ASSESSMENT OF THE SEVERITY OF BURN INJURY CONSIDERING BIOCHEMICAL AND IMMUNOLOGICAL FEATURES

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The development of new methods and research programs, both for cellular and molecular composition of human biological fluids and their integration into clinical laboratory diagnostics, contributes to enhancing the effectiveness of disease treatment and reducing the duration of temporary incapacity for the affected individuals. In this regard, identifying new approaches for clinical laboratory diagnostics in burn medicine remains relevant [1,2].

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In clinical laboratory diagnostics, determining the cellular and molecular composition of blood is commonly used for diagnosing and monitoring a wide range of diseases, including burn injuries. General clinical and biochemical blood analyses are currently the most frequently used methods for managing patients with burn injuries. Attention is mainly focused on the total white blood cell count, hemoglobin levels, and the presence of band neutrophils. In biochemical analysis, primary attention is given to the levels of liver transaminases (aspartate aminotransferase, alanine aminotransferase), as well as the representative of the acute-phase protein group, C-reactive protein. Overall, it is believed that the basic parameters defined in these studies are sufficient for the adequate management of burn injury patients. However, several laboratory indicators capable of providing a deeper characterization of the organism's condition during the course of burn disease and in preparing the patient for surgical intervention, such as autologous skin grafting, are not utilized.

The pathogenesis of burn injury significantly involves the interaction between the innate and adaptive immune responses. By affecting the most extensive organ in the human body-the skin-burn injuries initiate a cascade of sequential reactions involving participant cells such as keratinocytes, lymphocytes, Langerhans cells, and humoral factors like cytokines. Currently, there is widespread attention to the study of intercellular interactions among immune system components through cytokines, which act as universal mediators of the immune response. Data obtained from scientific research need to be integrated into clinical laboratory diagnostics practice.

Burn injuries are regarded as one of the leading social phenomena in the vast majority of developed countries. Among the total number of injuries in Russia, burns

rank fourth.

The leading surgical treatment method for burn-affected surfaces is free autologous dermoplasty, which involves covering the wound defect area with a perforated skin flap. Alongside the emergence of typical pathological processes associated with any surgical intervention, specific complications develop in almost half of all cases of autologous skin grafting.

One such specific complication is the lysis of the autograft, which occurs in up to a third of all free autologous dermoplasties. The lysis of the autograft leads not only to the loss of the integrity of already closed burn defect areas and the loss of the autograft itself but also to an increase in the affected area due to donor sites from which the perforated flap was taken. This results in the inevitable repetition of previously performed autologous skin grafting or prolonged conservative treatment. The leading cause of autologous skin transplantation failures is the lack of objective methods for clinical-laboratory assessment of the patient's readiness for this procedure.

For selecting perforated flaps for autografts to close wound areas, there are several clinical-pathophysiological signs. To increase the likelihood of a favorable outcome, the absence of the following characteristics is necessary: zones of necrosis, microvascular disorders, and hemorrhages. The main reason for negative treatment outcomes of wound areas after autologous skin grafting is the insufficiently thorough study of the pathological processes occurring during skin transplantation. There is an urgent need to utilize the capabilities of modern laboratory medicine in healthcare facilities that treat patients with burn injuries [3,4,5].

The absence of comprehensive diagnostic algorithms, including the timing of autologous skin grafting, underscores the need to search for laboratory predictive factors to enhance the probability of favorable outcomes for these patients, both in therapy overall and specifically in autologous skin grafting.

The use of these laboratory indicators in routine practice does not adequately assess the readiness of the wound for transplantation and, moreover, does not allow for predicting the graft's survival, which undoubtedly affects recovery times. Currently, the assessment of a wound's readiness for autologous skin grafting is based on evaluating the clinical condition of the patient and the visual granulation of the wound bed. The lack of objective assessment methods for the readiness of the wound for autologous skin grafting is one of the primary reasons for the development of negative outcomes in surgical treatment. It is known that the course of the wound process in burn patients is significantly influenced by the patient's immune reactivity. Despite the widespread availability and accessibility of laboratory methods for assessing immunological indicators, there are currently no recommendations for utilizing parameters of the immune response in patients with burn injuries to predict the outcomes of surgical treatment, particularly in autologous skin transplantation [6,7,8].

