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Case Study

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A CASE OF SUCCESSFUL REPLANTATION IN COMPLETE TRAUMATIC AMPUTIATION OF THE UPPER LIMB AT THE SHOULDER LEVEL

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ABSTRACT

This article considers a case from practice, when a 26-year-old patient, who was injured as a result of a hand getting into a rotating mechanism, managed to perform the replantation of the upper limb. Despite the purulent-necrotic complications that developed in the postoperative period, as a result of long-term sanitation followed by skin grafting, it was possible to achieve complete engraftment of the segment. However, the development of post-traumatic osteomyelitis required a second operation on the humerus, followed by its successful consolidation. Over time, a positive trend in the improvement of the sensory and motor functions of the hand was noted. The results of the treatment were recognized as good, so it was possible not only to save the limb, but also to improve its performance after rehabilitation.

KEYWORDS: Traumatic traction amputation, replantation, osteosynthesis, Ilizarov apparatus, skin plasty.

INTRODUCTION

Traumatic amputations of limbs, without a doubt, can be categorized as the most severe injuries. The loss of a hand leads not only to the development of the patient's disability, but is also a severe psychological trauma. The problem of performing replantations in case of complete traumatic amputation of the upper limb remains quite relevant today.

Patients with such injuries often arrive in a state of traumatic and hemorrhagic shock. Thus, according to the data obtained on the basis of an analysis of the work of both the RSCEMC and its branches for 2001-2022, the general condition of such patients upon admission was moderate-severe in 49.4% of cases, severe - in 48.3% and extremely severe - at 2.3%. The positive moment was that in the majority (76.3%) of the victims, the duration of anoxia of the damaged segments of the limb did not exceed 3 hours. In view of this, the decision to perform a reconstructive operation in severe and extremely severe conditions was made not at the time of admission of the patient, but only after stabilization of his condition. At the same time, not only the time of injury was taken into account, but also its mechanism and level of damage, since most authors rightly believe that the higher the level of amputation, the lower the probability of full recovery of function, and the traction mechanism of amputation is an aggravating factor.[1,2,5]
In such cases, the surgeon must take into account that:

- Damage to blood vessels and nerves are multifocal in nature and do not coincide with the level of separation;
- It is not always possible to clearly visually distinguish relatively healthy tissues from non-viable ones;
- Bone fractures are most often multi-comminuted, which often leads to their sequestration with the subsequent possible development of osteomyelitis;
- Extensive skin-soft tissue defects may occur;
- The immediate postoperative period rarely runs smoothly, there is a high probability of developing purulent-necrotic complications, which can lead to the development of arrosive bleeding and, ultimately, the loss of the segment;
- The restoration of the function does not always occur fully, and may subsequently require repeated corrective operations.[1,2,3,4,6]

Currently, an absolute contraindication to replantation is considered to be the level of dissection of the upper limb proximal to 1/3 of the shoulder, due to the significant trauma of the operation itself, the possibility of developing reperfusion syndrome when blood flow is restored, and the low probability of restoring limb function. A contraindication to replantation is also the presence of other life-threatening conditions (severe traumatic brain injury, damage to the organs of the chest and abdominal cavities, severe shock and massive blood loss).[2,3,4,5]

When evaluating the immediate results of replantations, the outcome is considered satisfactory, in which it was possible to achieve complete engraftment of the segment. If a segment is lost due to any postoperative

complications, the result should be regarded as unsatisfactory.[1,2,4]

AIM: To show the possibilities of modern replantation microsurgery on the presented clinical example.

Clinical example. Patient: E. Age: 26 years old
Date of admission: 10/26/2021.
Anamnesis: 2 hours before admission, he was injured while working on a corn grinder (Fig. 1-2) - his hand was pulled into the rotating blades, torn off and dragged through the entire unit, mixed with straw and grain. After the injury, the patient was taken to the hospital in Buki, where the wound of the axillary region was sutured, the wound of the stump was bandaged, the segment was wrapped in a bag, the patient was sent to the Republican Research Center of Emergency Medice. The total time from injury to surgery was 3 hours.

Fig. 1 – 2: The device that caused the injury.

DIAGNOSIS: Complete traumatic traction amputation of the right upper limb at the level of sn/3 shoulder. Sutured wound of the axillary region on the right. Traumatic shock II degree.

The appearance of the segment and stump, radiograph are shown in Fig. 3 - 6.

