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From Airway Assessment to Intubation: Nursing Responsibilities in Respiratory Care

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Abstract

Registered nurses (RNs) play a crucial role in managing patients with impending respiratory failure. This article explores the essential skills and knowledge required by RN generalists to effectively identify early warning signs, assess patients, and implement appropriate interventions. Key aspects include recognizing symptoms of hypoxemic and hypercapnic respiratory failure, conducting comprehensive patient assessments focusing on vital signs, work of breathing, and level of consciousness, and interpreting diagnostic tests such as arterial blood gases and imaging studies. The article also discusses various oxygen delivery systems, including low-flow, reservoir, and high-flow devices, along with their specific characteristics and clinical applications. Basic airway management techniques, such as head tilt-chin lift and jaw thrust maneuvers, are described, as well as the use of adjunct equipment like bag-mask ventilation and oropharyngeal and nasopharyngeal airways. The importance of RN preparedness for advanced interventions, including gathering necessary equipment and medications for intubation, is emphasized. The article highlights the

significance of effective communication, teamwork, and ongoing education in enhancing patient outcomes. By possessing a strong foundation in respiratory care, RNs can serve as integral members of the healthcare team, ensuring timely and appropriate interventions for patients with respiratory compromise.
Keywords: nurses, Intubation, Respiratory Care, Airway management

Introduction

The role of the registered nurse (RN) generalist is indispensable in managing patients exhibiting signs of impending respiratory failure. Nurses in this position must possess a profound ability to identify early indications of respiratory compromise and demonstrate the necessary confidence to implement timely and appropriate interventions. Their contributions are crucial to ensuring patient safety and mitigating the risks of deterioration associated with respiratory distress. This article delves into the identification of early warning signs of respiratory failure, the critical aspects of patient assessment during respiratory distress, and the interpretation of relevant laboratory studies. Moreover, it explores the different modes of oxygen delivery, fundamental airway management techniques such as bag-mask ventilation (BMV), and the application of oropharyngeal and nasopharyngeal airways.

An essential component of the RN generalist's responsibilities involves preparation for advanced interventions like tracheal intubation. While the RN's scope of practice may not encompass performing intubation or advanced airway procedures, their knowledge of the associated equipment and medications is vital to ensuring swift and effective collaboration with advanced care providers. This includes understanding the assembly of intubation tools, medication preparation for rapid sequence intubation (RSI), and anticipatory actions that optimize outcomes during emergencies. Such knowledge positions the RN generalist as a cornerstone of multidisciplinary teams addressing acute respiratory compromise, emphasizing their role in stabilizing patients before and during advanced interventions.

In addition to their clinical competencies, RNs must cultivate a solid foundation in the physiological mechanisms underpinning respiratory failure. This understanding allows them to assess subtle changes in patient condition accurately, differentiate between varying causes of respiratory distress, and implement evidence-based interventions tailored to individual patient needs. By correlating clinical findings with pathophysiological principles, RNs enhance their ability to deliver holistic and targeted care that aligns with best practices in respiratory management

Equally significant is the need for effective communication and teamwork. The RN's ability to relay critical information regarding a patient's condition to other members of the healthcare team—including respiratory therapists, physicians, and intensivists—is paramount. Accurate and concise communication facilitates informed decision-making, ensuring that patients receive timely and coordinated care. Furthermore, RNs often serve as advocates for their patients, ensuring that their voices are heard and that interventions align with their preferences and clinical needs.

The evolving landscape of healthcare underscores the importance of continuous education for RN generalists. Advances in respiratory care, such as the introduction of novel oxygen delivery devices and refinements in airway management techniques, necessitate ongoing professional development. Nurses must remain up to date with emerging evidence and technological advancements to maintain their competence and enhance patient outcomes. By participating in regular training sessions, simulations, and interdisciplinary case reviews, RNs not only refine their skills but also foster a culture of excellence within their practice settings.

