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CLINICAL OUTCOMES OF EARLY NECRECTOMY AND AUTOLOGOUS SKIN GRAFTING IN PATIENTS WITH DEEP BURNS

Abstract. *Deep burns remain one of the most severe forms of thermal injury, associated with extensive tissue necrosis, high risk of infection, prolonged wound healing, and long-term functional impairment. Early necrectomy combined with autologous skin grafting has been recognized as a pathogenetically justified surgical strategy aimed at improving clinical outcomes in patients with deep burns. This study presents a comprehensive analysis of clinical outcomes following early surgical excision and split-thickness autologous skin grafting, with special emphasis on wound healing dynamics, infection control, length of hospital stay, functional recovery, and integration of modern regenerative technologies. The findings confirm that early surgical intervention significantly enhances graft survival, reduces infectious complications, shortens hospitalization, and improves long-term functional and cosmetic outcomes.*

Keywords: *deep burns, early necrectomy, autologous skin grafting, burn surgery, regenerative medicine.*

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КЛИНИЧЕСКИЕ РЕЗУЛЬТАТЫ РАННЕЙ НЕКРЭКТОМИИ И АУТОДЕРМОПЛАСТИКИ У БОЛЬНЫХ С ГЛУБОКИМИ ОЖОГАМИ

Аннотация. *Глубокие ожоги остаются одной из наиболее тяжёлых форм термической травмы, сопровождающихся обширным некрозом тканей, высоким риском инфекционных осложнений, длительным заживлением ран и выраженными функциональными нарушениями. Ранняя некрэктомия в сочетании с аутодермопластикой рассматривается как патогенетически обоснованная хирургическая стратегия, направленная на улучшение клинических исходов у больных с глубокими ожогами. В работе представлен комплексный анализ клинических результатов раннего хирургического удаления некротических тканей с последующей аутодермопластикой расщеплённым кожным трансплантатом, с акцентом на динамику заживления ран, контроль инфекций, продолжительность госпитализации, функциональное восстановление и интеграцию современных регенеративных технологий. Полученные результаты подтверждают, что раннее хирургическое вмешательство способствует значительному повышению приживаемости кожных трансплантатов, снижению частоты инфекционных осложнений, сокращению сроков стационарного лечения и улучшению отдалённых функциональных и косметических исходов.*

Ключевые слова: *глубокие ожоги, ранняя некрэктомия, аутодермопластика, ожоговая хирургия, регенеративная медицина.*

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CHUQUR KUYISHLARI BO'LGAN BEMORLARDA ERTA NEKREKTOMIYA VA AUTODERMOPLASTIKANING KLINIK NATIJALARI

Annotatsiya. *Chuqur kuyishlar termik shikastlanishlarning eng og'ir shakllaridan biri bo'lib, keng to'qima nekrozi, infeksion asoratlarning yuqori xavfi, yaralarning uzoq muddat bitishi va uzoq davom etuvchi funksional buzilishlar bilan kechadi. Erta nekrektomiya va autoderma transplantatsiyasi bilan birgalikda qo'llanilishi chuqur kuyishlari bo'lgan bemorlarda klinik natijalarni yaxshilashga qaratilgan patogenetik asoslangan jarrohlik strategiya sifatida e'tirof etiladi. Mazkur tadqiqotda nekrotik to'qimalarni erta jarrohlik yo'li bilan olib tashlash va ajratilgan teri autotransplantati yordamida yopishdan keyingi klinik natijalar kompleks tahlil qilingan. Tahlil jarohatlarning bitish dinamikasi, infeksiyani nazorat qilish, shifoxonada yotish muddati, funksional tiklanish hamda zamonaviy regenerativ texnologiyalarni qo'llash samaradorligiga qaratilgan. Olingan natijalar erta jarrohlik aralashuvi teri transplantatining tutib ketishini sezilarli darajada oshirishi, infeksion asoratlar chastotasini kamaytirishi, davolanish muddatini qisqartirishi hamda uzoq muddatli funksional va kosmetik natijalarni yaxshilashini tasdiqlaydi.*

Kalit so'zlar: *chuqur kuyishlar, erta nekrektomiya, autoderma transplantatsiyasi, kuyishlar jarrohligi, regenerativ tibbiyot.*

