Nursing Assessment and Management of Acute Respiratory Distress Syndrome (ARDS)

Ahlam Owayn Alanazi[1], Samaher Thaamer Alrowily[2], Noura Saleh Aqil Alomim[3], Abdullah Dhafi Sayer Alanazi[3], Fatimah Mohammed Itran Alruwaili[4], Mona Aldafy H Alenezy[5], Alhazmi, Ahmad Dlash R[6], Nawal Alwandi Mauf Alruwaili[7], Alzahrani Majed Abdullah M[8], May Farhan S Alanazi[9]

[1]Nursing specialist, North Medical Tower, Arar, Saudi Arabia
[2]Nursing specialist, Dumat Al-Jandal General Hospital, Dumat Al-Jandal, Saudi Arabia
[3]Nursing specialist, Eradah Complex for Mental Health, Arar, Saudi Arabia
[4]Nursing technician, North Medical Tower, Arar, Saudi Arabia
[5]Nursing technician, Northern borders health cluster, Saudi Arabia
[6]Nursing, North Medical Tower, Arar, Saudi Arabia
[7]Nursing and Midwifery, Maternity and Children Hospital Al-Jouf, Saudi Arabia
[8]Pharmacy technician, Research Excellence Center, Faculty of Pharmacy, King Abdulaziz University, Saudi Arabia
[9]Nursing specialist, Northern borders health cluster, Saudi Arabia

Abstract

Acute Respiratory Distress Syndrome (ARDS) is a life-threatening condition characterized by rapid onset of severe respiratory failure due to various underlying causes, such as pneumonia, sepsis, or trauma. The nursing assessment for ARDS begins with a thorough evaluation of the patient's history, focusing on the onset and progression of respiratory symptoms, including dyspnea, cyanosis, and cough. Vital signs should be continuously monitored, particularly respiratory rate, oxygen saturation, and heart rate. Additionally, nurses should assess lung sounds, use pulse oximetry to determine the effectiveness of oxygenation, and evaluate the patient's work of breathing. Monitoring arterial blood gases (ABGs) is critical in determining the severity of hypoxemia and guiding further interventions. Management of ARDS requires a multidisciplinary approach, with nursing interventions playing a crucial role. The primary goals of management include optimizing oxygenation and ventilation while minimizing potential complications. This may involve the use of supplemental oxygen, mechanical ventilation with low tidal volume strategies, and careful fluid management to avoid overload. Nurses must be vigilant about positioning the patient in ways that enhance lung expansion, such as the prone position, and advocate for early mobility when feasible. Collaborative efforts with the healthcare team ensure that appropriate pharmacological therapies, such as corticosteroids or neuromuscular blockers, are initiated when indicated. Continuous patient education and monitoring for signs of complications, such as ventilator-associated pneumonia or barotrauma, are essential elements of effective ARDS management.

Ahlam Owayn Alanazi, Samaher Thaamer Alrowily, Noura Saleh Aqil Alomim, Abdullah Dhafi Sayer Alanazi, Fatimah Mohammed Itran Alruwaili, Mona Aldafy H Alenezy, Alhazmi, Ahmad Dlash R, Nawal Alwandi Mauf Alruwaili, Alzahrani Majed Abdullah M, May Farhan S Alanazi

Keywords: Acute Respiratory Distress Syndrome, Nursing Assessment, Respiratory Failure, Dyspnea, Vital Signs, Lung Sounds, Arterial Blood Gases, Oxygenation, Mechanical Ventilation, Low Tidal Volume, Fluid Management, Prone Position, Patient Education, Complications Monitoring.

Acute Respiratory Distress Syndrome (ARDS) is a life-threatening condition characterized by rapid onset of severe respiratory failure, leading to significant morbidity and mortality in critically ill patients. Defined by the Berlin definition, ARDS encompasses varying degrees of hypoxemia and respiratory distress resulting from a range of etiological factors, including pneumonia, sepsis, aspiration of gastric contents, and trauma. The hallmark of this disorder is the inflammation of the pulmonary parenchyma, which culminates in increased permeability of the alveolar-capillary membrane, ultimately resulting in pulmonary edema, atelectasis, and impaired gas exchange. Accurate nursing assessment and subsequent management remain critical components of patient care in ARDS, influencing outcomes and recovery trajectories [1].

Nursing professionals play an indispensable role in the comprehensive management of ARDS patients through vigilant assessment and intervention strategies. Given the rapid progression of the syndrome, effective nursing assessment is essential for early identification and intervention. Key components of nursing assessment in ARDS involve thorough respiratory evaluation, including the assessment of respiratory rate, oxygenation status (often indicated by arterial blood gas results), lung auscultation findings, work of breathing, and patient positioning. Furthermore, nurses must engage in standardized tools such as the Acute Physiology and Chronic Health Evaluation (APACHE) II or the Sequential Organ Failure Assessment (SOFA) score to quantitatively evaluate the severity of illness and determine appropriate nursing care plans [2].

The respiratory system is intricately connected to overall systemic physiology, which means that nurses must not only assess respiratory function but also monitor for potential complications that may arise from ARDS, including cardiovascular instability, renal dysfunction, and the risk of hospital-acquired infections. Holistic assessment includes frequent evaluation of hemodynamics, fluid balance, and neurological status, recognizing that ARDS often coexists with other organ system failures, necessitating a multidimensional approach to nursing care [3].

In terms of management, the nursing interventions for ARDS are multifaceted and are anchored in the concept of lung protective ventilation strategies. Evidence-based practices, such as low tidal volume ventilation, recruitment maneuvers, and the utilization of high-flow nasal cannula or non-invasive ventilation, have been shown to improve outcomes in ARDS patients. Nurses play a pivotal role in implementing these strategies, which not only aim to support oxygenation and ventilation but also to minimize ventilator-induced lung injury (VILI). The necessity for dedicated airway management, which may involve intubation or tracheostomy, introduces additional complexities that require skilled nursing intervention to ensure patient safety and comfort [4].

In addition to the technical aspects of care, psychological and emotional well-being during the critical illness phase deserves considerable attention. The experience of ARDS and its associated interventions can be distressing for both patients and their families. Thus, nursing management should also encompass elements of communication, education, and emotional support, as well as advocacy for family-centered care models, which can significantly improve overall patient and family experiences during critical illness [5].

