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SUCCESSFUL TREATMENT OF COMPLICATED CHRONIC POST-TRAUMATIC TIBIAL OSTEOMYELITIS (A CLINICAL CASE REPORT)

Case study

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Abstract

In the article, the authors describe a successful clinical case of treating chronic post-traumatic osteomyelitis of the tibia in a 43-year-old patient with non-union fracture and deep trophic shin ulcer. The team applied a combined surgical approach, which included segmental resection of the affected bone segment with external fixation, as well as soft tissue defect repair using a non-free skin-subcutaneous-fascial flap. Postoperative management involved antibacterial therapy, anticoagulant and antiplatelet support, and step-by-step rehabilitation. In the long-term follow-up, the patient achieved complete fracture union, absence of the infection recurrence, and restoration of limb weight-bearing function. This method proves effectiveness in complicated chronic osteomyelitis treatment in areas with soft tissue deficiency and may be recommended for clinical use.

Keywords: chronic post-traumatic osteomyelitis, tibia, non-union fracture, trophic ulcer, combined surgical treatment, external fixation device, bone grafting, cutaneous-fascial flap.

УСПЕШНОЕ ЛЕЧЕНИЕ ОСЛОЖНЕННОГО ХРОНИЧЕСКОГО ПОСТТРАВМАТИЧЕСКОГО ОСТЕОМИЕЛИТА БОЛЬШЕБЕРЦОВОЙ КОСТИ (КЛИНИЧЕСКОЕ НАБЛЮДЕНИЕ)

История болезни

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Аннотация

В статье авторами представлен успешный клинический случай лечения хронического посттравматического остеомиелита большеберцовой кости на фоне неконсолидированного ее перелома и глубокой трофической язвой голени у пациента 43 лет. Применен комбинированный хирургический подход, включающий сегментарную резекцию пораженного участка кости с наложением аппарата внешней фиксации, а также пластику дефекта мягких тканей несвободным кожно-подкожно-фасциальным лоскутом. Послеоперационное ведение включало антибактериальную терапию, антикоагулянтную и дезагрегантную поддержку, а также поэтапную реабилитацию. В отдаленном периоде достигнута полная консолидация перелома, отсутствие рецидива инфекции и восстановление опорной функции конечности. Данный метод демонстрирует эффективность при лечении хронического остеомиелита в зонах с дефицитом мягких тканей и может быть рекомендован для клинического применения.

Ключевые слова: хронический посттравматический остеомиелит, большеберцовая кость, неконсолидированный перелом, трофическая язва, комбинированное хирургическое лечение, аппарат внешней фиксации, костная пластика, кожно-фасциальный лоскут.

Introduction

Osteomyelitis is a widespread disease, accounting for up to 6% of musculoskeletal disorders and 7–12% of surgical infections [1], [2]. In cases of open bone fractures, it develops in 5.3–75.4% of patients, and in 7.6–33.2% of cases — following surgical treatment of closed fractures and orthopedic bone procedures [3]. Among purulent surgical infections, osteomyelitis holds a leading position due to its high prevalence, severe clinical course, diagnostic and therapeutic challenges, and a significant rate of diverse complications. Moreover, it represents a major socioeconomic burden, as up to 78% of patients are of working age (20–50 years), and this group exhibits the highest rate of disability (over 70%) [4], [5].

The treatment of chronic osteomyelitis remains one of the most challenging problems in modern surgery [6]. Currently, the standard approach — regardless of etiology, pathogenesis, or lesion localization, involves a two-stage surgical procedure. The first stage entails radical surgical debridement and adequate drainage of the purulent-necrotic focus, while the second stage focuses on eliminating residual bone cavities and soft tissue defects [7], [8].

The problem of bone defect reconstruction becomes most critical when the pathological focus is located in the distal shin and proximal foot regions. The soft tissue deficiency in these lower limb segments prevents the use of mobilized local tissues for bone cavity reconstruction and significantly limits the application of antibiotic-loaded methylmethacrylate spacers, which require adequate soft tissue coverage [9].