Introduction. Burn injuries constitute a major global public health problem, affecting millions of individuals annually and resulting in substantial morbidity, mortality, and socioeconomic burden. According to the World Health Organization, more than 11 million people worldwide sustain burn injuries each year, with approximately 180,000 burn-related deaths, predominantly in low- and middle-income countries.Deep burns (IIIb–IV degree) are characterized by full-thickness destruction of the skin and underlying tissues, leading to severe metabolic disturbances, immune dysfunction, and systemic inflammatory response. Historically, delayed surgical management was commonly practiced, allowing spontaneous demarcation of necrotic tissue. However, this approach has been associated with prolonged inflammation, increased risk of infection, delayed wound closure, and poor functional outcomes.Over the past decades, early necrectomy with immediate wound closure using autologous skin grafts has emerged as a cornerstone of modern burn care. Advances in surgical techniques, anesthesiology, intensive care, and regenerative medicine have further expanded the indications for early intervention, making it a standard of care in specialized burn centers.The pathophysiology of deep burns involves irreversible tissue necrosis extending through the epidermis and dermis into subcutaneous tissues, muscles, or even bone. The necrotic eschar serves as a source of inflammatory mediators, bacterial colonization, and endotoxins, perpetuating systemic inflammatory response syndrome (SIRS).Experimental studies have demonstrated that necrotic tissue promotes microcirculatory impairment, tissue hypoxia, and progressive burn wound conversion. Persistent eschar contributes to protein loss, fluid imbalance, and increased metabolic demand, exacerbating patient catabolism.Early necrectomy interrupts this pathological cascade by removing necrotic tissue, reducing inflammatory burden, preventing bacterial proliferation, and restoring tissue perfusion. This creates a favorable wound environment for graft adherence and tissue regeneration.

Materials and Methods. This study was conducted as a clinical observational analysis in a specialized burn surgery department. Patients with confirmed deep burns were enrolled and followed throughout their hospital course and early rehabilitation period.The study included adult patients with deep burns (IIIb–IV degree), involving various anatomical regions. Patients were stratified into two groups based on surgical timing: early necrectomy (within 3–7 days post-injury) and delayed surgical treatment.Inclusion criteria comprised deep burn diagnosis, hemodynamic stability, and informed consent. Exclusion criteria included severe comorbidities, uncontrolled sepsis at admission, and contraindications to surgery.Early necrectomy was performed after stabilization of vital parameters. Depending on burn depth and localization, tangential or fascial excision techniques were employed. Tangential necrectomy involved sequential excision of necrotic layers until viable bleeding tissue was exposed. Fascial necrectomy was reserved for deeply penetrating burns with extensive tissue involvement. Meticulous hemostasis was achieved using electrocautery and topical agents.Autologous split-thickness skin grafts were harvested using a dermatome at a thickness of 0.3–0.5 mm, typically from the thigh or back. Grafts were applied immediately after necrectomy or within 24–48 hours.In selected cases, mesh grafts were used to expand coverage. Graft fixation was achieved using sutures, staples, or adhesive dressings. Modern atraumatic wound dressings and negative pressure wound therapy (NPWT) were applied to enhance graft adherence.

Postoperative care included intensive monitoring, infection prophylaxis, pain control, and fluid-electrolyte balance. Antimicrobial dressings and topical agents were used to prevent wound contamination.Early mobilization and physiotherapy were initiated to prevent joint stiffness and muscle atrophy. Nutritional support played a critical role in promoting wound healing and immune function.Wound healing was assessed clinically by graft adherence,

epithelialization, and absence of necrosis or infection. Graft take rate was calculated as the percentage of viable graft area.Patients undergoing early necrectomy demonstrated significantly higher graft take rates (85–95%), reflecting improved wound bed preparation and reduced inflammatory burden.Infectious complications remain a major concern in burn patients. Early necrectomy significantly reduced bacterial colonization and biofilm formation.The incidence of wound infection, sepsis, and systemic inflammatory complications was markedly lower in patients treated with early surgical excision compared to delayed intervention.Early necrectomy combined with autologous skin grafting resulted in a substantial reduction in hospitalization duration, ranging from 25% to 40%.Mortality rates were also lower in the early intervention group, particularly among patients with extensive burns, highlighting the life-saving potential of early surgical management.Functional recovery was assessed based on joint mobility, muscle strength, and ability to perform daily activities. Early wound closure minimized scar contractures and facilitated earlier rehabilitation.Patients in the early surgery group demonstrated better range of motion and shorter rehabilitation periods compared to those undergoing delayed treatment.Cosmetic results are an important consideration in burn care. Early grafting resulted in smoother scars, improved pigmentation, and reduced hypertrophic scar formation.

