



Early Detection Of Respiratory Failure: A Critical Component Of Patient Care- Review Article

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ABSTRACT:

Oxygen is essential for all body cells to function effectively. The intake of oxygen is contingent upon the respiratory system's capacity and condition. Respiratory failure occurs when the respiratory system is unable to supply adequate oxygen to the body's tissues or remove carbon dioxide efficiently. Respiratory diseases have become a significant health burden globally, contributing to increased mortality rates. According to the National Family Health Survey (NFHS-5) conducted between 2019 and 2021, the prevalence of acute respiratory infections (ARI) among children under five was reported at 2.8% in urban areas and 3.0% in rural areas. This article delves into the causes, risk factors, and symptoms of respiratory failure, emphasizing the importance of early detection. Diagnostic tools such as the Modified Early Warning Score (MEWS) are discussed, along with various intervention strategies and preventive measures to mitigate complications associated with respiratory failure. The pivotal role of nurses in the early identification and management of respiratory failure is also highlighted.

Keywords: Early Detection, Respiratory Failure, Modified Early Warning Score (MEWS), Acute Respiratory Infections, Nursing Role.

Introduction

All body cells require oxygen to live and perform their specific function. Intake of oxygen total depends upon the level of work ability of respiratory system.. Respiration is the exchange of oxygen and carbon dioxide during cellular metabolism. The respiratory failure is a condition where the respiratory system fails to provide adequate oxygen to the body's tissues and fails to remove carbon dioxide

Incidence

- In year 2017 544.9 million people had Chronic respiratory disease and its leading cause of death 7.2% of all deaths of world-wide.¹ In year 2019-2020 the National family health survey reported 2.4% prevalence of respiratory tract infection in urban areas and 3.8% in rural areas.² As per Punjab's disease profile from 1960[2016], 21.7% of all deaths are attributed to chronic respiratory diseases while a survey found a 2.4% prevalence of respiratory tract infections in urban areas and 3.8% in rural areas

• Causes of Respiratory Failure

- Chronic Obstructive Pulmonary Disease (COPD)
- Pneumonia
- Acute Respiratory Distress Syndrome (ARDS),
- Asthma,
- Interstitial Lung Diseases,
- Cystic Fibrosis
- Pulmonary embolism.
- Muscular Dystrophy,
- Stroke and Spinal cord injuries are also examples of neuromuscular diseases that involve the respiratory system.
- Injuries that lead to inhalation and drug or alcohol overdose are other examples of respiratory failure.³

Risk Factors-

- Premature babies have higher risk of respiratory failure because their lungs are under developed
- Old age people also have increased the risk of respiratory failure due to weak of lung muscle and immune system.
- They can easily get infection and respiratory distress syndrome.
- Severe allergy with exposure to chemical and drug overdose with alcohol are also major risk factors which can cause respiratory failure.

Signs and Symptoms

- Signs and Symptoms of Respiratory Failure are Difficulty Breathing
- Cyanosis
- Confusion or Altered Mental State,
- Fatigue
- Increased Heart Rate
- Coughing and Wheezing
- Fainting
- Chest Pain and Rapid Breathing

Diagnostic Tests

- Arterial Blood Gas (ABG) Analysis
- Chest X-ray,
- Oxygen Saturation Monitoring
- CT scan
- Electrocardiogram

- Pulmonary Function Test and Complete Blood Count.

Complications

- Sepsis
- Kidney failure,
- Neurological complications occur due to hypoxic brain injury
- Permanent damage of lungs

Treatment

- Oxygen Therapy,
- Endotracheal support,
- Mechanical Ventilation,
- Medications such as antibiotics to treat the infection
- Diuretic to decrease the fluid from the lungs and body,
- Physical Therapy,
- Nutritional Support and Surgery

Why Early Detection is Crucial

- Improved Outcomes: Early identification of respiratory failure allows for rapid intervention, reducing mortality rates and complications associated with delayed treatment.
- Prevention of Escalation: Recognizing early signs can prevent the need for invasive procedures, such as intubation and mechanical ventilation.
- Reduction in Healthcare Costs: Prompt treatment can decrease the length of hospital stays and the need for intensive care resources.⁴

Key Indicators of Early Respiratory Failure

- Clinical Signs: Dyspnoea (shortness of breath), tachypnea (rapid breathing), use of accessory muscles, and cyanosis (bluish discoloration of skin).
- Vital Signs: Increased respiratory rate, low oxygen saturation (SpO_2), and altered arterial blood gas levels (e.g., hypoxemia or hypercapnia).
- Behavioural Changes: Restlessness, confusion, or drowsiness, which may indicate hypoxia or hypercapnia affecting brain function.⁵

Strategies for Early Detection

Continuous Monitoring:

- Use of pulse oximetry for oxygen saturation.
- Capnography to monitor carbon dioxide levels.
- Arterial blood gas analysis for precise measurements.

