

Surgical management of a dog bite in a patient with comorbidities. Case study

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Millions of people worldwide require urgent medical care annually due to bites and injuries inflicted by wild or domestic animals. Injured patients most frequently suffer from extensive and deep wounds resulting in traumatic shock of different degrees. The extensive wounds are characterized by severe damage to fascial muscles, tendons, bones, major vessels and nerve trunks. Therefore, the management of patients attacked by wild or domestic animals includes the elimination of life-threatening conditions and the application of various techniques and methods of reconstructive plastic surgery and their combinations to preserve the injured areas of the body (most commonly limbs). In each particular case, the prognosis and the choice of the most effective reconstructive surgery technique for the treatment of a wound defect depend on the state of the deep structures of the injured limb. The «reconstructive ladder principle» ensures the selection of the most appropriate treatment strategy, as it focuses on the nature of the injury and the patient's overall health status, thus providing an adequate assessment of all possible surgical risks, general postoperative complications and challenges in wound healing. This algorithm allows prioritizing the most beneficial techniques from simple to difficult, as well as considering the «second line» methods. The «second line» methods are defined as simpler techniques that may be applied in case of some complications occurring after the administration of the primary method. Some additional difficulties may be experienced throughout the period of wound management in children and the elderly, in patients with complicated comorbidities and exacerbation of chronic diseases.

This article presents a case study of a patient undergoing the treatment for an extensive and deep bite wound that is complicated by acute coronary syndrome and severe cardiogenic shock in the early postoperative period.

KEYWORDS

dog bite, a wound, microsurgical reconstruction, free flap, heart attack.

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Millions of people worldwide require urgent medical care annually due to bites and injuries inflicted by wild or domestic animals [2]. Injured patients most frequently suffer from extensive and deep wounds resulting in traumatic shock [5].

The treatment of extensive tissue loss remains a major surgical challenge, as it cannot be closed primarily.

The «reconstructive ladder principle» ensures the selection of the most appropriate treatment strategy [1, 8].

Some additional difficulties may be experienced throughout the period of wound management in the

elderly with complicated comorbidities or acute exacerbation of chronic diseases [3].

This article presents a case study of a patient undergoing the treatment for extensive and deep bite wound that is complicated by acute coronary syndrome and severe cardiogenic shock in the early postoperative period.

Case presentation

A 60-year-old male was admitted for a dog bite injury. He presented with extensive wounds on the 3/4 of the lower leg, massive blood loss and

third-degree traumatic shock. No signs of extensive damage to the muscles and tendons were observed. A portion of the tibia was exposed and the defect was 4 cm in length (Fig. 1). The patient's medical history revealed two heart attacks, severe atherosclerosis, and unstable angina pectoris. Clinically, the foot remained viable.

The surgical reconstruction using local skin flaps was proposed after the evaluation of the lower leg tissue condition that revealed a significant edema, an extensive wound, and multiple vascular traumas. Conservative treatment with negative pressure wound therapy (NPWT) was chosen for the lateral surface of the lower leg with the following skin grafting. Free anterolateral thigh (ALT) perforator flap was used for the wound coverage on the medial surface of the lower leg. After a washout procedure and debridement of the wound and two days of NPWT, the patient underwent the surgical reconstruction. The skin flap was anastomosed to the posterior tibial artery (the end-to-side technique) and the vein (the end-to-end technique). During the procedure, severe atherosclerosis was noted in the recipient's artery walls, as well as in the walls of the arteries on

which the flap was formed. Before the skin flap coverage, the open tibia area was fenestrated (Fig. 2, 3).

Despite pathological blood vessel changes, a clinical observation showed adequate blood flow in the skin flap (Fig. 4).

Postoperative period was generally uneventful. The skin flap was viable. On the second post-operative day, the minor venous congestion was observed but it was not progressing (Fig. 5). The anastomosis functioning was confirmed via Doppler control.

On postoperative day 7, the patient complained of sharp deterioration of his health condition, persistent and intense chest pain. Acute coronary syndrome and severe cardiogenic shock were diagnosed. The patient was transferred to the specialized department of the other hospital for the management of the life-threatening conditions. Unfortunately, severe circulatory failure led to the skin flap necrosis. On day 7, on repeated admission to the Burn and Plastic Surgery Center the skin flap necrosis was reported (Fig. 6).

After the removal of the necrotic skin flap, the granulation tissue growth out of the fenestrated tibia holes was noted (Fig. 7).