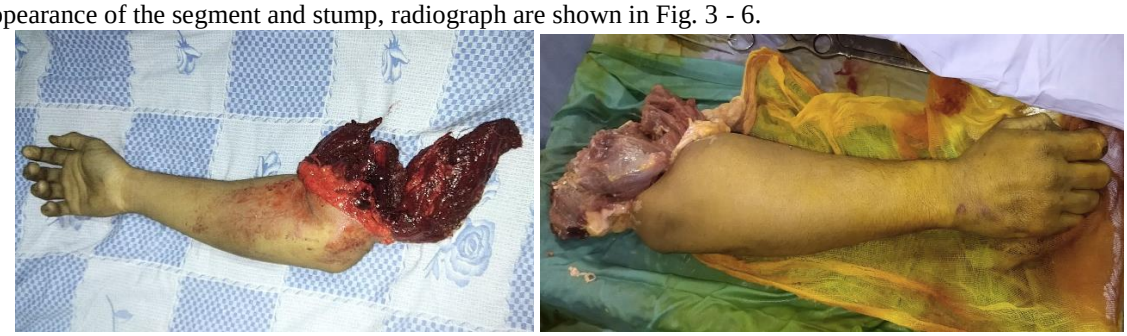

Fig. 3 – 4: View of the segment from the front and rear.

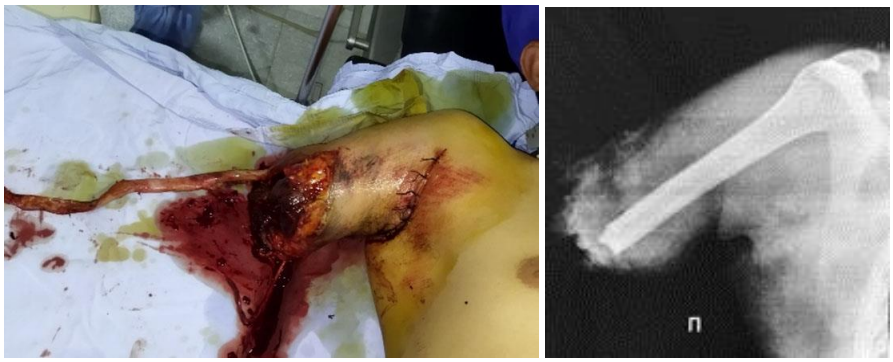

Fig. 5-6: Appearance of the stump and radiograph.

An operation was performed 1 hour after admission to the Center - replantation of the upper limb. Operation steps:

- Primary surgical treatment, with visual assessment and excision of all crushed tissues;
- Resection of bone fragments (total shortening of the stump and segment - 8 cm) and osteosynthesis of the humerus with Ilizarov wires;
- Anastomoses a. brachialis (d=5 mm), v. commitans (d=2.5 mm), v. basilica (d=7mm);
- Restoration of preserved muscles;
- Anastomosis v. caephalica (d=5mm):
- Restoration with epi-perineural sutures of the median nerve, transposition to the c/3 area of the forearm and reconstruction of the ulnar nerve. (The suture of the radial nerve was not made due to its crushing and a significant defect along the length).

The main stages of the operation are shown in Figures 7 - 13.

Fig. 7: Stage of osteosynthesis with wires.

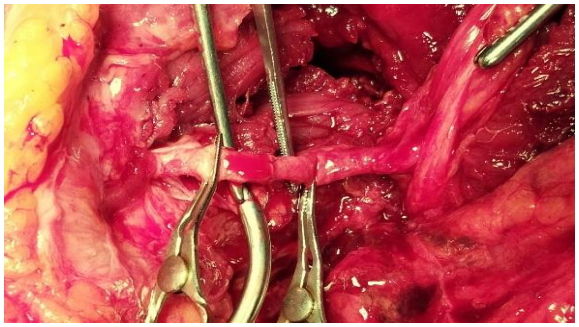

Fig. 8: Anastomosis of the brachial artery.

Fig. 9. Restored structures: v.commitans, a.brachialis, n.medianus.

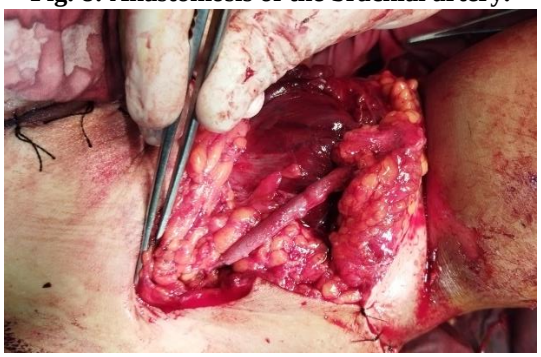

Fig. 10. Restored v.caephalica

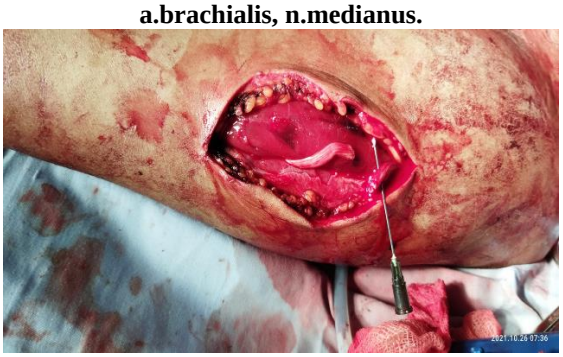

Fig. 11. Transposition n. ulnaris on the forearm

Fig. 12. View after the operation.