The RN generalist's role in respiratory care extends beyond immediate clinical interventions to include patient and family education. By providing clear explanations of respiratory conditions, treatment plans, and the use of medical equipment, RNs empower patients and

families to actively participate in care. This educational aspect is particularly critical for patients with chronic respiratory conditions, as it equips them with the knowledge and tools necessary to manage their health effectively outside of the hospital setting. Ultimately, this holistic approach reinforces the RN's position as an integral member of the healthcare team, dedicated to improving both immediate and long-term patient outcomes.

Identifying Respiratory Failure or Airway Compromise

Nurses are frequently the initial healthcare providers to recognize a patient experiencing airway distress. Therefore, it is imperative that all nursing staff are well-versed in identifying the fundamental signs and symptoms of respiratory deterioration and airway compromise. Familiarity with these clinical indicators, along with a solid understanding of standard respiratory assessment tools and techniques, equips nurses with the means to detect patients in crisis at an earlier stage, potentially preventing irreversible damage (Jungquist et al., 2017).

Respiratory failure can be classified into two primary types: hypoxemic respiratory failure and hypercapnic respiratory failure. Hypoxemic respiratory failure is characterized by lung failure that leads to inadequate oxygenation of the blood. Conversely, hypercapnic respiratory failure arises from a mechanical failure of the pulmonary system, resulting in insufficient removal of carbon dioxide. Hypoxemic respiratory failure often presents with symptoms such as dyspnea, pallor, hypertension, disorientation or euphoria, and tachycardia in mild to moderate cases. Severe cases may lead to bradycardia, cyanosis, hypotension, and seizures. In contrast, hypercapnic respiratory failure in its mild to moderate stages is associated with dyspnea, reduced reflexes, flushing, tachypnea, tachycardia, and drowsiness or confusion. Severe manifestations can escalate to coma and papilledema (Vo & Kharasch, 2014).

Patient Assessment

A comprehensive patient examination is essential in identifying individuals requiring emergency intervention due to respiratory failure. The initial assessment should prioritize three critical factors: vital signs, work of breathing, and level of consciousness. These elements collectively provide a robust framework for determining whether a patient is in crisis (Singh Lamba et al., 2016).

Vital signs are among the most valuable indicators for detecting respiratory failure and gauging its severity. Tachypnea, or an elevated respiratory rate, often represents one of the earliest compensatory responses to respiratory failure. In cases of advanced hypercapnic respiratory failure, respiratory rates may slow significantly, signaling decompensation. Early on, patients may also demonstrate tachycardia and elevated blood pressure, both compensatory mechanisms aimed at enhancing oxygen delivery to bodily tissues (Flenady et al., 2017). However, as compensatory mechanisms fail, bradycardia and hypotension may develop. Additionally, blood oxygen saturation, measured via pulse oximetry, offers a non-invasive estimation of hemoglobin oxygen saturation. For instance, a pulse oximeter reading of 90% correlates with a partial pressure of oxygen (PaO2) of approximately 60 mm Hg (Elliott & Baird, 2019).

Physical examination should prioritize evaluating the patient's work of breathing. Observations should include monitoring for tachypnea while considering age-specific norms (Fleming et al., 2011). Accompanying signs such as respiratory muscle retraction, nasal flaring, and audible indications of increased effort, such as grunting, warrant immediate intervention to support the patient and prevent potential respiratory collapse.

Patient Assessment and Diagnostic Testing

Patients should also be observed for indications of slow or shallow breathing patterns. Bradypnea, defined as a respiratory rate slower than normal, is frequently observed in individuals with neuromuscular disorders or those experiencing failure of the respiratory center. In cases where bradypnea results from neuromuscular compromise, patients may also

exhibit shallow breathing patterns that appear nonlabored. In addition to monitoring respiratory rate, it is critical to evaluate the symmetry of chest wall expansion. Paradoxical movement of the chest and abdomen, or asymmetric chest wall expansion, often signals severe respiratory distress or underlying pathological conditions, such as significant lung injury.