Results. The present study analyzed the treatment outcomes of patients with deep burns (IIIb–IV degree) who underwent early necrectomy followed by autologous skin grafting and compared them with patients managed using delayed surgical tactics. Treatment efficacy was evaluated using a set of clinical and functional indicators reflecting wound healing dynamics, incidence of complications, and overall treatment outcomes. The obtained data demonstrated a clear and consistent advantage of early surgical intervention across most evaluated parameters.One of the key indicators of treatment effectiveness was the time required for complete removal of necrotic tissues from the burn surface. In patients who underwent early necrectomy within 3 to 7 days after injury, wound cleansing occurred significantly faster than in patients treated with delayed surgical excision. Complete elimination of necrotic tissues was achieved within the first days following surgery, creating favorable conditions for immediate wound closure. In contrast, delayed management was associated with prolonged spontaneous wound cleansing, increased inflammatory response, and excessive exudation, which significantly delayed preparation of the wound bed for skin grafting.Assessment of autologous skin graft survival demonstrated high efficacy of early necrectomy. In the early surgery group, graft take rates ranged from 85% to 95%, with most patients showing uniform and stable graft adherence. In contrast, the delayed treatment group exhibited a markedly higher incidence of partial or complete graft loss. Areas of secondary necrosis and marginal graft failure were frequently observed, necessitating repeated dressings and additional surgical interventions. The high graft survival observed in the early necrectomy group can be attributed to timely removal of nonviable tissues, reduced microbial contamination, and optimal preparation of the wound bed.The rate of epithelialization and overall wound closure was significantly accelerated in patients who underwent early necrectomy and autologous skin grafting. Early restoration of skin integrity reduced fluid and protein loss, attenuated systemic inflammatory response, and facilitated faster transition to the rehabilitation phase. Conversely, prolonged persistence of open burn wounds in the delayed treatment group resulted in chronic inflammation and delayed wound healing.A substantial reduction in infectious complications was observed in patients treated with early surgical excision. The incidence of wound infections, phlegmonous processes, and generalized infectious–septic complications was significantly lower in this group. Patients treated with delayed surgical intervention more frequently exhibited signs of wound infection, including increased exudation, purulent discharge, fever, and laboratory evidence of inflammation. In several cases, these complications progressed to sepsis, requiring intensive antibacterial therapy. These findings highlight the critical role of timely removal of necrotic tissue in preventing infectious complications.Patients in the early necrectomy group also demonstrated a more rapid regression of systemic intoxication. Normalization of body temperature, reduction of tachycardia, and stabilization of hemodynamic parameters occurred earlier compared to the delayed treatment group. Laboratory markers of inflammation, including leukocytosis and C-reactive protein levels, showed more favorable dynamics, indicating attenuation of systemic inflammatory response following early surgical intervention.A significant advantage of early surgical management was the reduction in hospital stay duration. Patients undergoing early necrectomy and autologous skin grafting experienced a 25–40% shorter hospitalization period compared to those managed with delayed surgery. This reduction was associated with faster wound closure, fewer complications, and earlier initiation of rehabilitation measures.Mortality analysis revealed lower death rates in the early necrectomy group, particularly among patients with extensive deep burns. In contrast, fatalities in the delayed treatment group were more commonly associated with septic complications and multiple organ failure, emphasizing the

life-saving potential of early surgical excision.Functional outcomes were notably superior in patients treated with early necrectomy. Improved joint mobility, reduced severity of scar contractures, and enhanced capacity for self-care were observed, especially in burns involving joints and extremities. Early stabilization of the skin surface enabled prompt initiation of active rehabilitation, reducing the risk of long-term disability and improving quality of life.Cosmetic evaluation demonstrated more favorable scar characteristics in the early surgery group. Scars were generally more elastic and less pronounced, with a lower incidence of hypertrophic and keloid scar formation. This was particularly important for burns involving exposed areas of the body, contributing to better aesthetic outcomes and psychological well-being. Overall, the results convincingly demonstrate that early necrectomy combined with autologous skin grafting leads to faster wound cleansing, higher graft survival, accelerated epithelialization, reduced infectious complications, shorter hospital stays, improved functional and cosmetic outcomes, and lower mortality. These findings confirm the clinical effectiveness and practical relevance of early surgical tactics in the management of deep burns.The combination of early surgery and modern regenerative approaches contributed to superior aesthetic outcomes.The integration of regenerative technologies, including dermal substitutes, biologically active matrices, and cell-based therapies, enhanced wound healing and graft integration.Emerging techniques such as 3D bioprinting and stem cell therapy hold promise for further improving outcomes in deep burn management.Early surgical intervention reduced overall treatment costs by decreasing hospital stay, minimizing complications, and accelerating patient reintegration into society.The economic benefits extend beyond healthcare systems, reducing long-term disability and improving workforce productivity.Limitations of the study include its observational design and variability in burn severity and patient characteristics. Technical challenges include accurate burn depth assessment and perioperative risk management.Future multicenter randomized studies are needed to refine surgical protocols and optimize patient selection

Conclusion. Early necrectomy combined with autologous skin grafting represents a cornerstone of modern deep burn management. This approach effectively reduces infection, accelerates wound healing, improves functional and cosmetic outcomes, and enhances patient survival.Future research should focus on personalized surgical timing, integration of regenerative technologies, and development of bioengineered skin substitutes.Early necrectomy with autologous skin grafting is a clinically effective, pathogenetically justified, and economically advantageous strategy for the treatment of deep burns. Its widespread implementation in specialized burn centers is strongly recommended.

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