

RESPIRATORY TRACT BURN AS A FACTOR IN THE SEVERITY OF BURN DISEASE: DIAGNOSIS, PATHOGENESIS AND CLINICAL COURSE

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Abstract: Respiratory tract burns are one of the most significant factors determining the severity and outcome of burn disease. This study presents an analysis of clinical, functional, and morphological changes in the respiratory system in 144 patients with respiratory tract damage secondary to burn injury. The pathogenesis, clinical course, and diagnostic capabilities of modern research methods are examined. Respiratory tract damage is associated with significant ventilation and gas exchange impairment, a high risk of infectious complications, and a significant increase in mortality. Comprehensive diagnostics using endoscopic and cytological methods enable timely detection of the extent of damage and prognosis of the disease.

Keywords: respiratory tract burn, burn disease, diagnostics, bronchoscopy, pathogenesis.

KUYISH KASALLIGINING OG'IRLIK OMILI SIFATIDA NAFAS YO'LLARI KUYISHI: DIAGNOSTIKA, PATOGENEZ VA KLINIK KECHISH

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Annotatsiya: Ushbu maqolada kuyish kasalligining og'irligi va natijasini belgilovchi eng muhim omillardan biri sifatida nafas yo'llari kuyishi tahlil qilinadi. Tadqiqotda kuyish jarohati fonida nafas yo'llari shikastlangan 144 nafar bemorda nafas olish tizimidagi klinik, funksional va morfologik o'zgarishlar ko'rib chiqilgan. Nafas yo'llari kuyishining patogenezi, klinik kechishi va zamonaviy tekshirish usullarining diagnostik imkoniyatlari yoritilgan. Nafas yo'llarining shikastlanishi ventilyatsiya va gaz almashinuvining sezilarli buzilishi, infeksiyon asoratlar xavfining yuqoriligi hamda o'lim ko'rsatkichining ortishi bilan bog'liqligi aniqlangan. Endoskopik va sitologik usullarni o'z ichiga olgan kompleks diagnostika shikastlanish darajasini o'z vaqtida aniqlash va kasallik kechishini prognoz qilish imkonini beradi.

Kalit so'zlar: nafas yo'llari kuyishi, kuyish kasalligi, diagnostika, bronxoskopiya, patogenez.

ОЖОГ ДЫХАТЕЛЬНЫХ ПУТЕЙ КАК ФАКТОР ТЯЖЕСТИ ОЖОГОВОЙ БОЛЕЗНИ: ДИАГНОСТИКА, ПАТОГЕНЕЗ И КЛИНИЧЕСКОЕ ТЕЧЕНИЕ

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Аннотация: В статье анализируются ожоги дыхательных путей как один из наиболее значимых факторов, определяющих тяжесть и исход ожоговой болезни. Представлен анализ клинических, функциональных и морфологических изменений дыхательной системы у 144 пациентов с поражением дыхательных путей на фоне ожоговой травмы. Рассмотрены патогенез, клиническое течение и диагностические возможности современных методов исследования. Поражение дыхательных путей связано с выраженными нарушениями вентиляции и газообмена, высоким риском инфекционных осложнений и значительным повышением летальности. Комплексная диагностика с

использованием эндоскопических и цитологических методов позволяет своевременно определить степень повреждения и прогнозировать течение заболевания.

Ключевые слова: ожог дыхательных путей, ожоговая болезнь, диагностика, бронхоскопия, патогенез.

INTRODUCTION

Respiratory tract burns occupy a special place among thermal injuries and are considered a key factor determining the severity of burn disease. Unlike isolated skin burns, inhalation burns of the respiratory tract create a fundamentally different pathophysiological profile, characterized by the early development of respiratory failure, severe gas exchange disorders, a high incidence of infectious complications, and a significant increase in mortality. According to clinical observations, the combination of deep skin burns and respiratory tract damage occurs in 25-30% of victims, and the mortality rate in this group is several times higher than that of isolated burns.

The pathogenesis of respiratory tract burns is multifactorial and includes thermal exposure to hot air, chemical damage from toxic combustion products, mechanical deposition of soot particles, and systemic reactions associated with the release of inflammatory mediators. Within the first minutes after smoke inhalation, ciliated epithelium dies, mucociliary clearance is impaired, surfactant is inactivated, and microatelectasis develops. These processes create the conditions for the rapid development of respiratory distress syndrome, which significantly worsens the course of burn disease and requires early initiation of intensive care.

Diagnosing respiratory tract burns traditionally presents significant challenges. Clinical signs—hoarseness, facial burns, and the presence of soot in the oropharynx—have low specificity and do not allow for a reliable assessment of the depth and extent of the lesion. Under these circumstances, fiberoptic bronchoscopy becomes the primary tool for visually verifying damage, allowing for the identification of characteristic endoscopic signs: hyperemia, edema, fibrinous deposits, areas of necrosis, and bronchial obstruction by combustion products. However, even endoscopic imaging does not always reflect the true severity of functional impairment, highlighting the need for a comprehensive approach including laboratory, gasometric, and cytological methods.