Given the complexity and variability of ARDS presentation, alongside the dynamic

nature of patient responses to treatment, ongoing nursing assessment and intervention must be an iterative process [5]. Continuous monitoring and adaptation of nursing care plans are essential to address the persistent and evolving needs of ARDS patients. Furthermore, continued research into best practices for nursing management is required to enhance protocols, improve outcomes, and minimize long-term sequelae associated with ARDS [5].

Pathophysiology and Etiology of ARDS:

The pathophysiology of ARDS is complex and involves multiple interrelated processes, primarily characterized by an inflammatory response in the lung parenchyma. This response ultimately leads to the disruption of the alveolar-capillary membrane, resulting in increased permeability, pulmonary edema, impaired gas exchange, and, consequently, significant hypoxemia [6].

At the onset of ARDS, an inciting event triggers an inflammatory cascade. Common triggers include infections (particularly pneumonia), trauma, sepsis, aspiration of gastric contents, and systemic inflammatory response syndrome (SIRS). This initial insult causes the activation of inflammatory mediators, including cytokines (such as interleukin-1, interleukin-6, and tumor necrosis factor-alpha), leukocytes, and platelets. The activation of these mediators leads to the recruitment of neutrophils and macrophages to the site of injury, exacerbating local inflammation [7].

As the inflammatory response progresses, the integrity of the alveolar-capillary membrane becomes compromised. This disruption is characterized by damage to type I alveolar epithelial cells and endothelial cells of pulmonary capillaries. The loss of these cells impairs the barrier function of the alveoli, resulting in the leakage of fluid and proteins into the interstitial space and alveoli, leading to pulmonary edema. The accumulation of edema fluid and inflammatory exudates in the airspaces severely impairs gas exchange, culminating in atelectasis (collapse of lung units) and decreased lung compliance [8].

The increased pulmonary permeability and fluid influx cause alterations in ventilation-perfusion (V/Q) matching. In areas where the lungs are filled with fluid, ventilation occurs without adequate perfusion, leading to significant shunting and hypoxemia. Hypoxemia is further compounded by impaired diffusion of oxygen due to the presence of fluid in the alveoli, which thickens the alveolar membrane and reduces the surface area available for gas exchange [9].

The latter stages of ARDS are characterized by the development of acute lung injury with potential progression to fibrosis in some cases, particularly if there is prolonged involvement or recurrent injury. The fibrotic phase may lead to long-term respiratory dysfunction, necessitating prolonged mechanical ventilation and often leading to chronic respiratory failure [10].

The etiology of ARDS is diverse, and it is essential to classify the conditions that can lead to its development. ARDS can be classified into two main categories: direct and indirect lung injury [10].

Direct Lung Injury

Direct lung injury occurs when the lung parenchyma is injured from an insult that affects the lung directly. Some of the primary causes include:

1. Pneumonia: This is one of the most common causes of ARDS, typically seen in cases of severe bacterial, viral, or fungal pneumonia [11].
2. Aspiration: Inhalation of foreign materials, such as gastric contents, food, or chemical agents, directly damages the alveoli and can lead to inflammation, alveolar edema, and ARDS.
3. Toxic Lung Injury: Exposure to irritant gases such as chlorine, smoke (from fire), or industrial fumes can directly injure the lung parenchyma.
4. Pulmonary Contusion: Blunt trauma to the chest can lead to lung contusion and

subsequent ARDS, particularly in cases of thoracic injuries resulting from accidents.

Indirect Lung Injury

Indirect lung injury occurs as a result of systemic processes that do not primarily target the lungs. Some primary causes include:

1. Sepsis: This is a systemic inflammatory response secondary to infection. The resultant circulating inflammatory mediators can lead to multi-organ dysfunction and ARDS [12].
2. Severe Trauma: Trauma, particularly associated with significant blood loss and shock, can lead to systemic inflammation that affects the lungs.
3. Transfusion-Related Acute Lung Injury (TRALI): This is a rare but serious condition that generally occurs within six hours of a blood transfusion and is associated with the transfusion of blood products containing antibodies that react with the recipient's leukocytes.
4. Pancreatitis: Severe pancreatitis can lead to ARDS via the release of inflammatory mediators into the systemic circulation.
5. Cardiopulmonary Bypass and Major Surgical Interventions: Such procedures may induce systemic inflammatory responses, resulting in ARDS [13, 14].

Clinical Presentation and Symptoms of ARDS:

The pathophysiology involves damage to the alveolar-capillary membrane, leading to increased permeability and resultant pulmonary edema. This influx of fluid into the alveoli disrupts normal gas exchange, causing hypoxemia and, in severe cases, respiratory failure [15].

The clinical presentation of ARDS typically evolves over a period of hours to a few days following the precipitating event. Patients often exhibit respiratory distress, which may start with mild symptoms but can rapidly progress to severe difficulty in breathing. Clinically, this may present as increased work of breathing, tachypnea (rapid breathing), and the use of accessory muscles during respiration [15].

One of the hallmark characteristics of ARDS is acute hypoxemia. Patients may experience significant low oxygen saturation levels, often requiring supplemental oxygen or mechanical ventilation. Cyanosis, a bluish discoloration of the skin, particularly around the lips and extremities, may also occur as a direct result of hypoxemic states. In addition to respiratory changes, many patients exhibit tachycardia, a compensatory response to lower oxygen availability [16].

As ARDS progresses, specific symptoms may manifest that reflect the severity of the condition. Patients often report a sensation of breathlessness that can intensify. Coughing may also occur, although it is often dry and unproductive due to the absence of significant airway secretions [16].

A distinctive feature during the early stages of ARDS is that the respiratory distress may seem out of proportion to the physical examination findings, as patients may appear far more ill than their auscultation findings would suggest. This discrepancy is crucial in the recognition of ARDS, as bilateral crackles or wheezing may be absent even in severely hypoxic individuals [16].

During the progression of ARDS, patients may develop altered mental status due to hypoxemia or hypercapnia (elevated carbon dioxide levels), leading to confusion or lethargy. In some cases, metabolic derangements associated with sepsis or other underlying conditions may compound the clinical presentation, resulting in multi-organ failure [17].

Chest imaging is an integral component of the diagnostic approach to ARDS. In the acute setting, chest radiographs typically reveal bilateral infiltrates consistent with pulmonary edema, although they may not be specific to ARDS. Additionally, computed tomography (CT) scans may provide more detailed information, often showing ground-glass opacities and consolidations that can assess the extent of lung involvement [18].