Although the respiratory system is the primary focus of assessment, it is essential to consider potential contributors from other body systems. For example, cardiovascular evaluation can rule out conditions such as heart failure or arrhythmias as causes of respiratory difficulties. Changes in mental status are also relevant, as they may result from respiratory compromise or indicate neurological impairment. Using tools such as the Glasgow Coma Scale (GCS) enables nurses to evaluate the severity of neurological dysfunction. A GCS score of 8 or lower is indicative of severe impairment that may hinder the patient's ability to manage airway secretions, prompting recommendations for tracheal intubation (Mattar et al., 2015).

A comprehensive respiratory assessment should also account for patient history, including pre-existing conditions, recent illnesses, and medications that may contribute to respiratory failure.2 For instance, patients with a history of chronic obstructive pulmonary disease (COPD) or asthma may present unique challenges during an acute episode of respiratory distress. Furthermore, identifying potential environmental exposures, such as allergens or toxins, can provide critical insights into the underlying etiology.2 This holistic approach enhances the accuracy of diagnosis and informs tailored interventions.

Assessment findings should be corroborated with diagnostic imaging and laboratory studies to determine both the cause and severity of respiratory failure. Chest radiographs are indispensable in evaluating the presence of pulmonary infiltrates, pneumothorax, or other abnormalities that contribute to respiratory distress.2 If a cardiac origin is suspected, diagnostic tools such as electrocardiograms (ECGs) and echocardiograms are recommended to assess for arrhythmias or structural cardiac abnormalities.2 Additional diagnostic tools, such as point-of-care ultrasonography, have gained prominence for their utility in evaluating pleural effusions and assessing cardiac function in real time.2

Laboratory studies play a pivotal role in assessing respiratory status and identifying contributing factors. Arterial blood gas (ABG) analysis is a cornerstone of respiratory assessment, providing precise information about oxygen and carbon dioxide exchange, as well as insights into the nature and duration of respiratory failure.8,9 The ABG includes three primary components: pH, partial pressure of carbon dioxide (PaCO2), and bicarbonate (HCO3).8,9 The pH reflects the patient's acid-base status, with a normal range of 7.35 to 7.45. Values above this range indicate alkalosis, while values below suggest acidosis.8 The PaCO2 is instrumental in distinguishing between respiratory and metabolic causes of failure, while HCO3 provides a comprehensive understanding of the acid-base balance.9 Although interpreting ABG results requires specialized training, nurses should be familiar with identifying abnormalities that necessitate further evaluation and immediate intervention.8

Additional laboratory tests contribute valuable information regarding the underlying etiology of respiratory failure. A complete blood count (CBC) can identify infections or conditions like anemia that impair oxygen transport within the bloodstream.2 Elevated white blood cell counts may indicate systemic infection, while low hemoglobin levels suggest reduced oxygen-carrying capacity. Metabolic panels are equally critical, offering insights into conditions such as electrolyte imbalances. For instance, hyponatremia (low sodium levels) can lead to seizures and neurological impairment, further exacerbating respiratory distress.2 Assessment of renal and hepatic function through metabolic panels may also reveal systemic conditions contributing to respiratory compromise.2

Emerging biomarkers and advanced diagnostic tests offer additional dimensions to respiratory assessment. For example, measurement of lactate levels can indicate tissue hypoxia and provide a gauge of disease severity in critically ill patients.2 Procalcitonin levels, commonly

associated with bacterial infections, may assist in distinguishing between infectious and non-infectious causes of respiratory failure.2 Furthermore, newer technologies, such as capnography, allow for continuous monitoring of exhaled carbon dioxide, providing real-time feedback on ventilation efficiency.2 These tools enhance the nurse's ability to respond dynamically to changes in the patient's condition, ensuring timely and effective interventions. While diagnostic tests are invaluable, it is crucial to emphasize that emergency interventions should not be delayed while awaiting results.2 Prompt action based on clinical judgment remains the cornerstone of effective respiratory care, underscoring the critical role of the nurse in managing patients with acute respiratory failure.2