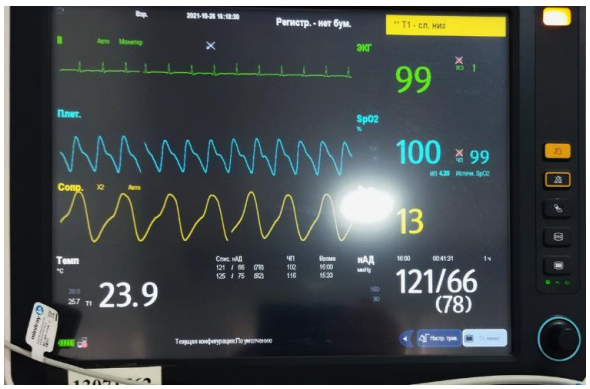

Fig. 13. Pulse oximetry.

In the postoperative period, therapy was carried out:
- Direct acting anticoagulants
- Antioxidants
- Infusion therapy, hemo- and plasma transfusions;
- Antibiotic therapy;
- Analgesics.

Postoperative period. In the first 3 days, a pronounced edema of the entire limb of traumatic and lymphatic genesis was noted (Figures 14-15).

На 5-е сутки течение заболевания осложнилось некрозом мышц по задней поверхности с последующим нагноением (рис.16).

Fig. 16: Necrosis and suppuration of muscles.

Within 2 weeks, a phased necrectomy and debridement of the wound was carried out until the appearance of granulation tissue. The stages are presented in figures 17 - 20.

Fig. 17. Gradual cleansing of the wound.

Fig. 18. Growth of granulation tissue..

Rice. 19 - 20. Secondary sutures on granulation (19th day after replantation).

On the 29th day after replantation, free autodermoplasty (ADP) of the granulating wound was performed with a full-thickness graft (Fig. 21-24).

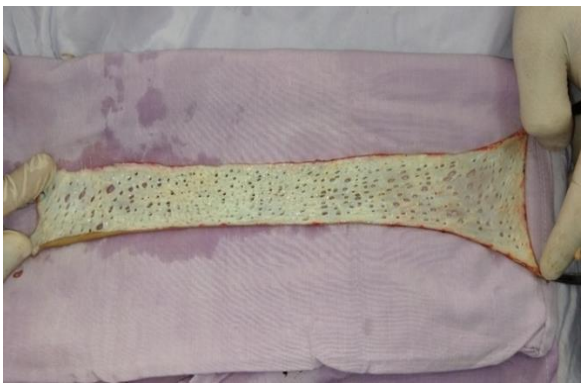

Fig. 21. View of the wound before surgery

Fig.22. Autoskin graft, taken from the anterior wall of the abdomen.

Fig. 23 – 24: View of the limb after ADP.

On the 11th day after ADP, complete engraftment of the graft was noted (Fig. 25-27).

Fig. 25–27: View of the limb on the 11th day after ADP.

The control X-ray showed unstable fixation and diastasis between the bone fragments of the humerus (Fig. 28).

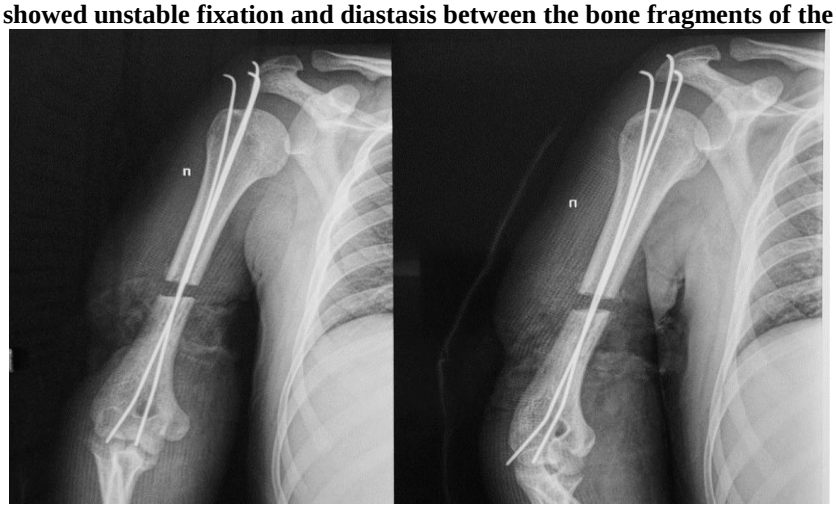

Fig. 28: Control radiograph on the 40th day after replantation.