Laboratory analysis reveals arterial blood gas (ABG) abnormalities that reflect the underlying hypoxemia and respiratory compromise. A hallmark finding includes a reduced PaO2/FiO2 ratio, often guiding the classification of the syndrome into mild, moderate, and severe ARDS based on severity criteria [18].

Despite the severe respiratory symptoms, some patients may also present with normal lung compliance in the early stages, complicating the diagnosis. Therefore, clinical judgment alongside imaging and laboratory findings is essential for a conclusive diagnosis [19].

The clinical presentation of ARDS can be similar to other conditions such as pneumonia, pulmonary embolism, and congestive heart failure. It is critically important to distinguish ARDS from these entities, as management strategies differ significantly. For example, congestive heart failure often requires diuretics and fluid management, while ARDS management focuses on lung protective ventilation strategies and addressing the underlying cause [19].

Comprehensive Nursing Assessment:

Physical Assessment

1. Observation: The physical examination begins with observing the patient's respiratory effort. Signs such as use of accessory muscles, nasal flaring, and cyanosis should be documented. Assess whether the patient is in a state of distress and the position they are adopting; patients with ARDS often prefer to sit upright or lean forward, which is known as the "tripod position."

2. Vital Signs Monitoring: Continuous arterial saturation monitoring via pulse oximetry is essential. Additionally, thorough assessment of vital signs — including respiratory rate, heart rate, blood pressure, and temperature — provides valuable information about the patient's overall stability and response to treatment.

3. Auscultation: Lung auscultation can reveal abnormal lung sounds such as crackles or wheezing. The nurse must be vigilant in assessing for the presence of bilateral crackles, which can indicate fluid accumulation in the alveoli.

Diagnostic Tools

Various adjunctive diagnostic tools can enhance the assessment process:

1. Imaging Studies: Chest X-rays and CT scans are pivotal in identifying lung pathology. The presence of bilateral infiltrates helps confirm the diagnosis of ARDS.

2. Laboratory Tests: Arterial blood gas (ABG) analysis is critical in measuring oxygenation and carbon dioxide levels. The results provide insight into the severity of respiratory compromise and guide management decisions.

3. Ventilation-Perfusion (V/Q) Scans: In certain cases, a V/Q scan can assess for pulmonary embolism, even though ARDS is the more likely diagnosis in high-risk patients.

Diagnostic Criteria and Imaging for ARDS:

Acute Respiratory Distress Syndrome (ARDS) represents a critical condition characterized by widespread inflammation in the lungs, leading to profound respiratory failure. It is a common complication in critically ill patients, associated with various etiologies such as pneumonia, sepsis, trauma, and aspiration. The diagnosis of ARDS requires a careful assessment based on clinical criteria and imaging studies. Current diagnostic criteria, primarily defined by the Berlin definition, offer a structured approach to identifying ARDS, while imaging techniques, particularly chest X-rays and computed tomography (CT) scans, are fundamental in assessing the extent and severity of lung involvement. This essay explores the diagnostic criteria for ARDS and the radiological imaging modalities utilized in its evaluation [20].

The Berlin definition of ARDS, established at the European Society of Intensive Care Medicine conference in 2011, refined the diagnostic criteria into three main categories: the timing of onset, the severity of hypoxemia, and the presence of bilateral opacities [21].

1. Timing of Onset

ARDS is categorized based on the timing of onset of respiratory symptoms following an inciting event. Symptoms can arise within 1 week of a known clinical insult or the worsening of an existing respiratory condition. This timing distinction is essential as it helps differentiate ARDS from other lung pathologies with similar presentations, such as pneumonia and pulmonary edema [22].

2. Severity of Hypoxemia

The severity of ARDS is classified based on the degree of hypoxemia, assessed using the partial pressure of oxygen to fraction of inspired oxygen ratio (PaO2/FiO2). The classification is as follows:

- Mild ARDS: 200 mmHg < PaO2/FiO2 ≤ 300 mmHg.
- Moderate ARDS: 100 mmHg < PaO2/FiO2 ≤ 200 mmHg.
- Severe ARDS: PaO2/FiO2 ≤ 100 mmHg.

This stratification into mild, moderate, and severe ARDS plays a crucial role in guiding treatment strategies and prognostic considerations [22].

3. Bilateral Opacities

Chest imaging studies play a pivotal role in the diagnostic process for ARDS. The Berlin definition specifies that patients must exhibit bilateral opacities on imaging, which are not fully explained by pleural effusion, lobar or lung collapse, or nodules. The presence of these opacities indicates the underlying pathophysiological changes in the lungs, primarily the accumulation of fluid in the alveoli [23].

In diagnosing ARDS, it is essential to exclude other causes of respiratory failure, such as cardiac failure or fluid overload, which can also lead to pulmonary edema. This necessitates an assessment of the patient's clinical history, physical examination, and, when necessary, additional tests such as echocardiography to evaluate cardiac function [24].

Imaging Modalities in ARDS

The imaging of ARDS primarily relies on chest X-rays and CT scans, both of which provide essential insights into the degree of lung involvement and guide therapeutic interventions [25].

1. Chest X-ray

The initial imaging modality typically employed in suspected ARDS is the chest X-ray. Although it is less sensitive than CT in detecting early changes in the lung parenchyma, it remains widely available and faster to perform. Common findings in ARDS on chest X-ray include:

- Bilateral infiltrates: These may appear as fluffy or patchy opacities, indicating the presence of fluid accumulation.
- Air bronchograms: The presence of air-filled bronchi amidst consolidated lung tissue can suggest the filling of alveoli with fluid.
- Normal heart size: In ARDS, the heart size is usually normal, suggesting that the pulmonary edema is not due to congestive heart failure.

Serial chest X-rays can be utilized to monitor the progression of ARDS and response to therapy [26].

2. Computed Tomography (CT) Scan

CT imaging is more sensitive than X-ray in detecting subclinical abnormalities in ARDS. High-resolution CT (HRCT) scans can reveal detailed morphologic changes in the lung architecture. Common CT findings in ARDS include:

- Ground-glass opacities: These indicate areas of partial alveolar filling and are often seen early in the course of ARDS.
- Consolidation: This represents complete filling of the alveoli with fluid, inflammatory cells, or proteinaceous material.
- Reticular patterns: Associated with interstitial edema, these patterns may reflect the severity of lung involvement.
- Pleural effusions: Although not common, they may occur and should be differentiated from the edema related to ARDS.