The relevance of immunological studies in burn medicine lies in the fact that the immune status of patients with severe thermal injuries is formed against a backdrop of numerous immunosuppressive factors. During severe thermal injuries, cellular defense mechanisms of the immune system are most affected. Significant suppression of both branches of immunity (T- and B-cells) leads to decreased resistance to infectious agents, including both local and systemic manifestations, up to burn sepsis. Moreover, when considering the issue of sepsis development, significant attention is paid to the disruption of the body's cytokine balance. Nevertheless, there is currently a limited number of studies dedicated to understanding the cytokine status in relation to the pathogenesis of burn disease.

Burn injury represents a disruption of skin integrity and its appendages due to various damaging factors: thermal, chemical, electrical, radiation, or a combination of these.

Due to its prevalence and high mortality, burn injury ranks fourth among all types of injuries. In Russia, the leading type of burn injury is caused by open flames-thermal burns [9,10,11].

Among the burned patients hospitalized, 60-80% have superficial and borderline burns, while up to 40% have deep burns. Children under the age of five are the most frequent victims of burns, followed by adults aged 21 to 50. It should be noted that men suffer burns more frequently than women. The body’s reaction to damage entirely depends on the area and depth of the injury. When burns cover more than 20% of body surface area, and deep burns exceed 10%, burn disease develops.

Burn disease is a complex symptom complex of interrelated pathophysiological processes in the body in response to burn damage, including primary local damage to the coverings and secondary dysfunction of organs and systems. The severity of burn disease also depends on the extent of the injury and determines the recovery process.

In Uzbekistan, four degrees of burns are classified based on depth. This classification was adopted at the XXXVII All-Union Congress of Surgeons in 1960.

Degree I: Redness of the skin with clear contours, sometimes with swelling but without damage to the epidermis. Resolves within a few hours or 1-2 days [12,13,14].

Degree II: Formation of thin-walled blisters with clear contents and abundant exudation lasting 2-4 days. Resolves within 7-14 days.

Degree III-A: Characterized by blisters with thick walls, with some integrity disruption, containing plasma. Pain sensitivity is preserved, but vascular response is absent. Resolves within 3-5 weeks.

Degree III-B: Affects all layers of the skin. A zone of dry necrosis may develop, forming a scab. Sometimes liquefactive (wet) necrosis occurs, characterized by swelling and blister formation filled with exudate. Vascular and pain responses are absent.

Degree IV: Necrosis of all skin layers, as well as muscles and bony structures, with either coagulative or liquefactive scab formation. The area of necrotic tissue is accompanied by marginal edema.

Degrees I, II, and III-A are classified as superficial burns, while III-B and IV degrees are classified as deep burns [15,16,17].

In cases of deep burns requiring surgical treatment, 90% of all surgeries performed involve free autologous dermoplasty. This type of surgical assistance for burn patients is considered the gold standard due to its relative technical simplicity and accessibility and is used for both extensive and limited subfascial injuries. However, despite the evident, time-tested advantages of plastic closure of wounds, various complications arise related to the death of anatomical structures. The risk of complications arising from typical pathological processes after autologous skin grafting is estimated to range from 20% to 50%, with lysis of the autologous graft accounting for 10-30%.

Lysis leads not only to the loss of the autograft and exposure of the wound but also to increased damage from the donor site, thereby prolonging treatment duration. Currently, the assessment of the wound's readiness for autologous skin grafting is based on the clinical condition of the patient and visual inspection of granulation. The lack of objective assessment methods is one of the main reasons for the development of negative outcomes in surgical treatment.

Burns cause immunodeficient conditions due to intoxication from breakdown products, the addition of bacterial infection, and other factors. During burn injuries, as a result of an inflammatory response involving effectors from both innate and adaptive immune responses, disruptions occur in various branches of immunity. Features of the immune response influence the course of burn injuries and mortality from infectious complications during the post-traumatic period. Furthermore, the immune system has a significant impact in the postoperative period on the outcome of autologous skin grafting, affecting the development of complications and the survival of the skin flap [18,19,20,21].

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