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## Optimized approach to surgical treatment of wound surfaces

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**Key words:** *Wound, Ulcer, Plastic Surgery, Surgical Flaps.*

Treatment of traumatic defects and chronic venous ulcers is one of the persistent problems of medical science.

**Objective.** To improve outcomes of patients with wounds, traumatic, functional and aesthetic defects by developing a comprehensive program of surgery to restore form and functions of the body.

**Materials and methods.** We have operated on 179 patients with wound defects of various etiology in the clinic. Depending on the cause of wound defect, the patients were divided into groups: trophic ulcers of vascular etiology – 75 patients, post-traumatic (mechanical) wound defects – 42 patients, postischemic wound defects (compartment syndrome) – 12 patients, neurotrophic ulcers – 15 patients, consequences of purulent – inflammatory diseases – 35 patients. We consider the ultrasound duplex scanning with color mapping as the primary diagnostic criterion in choosing patients' treatment tactics.

**Results.** In the patients' group with trophic ulcers of vascular etiology the first stage of treatment was sanation of trophic defect with the mandatory appointment of specific antibacterial therapy, in 58 patients autodermoplasty with the split, perforated flap was performed, in 4 patients it was carried out with single-step alofibroblasts' transplantation, 17 patients were performed transplantation of full layer skin grafts. In patients with wounds after injury cellulocutaneous and musculocutaneous flaps on the vascular pedicle, plasty with local tissues and split seed grafting autodermoplasty were used. In compartment syndrome secondary sutures were imposed and autodermoplasty with split seed grafting was performed. In neurotrophic ulcers of vertebral localization and in the greater trochanters' area plasty with one or two V – like musculocutaneous rotation flaps, cellulocutaneous double lobe pedicle flap was used. In patients with consequences of purulent – inflammatory complications autodermoplasty with split seed grafting and rotation cellulocutaneous flaps on the axial blood supply were performed.

**Conclusion.** The choice of surgical treatment in patients with wound defects of trunk and extremities is determined by anatomic functional and hemodynamic features of the damaged area and the results of surgical correction of wound surfaces depend on a technically perfect surgery and adequate antibacterial therapy.

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### Оптимізований підхід до хірургічного лікування ранових поверхонь

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Лікування ранових дефектів і хронічних трофічних виразок залишається однією з постійних проблем медичної науки.

**Мета роботи** – поліпшити результати лікування хворих із ранами, рановими, функціональними та естетичними дефектами шляхом розробки комплексної програми хірургічного лікування для відновлення форми та функції частин тіла.

**Матеріали та методи.** У клініці були прооперовані 179 пацієнтів із рановими дефектами різноманітної етіології. Залежно від причини виникнення ранового дефекту пацієнтів поділили на групи: трофічні виразки судинної етіології – 75 хворих, посттравматичні (механічні) ранові дефекти – 42, постішемичні ранові дефекти (компаратмент синдром) – 12, нейротрофічні виразки – 15, наслідки гнійно-запальних захворювань – 35 осіб. Провідним діагностичним критерієм у виборі тактики ведення пацієнтів вважаємо ультразвукове дуплексне сканування з кольоровим картуванням.

**Результати.** У групі хворих із трофічними виразками судинної етіології першим етапом лікування була санація трофічного дефекту з обов'язковим призначенням специфічної антибактеріальної терапії, у 58 хворих здійснена аутодермопластика розщепленим, перфорованим клаптом, з одномоментною трансплантацією алофіброblastів у 4 хворих, 17 особам виконали пересадку повношарових шкірних клаптів. У хворих із ранами після травми використовували шкірно-жирові та шкірно-м'язові клапті на судинній ніжці, пластику місцевими тканинами та аутодермопластику розщепленим шкіряним клаптом. При компартмент синдромі накладали вторинні шви та виконували аутодермопластику розщепленим шкіряним клаптом. При нейротрофічних виразках хребцевої локалізації та в ділянці великих вертелів використовували пластику одним чи двома V-подібними шкірно-м'язовими ротаційними клаптями, шкірно-жировим дводольним клаптом на ніжці. У хворих із наслідками гнійно-запальних ускладнень виконували аутодермопластику розщепленим шкіряним клаптом і ротаційні шкірно-жирові клапті на осьовому кровопостачанні.