Implementation of Early Warning Scores (EWS):⁶

- Tools like the Modified Early Warning Score (MEWS)
- assess vital signs and provide actionable alerts for early deterioration

Clinical Education

- Training healthcare providers to recognize subtle signs of respiratory compromise.
- Simulation-based training to improve response times and decision-making.

Technological Aids

Integration of artificial intelligence and predictive analytics in monitoring systems to identify at-risk patients early

- Oxygen Therapy: Administering supplemental oxygen to maintain adequate blood oxygen levels.
- Non-Invasive Ventilation (NIV): CPAP or BiPAP to support breathing without intubation.
- **Pharmacologic Treatment: Use of bronchodilators, corticosteroids, or antibiotics depending on the underlying cause.**
- Advanced Support: In severe cases, initiation of invasive mechanical ventilation or extracorporeal membrane oxygenation (ECMO) may be required.
- The National Institute for Health and Clinical Excellence recommends that standardized early warning systems, such as the Early Warning Score (EWS) or Modified Early Warning Score (mEWS), be used to monitor all adult patients in acute hospital settings to facilitate the recognition of patient deterioration and ensure timely escalation of care ⁷

The Early Warning Score (EWS)

- The Early Warning Score (EWS) was developed to identify patients at risk of clinical deterioration by using a numerical scoring system based on physiological parameters. The EWS focuses on six key physiological variables:
- Respiratory Rate: An indicator of respiratory distress or compromise.
- Oxygen Saturation: Reflects the adequacy of oxygenation.
- Heart Rate: Abnormalities may indicate cardiovascular stress or systemic changes.
- Systolic Blood Pressure: Hypotension or hypertension can signal underlying issues.
- Temperature: Deviations from normal ranges may indicate infection or other systemic processes.
- Level of Consciousness: Assessed using the AVPU scale (Alert, Voice, Pain, Unresponsive)

How EWS Works

- Each parameter is assigned a score from 0 to 3, depending on how far it deviates from normal ranges.
- The total score is calculated by summing the scores for all parameters.
- A higher total score suggests a greater risk of deterioration.

Interpretation and Escalation

- Low Scores (0-2): Routine monitoring.
- Moderate Scores (3-5): Increased frequency of monitoring and review by a nurse or doctor.
- High Scores (≥ 6): Immediate review and possible transfer to a higher level of care, such as an intensive care unit (ICU).
- Rapid response systems are comprehensive hospital-wide strategies designed to reduce failure to rescue by enhancing patient monitoring on general wards (afferent component) and ensuring an effective response to clinical deterioration through specialized teams,
- Such as Critical Care Outreach Teams, Rapid Response Teams, or Medical Emergency Teams (efferent component). 4

Role of Nurse –

- Vital sign monitoring-Nurse regularly monitors vital sign such as respiratory rate. Oxygen saturation and heart rate
- Respiratory assessment- Nurse will assess the respiratory status ,e,g lung sounds , breathing patterns and oxygen saturation
- Patient history –Nurse will take complete history including medical conditions, allergies and medications.

Assessment of Early Warning Sign-

Nurse will assess early warning sign like

- Increased respiratory rate can be an early sign of respiratory distress.
- Hypoxemia -Can be detected with pulse oxymetry.
- Change in mental status like confusion, agitation or altered mental status can indicate respiratory failure.
- Use of accessory muscles during breathing indicates breathing difficulty.
- Notify to the health care team immediately if respiratory distress is suspected
- Collaborate with healthcare team to develop a care plan.
- Administering oxygen therapy as prescribed
- Position the patient to provide optimize breathing
- Reduced complications such as cardiac and respiratory arrest
- Enhanced patient safety to assess the early complication.

Conclusion

Early detection of respiratory failure is a critical component of patient care, enabling timely and effective interventions that can save lives and reduce the burden on healthcare systems.

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