Effective soft tissue defect reconstruction necessitates the use of tissue complexes that most closely match the anatomical and functional characteristics of the lost tissues. In such cases, optimal clinical outcomes can be achieved by utilizing tissues from adjacent areas that share similar properties with the defect-surrounding integumentary structures [10].

This clinical observation makes the authors' following case report of particular professional interest.

Clinical Case Report

Patient Yu., 43 years old male, was admitted to Surgical Department No. 2 of the Propaedeutic Surgery Clinic at Samara State Medical University (hereinafter — SamSMU) on January 30, 2023, with a diagnosis of "Non-union fracture of the left tibia. Chronic post-traumatic osteomyelitis of the left tibia. Deep (bony) post-traumatic trophic ulcer of the left shin". The diagnosis and clinical presentation corresponded to type IV of the Cierny–Mader classification of osteomyelitis [11], while the trophic ulcer matched a medium-sized defect and grade III depth according to Obolensky [12].

Upon admission, the patient complained of:

· a non-healing skin and soft tissue defect in the middle third of the anterior surface of the left shin with scanty purulent discharge;

· moderate pain in the affected area;

· lack of weight-bearing capacity in the left lower limb.

Medical history revealed that in June 2022, the patient sustained a comminuted fracture of both bones of the left shin due to a traffic accident. Emergency care providers transported him to the trauma department of a district hospital, where surgeons urgently performed open reduction and extra-cortical fixation of the tibia and fibula using plate osteosynthesis. In the postoperative period, an infectious complication developed at the surgical site, which required surgical debridement. Follow-up radiographic examination showed no signs of fracture consolidation.

In September 2022, the patient was readmitted to the same hospital due to the formation of a chronic wound with purulent discharge at the surgical site. Surgeons performed wound debridement supplemented by osteoperforation of the tibia. Radiography of the injured area showed no signs of tibial fracture consolidation. In the postoperative period, purulent discharge from the wound persisted.

By November 2022, doctors removed the bone plates and performed osteonecrectomy of the tibia. However, the shin wound failed to heal, and local post-traumatic trophic disorders developed in the surrounding soft tissues.

As part of scheduled care, the patient was referred for consultation at the SamSMU Clinics. Following evaluation, physicians established the diagnosis: "Non-union fracture of the left tibia. Chronic post-traumatic osteomyelitis of the left tibia. Deep (bony) post-traumatic trophic ulcer of the left shin". The medical team recommended subsequent hospitalization for radical treatment of chronic osteomyelitis.

On admission to SamSMU Clinics, the patient's general condition was satisfactory. Body temperature measured 36.7°C. Physical examination revealed no pathological changes in organ systems. The patient ambulated exclusively using crutches without bearing weight on the left lower extremity.

Laboratory findings demonstrated the following profile.

Complete blood count:

Erythrocytes: 3.89×10^{12}/L

Hemoglobin: 136 g/L

Platelets: 379×10^{9}/L

Leukocytes: 8.6×10^{9}/L (band neutrophils: 2%, segmented neutrophils: 56%, lymphocytes: 28%, monocytes: 4%)

Erythrocyte Sedimentation Rate (ESR): 26 mm/h

Biochemical analysis:

Total protein: 85.8 g/L

Urea: 7.8 mmol/L

Creatinine: 110 μmol/L

Glucose: 4.5 mmol/L

Coagulation profile:

