critical medical treatment that provides supplemental oxygen to patients who cannot maintain adequate oxygen levels through normal breathing. The primary goals of oxygen therapy include improving oxygen saturation, relieving symptoms of hypoxia, reducing the workload on the heart and lungs, and promoting tissue healing. It is essential for managing conditions like chronic obstructive pulmonary disease (COPD), pneumonia, and heart failure, where low blood oxygen levels can lead to severe complications. By increasing the oxygen available to tissues and organs, oxygen therapy enhances tissue oxygenation, alleviates symptoms such as shortness of breath and fatigue, and improves overall quality of life. It supports patients with both chronic and acute respiratory issues, helping to stabilize their condition, improve exercise tolerance, and speed up recovery from surgeries. Additionally, oxygen therapy can prevent organ damage and reduce

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hospitalizations, offering flexibility with various administration methods to suit individual needs. Overall, it plays a crucial role in maintaining health and improving daily functioning for those with compromised respiratory or cardiovascular systems.[4]

1. Enhancing Oxygen Levels

Critical for Hypoxemia: Oxygen therapy is essential for patients experiencing hypoxemia, a condition where blood oxygen levels are abnormally low. This can occur due to various respiratory or cardiovascular conditions, such as chronic obstructive pulmonary disease (COPD), pneumonia, or heart failure.[5]

Improves Tissue Oxygenation: By increasing the amount of oxygen in the blood, oxygen therapy ensures that tissues and organs receive adequate oxygen, which is vital for their proper functioning and survival.

2. Managing Chronic Respiratory Conditions

COPD Management: For patients with chronic obstructive pulmonary disease (COPD), long-term oxygen therapy can slow disease progression and improve quality of life. It helps reduce the burden on the heart and prevents complications related to low oxygen levels.

Emphysema and Chronic Bronchitis: Oxygen therapy can also benefit individuals with emphysema or chronic bronchitis by providing supplemental oxygen that helps alleviate symptoms and improve respiratory function.

3. Supporting Acute Medical Conditions

Respiratory Distress: In acute situations, such as during a severe asthma attack or acute respiratory distress syndrome (ARDS), oxygen therapy can stabilize oxygen levels and support breathing.

Recovery from Surgery: Post-surgical patients, especially those who have undergone major surgeries or have compromised lung function, may benefit from supplemental oxygen to aid in recovery.

4. Improving Exercise Tolerance

Enhanced Physical Activity: For patients with respiratory conditions, oxygen therapy can improve exercise tolerance and overall physical activity. This can lead to better physical health, reduced fatigue, and an enhanced ability to perform daily activities.

5. Reducing Symptoms and Improving Quality of Life

Alleviating Symptoms: Oxygen therapy can help reduce symptoms such as shortness of breath, confusion, and fatigue associated with low oxygen levels. This improvement in symptoms contributes to a better quality of life.

Mental and Emotional Well-being: Adequate oxygen levels can improve cognitive function and mood, leading to enhanced mental and emotional well-being.

6. Preventing Complications

Avoiding Organ Damage: Chronic low oxygen levels can lead to serious complications, including organ damage and heart failure. Oxygen therapy helps prevent these complications by ensuring that vital organs receive sufficient oxygen.

Reducing Hospitalizations: For chronic patients, effective oxygen therapy can reduce the frequency of hospitalizations related to respiratory complications.

7. Flexibility in Administration

Various Methods: Oxygen therapy can be administered through different methods, including nasal cannulas, oxygen masks, or portable oxygen concentrators. This flexibility allows for tailored treatment based on the patient's needs and lifestyle.

Home Use: Many patients with chronic conditions use oxygen therapy at home, which enables them to manage their condition more effectively and maintain a more normal lifestyle.