Oxygen Delivery Systems

There are multiple methods for administering oxygen, and the selection of an appropriate delivery system depends on various factors, including the patient's specific diagnosis, oxygen requirements, practicality, effectiveness, and the patient's comfort and acceptance of the system.10 A comprehensive understanding of oxygen flow rates and the fraction of inspired oxygen (FiO_2) is essential. The oxygen flow rate refers to the volume of oxygen delivered to the patient, measured in liters per minute (L/min), while the FiO_2 denotes the concentration of oxygen in the air inhaled by the patient, expressed as a percentage (Fuentes & Chowdhury, 2024). The precise FiO_2 may vary depending on the type of oxygen delivery device used. For example, ambient room air contains an FiO_2 of 21% (Fuentes & Chowdhury, 2024).

Categorizing Oxygen Delivery Devices

Oxygen delivery devices are classified into three main categories based on their flow characteristics: low-flow systems, reservoir systems, and high-flow systems.

Low-flow oxygen delivery systems provide a flow rate that is insufficient to meet the patient's inspiratory needs, requiring supplemental room air to be inhaled. Examples of low-flow systems include the low-flow nasal cannula, non-rebreather mask, and transtracheal oxygen catheter. These devices are commonly used for mild hypoxia but may result in imprecise FiO_2 levels due to room air dilution (Hardavella et al., 2019).

Reservoir systems store oxygen during both the inspiratory and expiratory phases, enabling more efficient oxygen use by reducing wastage. Typical examples include reservoir cannulas and masks, which are particularly effective in situations where higher oxygen concentrations are needed without compromising efficiency.

High-flow oxygen delivery systems deliver oxygen at a rate exceeding the patient's inspiratory demand, allowing for precise control over FiO_2 levels.10 Common devices in this category include the rebreather mask, simple face mask, Venturi mask, and high-flow nasal cannula.12 These systems are used in scenarios where specific FiO_2 concentrations are crucial, such as in patients with chronic obstructive pulmonary disease (COPD).

Oxygen Storage Methods

Hospitals typically store oxygen in large quantities to ensure availability for patients. Liquid oxygen (LOX) is a widely used storage method due to its efficiency; one liter of LOX is equivalent to approximately 860 liters of gaseous oxygen. Compressed gas cylinders serve as an alternative and are often utilized during patient transport or in emergency situations. Smaller E cylinders, containing roughly 679 liters of oxygen, are portable and suitable for short-term use, whereas larger H cylinders can store approximately 6900 liters, making them appropriate for extended periods (Blakeman & Branson, 2013).

The internal pressure of oxygen storage systems differs significantly between LOX and compressed gas cylinders, which impacts handling safety. LOX systems typically operate at around 130 psi, while compressed gas cylinders range from 2000 to 2200 psi. Improper handling of compressed gas cylinders can lead to hazardous situations, including their potential to become dangerous projectiles. Ensuring appropriate training in cylinder handling and

awareness of storage pressures is vital to maintaining patient and staff safety (Blakeman & Branson, 2013).

Detailed Descriptions of Oxygen Delivery Systems

Several commonly used oxygen delivery systems have specific characteristics and clinical applications that nurses must understand to provide comprehensive patient care (Spoletini et al., 2015).

The low-flow nasal cannula delivers oxygen at a flow rate of 1–6 L/min, achieving an FiO_2 of 24%–44%. This device is suitable for mild hypoxia and allows patients to eat and talk comfortably while wearing it. However, it is not recommended for patients with conditions such as a deviated septum or nasal polyps, and flow rates exceeding 6 L/min can cause nasal dryness.

The simple face mask provides oxygen at 5–10 L/min, achieving an FiO_2 of 35%–55%. It is often used for moderate oxygen requirements and can include humidified air to alleviate nasal dryness. However, it may cause discomfort and hinder activities such as eating and drinking, which could make some patients feel claustrophobic.