CT imaging not only aids in confirming the diagnosis of ARDS but also provides

information about underlying causes, such as infections or embolic events, which may concurrently contribute to respiratory failure [27].

Evidence-Based Nursing Management Strategies:

Acute Respiratory Distress Syndrome (ARDS) is a life-threatening condition characterized by severe inflammation of the lungs, resulting in hypoxemia (low blood oxygen levels) and respiratory failure. It can be precipitated by various etiological factors, including pneumonia, sepsis, trauma, and aspiration. The management of ARDS requires a multidisciplinary approach, with nursing care playing a critical role in optimizing patient outcomes. This essay explores evidence-based nursing management strategies for patients with ARDS, emphasizing the importance of early identification, supportive care, mechanical ventilation, fluid management, and psychological support [28].

ARDS is defined by the Berlin definition, which classifies the syndrome based on the timing of onset, chest imaging, origin of edema, and the degree of hypoxemia. ARDS is characterized by three stages: mild (P/F ratio 200-300 mmHg), moderate (P/F ratio 100-200 mmHg), and severe (P/F ratio <100 mmHg). The complex pathophysiology involves damage to the alveolar-capillary membrane, leading to increased permeability and pulmonary edema, which can compromise gas exchange [28].

Nurses must have a thorough understanding of ARDS to promptly identify its signs and symptoms, which include acute onset dyspnea, tachypnea, hypoxemia despite oxygen therapy, and bilateral infiltrates on chest imaging [29].

Early recognition of ARDS is crucial in improving outcomes. Nurses must be vigilant in monitoring patients at risk, particularly those with known risk factors such as sepsis, pneumonia, or history of trauma. Routine assessments of vital signs, respiratory status, and oxygen saturation levels are imperative. The use of standardized assessment tools, such as the ARDS severity score, can help quantify the impact of the syndrome and guide management plans [30].

Additionally, regular assessment for complications such as ventilator-associated pneumonia (VAP), pressure injuries, and delirium is necessary. Continuous monitoring of laboratory values, including blood gases, electrolytes, and infection markers, enables timely interventions [31].

Supportive care is a cornerstone of managing patients with ARDS. Providing supplemental oxygen is often the first step in addressing hypoxemia. If patients are unable to maintain adequate oxygen levels despite high-flow oxygen, non-invasive ventilation (NIV) or mechanical ventilation may be indicated. Nurses should be proficient in setting up oxygen delivery systems and understanding their indications and limitations [31].

Positioning the patient plays a significant role in optimizing lung function. The practice of prone positioning has gained evidence as an effective strategy for improving oxygenation in severe ARDS cases. Studies demonstrate that proning enhances lung recruitment and reduces shunting, ultimately improving survival rates. Nurses must be skilled in safely repositioning patients and monitoring their respiratory status closely during and after the intervention [31].

When patients progress to require mechanical ventilation, nursing management strategies become more specialized. The application of lung-protective ventilation strategies is critical. This involves using low tidal volumes (6 ml/kg of predicted body weight) to minimize ventilator-induced lung injury while maintaining sufficient minute ventilation [32].

Nurses must monitor plateau pressures and tidal volumes strictly, ensuring compliance with ventilator settings, and be alert for signs of barotrauma or volutrauma. Sedation and analgesia protocols must also be tailored to the patient, balancing comfort with the need for spontaneous breathing trials as the patient stabilizes [32].

Nurses should also be integral in implementing protocols for weaning off mechanical ventilation, which includes assessing readiness based on improved PaO2, respiratory mechanics, and consciousness levels [33].

Fluid management in ARDS is a delicate balance. Overzealous fluid resuscitation can lead to volume overload and worsen pulmonary edema, while under-resuscitation can compromise perfusion. Evidence supports the use of conservative fluid management strategies that prioritize minimizing extravascular lung water. Nurses play a vital role in monitoring input and output, tracking daily weights, and being aware of signs of fluid overload [34].

Nutritional support is essential in managing patients with ARDS, as these patients often experience hypermetabolism and catabolism due to critical illness. Enteral nutrition is typically preferred, as it can help maintain gut integrity and reduce infection risk. Nursing interventions should focus on ensuring proper feeding protocols, monitoring tolerance, and adapting to potential complications such as gastric residuals [35].

The impact of ARDS extends beyond the physiological entanglements; it inevitably affects the psychological well-being of patients and their families. Patients may experience anxiety, depression, post-traumatic stress disorder (PTSD), or delirium, necessitating comprehensive psychosocial support. Nurses should assess patients' mental health needs routinely, applying evidence-based interventions such as creating a calm environment, utilizing family engagement, and promoting early mobilization when the patient is stable [36].

Supporting the family is equally important, as they often experience emotional distress when faced with the uncertainty of their loved one's prognosis. Open communication, providing regular updates on patient status, and facilitating family meetings can foster a supportive healing environment [36].

Multidisciplinary Approach to ARDS Care:

Acute Respiratory Distress Syndrome (ARDS) is a critical condition characterized by widespread inflammation in the lungs, leading to severe hypoxemia and respiratory failure. The management of ARDS presents significant challenges due to its complex pathophysiology and the potential for rapid deterioration in patient condition. A multidisciplinary approach to ARDS care has emerged as a vital model, integrating diverse clinical expertise to enhance patient outcomes. This essay delves into the rationale behind this approach, explores the roles of various healthcare professionals, and outlines effective strategies to coordinate care [37].

To appreciate the importance of a multidisciplinary approach, it is essential first to understand the underlying process of ARDS. The syndrome results from various insults to the lung, including pneumonia, sepsis, trauma, and inhalation injuries, among others. These insults lead to the activation of inflammatory pathways, resulting in increased permeability of the alveolar-capillary membrane, pulmonary edema, and impaired gas exchange. Clinicians must not only address the immediate respiratory failure but also consider the underlying cause of the ARDS, potential complications, and long-term outcomes such as physical disability or psychological distress among survivors [38].

Given the complex nature of ARDS, a single-discipline approach often falls short of addressing the myriad factors affecting patient recovery. The multidisciplinary model prioritizes collaboration among various healthcare professionals, including intensivists, nurses, respiratory therapists, pharmacists, nutritionists, and rehabilitation specialists. This collaboration is essential not only in providing comprehensive care but also in fostering effective communication and coordination that are critical in a high-stakes environment such as the intensive care unit (ICU) [39].