Methods of Oxygen Administration

The choice of oxygen delivery method is determined by the patient's clinical condition, oxygen needs, and the level of precision required. Oxygen administration methods can be broadly categorized into two main categories: invasive and non-invasive. These methods are chosen based on the patient's clinical condition, the severity of their respiratory distress, and the specific oxygen requirements.[6]

Non-Invasive Methods of Oxygen Administration: Non-invasive methods of oxygen administration do not require the insertion of medical devices or procedures that penetrate the body. They are generally more comfortable for patients and are often used for those with less severe respiratory issues or as initial treatments. Here are some of the primary methods of oxygen administration:

1. **Nasal Cannula:** Administering oxygen through a nasal cannula is a common and effective method for providing supplemental oxygen to patients with respiratory issues. This is the most common method and involves inserting two prongs into the patient's

nostrils, delivering a low to moderate flow of oxygen. A traditional nasal cannula can deliver up to 4-6 Liters of oxygen per minute (1). The prongs of the cannula Nasal Cannula are Positioned into the patient's nostrils. The tubing should be adjusted to sit comfortably around the patient's ears and under their chin, securing it in place. Potential Issues common in this method is dryness because oxygen can dry out the nasal passages. Using a humidifier may help alleviate this discomfort. (Fig. 1)

Fig. 1: Nasal Cannula

2. **Oxygen Mask:** Masks are used when higher oxygen concentrations are required, covering the nose and mouth to ensure more efficient oxygen delivery. The mask provides a higher concentration of oxygen compared to other methods, like nasal cannulas, and is particularly useful in situations where patients require a more substantial increase in oxygen levels. The mask fits securely over the patient's face, allowing for a steady flow of oxygen to be inhaled with each breath. It is essential to ensure that the mask fits well to prevent leaks and to monitor the patient's comfort and oxygen saturation regularly. This method can effectively improve oxygenation, alleviate symptoms of hypoxia, and enhance overall respiratory function, contributing to better patient outcomes and quality of life. (Fig. 2)

Fig. 2: Oxygen Mask

3. **Non-Rebreather Mask**: This high-flow mask includes a one-way valve and reservoir bag to deliver nearly 100% oxygen. The non-rebreather mask is a specialized device used in medical settings to deliver a high concentration of oxygen to patients experiencing severe respiratory distress or hypoxia. This mask features a design that includes a reservoir bag attached to the mask, which holds a supply of oxygen. When the patient inhales, they draw oxygen from both the reservoir bag and the direct flow of oxygen from the supply. The mask is equipped with one-way valves that prevent exhaled air from re-entering the reservoir bag, ensuring that the patient receives a higher concentration of oxygen compared to other masks. The non-rebreather mask is typically used in emergencies or situations where rapid and effective oxygenation is needed, such as in cases of acute respiratory failure, carbon monoxide poisoning, or severe chronic obstructive pulmonary disease (COPD). The mask is secured over the patient's nose and mouth, and it is important to ensure a snug fit to minimize leakage. Monitoring is crucial while using a non-rebreather mask; healthcare providers need to assess the patient's oxygen saturation levels and overall condition frequently. This mask should be used with caution, as it is not suitable for long-term use or for patients who are unable to breathe spontaneously, as it may not deliver adequate oxygen in such cases. (Fig. 3)

Fig. 3: Non-Rebreather Mask

4. **Venturi Mask**: The Venturi mask delivers precise, controlled oxygen concentrations, making it useful in situations where accuracy is crucial. The Venturi mask is a precision device used for delivering a controlled amount of oxygen to patients, making it especially

valuable in managing conditions that require specific oxygen concentrations. Unlike other oxygen masks, the Venturi mask is designed with interchangeable colour-coded adapters that control the precise flow rate of oxygen mixed with room air. This allows healthcare providers to administer a fixed concentration of oxygen, ranging typically from 24% to 50%, depending on the adapter used. The mask itself is equipped with a venturi valve that utilizes the Bernoulli principle to mix oxygen with ambient air (2). As oxygen flows through the mask, the venturi valve creates a jet stream that pulls in a proportional amount of room air, achieving a controlled and accurate oxygen concentration. This precision is particularly important for patients with chronic respiratory conditions like COPD, where maintaining a specific oxygen level is crucial to avoid complications such as carbon dioxide retention. The Venturi mask is fitted over the patient's nose and mouth and is secured with adjustable straps to ensure a snug fit and minimize air leaks. Regular monitoring is essential to ensure the correct oxygen concentration is maintained and to assess the patient's response to therapy. The ability to deliver precise oxygen levels makes the Venturi mask an important tool in the management of various respiratory conditions, enhancing patient safety and treatment effectiveness. (Fig. 4)