The non-rebreather mask delivers oxygen at a rate of 10–15 L/min, with an FiO_2 of up to 90%. It is ideal for emergency use in patients experiencing severe hypoxia. However, it carries a risk of carbon dioxide retention and aspiration if the patient vomits. The mask must fit tightly to ensure efficacy, which can be uncomfortable.

The Venturi mask, which allows for precise FiO_2 control ranging from 24%–50%, is commonly used for patients with COPD. It utilizes color-coded ports to adjust oxygen concentration and does not dry the mucous membranes. However, it may impede speech and eating.

The high-flow nasal cannula provides oxygen at up to 60 L/min with an FiO_2 of up to 100%. This system humidifies and warms the oxygen, reducing the work of breathing and enhancing patient comfort by clearing secretions and minimizing dryness. It is particularly beneficial for patients requiring high oxygen levels with improved overall comfort.

These various oxygen delivery systems each have unique benefits and limitations. By understanding their specific applications, nurses can make informed decisions to optimize patient outcomes while ensuring comfort and safety (Spoletini et al., 2015).

Basic Airway Management Techniques

Basic life support skills, including airway management, are essential for healthcare providers. However, registered nurses (RNs) may not regularly practice airway management, necessitating periodic review. The first step in managing an unconscious patient is opening the airway, which may stimulate spontaneous breathing if the airway obstruction is caused by the tongue (Barker, 2019). There are two primary techniques for airway opening.

The first technique, the head tilt-chin lift maneuver, involves placing one hand on the patient's forehead to tilt the head backward slightly while the other hand lifts the chin. This maneuver opens the airway by tilting the head and moving the tongue forward as the mandible is displaced, thereby alleviating tongue-related obstruction. The second technique, the jaw thrust maneuver, is preferred when a cervical spine injury is suspected or confirmed. This method involves placing both hands at the mandibular angles on either side of the patient's head. With the thumbs directed toward the patient's feet, the index and middle fingers are used to push the mandible forward, while gentle pressure may be applied to the chin to open the airway.

Adjunct Airway Equipment

When patients fail to breathe spontaneously or exhibit inadequate respiratory effort after their airway is opened, bag-mask ventilation (BMV) may be necessary. Effective BMV requires an unobstructed airway, a proper mask seal, and sufficient pressure to achieve visible chest rise when the bag is compressed (Meissen & Johnson, 2018).

In the one-person BMV technique, the clinician typically uses the left hand to create a seal by forming a "C" shape with the thumb and index finger over the mask, while the remaining

fingers lift the mandible to form a secure seal. The right hand compresses the bag to deliver breaths. In contrast, the two-person technique employs one person to form a "C" shape on both sides of the mask using both hands while pulling the mandible forward. The second person delivers ventilation by compressing the bag. Adequacy of ventilation is verified by observing the chest rise and fall, as with mouth-to-mask ventilation. If ventilation is ineffective, reposition the head and reattempt. If this fails and there is no foreign body obstruction, adjuncts such as oropharyngeal or nasopharyngeal airways may be necessary.

Oropharyngeal airways assist in maintaining a patent airway and are used exclusively in unconscious patients. In responsive patients with intact airway reflexes, the use of an oropharyngeal airway may induce gagging, vomiting, or laryngospasm, a condition in which the vocal cords close and obstruct ventilation. These airways are available in various sizes, with common adult sizes being 80 mm, 90 mm, and 100 mm. Proper sizing is achieved by aligning the flange at the corner of the mouth, with the curved end reaching the mandible's angle. Correct insertion involves either using a tongue blade to hold the tongue down during placement or initially inserting the airway upside down and rotating it 180° once past the tongue to secure its position in the posterior pharynx. Misplacement or incorrect sizing may result in tissue trauma or airway obstruction by displacing the tongue posteriorly.