Roles of Healthcare Professionals

1. Intensivists and Pulmonologists: Physicians with expertise in critical care medicine and pulmonary diseases are crucial in

diagnosing ARDS and managing its treatment protocols, which may include mechanical ventilation, pharmacologic interventions, and the identification and treatment of comorbid conditions. They lead the decision-making process regarding the initiation of advanced therapies such as prone positioning, neuromuscular blockade, or extracorporeal membrane oxygenation (ECMO) for the most severe cases [40].

2. Nurses: Nursing teams play a central role in patient monitoring, assessment, and management. ICU nurses provide around-the-clock care, vital sign monitoring, and timely interventions. They are also responsible for implementing sedation protocols, managing ventilator settings, and ensuring that patients' comfort and hygiene needs are met. Furthermore, nurses are often the primary communicators with families, providing updates and emotional support during an incredibly stressful time [40].

3. Respiratory Therapists: These specialists are essential for assessing and managing patients' respiratory status. They have expertise in ventilation strategies and ensure the proper function of respiratory equipment. Through active involvement in ventilator management and adjustment of support modalities, they contribute significantly to ensuring adequate oxygenation and ventilation in ARDS patients [40].

4. Pharmacists: Clinical pharmacists ensure that patients receive appropriate medications, including sedation, analgesia, antibiotics, and lung-protective pharmacotherapy. They play a vital role in optimizing medication regimens, monitoring for drug interactions, and advising the healthcare team on best practices for medication administration [41].

5. Nutritionists: In critically ill patients, nutritional support is paramount to preserve lean body mass and prevent infection. Dietitians assess caloric and protein needs, developing early enteral nutrition plans to ensure optimal metabolic care. They collaborate with the medical team to modify nutrition plans based on a patient's clinical status [41].

6. Rehabilitation Specialists: Early mobilization is increasingly recognized as a critical component of ARDS care. Rehabilitation teams, including physiotherapists and occupational therapists, work with patients to maintain mobility and reduce the risk of ICU-acquired weakness. Early intervention can significantly improve recovery trajectories, preventing Long COVID syndromes and other complications associated with prolonged bed rest [41].

For the multidisciplinary approach to be effective, clear communication and coordinated efforts are essential. Regular interdisciplinary rounds should be established to ensure that all team members are informed of each patient's status, care plans, and changes in condition. Utilizing electronic health records efficiently can streamline communication and access to patient information, enabling quick decision-making [42].

Standardized protocols and guidelines can facilitate consistency in care delivery. The ARDSnet protocols for mechanical ventilation, for example, have provided an evidence-based framework that integrates the knowledge and expertise of multiple disciplines. Ensuring team members understand their distinctive roles and responsibilities fosters a culture of teamwork that can lead to improved patient outcomes [42].

Additionally, family involvement in care is an often-overlooked aspect of the multidisciplinary approach. Healthcare teams should prioritize communication with the patient’s family—keeping them informed and engaged in decision-making. Providing education on ARDS and its treatment can help families understand the severity of the situation and foster a supportive environment that can contribute to patient recovery [42].

Nursing Interventions and Patient Education in ARDS Management:

Acute Respiratory Distress Syndrome (ARDS) is a severe inflammatory condition

characterized by widespread alveolar damage and increased permeability of the pulmonary capillaries, resulting in pulmonary edema, severe hypoxemia, and reduced lung compliance. ARDS can occur in various clinical contexts, including trauma, pneumonia, sepsis, and aspiration. Given the complexity and severity of ARDS, effective management necessitates a multidisciplinary approach, with nursing interventions and patient education playing pivotal roles. This essay explores essential nursing interventions and strategies for patient education in the management of ARDS [43].

Before delving into nursing interventions and patient education, it is crucial to understand the pathophysiology of ARDS. It typically presents with acute onset of dyspnea and hypoxemia within one week of a known insult. Clinically, it is classified into three stages based on the Berlin definition: mild, moderate, and severe ARDS. The management of ARDS is centered on improving oxygenation, supporting lung function, and treating the underlying cause. However, due to the complexity of the syndrome, healthcare providers, particularly nurses, must implement targeted interventions to optimize patient outcomes [44].

Nursing Interventions in ARDS Management

1. Assessment and Monitoring: Thorough assessment and continuous monitoring are essential nursing responsibilities in ARDS management. Nurses must routinely evaluate the patient's vital signs, oxygen saturation levels, respiratory patterns, and lung sounds. Early identification of deterioration in respiratory status enables prompt interventions, which can significantly improve patient outcomes [46].

2. Oxygen Therapy: Administering supplemental oxygen is a fundamental nursing intervention for patients with ARDS. Nurses must ensure that patients receive the appropriate mode of oxygen delivery (nasal cannula, masks, or high-flow nasal cannula), titrating the oxygen levels to maintain adequate saturation (usually ≥ 92%) [47].

3. Mechanical Ventilation Management: In moderate to severe cases of ARDS, mechanical ventilation often becomes necessary. Nurses play a crucial role in ventilator management, ensuring settings are optimized to provide effective ventilation while minimizing ventilator-induced lung injury (VILI). This involves monitoring tidal volumes, airway pressures, and addressing patient-ventilator synchrony [47].

4. Positioning: The positioning of ARDS patients can significantly affect their oxygenation and comfort. Prone positioning has been shown to improve ventilation-perfusion matching and oxygenation in ARDS patients. Nurses should collaborate with the healthcare team to safely reposition patients, especially those with moderate to severe ARDS [48].

5. Fluid Management: Patients with ARDS are at risk for both hypovolemia and fluid overload. Nurses must carefully monitor fluid intake and output, assessing for signs of fluid overload (such as edema or worsening pulmonary congestion) and implementing fluid restriction protocols as necessary [49].

6. Sedation and Analgesia: ARDS patients often require sedation and analgesia, especially if they are on mechanical ventilation. Nurses must be vigilant in assessing pain and discomfort, as well as adjusting sedation levels to ensure patient comfort without over-sedation, which can compromise respiratory drive [50].

7. Preventing Complications: ARDS entails a risk of complications, including venous thromboembolism and pressure ulcers. Nurses must implement preventive measures, such as ensuring appropriate use of anticoagulants and regular skin assessments, to mitigate these risks [51].