Fig. 4: Venturi Mask

5. **Oxygen Hood**: Paediatric patients or those requiring a high flow of oxygen can be administered oxygen through a transparent hood. An oxygen hood is a device used to deliver supplemental oxygen to infants and young children, especially those with respiratory distress or requiring extra oxygen support. It is a clear, dome-shaped plastic enclosure that fits over the child's head and shoulders, creating a controlled environment where a higher concentration of oxygen can be delivered. The hood is connected to an oxygen supply, and oxygen is directed into the hood through small openings or ports. This setup allows for a continuous flow of oxygen to surround the child, making it easier to maintain adequate oxygen levels without the need for more invasive methods. The oxygen hood can be adjusted to ensure it fits snugly around the child's neck while allowing for ventilation and movement. The use of an oxygen hood is particularly beneficial in neonatal and paediatric care settings, where it helps in managing conditions like respiratory distress syndrome, hypoxia, or other respiratory issues. By providing a consistent and controlled oxygen environment, the hood helps improve oxygenation and supports the child's respiratory needs while minimizing discomfort and the need for more intrusive oxygen delivery methods. Regular monitoring is essential to ensure that the oxygen levels within the hood are adequate and that the child is comfortable. The oxygen hood also allows for ease of observation and access to the patient while maintaining the benefits of supplemental oxygen therapy.(Fig.5)

Fig. 5: Oxygen Hoods

6. **High-Flow Nasal Cannula (HFNC):** High-Flow Nasal Cannula (HFNC) is a respiratory support device used to deliver a high flow of warmed and humidified oxygen to patients through nasal prongs. It's often used in various

medical settings, including intensive care units and emergency departments, to manage patients with respiratory distress or failure. HFNC can provide up to 60 litres per minute (L/min) of oxygen.[3] The oxygen delivered is both heated and humidified, which helps keep the airway moist and comfortable. This is particularly important for patients who may be at risk of airway dryness and irritation. HFNC provides a mild positive pressure that can help keep the alveoli (air sacs in the lungs) open, which improves oxygenation and reduces the work of breathing. HFNC is generally well-tolerated and more comfortable than other forms of respiratory support, like face masks or intubation. It provides respiratory support without needing invasive procedures, which can be advantageous for patient comfort and reduced risk of complications. The high flow and humidification improve oxygen delivery and gas exchange in the lungs, which can be beneficial for patients with conditions like acute respiratory distress syndrome (ARDS), pneumonia, or chronic obstructive pulmonary disease (COPD). By providing a high flow of oxygen, HFNC can reduce the effort required by the patient to breathe, which is especially helpful in acute respiratory distress. HFNC is used in various clinical situations, including Acute respiratory failure or distress, Hypoxemia, Post-extubation respiratory support and Certain patients with chronic respiratory conditions. (Fig. 6)