Figure 1. Bite wound, day 5 after injury: medial (A) and lateral (B) lower leg surface



Figure 2. Anterolateral (ALT) flap harvesting

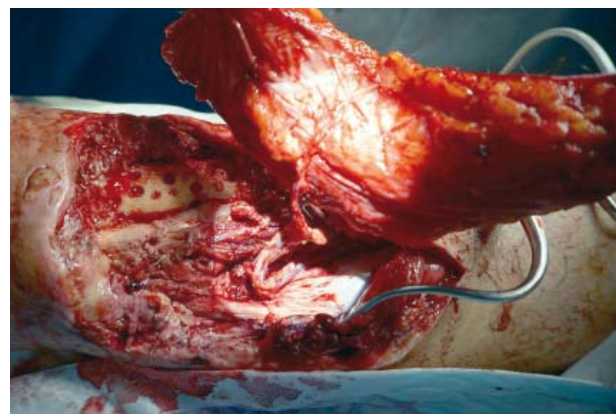


Figure 3. ALT flap transferred to the wound area and connected to the blood flow. The open tibia area was fenestrated



Figure 4. **Transferred ALT flap with adequate blood circulation at the end of the surgery**



Figure 5. **Postoperative day 3. The skin flap with venous congestion**



Figure 6. **Skin flap necrosis after cardiogenic shock**



Figure 7. **Medial lower leg wound after necrotic skin flap removal**



Figure 8. **NPWT of two lower leg wounds**

Taking into account the patient's overall condition and severe atherosclerosis of the blood vessels in the lower leg that had been diagnosed during a microsurgical operation phase, any variant of the skin flap reconstruction was excluded.

It was decided to choose the simplest but appropriate strategy of wound management — conservative treatment with NPWT (Fig. 8).

After 3 weeks of NPWT, the wounds were filled with granulated tissue indicating satisfactory conditions for skin grafting (Fig. 9).

Both wounds were covered with the skin grafts under local anesthesia. The lower extremity is fully functional. Walking ability is preserved (Fig. 10).

The treatment of extensive wounds, involving the extremities, is quite often significantly complicated by chronic diseases of the patients. In the elderly, comorbidities and severe traumas almost always mutually complicate each other, thus increasing the risk of severe postoperative and even life-threatening complications during any phase of the treatment.

Therefore, the most effective surgical treatment requires a lot of flexibility from a surgeon when it comes to choosing a suitable therapy, as well as considering the plan B measures. When patients have several wounds, it is acceptable to use several methods simultaneously. For the wounds with exposed bones, it is appropriate to use the skin flaps with their own blood supply, whereas for the partial thickness wounds without exposed bones, it may be sufficient to perform wound debridement and intensive NPWT with skin graft transplantation. For the coverage of exposed bones, it is recommended to consider the methods by their complexity, from the simplest to the most complex. However, when the application of the local

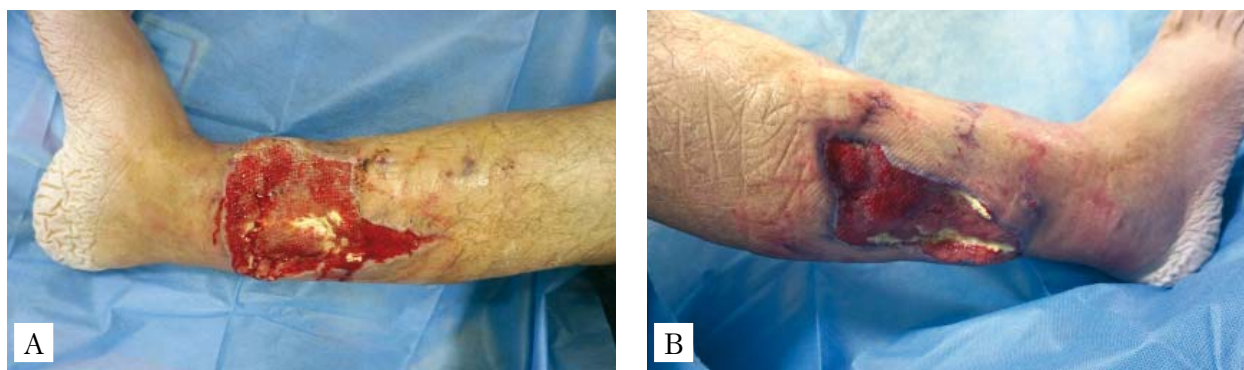


Figure 9. **Wounds after NPWT therapy filled with granulated tissue: medial (A) and lateral (B) surface**