8. Psychosocial Support: The experience of ARDS can be traumatic for patients and their families. Nurses should provide emotional support, facilitating communication and addressing concerns about prognosis and treatment goals. Incorporating family members

into care discussions fosters a collaborative approach to managing the patient's illness [52].

Patient Education in ARDS Management

Patient education plays a critical role in ARDS management, particularly when it comes to preventative measures, understanding treatment protocols, and recovery expectations. While many patients may be unconscious or intubated during the acute phase, education will become increasingly relevant as their respiratory status improves [53].

1. Explaining the Condition: Once a patient is stable, providing clear and concise information about ARDS, including its causes, treatment, and prognosis, is essential. Patients and their families should understand the nature of ARDS, emphasizing the importance of timely intervention and the potential for recovery [54].

2. Guidance on Treatment Plan: Nurses should educate patients about the treatment plan, including information on mechanical ventilation, oxygen therapy, and the rationale behind fluid management strategies. Understanding the treatment process may alleviate anxiety and empower patients during their recovery [55].

3. Rehabilitation and Recovery: Education on the potential long-term effects of ARDS, including respiratory issues or reduced exercise tolerance, is essential. Nurses should inform patients about pulmonary rehabilitation programs and encourage participation in such programs post-discharge to enhance lung function and overall recovery [56].

4. Recognizing Red Flags: Teaching patients to recognize signs of potential complications or exacerbation of their condition is vital. Patients should understand when to seek medical attention, whether for difficulty breathing, increasing fatigue, or other concerning symptoms [57].

5. Promoting Self-Management: Encouraging patients to actively participate in their recovery process is crucial. This includes teaching them about deep breathing exercises, incentive spirometry to improve lung function, and emphasizing the importance of adherence to prescribed medications and follow-up appointments [58].

6. Support Resources: Finally, nurses should provide information on available support resources, such as support groups for patients recovering from critical illness or educational materials about ARDS and respiratory health. This helps in fostering a supportive community for patients navigating their recovery [59].

Conclusion:

In conclusion, the nursing assessment and management of acute respiratory distress syndrome (ARDS) are critical components in improving patient outcomes and mitigating the severity of this life-threatening condition. A thorough understanding of the pathophysiology, clinical presentation, and appropriate assessment techniques enables nurses to identify ARDS early and implement timely interventions. Evidence-based management strategies, including the optimization of oxygenation, mechanical ventilation support, and fluid management, are essential in stabilizing patients and enhancing recovery. Furthermore, the importance of a collaborative multidisciplinary approach cannot be overstated, as it promotes comprehensive care and supports optimal decision-making in complex clinical scenarios. By focusing on patient-centered communication and education, nurses play a pivotal role in promoting awareness and enabling active participation from patients and their families in the management of ARDS. Ongoing education and training for nursing professionals are vital in maintaining competency and readiness to face the challenges presented by ARDS, ultimately contributing to improved patient outcomes and quality of care.

WORKS CITED

Sharma NS, Lal CV, Li JD, Lou XY, Viera L, Abdallah T, King RW, Sethi J, Kanagarajah P, Restrepo-Jaramillo R, Sales-Conniff A, Wei S, Jackson PL, Blalock JE, Gaggar A, Xu X. The neutrophil chemoattractant peptide proline-glycine-proline is associated with acute respiratory distress syndrome. Am J Physiol Lung Cell Mol Physiol. 2018 Nov 01;315(5):L653-L661.

Gajic O, Dabbagh O, Park PK, Adesanya A, Chang SY, Hou P, Anderson H, Hoth JJ, Mikkelsen ME, Gentile NT, Gong MN, Talmor D, Bajwa E, Watkins TR, Festic E, Yilmaz M, Iscimen R, Kaufman DA, Esper AM, Sadikot R, Douglas I, Sevransky J, Malinchoc M., U.S. Critical Illness and Injury Trials Group: Lung Injury Prevention Study Investigators (USCIITG-LIPS). Early identification of patients at risk of acute lung injury: evaluation of lung injury prediction score in a multicenter cohort study. Am J Respir Crit Care Med. 2011 Feb 15;183(4):462-70.

Rawal G, Yadav S, Kumar R. Acute Respiratory Distress Syndrome: An Update and Review. J Transl Int Med. 2018 Jun;6(2):74-77.

Bellani G, Laffey JG, Pham T, Fan E, Brochard L, Esteban A, Gattinoni L, van Haren F, Larsson A, McAuley DF, Ranieri M, Rubenfeld G, Thompson BT, Wrigge H, Slutsky AS, Pesenti A., LUNG SAFE Investigators. ESICM Trials Group. Epidemiology, Patterns of Care, and Mortality for Patients With Acute Respiratory Distress Syndrome in Intensive Care Units in 50 Countries. JAMA. 2016 Feb 23;315(8):788-800.

Vieillard-Baron A, Schmitt JM, Augarde R, Fellahi JL, Prin S, Page B, Beauchet A, Jardin F. Acute cor pulmonale in acute respiratory distress syndrome submitted to protective ventilation: incidence, clinical implications, and prognosis. Crit Care Med. 2001 Aug;29(8):1551-5.

Zambon M, Vincent JL. Mortality rates for patients with acute lung injury/ARDS have decreased over time. Chest. 2008 May;133(5):1120-7.

National Heart, Lung, and Blood Institute Acute Respiratory Distress Syndrome (ARDS) Clinical Trials Network. Wiedemann HP, Wheeler AP, Bernard GR, Thompson BT, Hayden D, deBoisblanc B, Connors AF, Hite RD, Harabin AL. Comparison of two fluid-management strategies in acute lung injury. N Engl J Med. 2006 Jun 15;354(24):2564-75.

Sedhai YR, Yuan M, Ketcham SW, Co I, Claar DD, McSparron JI, Prescott HC, Sjoding MW. Validating Measures of Disease Severity in Acute Respiratory Distress Syndrome. Ann Am Thorac Soc. 2021 Jul;18(7):1211-1218.

Huang D, Ma H, Xiao Z, Blaivas M, Chen Y, Wen J, Guo W, Liang J, Liao X, Wang Z, Li H, Li J, Chao Y, Wang XT, Wu Y, Qin T, Su K, Wang S, Tan N. Diagnostic value of cardiopulmonary ultrasound in elderly patients with acute respiratory distress syndrome. BMC Pulm Med. 2018 Aug 13;18(1):136.