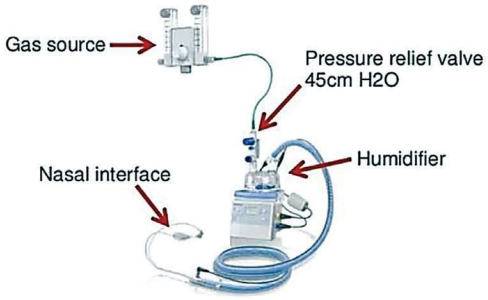

Fig. 6: HFNC

7. **Non-Invasive Positive Pressure Ventilation (NIPPV):** Non-Invasive Positive Pressure Ventilation (NIPPV) is a form of respiratory support that helps patients breathe without the need for invasive procedures like intubation.[4] NIPPV delivers positive pressure air through a mask or other interface to support breathing and improve oxygenation. This method is used in various clinical settings, particularly for patients with respiratory insufficiency or failure. NIPPV provides air under positive pressure to help inflate the lungs and improve ventilation. This can be achieved through various modes, including Continuous Positive Airway Pressure (CPAP) and Bi-level Positive Airway Pressure (BiPAP). Unlike mechanical ventilation which requires endotracheal intubation or a tracheostomy, NIPPV is delivered via a mask that covers the nose, mouth, or both. This makes it less invasive and often more comfortable for patients. NIPPV systems often include features to heat and humidify the air, reducing the risk of airway dryness and irritation. (Fig. 7)
8. **Modes of NIPPV:**
9. **Continuous Positive Airway Pressure (CPAP)**: CPAP maintains a continuous level of positive pressure throughout the respiratory cycle. It is commonly used for conditions like obstructive sleep apnoea and in some cases of acute respiratory distress to keep the airways open.
10. **Bi-level Positive Airway Pressure (BiPAP):** BiPAP provides two levels of pressure—higher pressure during inhalation (IPAP) and lower pressure during exhalation (EPAP). This mode can be beneficial for patients with more complex respiratory issues, such as chronic obstructive pulmonary disease (COPD) or acute respiratory failure, by making it easier to breathe in and out.

Benefits of NIPPV:

1. **Reduced Invasiveness**: By avoiding intubation, NIPPV reduces the risk of complications associated with invasive mechanical ventilation, such as infections or injury to the airway.
2. **Improved Comfort**: Many patients find NIPPV more comfortable than invasive ventilation options because it doesn't involve a tube inserted into the airway.
3. **Enhanced Oxygenation and Ventilation**: NIPPV helps improve oxygen levels and remove carbon dioxide from the blood by providing positive pressure that assists with lung expansion and gas exchange.
4. **Decreased Work of Breathing**: The positive pressure provided by NIPPV can reduce the effort needed for breathing, which is beneficial for patients with respiratory distress.

Indications for NIPPV:

1. **Chronic Obstructive Pulmonary Disease** (COPD): NIPPV can help manage acute

exacerbations and improve breathing in chronic COPD patients.

2. **Acute Respiratory Failure**: In cases where patients experience respiratory failure without the need for invasive ventilation.
3. **Obstructive Sleep Apnoea** (OSA): CPAP is a common treatment for OSA, helping to keep the airway open during sleep (5).
4. **Congestive Heart Failure**: NIPPV can be used to manage acute pulmonary edema and improve breathing in heart failure patients.

Fig. 07: NIPPV

Invasive Methods of Oxygen Administration:

Invasive methods require medical devices or procedures that penetrate the patient's body, often used in more critical or challenging cases.

1. **Transtracheal Oxygen Delivery:** Transtracheal oxygen delivery is a method used to administer supplemental oxygen directly to the trachea through a small catheter inserted into the trachea. This technique is often considered for patients who need long-term oxygen therapy but either have difficulty using standard oxygen delivery methods or require a more efficient system. It delivers oxygen directly to the lungs, often requiring lower flow rates compared to other methods like nasal cannulas or masks. This can be beneficial for patients who need a high flow of oxygen. Unlike nasal cannulas or masks, it avoids irritation to the nasal passages and skin but the insertion procedure is invasive and carries risks, such as infection or injury to the trachea. It requires regular cleaning and monitoring to prevent blockages or infections. Potential complications include tracheal trauma, catheter dislodgment, and mucous plug formation.[7]
2. **Invasive Positive Pressure Ventilation (IPPV):** Invasive positive pressure ventilation (IPPV) is a medical intervention used to support or replace spontaneous breathing in patients who are unable to breathe adequately on their own. This technique involves using a mechanical ventilator to deliver air or a mixture of gases into the patient's lungs via an artificial airway.

Key Components of Invasive Positive Pressure Ventilation:

A. Artificial Airway:

Endotracheal Tube: A tube inserted through the mouth or nose into the trachea.