Activated Partial Thromboplastin Time (aPTT): 26.8 sec

International Normalisation Ratio (INR): 1.23

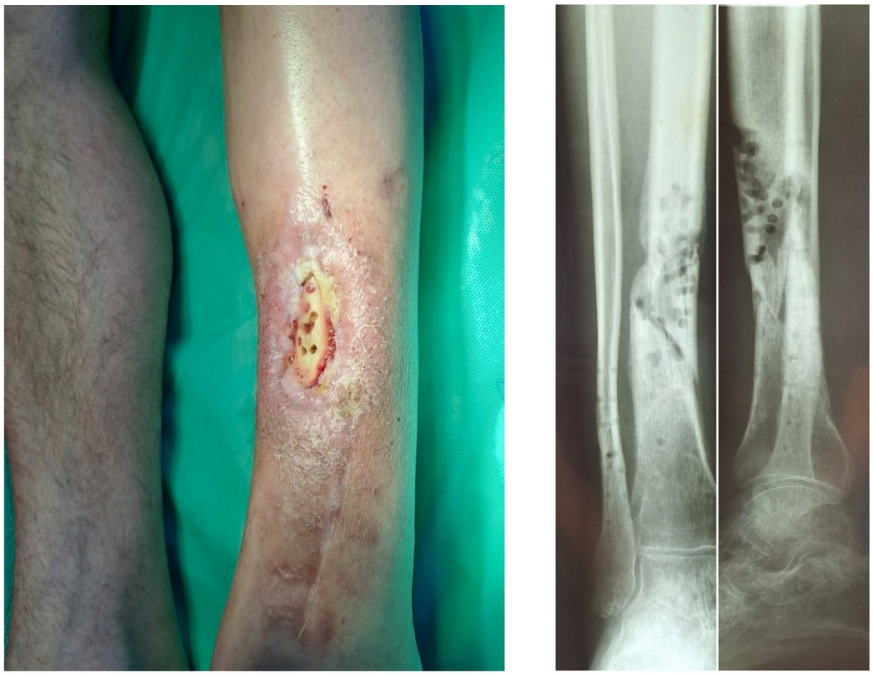
Prothrombin time: 10.3 sec

Quick's prothrombin activity: 64%

The left shin showed no edema or erythema. On the anterior surface of its middle third, there was a 6 × 2 cm skin and soft tissue defect with scanty purulent discharge. The base of the defect consisted of ulcerated grayish tibial bone with multiple osteoperforation fenestra (Figure 1a). Pathological mobility of the shin was evident in the area of the trophic ulcer. Range of motion in the joints of the left lower extremity remained intact, with preserved sensation. Peripheral pulses (dorsalis pedis, popliteal, and femoral arteries) were palpable. No signs of venous insufficiency were detected.

Microbiological examination of the wound discharge revealed Staphylococcus aureus with a concentration of 10^{6} microbial cells, sensitive to ceftriaxone, ampicillin-clavulanate, amikacin, levofloxacin, and ciprofloxacin.

Radiographic examination. X-ray of the left shin in two projections (Figure 1b) showed a non-consolidated comminuted fracture of the tibia, multiple postoperative defects (osteoperforation fenestra) in the middle third of the tibia, and localized areas of bone destruction (osteomyelitis); the X-ray also revealed a consolidated fracture of the distal third of the fibula. Chest X-ray did not detect any focal or infiltrative changes in the lungs.



a *b*

Figure 1 - External appearance (*a*) and radiograph (*b*) of the left shin of patient Yu., 43 years old, upon admission to the Clinics of SamSMU
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On February 1, 2023, after standard preoperative assessment, the patient underwent surgery with epidural anesthesia. The surgical team performed segmental resection of both bones of the left shin. The anterior semicircumference of the tibia, measuring 6 cm in length, presented as a sequestrum with multiple osteoperforative fenestra and therefore was excised. They aligned the proximal and distal bone fragments using the posterior semicircumferences of the tibia. For this purpose, they applied an external fixation device (Figure 2).