Guérin C, Reignier J, Richard JC, Beuret P, Gacouin A, Boulain T, Mercier E, Badet M, Mercat A, Baudin O, Clavel M, Chatellier D, Jaber S, Rosselli S, Mancebo J, Sirodot M, Hilbert G, Bengler C, Richecoeur J, Gainnier M, Bayle F, Bourdin G, Leray V, Girard R, Baboi L, Ayzac L., PROSEVA Study Group. Prone positioning in severe acute respiratory distress syndrome. N Engl J Med. 2013 Jun 06;368(23):2159-68.

Wang Y, Zhang L, Xi X, Zhou JX., China Critical Care Sepsis Trial (CCCST) Workgroup. The Association Between Etiologies and Mortality in Acute Respiratory Distress Syndrome: A Multicenter Observational Cohort Study. Front Med (Lausanne). 2021;8:739596.

Cherian SV, Kumar A, Akasapu K, Ashton RW, Aparnath M, Malhotra A. Salvage therapies for refractory hypoxemia in ARDS. Respir Med. 2018 Aug;141:150-158.

National Heart, Lung, and Blood Institute PETAL Clinical Trials Network. Moss M, Huang DT, Brower RG, Ferguson ND, Ginde AA, Gong MN, Grissom CK, Gundel S, Hayden D, Hite RD, Hou PC, Hough CL, Iwashyna TJ, Khan A, Liu KD, Talmor D, Thompson BT, Ulysse CA, Yealy DM, Angus DC. Early Neuromuscular Blockade in the Acute Respiratory Distress Syndrome. N Engl J Med. 2019 May 23;380(21):1997-2008.

Shrestha GS, Khanal S, Sharma S, Nepal G. COVID-19: Current Understanding of Pathophysiology. J Nepal Health Res Counc. 2020 Nov 13;18(3):351-359.

Chen WL, Lin WT, Kung SC, Lai CC, Chao CM. The Value of Oxygenation Saturation Index in Predicting the Outcomes of Patients with Acute Respiratory Distress Syndrome. J Clin Med. 2018 Aug 08;7(8).

Villar J, Schultz MJ, Kacmarek RM. The LUNG SAFE: a biased presentation of the prevalence of ARDS! Crit Care. 2016 Apr 25;20(1):108.

Yang P, Formanek P, Scaglione S, Afshar M. Risk factors and outcomes of acute respiratory distress syndrome in critically ill patients with cirrhosis. Hepatol Res. 2019 Mar;49(3):335-343.
Combes A, Hajage D, Capellier G, Demoule A, Lavoué S, Guervilly C, Da Silva D, Zafrani L, Tirot P, Veber B, Maury E, Levy B, Cohen Y, Richard C, Kalfon P, Bouadma L, Mehdaoui H, Beduneau G, Lebreton G, Brochard L, Ferguson ND, Fan E, Slutsky AS, Brodie D, Mercat A. EOLIA Trial Group, REVA, and ECMONet. Extracorporeal Membrane Oxygenation for Severe Acute Respiratory Distress Syndrome. N Engl J Med. 2018 May 24;378(21):1965-1975.
Brodie D, Bacchetta M. Extracorporeal membrane oxygenation for ARDS in adults. N Engl J Med. 2011 Nov 17;365(20):1905-14.
Rodrigo C, Leonardi-Bee J, Nguyen-Van-Tam J, Lim WS. Corticosteroids as adjunctive therapy in the treatment of influenza. Cochrane Database Syst Rev. 2016 Mar 07;3:CD010406.
Annane D, Pastores SM, Rochwerg B, Arlt W, Balk RA, Beishuizen A, Briegel J, Carcillo J, Christ-Crain M, Cooper MS, Marik PE, Umberto Meduri G, Olsen KM, Rodgers S, Russell JA, Van den Berghe G. Correction to: Guidelines for the diagnosis and management of critical illness-related corticosteroid insufficiency (CIRCI) in critically ill patients (Part I): Society of Critical Care Medicine (SCCM) and European Society of Intensive Care Medicine (ESICM) 2017. Intensive Care Med. 2018 Mar;44(3):401-402.
Gadre SK, Duggal A, Mireles-Cabodevila E, Krishnan S, Wang XF, Zell K, Guzman J. Acute respiratory failure requiring mechanical ventilation in severe chronic obstructive pulmonary disease (COPD). Medicine (Baltimore). 2018 Apr;97(17):e0487.
Chiumello D, Coppola S, Froio S, Gotti M. What's Next After ARDS: Long-Term Outcomes. Respir Care. 2016 May;61(5):689-99.
Anand R, McAuley DF, Blackwood B, Yap C, ONeill B, Connolly B, Borthwick M, Shyamsundar M, Warburton J, Meenen DV, Paulus F, Schultz MJ, Dark P, Bradley JM. Mucoactive agents for acute respiratory failure in the critically ill: a systematic review and meta-analysis. Thorax. 2020 Aug;75(8):623-631.
Bos LD, Cremer OL, Ong DS, Caser EB, Barbas CS, Villar J, Kacmarek RM, Schultz MJ. MARS consortium. External validation confirms the legitimacy of a new clinical classification of ARDS for predicting outcome. Intensive Care Med. 2015 Nov;41(11):2004-5.
Young D, Lamb SE, Shah S, et al. OSCAR Study Group. High-frequency oscillation for acute respiratory distress syndrome. N Engl J Med 2013;368:806–13.
Bernard GR, Artigas A, Brigham KL, et al. The American-European Consensus Conference on ARDS. Definitions, mechanisms, relevant outcomes, and clinical trial coordination. Am J Respir Crit Care Med 1994;149:818–24.
Bellani G, Laffey JG, Pham T, et al. LUNG SAFE Investigators; ESICM Trials Group. Epidemiology, patterns of care, and mortality for patients with acute respiratory distress syndrome in intensive care units in 50 countries. JAMA 2016; 315:788–800.
Guérin C, Reignier J, Richard J-C, et al. PROSEVA Study Group. Prone positioning in severe acute respiratory distress syndrome. N Engl J Med 2013;368:2159–68.
Alhazzani W, Belley-Cote E, Møller MH, et al. Neuromuscular blockade in patients with ARDS: a rapid practice guideline. Intensive Care Med 2020;46:1977–86.
Ferguson ND, Cook DJ, Guyatt GH, et al. OSCILLATE Trial Investigators; Canadian Critical Care Trials Group. High-frequency oscillation in early acute respiratory distress syndrome. N Engl J Med 2013;368:795–805.
Laffey JG, Madotto F, Bellani G, et al. LUNG SAFE Investigators; ESICM Trials Group. Geo-economic variations in epidemiology, patterns of care, and outcomes in patients with acute respiratory distress syndrome: insights from the LUNG SAFE prospective cohort study. Lancet Respir Med 2017;5:627–38.
Papazian L, Aubron C, Brochard L, et al. Formal guidelines: management of acute respiratory distress syndrome. Ann Intensive Care 2019;9:69.
Fan E, Del Sorbo L, Goligher EC, et al. American Thoracic Society; European Society of Intensive Care Medicine; Society of Critical Care Medicine. An official American Thoracic Society/European Society of Intensive Care Medicine/Society of Critical Care Medicine clinical practice guideline: mechanical ventilation in adult patients with acute respiratory distress syndrome. Am J Respir Crit Care Med 2017;195:1253–63.
Herridge MS, Tansey CM, Matté A, et al. Canadian Critical Care Trials Group. Functional disability 5 years after acute respiratory distress syndrome. N Engl J Med 2011;364:1293–304.

