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ACUTE RESPIRATORY DISTRESS SYNDROME IN BURN PATIENTS

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Abstract

Acute Respiratory Distress Syndrome (ARDS) represents a severe pulmonary complication that may develop following burn injury. Its pathogenesis involves either direct damage to lung tissue caused by inhalation of smoke and toxic gases or an indirect systemic inflammatory response triggered by burn trauma and subsequent infections.

This prospective cohort study was conducted between January and December 2025 to evaluate the incidence, severity, and determinants of ARDS among burn patients. Clinical, demographic, and prognostic data, including burn extent and depth, were systematically collected.

A total of 85 patients were included. The mean total body surface area (TBSA) affected was 28.3%, and inhalation injury was identified in 35.3% of cases. ARDS developed in 38.6% of patients requiring invasive mechanical ventilation. Mortality remained high and demonstrated a strong association with ARDS occurrence.

Keywords

burn injury, ARDS, risk factors, intensive care, mortality

Introduction.

Acute Respiratory Distress Syndrome is characterized by rapid onset of severe hypoxemia resulting from diffuse alveolar damage. This condition is primarily driven by inflammatory mechanisms that lead to increased permeability of the alveolar-capillary membrane and accumulation of protein-rich fluid within the pulmonary interstitium.

In patients with burn injuries, ARDS may arise through multiple pathways. Direct inhalation of smoke and toxic substances causes immediate damage to airway structures, while systemic inflammatory responses contribute to secondary lung injury. Moreover, extensive burns induce generalized capillary leakage not only at the site of injury but also in distant organs, including the lungs.

This systemic permeability promotes interstitial edema and worsens pulmonary function, especially when combined with inhalation trauma. Understanding the epidemiological characteristics and clinical predictors of ARDS in burn patients is essential for improving prevention strategies and optimizing treatment outcomes.

The present study aims to determine the incidence of ARDS and identify its major risk factors in adult patients with thermal injuries.

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Material and methods.

A prospective observational cohort study was performed in the intensive care unit (ICU) specializing in burn management at Samarkand State Medical University. All adult patients admitted between January 1 and December 31, 2025, were consecutively enrolled.

Patient data were extracted from medical records and included demographic characteristics, clinical diagnosis, timing of injury, admission details, and hospital outcomes. Particular attention was given to burn severity, including total body surface area involvement and depth of tissue damage.

Inhalation injury was suspected based on clinical indicators such as exposure to fire in enclosed spaces, facial burns, singed nasal hairs, carbonaceous sputum, voice changes, or respiratory distress. Diagnostic bronchoscopy was used to confirm airway injury. Patients with significant airway edema were intubated, and mechanical ventilation was initiated when respiratory compromise was evident or anticipated.

The timing of ARDS onset, duration of mechanical ventilation, and patient outcomes at ICU discharge were recorded.

Results.

Eighty-five patients met the inclusion criteria. The median time from burn injury to ICU admission was two days. Severe burns (third-degree) were present in the majority of patients.

Mechanical ventilation was required in more than half of the cohort, with a median duration exceeding two weeks. Patients requiring ventilatory support had significantly larger burn areas compared to those who did not. Inhalation injury was particularly common in this group.

ARDS was diagnosed in 20% of all patients and in 38.6% of those receiving invasive ventilation. Patients who developed ARDS had a greater extent of burns compared to those without this complication.

Multivariate analysis identified inhalation injury as the most significant independent predictor of ARDS development.

Mortality rates were markedly higher among patients with ARDS compared to those without it.

Discussion.

The findings demonstrate a substantial incidence of ARDS among critically ill burn patients, particularly in those requiring mechanical ventilation. The strong association between inhalation injury and ARDS highlights the critical role of airway damage in disease pathogenesis.

Pathophysiologically, inhaled smoke introduces particulate matter composed of fibrin, inflammatory cells, mucus, and epithelial debris, leading to airway obstruction. This results in impaired ventilation, increased intrapulmonary shunting, and disruption of ventilation-perfusion balance.

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Additionally, mechanical ventilation may contribute to further lung injury through overdistension of alveoli and the release of inflammatory mediators, exacerbating pulmonary dysfunction.

The elevated mortality observed in this study is consistent with the severity of ARDS and may also reflect delayed hospital admission, comorbid conditions, and the presence of secondary complications such as infections and renal failure. Limited access to specialized burn care facilities may further contribute to adverse outcomes.

Although ICU stays were prolonged in patients with ARDS, overall hospital stay did not differ significantly, likely due to the extended recovery period required for burn treatment and rehabilitation.

Conclusion.

ARDS remains a frequent and severe complication in burn patients, especially among those requiring mechanical ventilation. Its development is strongly associated with inhalation injury and is linked to increased mortality.

Given the multifactorial nature of ARDS in burn patients, further research is necessary to refine preventive strategies, including optimized ventilation techniques and fluid management approaches, in order to improve patient survival.

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