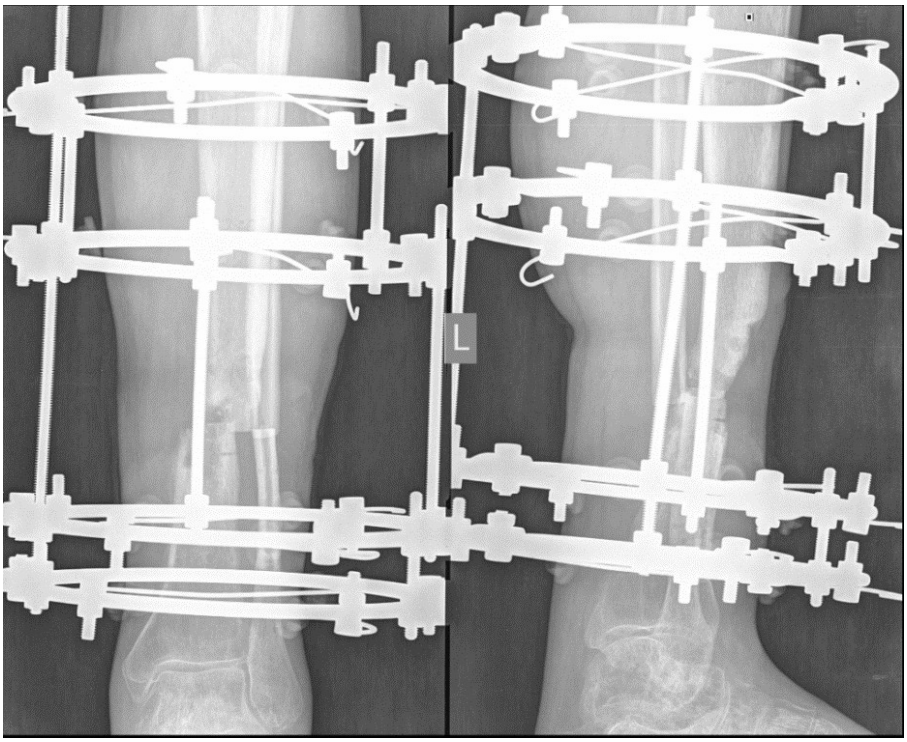

Figure 2 - Intraoperative radiograph of the left shin of patient Yu., 43 years old
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To close the skin and soft tissue defect, surgeons performed reconstruction using a non-free (pedicled) skin-subcutaneous-fascial flap transposed from the anterolateral surface of the left lower leg (Figure 3).

Figure 3 - Surgical stage - formation of a pedicled skin-subcutaneous-fascial flap for wound closure
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On postoperative day 7, superficial skin necrosis (4 × 2 cm) developed in the medial portion of the transposed flap (Figure 4). This complication did not require additional surgical intervention and subsequently resolved spontaneously through natural cleansing and epithelialization.

Figure 4 - Postoperative appearance of the left shin in patient Yu., 43 years old, on day 7 after surgery
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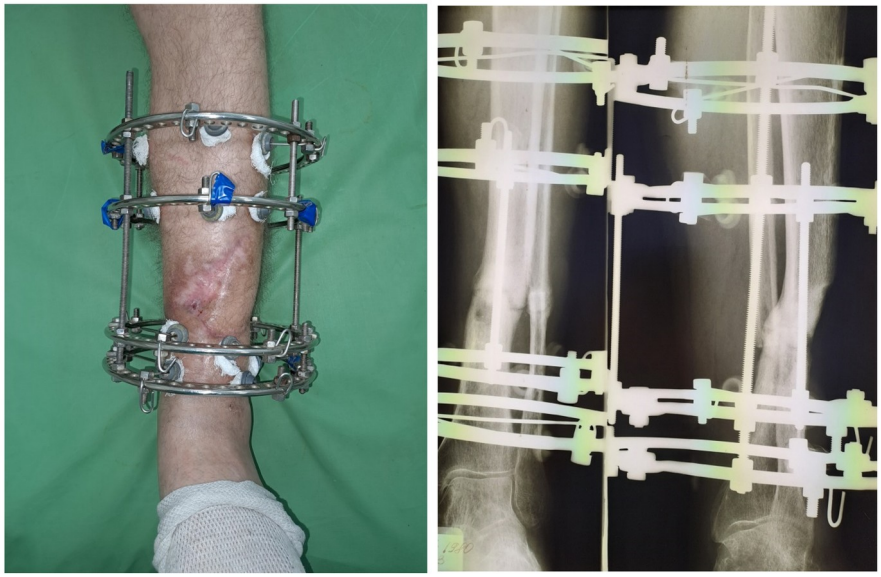
The systemic conservative treatment included antibacterial therapy (ceftriaxone 2.0 g intravenously twice daily for 10 days), anticoagulant and antiplatelet therapy (heparin 5,000 IU three times daily for 7 days; pentoxifylline 10 mL intravenous drip in normal saline once daily for 7 days), and analgesia (continuous ropivacaine infusion via epidural catheter using an infusion pump during the first 3 postoperative days, followed by ketorolac 1.0 mg intramuscularly three times daily for the next 7 days). During the postoperative period, the medical team performed wound dressings with povidone-iodine solution - daily for 5 days, then every other day. Finally, physicians removed the surgical sutures on postoperative day 12.