Briel M, Meade M, Mercat A, et al. Higher vs lower positive end-expiratory pressure in patients with acute lung injury and acute respiratory distress syndrome: systematic review and meta-analysis. JAMA 2010;303:865–73.

Papazian L, Forel JM, Gacouin A, et al. ACURASYS Study Investigators. Neuromuscular blockers in early acute respiratory distress syndrome. N Engl J Med 2010;363:1107–16.

Amato MB, Barbas CS, Medeiros DM, et al. Effect of a protective-ventilation strategy on mortality in the acute respiratory distress syndrome. N Engl J Med 1998;338:347–54.

National Heart, Lung, and Blood Institute PETAL Clinical Trials Network; Moss M, Huang DT, Brower RG, et al. Early neuromuscular blockade in the acute respiratory distress syndrome. N Engl J Med 2019;380:1997–2008.

Fan E, Brodie D, Slutsky AS. Acute respiratory distress syndrome: advances in diagnosis and treatment. JAMA 2018;319:698–710.

Griffiths MJD, McAuley DF, Perkins GD, et al. Guidelines on the management of acute respiratory distress syndrome. BMJ Open Respir Res 2019;6:e000420.

Ashbaugh DG, Bigelow DB, Petty TL, et al. Acute respiratory distress in adults. Lancet 1967;2:319–23.

Herridge MS, Cheung AM, Tansey CM, et al. Canadian Critical Care Trials Group. One-year outcomes in survivors of the acute respiratory distress syndrome. N Engl J Med 2003;348:683–93.

ARDS Definition Task Force; Ranieri VM, Rubenfeld GD, Thompson BT, et al. Acute respiratory distress syndrome: the Berlin Definition. JAMA 2012;307:2526–33.

Ferguson ND, Fan E, Camporota L, et al. The Berlin Definition of ARDS: an expanded rationale, justification, and supplementary material. Intensive Care Med 2012;38:1573–82.

Bellani G, Laffey JG, Pham T, et al. LUNG SAFE Investigators; ESICM Trials Group. Noninvasive ventilation of patients with acute respiratory distress syndrome. Insights from the LUNG SAFE study. Am J Respir Crit Care Med 2017;195:67–77.

Cochi SE, Kempker JA, Annangi S, et al. Mortality trends of acute respiratory distress syndrome in the United States from 1999 to 2013. Ann Am Thorac Soc 2016;13:1742–51.

Laffey JG, Madotto F, Bellani G, et al. LUNG SAFE Investigators; ESICM Trials Group. Geo-economic variations in epidemiology, patterns of care, and outcomes in patients with acute respiratory distress syndrome: insights from the LUNG SAFE prospective cohort study. Lancet Respir Med 2017;5:627–38.

Spinelli E, Mauri T, Beitler JR, et al. Respiratory drive in the acute respiratory distress syndrome: pathophysiology, monitoring, and therapeutic interventions. Intensive Care Med 2020;46:606–18.

Zhou Y, Jin X, Lv Y, et al. Early application of airway pressure release ventilation may reduce the duration of mechanical ventilation in acute respiratory distress syndrome. Intensive Care Med 2017;43:1648–59.

Gattinoni L, Chiumello D, Caironi P, et al. COVID-19 pneumonia: Different respiratory treatments for different phenotypes? Intensive Care Med 2020;46:1099–102.

McGrath BA, Brenner MJ, Warrillow SJ, et al. Tracheostomy in the COVID-19 era: global and multidisciplinary guidance. Lancet Respir Med 2020;8:717–25.

WHO Rapid Evidence Appraisal for COVID-19 Therapies (REACT) Working Group; Sterne JAC, Murthy S, Diaz JV, et al. Association between administration of systemic corticosteroids and mortality among critically ill patients with COVID-19: a meta-analysis. JAMA 2020;324:1330–41.

Calfee CS, Delucchi K, Parsons PE, et al. NHLBI ARDS Network. Subphenotypes in acute respiratory distress syndrome: latent class analysis of data from two randomised controlled trials. Lancet Respir Med 2014;2:611–20.

Alhazzani W, Evans L, Alshamsi F, et al. Surviving sepsis campaign guidelines on the management of adults with coronavirus disease 2019 (COVID-19) in the ICU: first update. Crit Care Med 2021;49:e219–34.

Tobin MJ, Laghi F, Jubran A. P-SILI is not justification for intubation of COVID-19 patients. Ann Intensive Care 2020;10:105.

Gattinoni L, Coppola S, Cressoni M, et al. COVID-19 does not lead to a “typical” acute respiratory distress syndrome. Am J Respir Crit Care Med 2020;201:1299–300.

REMAP-CAP Investigators; Gordon AC, Mouncey PR, Al-Beidh F, et al. Interleukin-6 receptor antagonists in critically ill patients with COVID-19. N Engl J Med 2021;384:1491–502.

Schenck EJ, Hoffman K, Goyal P, et al. Respiratory mechanics and gas exchange in COVID-19-associated respiratory failure. Ann Am Thorac Soc 2020;17:1158–61.