Tracheostomy Tube: A tube inserted directly into the trachea through a surgical opening.

B. Mechanical Ventilator:

A machine that provides controlled breaths to the patient, adjusting parameters like tidal volume, respiratory rate, and inspiratory pressure according to the patient's needs.

Ventilation Modes:

Assist-Control Ventilation (ACV): Delivers a preset number of breaths and provides additional breaths if the patient initiates them.

Synchronized Intermittent Mandatory Ventilation (SIMV): Provides a set number of mandatory breaths and allows for spontaneous breaths in between.

Pressure Support Ventilation (PSV): Supports spontaneous breaths with a preset pressure, reducing the work of breathing.

Indications for Invasive Positive Pressure Ventilation:

- Respiratory Failure: When the patient is unable to maintain adequate oxygenation or ventilation on their own, due to conditions like acute respiratory distress syndrome (ARDS), chronic obstructive pulmonary disease (COPD), or severe pneumonia.
- Airway Protection: To protect the airway in patients who are unconscious or have impaired airway reflexes.
- Surgical Procedures: During or after surgeries that require mechanical ventilation due to the effects of anaesthesia or the nature of the surgery.

Advantages of Invasive Positive Pressure Ventilation:

- Controlled Ventilation: Provides precise control over respiratory parameters and can be adjusted according to the patient's needs.

- Effective Oxygenation: Ensures adequate oxygen delivery and carbon dioxide removal, which is crucial in severe respiratory conditions.
- Ability to Rest Respiratory Muscles: Allows patients to rest their respiratory muscles during acute illness or recovery.

Potential Complications:

- Ventilator-associated pneumonia (VAP): Infection that can occur due to the presence of the artificial airway and the mechanical ventilation process.[6]
- Barotrauma: Injury to the lungs caused by overdistension of alveoli from excessive pressure.
- Tracheal Injury: Damage to the trachea or surrounding tissues from the artificial airway.
- Hemodynamic Instability: Changes in intrathoracic pressure can affect cardiovascular function and blood pressure.
    - ♦ Patient-ventilator Asynchrony: Discrepancies between the patient's spontaneous breathing efforts and the ventilator's settings can cause discomfort and ineffective ventilation.[7]

Care and Management:

- Monitoring: Continuous monitoring of ventilatory parameters, blood gases, and patient comfort is essential.
- Humidification: Providing humidified air to prevent drying and damage to the airways.
- Sedation and Analgesia: Ensuring the patient is comfortable and appropriately sedated, if necessary.
- Weaning: Gradual reduction of ventilatory support as the patient's condition improves, leading to eventual discontinuation of mechanical ventilation.

3. **Extracorporeal Membrane Oxygenation (ECMO):** ECMO is a sophisticated and life-saving technology used in critical situations where other forms of support are inadequate. While it offers significant benefits, its complexity requires meticulous management to minimize risks and optimize patient outcomes. This technique is used to provide prolonged cardiac and respiratory support to patients whose heart and lungs are severely compromised and unable to function effectively. ECMO is typically employed in situations where traditional methods of ventilation and medication are insufficient.[8]

How ECMO Works:

1. Cannulation: Blood is drawn from the patient's body through cannulas inserted into major blood vessels. The location of cannulation can vary depending on the type of ECMO and the patient's condition:
    i. Veno-venous (VV) ECMO: Cannulas are placed in a vein, often in the femoral and internal jugular veins, to support the lungs.
    ii. Veno-arterial (VA) ECMO: Cannulas are placed in a vein and an artery (usually the femoral vein and artery or the internal jugular vein and aorta), providing support to both the heart and lungs.
3. Oxygenation and Carbon Dioxide Removal: The blood is pumped through an artificial lung (the membrane oxygenator) where it is oxygenated and carbon dioxide is removed.
4. Reinfusion: The oxygenated blood is then returned to the patient's body through a second cannula, usually in an artery or vein, depending on the ECMO configuration.