On the 13th day after ADP (42 days after replantation), an operation was performed - closed osteosynthesis of the humerus with a BIOS pin under the control of an image intensifier. The radiograph after the operation is shown in Figure 29.

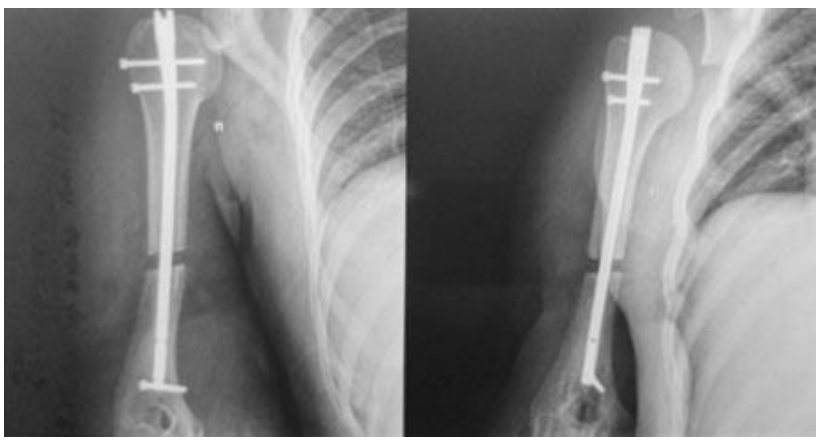

Fig. 29. Control radiograph after osteosynthesis.

As a result of the treatment, complete engraftment of the segment was noted.

On the 7th day after osteosynthesis (48th day after replantation), the patient was discharged for outpatient treatment.

The view of the limb is shown in Figures 30 - 32.

Rice. 30 - 32. A view of the limb at discharge.

After 3 weeks, the patient showed signs of osteomyelitis of the humerus in the form of the appearance of fistulas with purulent discharge.

On January 19, 2022 (37 days after discharge), an operation was performed in the osteomyelitis department of the TMA-1 clinic: **revision, fistula-sequestrectomy and repeated osteosynthesis with a cement-antibiotic pin and the Ilizarov apparatus.**

The limb view and radiograph are shown in Figures 33-34.

Fig. 33-34: View of the limb and radiograph of the patient E. after the operation.

At the control examination, 6 months after the last operation, a partial restoration of the function of flexion of the hand, active rocking flexion movements of the fingers, but a complete absence of active extension of both the hand and fingers (function of the radial nerve) were noted.

The view of the limb is shown in Figures 35 - 36.

Fig. 35-36: View of the upper limb of the patient E. 11 months after replantation.

RESULT AND DISCUSSION

In the described case, a 26-year-old patient had a complete traumatic traction amputation of the right upper limb at the level of n/3 of the shoulder with crushing and contamination of the segment. Taking into account the stable condition of the patient, his young age and persistent desire to save his hand (even a non-functional one), a decision was made to replant the limb. During the operation, after osteosynthesis, the circulation of the limb was restored by applying arterial and venous end-to-end anastomoses. Simultaneously, despite extensive crushing, the restoration of the median and ulnar nerves was performed. The suture of the radial nerve was not made due to its significant defect throughout. In the postoperative period, wound purulent-necrotic complications developed, but necrectomy and careful debridement of the wound, followed by growth of granulation tissue, created conditions for free auto-dermoplasty of the wound defect on the 29th day after replantation. The skin autograft completely engrafted. However, the initial osteosynthesis was unstable, the

fracture did not consolidate, which required repeated osteosynthesis. Unfortunately, this operation caused the development of osteomyelitis, which was probably due to the intervention on the background of a "dormant" infection. And only a second operation - fistula-sequestrectomy, the use of a cement-antibiotic pin and the Ilizarov apparatus made it possible to achieve the final consolidation of the fracture, the healing of fistulas and, ultimately, the preservation of the hand as an organ. In the long-term period (11 months after replantation), there was a positive dynamics in the restoration of sensitivity and motor function of the limb. Subsequently, additional surgeries are likely to be required to improve the function of the elbow joint and hand. However, the results achieved by the patients themselves were rated as good.

CONCLUSIONS

1. The decision on the possibility of performing a reconstructive operation for traumatic amputations should be made strictly individually, taking into account the mechanism and level of damage, the nature of the wound, the general condition and age of the patient.
2. The main points of replantation are the thorough excision of all apparently non-viable tissues, stable osteosynthesis, precise isolation and preparation of vessels and nerves using optical magnification.
3. The likelihood of developing purulent-necrotic complications is quite high, but it can be reduced if all of the above points are met.
4. The use of full-thickness autoskin grafts for closing granulating defects of a limited area is the method of choice.
5. Restoration of motor function and sensitivity occurs due to the earliest possible and adequately selected rehabilitation therapy, as well as, if necessary, by carrying out appropriate corrective operations.

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