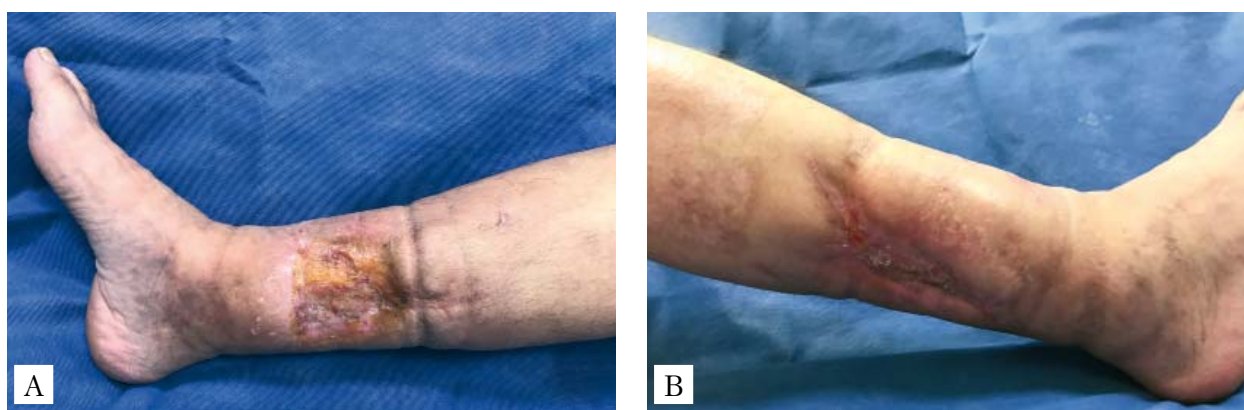


Figure 10. **Result of the wound treatment and skin grafting 1 month after operation: medial (A) and lateral (B) surface**

skin flaps is impossible, the skin flaps with microvascular anastomosis should be used. Even though this complex surgical technique poses the greatest surgical risks, it still remains more beneficial than a technically simpler cross-leg flap operation, since, in the elderly, the long-term maintenance of a lying position may trigger the exacerbation of heart problems, lung diseases or orthopedic conditions, thus significantly complicating proper medical care in the postoperative period. Nevertheless, the cross-leg flap operation using the contralateral leg as a recipient still remains the ultimate plan B even at highly advanced clinics [4, 7]. Prediction of possible complications and plan B should be an integral part of any microsurgery. For example, it is recommended to perform cortical bone fenestration for granulated tissue growth stimulation. It should be noted that the presence of chronic diseases (especially of the circulatory system) poses high surgical risks, leads to acute deteriorations, critical ischemic complications. Thus, the surgeons should not underestimate the potential of simpler methods for the treatment of extensive wounds. However, they should be ready to administer long-term wound treatment, which may produce less aesthetic result but will definitely preserve an extremity and its function [6].

Conclusions

Even the clinics applying high tech microsurgical reconstructive methods cannot guarantee the intended result of the treatment due to the adverse effects exerted by local and general factors on wound healing. The specialists should be ready to apply plan B, which is a suitable surgical technique for each particular case.

DECLARATION OF INTERESTS

The authors declare that they have no conflicts of interest.

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None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this manuscript.

ETHICS APPROVAL AND WRITTEN INFORMED CONSENTS STATEMENTS

Treatment of the patient was conducted fully in accordance with the Helsinki Declaration.

Informed consent was obtained from all individual participants included in the study.

Treatment of the patient was not related to any of the clinical trials.

AUTHOR CONTRIBUTIONS

P.O. Badiul: the idea of the publication, surgery, writing the manuscript, photo documentation, review of the scientific literature; S.V. Sliesarenko: the idea of the publication, surgery, patient care, administrative and material support; O.V. Nosulko: surgery, patient care; O.I. Rudenko: surgery, patient care, writing the manuscript.

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Хірургічне лікування укусу собаки у пацієнта із супутніми захворюваннями. Клінічний випадок

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Щорічно в світі до клінік невідкладної медицини звертаються десятки тисяч постраждалих з приводу укусів як домашніх, так і диких тварин. Дуже часто травмовані пацієнти мають значні за площею та глибиною рани та різний за ступенем тяжкості травматичний шок. Для великих укушених ран часто характерні тяжкі ураження фасцій, м'язів, сухожилок, кісток, магістральних судин і нервових стовбурів. Як наслідок, під час лікування постраждалих від нападу тварин нерідко доводиться усувати небезпечні для життя стани для збереження травмованих ділянок тіла (найчастіше — кінцівок), застосовувати різні техніки і методики реконструктивної пластичної хірургії та їх комбінації. Саме статус глибоких структур ураженої кінцівки найчастіше визначає прогноз у конкретному випадку та найперспективніший спосіб реконструктивного лікування ранового дефекту. Для вибору оптимальної тактики ведення укушених ран доцільно застосовувати «алгоритм реконструктивних сходинок». Його концепція враховує найімовірніші ризики під час оперативних втручань та післяопераційних ускладнень як з боку рани, так і щодо загального стану пацієнта, зумовлені характером ушкодження і актуальним статусом хворого. Зазначений алгоритм дає змогу обрати кращий із методів, розглядаючи їх за пріоритетом (від простішого до складнішого) та з урахуванням «резервних» методів. До останніх відносять простіші способи, які застосовують у разі появи ускладнень при використанні первинно обраного. Часто менеджмент пацієнта ускладнює дитячий або похилий вік, наявність складної супутньої патології, загострення хронічних захворювань під час лікування ран. Наведено випадок лікування великих глибоких укушених ран у пацієнта з виразною супутньою патологією.

Ключові слова: укусу собаки, рана, мікрохірургічна реконструкція, вільний клапот, інфаркт.

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