**Висновки.** Вибір хірургічної тактики у хворих із рановими дефектами тулуба та кінцівок визначається анатомо-функціональними та гемодинамічними особливостями ділянки пошкодження, а результати хірургічної корекції ранових поверхонь залежать від технічно досконалого оперативного втручання та адекватної антибактеріальної терапії.

**Ключові слова:** *рани, виразка, пластична хірургія, хірургічні клапті.*

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### Оптимизированный подход к хирургическому лечению раневых поверхностей

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Лечение раневых дефектов и хронических трофических язв остаётся одной из постоянных проблем медицинской науки.

**Цель работы** – улучшить результаты лечения больных с ранами, раневыми, функциональными и эстетическими дефектами путём разработки комплексной программы хирургического лечения для восстановления формы и функции частей тела.

**Материалы и методы.** В клинике было прооперировано 179 пациентов с раневыми дефектами различной этиологии. В зависимости от причины возникновения раневого дефекта пациентов разделили на группы: трофические язвы сосудистой этиологии – 75 больных, посттравматические (механические) раневые дефекты – 42 пострадавших, постисшемические раневые дефекты (компаратмент синдром) – 12 больных, нейротрофические язвы – 15, последствия гнойно-воспалительных заболеваний – 35 пациентов. Ведущим диагностическим критерием в выборе тактики ведения пациентов считаем ультразвуковое дуплексное сканирование с цветным картированием.



**Результаты.** В группе больных с трофическими язвами сосудистой этиологии первым этапом лечения была санация трофического дефекта с обязательным назначением специфической антибактериальной терапии, у 58 проведена аутодермопластика расщеплённым перфорированным лоскутом с одномоментной трансплантацией аллофибробластов у 4 больных, 17 пациентам выполнена пересадка полнослойных лоскутов. У больных с ранами после травмы использовали кожно-жировые и кожно-мышечные лоскуты на сосудистой ножке, пластику местными тканями и аутодермопластику расщеплённым кожным трансплантатом. При компартмент синдроме накладывали вторичные швы и выполняли аутодермопластику расщеплённым кожным трансплантатом. При нейротрофических язвенных дефектах позвоночной локализации и в области больших вертелов использовали пластику одним или двумя V-образными кожно-мышечными ротационными лоскутами, кожно-жировым двудольным лоскутом на ножке. У больных с последствиями гнойно-воспалительных осложнений выполняли аутодермопластику расщеплённым кожным трансплантатом и ротационные кожно-жировые лоскуты на осевом кровоснабжении.

**Выводы.** Выбор хирургической тактики у больных с раневыми дефектами туловища и конечностей определяется анатомо-функциональными и гемодинамическими особенностями участка повреждения, а результаты хирургической коррекции раневых поверхностей зависят от технически совершенного оперативного вмешательства и адекватной антибактериальной терапии.

**Ключевые слова:** раны, язва, пластическая хирургия, хирургические лоскуты.

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**T**reatment of wound defects and chronic trophic ulcers is one of the persistent problems of medical science. According to the literature sources among the surgical diseases the percentage of this category of patients reaches 15–25% [1,2,4].

Mechanical damage of skin integuments with the formation of large wound defects in severe trauma is often accompanied by significant blood loss, shock, followed by the possibility of skin flaps' necrosis, development of wound infection. In the process mortality from injuries has grown by 32.7% for the last 10 years [3].

The main factors of trophic ulcers is a disturbance of venous outflow in the lower limbs due to the growing progressively worse of chronic venous or chronic lymph-venous insufficiency. Less commonly, ulcers of other genesis occur against the background of arterial disease, vasculitis, hypertensive (Martorell syndrome), diabetic, neurotrophic (including decubital) ones [4].