Indications for ECMO:

1. Severe Respiratory Failure: Conditions like Acute Respiratory Distress Syndrome (ARDS), severe pneumonia, or COVID-19-related respiratory failure that do not respond to conventional mechanical ventilation.[8]
2. Cardiac Failure: Conditions such as cardiogenic shock, post-cardiotomy failure, or severe heart failure where the heart is unable to pump effectively.[8]
3. Bridge to Recovery or Transplant: ECMO can be used as a temporary support system while waiting for recovery of the heart or lungs or a heart or lung transplant.

Types of ECMO:

1. Veno-Venous (VV) ECMO: Primarily supports respiratory function by oxygenating blood and removing carbon dioxide. Indications for this type are severe lung conditions where the heart is still functioning reasonably well[9].
2. Veno-Arterial (VA) ECMO: Supports both cardiac and respiratory functions by providing oxygenated blood to the body and helping the heart pump (10). Indications are severe cardiac conditions with or without compromised lung function.

Advantages of ECMO:

1. **Effective Support:** Provides critical support for patients with life-threatening heart or lung failure, potentially saving lives when other treatments have failed.
2. **Time for Recovery:** Allows time for the underlying condition to improve or for the patient to be evaluated for transplant.
3. **Reduced Mechanical Ventilation:** This can reduce the need for high settings on mechanical ventilators, which may decrease lung injury.

Potential Complications:

1. **Bleeding:** Due to the anticoagulation therapy required to prevent blood clots in the ECMO circuit, there is an increased risk of bleeding complications.[11]
2. **Infection:** The presence of cannulas and the need for prolonged support increases the risk of infection.
3. **Thrombosis:** The formation of blood clots within the ECMO circuit can lead to complications and compromise the effectiveness of the therapy.
4. **Organ Dysfunction:** Prolonged ECMO support can impact other organs, such as the kidneys or liver, potentially leading to additional complications.[12]
5. **Mechanical Issues:** Problems with the ECMO machine or cannulas, such as malfunctions or dislodgement, can pose risks to patient safety.[8]

Care and Management:

1. **Monitoring:** Continuous monitoring of hemodynamic parameters, blood gases, and ECMO machine function is crucial.
2. **Anticoagulation Management:** Regular monitoring and adjustment of anticoagulation therapy to balance the risk of clotting and bleeding.
3. **Nursing Care:** Specialized care for maintaining cannula placement, preventing infection, and supporting the patient through complex medical needs.
4. **Multidisciplinary Approach:** Involves a team of specialists, including intensivists, surgeons, nurses, and respiratory therapists, working together to manage the patient's condition and ECMO support.

Table 1: Settings of Oxygenation Devices

Device	Flow Rates and Oxygen Percentage
Nasal Cannula	Flow rate: 1-6 L/min FiO2: 24% to 44%
High-Flow Nasal Cannula	Flow rate: up to 60 L/min FiO2: Up to 100%
Simple Mask	Flow rate: 6-10 L/min FiO2: 28% to 50%
Non-Rebreather Mask	Flow rate: 10 to 15 L/min FiO2: 60-80% Safety Note: The reservoir bag should always be partially inflated.
CPAP, BiPAP, Venturi Mask, Mechanical Ventilator	Use the settings provided by the respiratory therapist and/or provider order.
Bag Valve Mask	Flow rate: 15 L/min FiO2: 100% Squeeze the bag once every 5 to 6 seconds for an adult or once every 3 seconds for an infant or child.

Source: https://www.ncbi.nlm.nih.gov/books/NBK593208/table/ch11oxytherapy.T.settings_of_oxygenation/?report=objectonly

The Role of Nurses in Oxygen Administration

The role of nurses in oxygen administration is multifaceted and crucial to the overall well-being of patients. Oxygen is a life-saving therapy used in a wide range of medical conditions, and nurses are at the forefront of ensuring its effective and safe delivery. Here are the key aspects of a nurse's role in oxygen administration:

1. **Assessment and Monitoring**: Nurses play a pivotal role in assessing a patient's need for oxygen therapy. They use their clinical judgment to evaluate a patient's oxygen saturation levels, respiratory rate, breath sounds, and overall clinical condition. Nurses perform thorough assessments to determine the patient's oxygen needs, monitor vital signs, and assess the effectiveness of oxygen therapy. This assessment guides them in determining the appropriate oxygen delivery method and flow rate.[9]
2. **Selection of Equipment**: Nurses select the appropriate oxygen delivery system, considering the patient's condition, prescription, and comfort. Nurses are responsible for choosing the right oxygen delivery system based on the patient's condition, physician's orders, and the patient's comfort. Whether it's a nasal cannula, oxygen mask, or more specialized equipment like a Venturi mask or non-rebreather mask, nurses ensure that the equipment is suitable for the patient's needs.[10]

3. **Setting Flow Rates**: Nurses are responsible for adjusting and maintaining the oxygen flow rate to achieve and maintain target oxygen saturation levels. Determining the appropriate oxygen flow rate is a critical aspect of oxygen administration. Nurses need to calculate and set the flow rate that will achieve the desired oxygen saturation levels while avoiding oxygen toxicity. They continuously monitor the patient's response and make necessary adjustments.
4. **Patient Education:** Educating patients and their families on the importance of oxygen therapy, proper device usage, and safety measures is a key responsibility of nurses. Nurses are educators, and they take the time to explain the purpose of oxygen therapy to patients and their families. They ensure patients understand the benefits of oxygen administration and provide guidance on how to use the equipment properly, emphasizing safety measures.
5. **Monitoring and Documentation**: Continuous monitoring of the patient's response to oxygen therapy is essential. Nurses regularly check vital signs, oxygen saturation levels, and the patient's overall well-being. They meticulously document these observations, which is critical for evaluating the effectiveness of the therapy and for continuity of care. Accurate and detailed documentation of the patient's oxygen therapy, including flow rates, any complications, and patient response, is crucial for continuity of care.
6. **Troubleshooting:** Nurses are trained to identify and address issues with oxygen equipment or delivery systems promptly. Oxygen therapy can encounter various issues, such as equipment malfunction or patient discomfort. Nurses are trained to identify and address these issues promptly, ensuring that patients receive uninterrupted therapy. This involves changing oxygen delivery devices, addressing discomfort, or replacing faulty equipment.
7. **Collaborative Care**: Nurses work closely with other healthcare professionals, such as physicians, respiratory therapists, and pharmacists, to ensure coordinated care. They communicate changes in the patient's condition and collaborate to make necessary adjustments to the oxygen therapy plan.
8. **Comfort and Communication**: Patients on oxygen therapy can sometimes feel anxious, claustrophobic, or uncomfortable. Nurses excel in providing emotional support and clear communication to alleviate patient anxiety, ensuring they understand the purpose of oxygen therapy and its benefits.
9. **Emergency Response**: In critical situations, such as cardiac arrest or respiratory distress, nurses are often the first responders. They are trained to initiate high-flow oxygen therapy quickly and efficiently, stabilizing the patient while awaiting further medical intervention.
10. **Patient Advocacy**: Nurses serve as patient advocates, ensuring that patients receive appropriate and timely oxygen therapy. They communicate any concerns or barriers to care to the healthcare team, advocating for the best interests of their patients. Beyond just the technical aspects of oxygen administration, nurses advocate for their patients' well-being. They ensure that patients receive the right oxygen therapy, educate them on the importance of compliance, and work with the healthcare team to optimize the patient's treatment plan.
11. **Paediatric and Geriatric Care**: Oxygen administration can be especially challenging in paediatric and geriatric populations due to varying oxygen requirements and cognitive differences. Nurses are adept at adapting their care to meet the unique needs of these patients, whether it's through creative communication methods with children or ensuring the safety and comfort of elderly individuals.
12. **Education and Training**: Nurses undergo extensive training in oxygen therapy, ensuring they are up-to-date with the latest guidelines and best practices. They are also responsible for educating their colleagues and students, perpetuating the knowledge and expertise within the nursing profession.[11]