The nasopharyngeal airway, also referred to as a nasal trumpet, is pliable and generally well-tolerated by awake or semiconscious patients (Bullard et al., 2012). Common sizes for adults range from 6 cm to 8 cm, and the appropriate size is determined by aligning the flange with the nostril and ensuring the curved tip extends to the earlobe. The diameter of the device should be slightly smaller than the nares to avoid complications. Prior to insertion, the airway should be lubricated with a water-soluble lubricant. The device is then inserted through the nostril in a perpendicular direction following the nasopharynx floor. Resistance may necessitate rotation of the device or attempting the opposite nostril (16). Although the nasopharyngeal airway is generally tolerated, it can provoke vomiting or laryngospasm. It is contraindicated in patients with facial fractures, suspected basilar skull fractures, coagulopathies, or those receiving anticoagulant therapy due to the risk of bleeding.

Preparation for Intubation

In cases where airway intubation is required, RNs must be familiar with the necessary equipment and medications and be prepared to assist in the procedure. Although rapid response teams often bring the required supplies, it is prudent for RNs to gather additional airways, endotracheal tubes, and stylets in case of unforeseen difficulties or equipment shortages (Dalley et al., 2012). Continuous suction must be available and positioned near the patient's head to ensure airway patency. Verifying the functionality of the laryngoscope, including checking batteries and light intensity, is critical. By ensuring proper preparation, RNs can facilitate an efficient and safe intubation process.

Medications

In cases where the patient is conscious, medications may be required to facilitate airway management. Administering medications not only improves patient comfort but can also make the procedure safer and less traumatic. The primary categories of drugs used for airway management include sedatives, induction agents, and muscle relaxants. The selection of specific medications depends on the patient's medical condition and the healthcare provider's familiarity and experience with the drugs (Groth et al., 2018).

Propofol is a commonly used induction agent that induces unconsciousness for general anesthesia but can also be administered in lower doses for sedation (19, 20). This drug is frequently chosen to achieve sedation or an unconscious state; however, it carries the risk of significant hypotension. Therefore, continuous blood pressure monitoring and the availability of medications to manage hypotension are essential during its use. Etomidate, another

induction agent, is often preferred when cardiovascular stability is a concern, as it provides greater stability compared to propofol. Additionally, benzodiazepines, such as midazolam in lower doses, can effectively alleviate anxiety and produce amnesia during airway management without inducing unconsciousness or apnea (Groth et al., 2018).

Muscle relaxants are also utilized to facilitate airway management by relaxing the airway muscles and creating optimal conditions for intubation (19, 20). Succinylcholine, a depolarizing muscle relaxant, and rocuronium, a nondepolarizing muscle relaxant, are two commonly used options. Succinylcholine provides rapid onset of excellent intubating conditions within 60 seconds, with a short duration of action of 4 to 6 minutes. However, it is non-reversible, may cause bradycardia, and has several contraindications, including a black box warning for pediatric patients (19, 20). Rocuronium, on the other hand, has fewer contraindications and adverse effects but has a slower onset and a longer duration of action compared to succinylcholine (Groth et al., 2018).

It is crucial to note that these medications should only be administered by healthcare professionals who are highly skilled in airway management. Nurses should understand the potential effects of these drugs, including sedation, unconsciousness, and paralysis, to ensure safe and effective care.

Conclusion

Effective management of airway and respiratory challenges is a fundamental responsibility of the registered nurse (RN) generalist, requiring a combination of technical skills, clinical judgment, and interprofessional collaboration. From identifying early signs of respiratory distress to employing basic airway management techniques and understanding advanced interventions, RNs play a pivotal role in ensuring patient safety. Mastery of adjunct airway devices and familiarity with medications used in airway management further enhance their ability to provide comprehensive care.

Ongoing education and simulation training are vital to maintaining these competencies, especially as medical technology and evidence-based practices evolve. By fostering a proactive approach to respiratory care and emphasizing patient-centered strategies, nurses can significantly contribute to improved clinical outcomes and overall patient satisfaction. Whether managing acute respiratory failure or preparing for emergent intubation, the RN\u2019s commitment to excellence remains central to the delivery of safe and effective care.

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