Thus, despite the numerous means of conservative therapy and surgical treatment methods that have been broadly dealt with in many prominent publications, the problem of treatment wound defects with different etiology still remains. However, the recent success of developments in the medical-biological sciences give every reason to the formation of new approaches concerning the treatment of many diseases, including wound defects and trophic ulcers.

### Objective

To improve patients' outcomes with wounds, traumatic, functional and aesthetic defects by developing a comprehensive program of surgery to restore the form and functions of body parts.

### Materials and methods

We have operated on 179 patients with wound defects of various etiology in the clinic. Of them there were 88 men (49.2%), 91 women (50.8%). The patients' age ranged from 17 to 72 years.

Depending on the cause of wound defect, the patients were divided into groups:

1. Trophic ulcers of vascular etiology – 75 patients (41.9 %).
2. Post-traumatic (mechanical) wound defects – 42 patients (23.5 %).
3. Postischemic wound defects (compartment syndrome) – 12 patients (6.7 %).

4. Neurotrophic ulcers – 15 patients (8.4 %).

5. Aftereffects of purulent-inflammatory diseases – 35 patients (19.5 %).

All the patients were examined either in the outpatient procedure or in the hospital on the protocols developed according to the nosology of the disease. To the standard methods of diagnosis were attributed the following ones: general clinical investigation, angiologic, neurologic study, clinical-laboratory diagnostics, microbiological monitoring, histological studies electroneuromyography, ultrasound scanning and Dopplerography, angiography, grade scales, photographic documentation.

We consider ultrasonic duplex scanning with color mapping as the leading diagnostic criterion in choosing the therapeutic approach of patients with chronic venous insufficiency of the lower limbs [5]. The study was performed on the apparatus "Vivid 3 Expert" firm "General Electric" (USA), using the linear sensor with a frequency range of 3.5–5 MHz (for the study of patients with overweight and with considerable edema of the lower limbs). The research objectives included the confirmation of the venous patency for the whole length, identifying functional insufficiency of venous valves, getting the characteristics of vessel lumen and its wall, determining pathological vein – venous refluxes.

In addition, the method of ultrasonic duplex scanning is used by us for the study of regional hemodynamics in the area of wound defect and in the donor area of the future complex vascular pedicle flap on, namely marking musculocutaneous flap. Under the sensor control the length and the width of the pedicle and the flap and its direction is determined. Also the characteristics of the artery – its inner diameter, linear blood flow velocity, the presence of collateral branches, anastomoses and perforants is evaluated, which is especially important for the transplanting of complex grafts using sophisticated microsurgical techniques.

In patients with concomitant diabetes mellitus for the study of peripheral arterial blood flow dopplerography research and reovasography were used.

The development of aesthetic medicine and experience of literature allowed to use the technique of mesotherapy and redermalization in modern surgery too that is in the treatment of long-term existing trophic ulcers. Our clinic has developed and patented the original technique of using unstructured hyaluronic



acid for the treatment of trophic ulcers in the lower extremity with vascular etiology.

Currently histological and cytometric studies are conducted that will scientifically substantiate the choice of surgery method, depending on the functional possibilities of damaged area, “aging” of tissue and regional hemodynamics.

### Results

In the group of patients with trophic ulcers of vascular etiology the first stage of treatment was sanation of trophic defect with the mandatory appointment of specific antibiotic therapy. In patients (69 patients) with decompensated forms of chronic venous or lymph-venous insufficiency of the lower limbs corrective surgery was performed on the superficial venous system with the appointment of phlebotonics and elastic compression hosiery. In chronic arterial circulatory insufficiency of the lower limbs III–IV degree (3 patients) restorative surgery was performed (if peripheral blood flow was present) or intervention aimed to improve the collateral circulation. Three patients with diabetic foot mixed form were prescribed the standard course of angioprotective therapy in conjunction with the methodology of redermalization. Simultaneously with the second phase all the patients were performed ulcer closure with skin flaps. Depending on the size of the trophic defect and the status of blood flow in 58 patients autodermoplasty with the split, perforated flap with single-step alofibroblasts’ transplantation was carried out in 4 patients, 17 patients were performed transplantation of skin grafts. In 4 cases trophic ulcer relapse was marked in the period from 1.5 to 9 months, the repeated surgical intervention was performed.