Challenges in oxygen administration also need to be addressed. These include:

1. **Safety Concerns**: Oxygen is highly combustible, making it a fire hazard when used in conjunction with flammable materials. Nurses need to be vigilant in ensuring a safe environment for oxygen therapy.
2. **Oxygen Toxicity**: Administering too much oxygen for extended periods can lead to oxygen toxicity, potentially causing lung damage. Nurses closely monitor and adjust oxygen flow rates to mitigate this risk.
3. **Patient Compliance**: Some patients may resist

or refuse oxygen therapy due to discomfort or misconceptions. Nurses must employ their communication skills to educate and persuade patients about the benefits of oxygen therapy.

4. **Resource Management**: Ensuring the availability of oxygen equipment, such as tanks and concentrators, is essential. Nurses often collaborate with supply chain management to ensure a constant supply of oxygen resources. (12)

CONCLUSION

In conclusion, the administration of oxygen is a crucial aspect of patient care, and nurses are central to this process. Their role is multifaceted, involving assessment, education, monitoring, and advocacy to ensure safe and effective oxygen therapy. Nurses' expertise in selecting and managing oxygen therapy is vital for improving patient outcomes and quality of life. As frontline healthcare providers, they advocate for patients, uphold safety standards, and contribute significantly to positive healthcare outcomes. Their knowledge, compassion, and dedication make them indispensable in delivering patient-centred care and ensuring access to this essential treatment.

REFERENCES

1. Sharma S, Danckers M, Sanghavi DK, Chakraborty RK. High-Flow Nasal Cannula. 2024.
2. Al-Shaikh B, Stacey S. Masks and oxygen delivery devices. In: Essentials of Anaesthetic Equipment. Elsevier; 2013. p. 99–110.
3. Park SY. High-flow nasal cannula for respiratory failure in adult patients. Vol. 36, Acute and Critical Care. Korean Society of Critical Care Medicine; 2021. p. 275–85.
4. Faria DAS, da Silva EMK, Atallah ÁN, Vital FMR. Noninvasive positive pressure ventilation for acute respiratory failure following upper abdominal surgery. Vol. 2015, Cochrane Database of Systematic Reviews. John Wiley and Sons Ltd; 2015.
5. Mehta RS, Anderson WG, Hunt S, Chaitin EK, Arnold RM. Withholding and Withdrawing Life-Sustaining Therapies. In: Palliative Care. Elsevier; 2011. p. 300–18.
6. Coelho L, Moniz P, Guerreiro G, Póvoa P. Airway and Respiratory Devices in the Prevention of Ventilator-Associated Pneumonia. Vol. 59, Medicina (Lithuania). MDPI; 2023.
7. Holanda MA, Vasconcelos R dos S, Ferreira JC, Pinheiro BV. Patient-ventilator asynchrony. Vol. 44, Jornal Brasileiro de Pneumologia. Sociedade Brasileira de Pneumologia e Tisiologia; 2018. p. 321–33.
8. Staley EM, Wool GD, Pham HP, Dalton HJ, Wong ECC. Extracorporeal corporeal membrane oxygenation: indications, technical considerations, and future trends. Vol. 7, Annals of Blood. AME Publishing Company; 2022.
9. Vyas A, Bishop MA. Extracorporeal Membrane Oxygenation in Adults. 2024.
10. Guglin M, Zucker MJ, Bazan VM, Bozkurt B, El Banayosy A, Estep JD, *et al*. Venoarterial ECMO for Adults. J Am Coll Cardiol. 2019 Feb;73(6):698–716.
11. Olson SR, Murphree CR, Zonies D, Meyer AD, McCarty OJT, Deloughery TG, *et al*. Thrombosis and Bleeding in Extracorporeal Membrane Oxygenation (ECMO) Without Anticoagulation: A Systematic Review. ASAIO Journal. 2021 Mar 1;67(3):290–6.
12. Ostermann M, Lumlertgul N. Acute kidney injury in ECMO patients. Vol. 25, Critical Care. BioMed Central Ltd; 2021.