

SEPSIS-INDUCED RESPIRATORY COMPLICATIONS AND ACUTE RESPIRATORY DISTRESS SYNDROME (ARDS)

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Abstract

Introduction: Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection, with the lungs being the most frequent and early target organ damaged. The spectrum of sepsis-induced respiratory complications ranges from mild hypoxemia to severe, life-threatening acute respiratory distress syndrome (ARDS).

Objective: The objective of this review is to provide a comprehensive systematization of the epidemiological indicators, pathophysiological mechanisms, and contemporary therapeutic management strategies for sepsis-induced respiratory complications and ARDS.

Global data indicate that sepsis serves as the underlying etiology in 30-50% of patients hospitalized with ARDS. Within intensive care units (ICUs), ARDS develops in 6-10% of septic patients, whereas in cases of severe sepsis and septic shock, this rate reaches up to 40%. The mortality rate associated with sepsis-induced ARDS remains high, ranging between 35% and 45%. The pathophysiological hallmark of sepsis-associated ARDS involves the excessive production of pro-inflammatory cytokines (TNF- α , IL-1, IL-6), neutrophil aggregation, endothelial leak, and alveolar edema. Neutrophils release proteolytic enzymes and reactive oxygen species (ROS), damaging the alveolar-capillary membrane. Disruption of both epithelial and endothelial barriers increases vascular permeability, resulting in the accumulation of protein-rich exudate within the alveoli. Damage to type II pneumocytes reduces surfactant production, leading to alveolar collapse, microatelectasis, and ventilation-perfusion mismatch.

Diagnosis and Assessment The diagnosis of ARDS is based on the Berlin Definition criteria: **Timing (Onset):** Respiratory failure symptoms must manifest or worsen within 1 week of a known clinical risk factor (e.g., pneumonia, sepsis, trauma). **Radiological Findings (Imaging):** Chest radiograph or computed tomography (CT) scan reveals bilateral infiltrates that are not fully explained by lung collapse, nodules, or pleural effusion. **Origin of Edema:** Respiratory failure and pulmonary edema must not be fully explained by heart failure or fluid overload (hypervolemia). **Oxygenation and Severity Classification :** The severity of the condition is determined by the ratio of arterial oxygen partial pressure to fractional inspired oxygen (PaO₂/FiO₂ ratio) while the patient is receiving positive end-expiratory pressure (PEEP) or continuous positive airway pressure (CPAP) of ≥ 5 cm H₂O. **Expanded Support:** Diagnosis now permits high-flow nasal oxygenation (HFNO ≥ 30 L/min) rather than relying solely on invasive mechanical ventilation. **Ultrasound:** Lung ultrasound (LUS) has been officially integrated alongside chest radiography for thoracic visualization. **New Index:** As an alternative to arterial blood gas analysis (PaO₂), using pulse oximetry data with an SpO₂/FiO₂ ≤ 315 index is also acceptable.

Contemporary Therapeutic Strategies Effective sepsis management entails the immediate initiation of antimicrobial therapy and timely source control. For respiratory support, lung-protective ventilation plays a pivotal role; specifically, limiting tidal volume to 4-8 mL/kg of predicted body weight and maintaining plateau pressure below 30 cm H₂O, which significantly reduces the risk of volutrauma and barotrauma. Furthermore, adequate PEEP titration and selection of optimal parameters are essential to prevent alveolar collapse. In severe ARDS (PaO₂/FiO₂ < 150), prone positioning for at least 16 hours per day significantly

reduces mortality. Concurrently , implementing conservative fluid therapy effectively decreases duration of mechanical ventilation and ICU length of stay.

Conclusion Sepsis-induced respiratory complications and ARDS remain leading causes of morbidity and mortality in intensive care. Early identification of epidemiological risk factors, clear understanding of pathophysiology, and timely implementation of lung –protective ventilation protocols are critically important for improving patient outcomes .

References

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