In mechanical trauma (42 patients) the choice of surgical policy depended on the anatomic functional and hemodynamic features of damaged areas. Thus, in 3 cases in the presence of a wound defect on the heel cellulo-cutaneous flap was used in the axial blood supply. In 1 case of traumatic amputation of the upper limb at the level of shoulder joint, to form functional prosthetic stump musculocutaneous flap of a broad back muscle on the vascular pedicle was used. Patients were discharged on 10–14 days with a positive result. In 11 patients plasty with local tissues also with a satisfactory result was used. 27 patients with minor surface wound defects and active granulation were performed autodermoplasty with a split seed grafting.

In all the cases of compartment syndrome (12 cases) patients with post ischemic wound defects were presented, in whom the method of fasciotomy had not been used correctly. The first stage was wound defect debridement and necrectomy of deadened areas was performed, then the second stage in 4 cases was mobilization of wound edges and the secondary sutures imposing, in 8 cases autodermoplasty was performed with a split seed grafting. In all cases positive results were achieved.

In neurotrophic ulcers (3 patients) with damage to peripheral

nerve trunks electroneuromyographic studies were compulsory conducted and neurosurgeon’s examination with the appointment of a special treatment. In 2 cases, in trophic ulcers of the lower limbs autodermoplasty was performed with a split seed grafting, in 1 case of wound defect on the forearm plasty was performed with a rotation cellulo-cutaneous flap in the axial blood supply. In 12 patients decubital trophic defects III–IV degree were diagnosed in the area of the vertebra (8 cases) and the area of greater trochanter of the femur (7 cases). In 3 patients 2 localizations occurred simultaneously, 2 patients – 3 localizations. In vertebral localization of neurotrophic ulcers in 2 cases plasty with one or two V-like musculocutaneous rotation flaps was used and in 8 cases – plasty with cellulocutaneous double lobe pedicle flap (Esser, 1918; Zimany, 1953) in 5 patients with neurotrophic ulcers in the area of greater trochanter plasty with rotation cellulocutaneous double lobe pedicle flap was performed. The surgical intervention was necessarily preceded by preparation. It included a rational antibacterial therapy in consideration of inoculated flora sensitivity, restoring of electrolyte, water and protein balance.

In all the cases primary healing of wound defects was observed. No cases of rejection, marginal flaps’ necrosis were found. In 3 cases, it was noticed the emergence of small size subflap seroma, which was successfully eliminated. In the long-term period neurotrophic ulcer recurrence is not observed.

Of the 35 cases of the consequences of purulent-inflammatory complications there were 19 patients with wound defects after phlegmonous forms of erysipelas, 7 patients with wound defects after abscesses and 8 patients after soft tissue of trunk and extremities’ phlegmons. Most of the patients were hospitalized into in-patient specialized hospital with granulating wound defects. In 31 cases autodermoplasty was performed with a split seed grafting, at large scale defects – with a perforated one. In 4 cases rotation cellulocutaneous flap in axial blood supply was used. In one case in the early postoperative period flap necrosis occurred, followed by necrectomy and re-plasty with a split seed grafting.

### Conclusions

1. The choice of surgical treatment in patients with wound defects of trunk and extremities is determined by anatomic functional and hemodynamic features of the damaged area.

2. We consider ultrasonic duplex scanning as the most effective method of diagnosis, which allows not only differential approach to the choice of surgical correction, as well as to explore the donor’s area of the future complex flap on the vascular pedicle.

3. The results of surgical correction of wound surfaces depend on a technically perfect surgery and adequate antibacterial therapy.

**Conflicts of Interest:** authors have no conflict of interest to declare.

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