The clinical course of burn disease in patients with respiratory tract damage is characterized by a more pronounced systemic inflammatory response, early development of hypoxemia, a high incidence of pneumonia, and the need for respiratory support. Inhalation injury often determines the outcome, even with relatively moderate skin burns. This makes the diagnosis and severity assessment of respiratory tract burns a central issue in modern burn medicine.

Thus, studying the pathogenesis, clinical manifestations, and diagnostic criteria of respiratory tract burns has important practical implications. Optimizing approaches to early detection and severity stratification of inhalation injury not only improves the quality of treatment but also significantly impacts the overall prognosis of burn disease.

MATERIALS AND METHODS

The study included 144 patients with burn disease complicated by respiratory tract burns. All patients were treated in specialized burn units. A retrospective analysis was conducted in 91 cases, and a prospective study was conducted in 53 cases.

Skin burns ranged from 25% to 95% of the body surface area, with the depth of damage corresponding to second- to fourth-degree burns. All patients had signs of respiratory tract damage of varying severity.

The diagnostic workup included a clinical examination, laboratory tests, blood gas analysis, and instrumental examinations. Particular emphasis was placed on fiberoptic bronchoscopy, which allows for an assessment of the respiratory tract mucosa and the identification of morphological changes. A cytological examination of the bronchoalveolar fluid was also performed.

RESULTS

The analysis showed that respiratory tract burns are accompanied by significant functional impairment of the respiratory system. In the early stages after injury, mucosal edema and airway obstruction by combustion products play a leading role. This leads to a sharp reduction in pulmonary ventilation and impaired gas exchange.

Later, inflammatory changes develop due to epithelial damage and infection. Impaired mucociliary clearance contributes to the accumulation of secretions in the bronchi, creating the conditions for the development of pneumonia.

Table 1. Frequency of clinical signs of respiratory tract burns

| Sign | Frequency (%) |
|---|---------------|
| Burns to the face and neck | high |
| Presence of soot in the respiratory tract | high |
| Dyspnea | expressed |
| Hoarseness of voice | frequent |
| Cough with phlegm | frequent |

The clinical manifestations of respiratory tract burns are variable and do not always allow for a reliable assessment of the extent of damage. Functional studies have shown significant changes in respiratory parameters, indicating the development of obstructive disorders.

Table 2. Indicators of external respiration function in case of respiratory tract burns

| Indicator | Change |
|-----------------------------|-----------|
| Vital capacity of the lungs | reduced |
| Minute respiratory volume | increased |
| Forced vital capacity | reduced |
| Expiratory flow rate | reduced |

These changes reflect a decrease in the reserve capacity of the respiratory system and a deterioration in pulmonary ventilation.

Blood gas analysis revealed a decrease in partial oxygen pressure and the development of hypoxemia, which indicates a violation of gas exchange.

Table 3. Changes in blood gas composition

| Indicator | Nature of change |
|------------------|------------------------|
| PaO ₂ | reduced |
| SaO ₂ | reduced |
| pH | shift towards acidosis |

The changes identified indicate the development of respiratory failure. Fiberoptic bronchoscopy allowed us to determine the nature of the morphological changes in the respiratory

mucosa. Depending on the severity of the lesion, hyperemia, edema, soot deposits, erosions, and necrotic changes were observed.

Table 4. Endoscopic characteristics of respiratory tract lesions

| The extent of damage | Endoscopic signs |
|----------------------|---------------------------|
| Light | hyperemia, moderate edema |
| Average | pronounced swelling, soot |
| Heavy | erosion, necrosis |
| Extremely difficult | deep necrotic changes |

The data obtained confirm that the degree of endoscopic changes correlates with the severity of the clinical course. Cytological examination of the bronchoalveolar fluid revealed pronounced inflammatory changes characterized by an increase in the number of neutrophilic granulocytes. This indicator had prognostic significance and correlated with the development of complications.

Table 5. Cytological characteristics of bronchoalveolar contents

| Cellular element | Change |
|------------------|-----------|
| Neutrophils | increased |
| Macrophages | changed |
| Epithelial cells | damaged |

This indicates the development of an inflammatory process and damage to the epithelium of the respiratory tract.

DISCUSSION

The study results confirm that respiratory tract burns are a complex pathological process involving thermal and chemical damage. Damage to the mucous membrane structure leads to the loss of its protective functions, creating conditions conducive to the development of infectious complications.

Significant changes in respiratory function and gas exchange are caused by a combination of obstructive disorders and damage to the alveolar-capillary membrane. The development of hypoxemia and acidosis indicates the severity of the condition and requires intensive care.

Fiberoptic bronchoscopy plays a key role in the diagnosis of respiratory tract burns, allowing for an objective assessment of the extent of damage and monitoring the progression of the pathological process. Cytological examination complements the endoscopic picture and allows for the assessment of inflammatory activity.

CONCLUSION

Respiratory tract burns are a key factor determining the severity of burn disease. Their development is accompanied by significant morphological and functional changes in the respiratory system, leading to impaired gas exchange and a high risk of complications. A comprehensive diagnostic approach, including clinical, endoscopic, and cytological methods, enables timely detection of the extent of damage and prognosis of the disease's progression.

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