The patient was discharged on February 14, 2023 with the following recommendations: povidone-iodine wound dressings until complete wound healing (epithelialization), static weight-bearing on the left lower limb in corrective footwear one month after surgery, and follow-up examination three months postoperatively. Following discharge, the patient received outpatient care. He gradually began ambulating with weight-bearing on the left lower limb using corrective footwear. The left leg shortening measured 4 cm.

The patient arrived for the initial follow-up examination 5 months postoperatively. The left shin showed no signs of inflammation. No local tissue defects or fistulas were observed. The external fixation device remained stable. The patient ambulated using orthopedic footwear with crutch support. Radiographic imaging demonstrated callus formation in both bones of the left shin (Figures 5 a, b).



a *b*

Figure 5 - Clinical appearance (*a*) and radiographic image (*b*) of the left shin in patient Yu., 43 years old, at 5-month postoperative follow-up

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On September 6, 2023 (7 months postoperatively), the patient was readmitted to Surgical Department No. 2 of the Propaedeutic Surgery Clinic at SamSMU Clinics for removal of the external fixation device. Upon admission, clinical examination revealed no local tissue defects or fistulas in the left lower limb. The patient ambulated independently with crutch support. Control radiographs demonstrated evidence of fracture consolidation in both bones of the left shin (Figures 6 a, b).

On September 7, 2023, the patient underwent scheduled surgical removal of the external fixation device. The postoperative course was uncomplicated. The medical team discharged the patient on September 11, 2023 with the following recommendations: continuation of treatment in the medical rehabilitation department, gradual increase of weight-bearing on the left lower limb, and ambulation with corrective orthopedic footwear.

a b

Figure 6 - Clinical appearance *(a)* and radiographic findings *(b)* of the left shin in patient Yu., 43 years old, at 7-month postoperative follow-up

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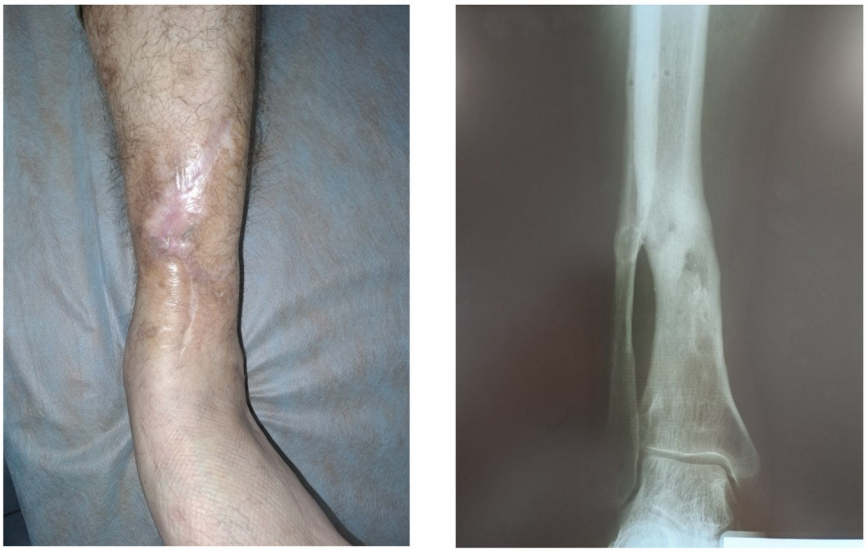
Long-term outcomes. At the 1-year and 1-month postoperative follow-up, clinical examination revealed no tissue defects or fistulas in the left lower limb, though the 4 cm limb shortening persisted. The patient ambulated independently using corrective footwear. Control radiographs of the left lower leg demonstrated complete bony union of both tibial and fibular fractures (Figures 7 a, b).



a *b*

Figure 7 - Clinical appearance (*a*) and radiographic imaging (*b*) of the left shin in patient Yu., 43 years old, at 13-month postoperative follow-up

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Discussion

This case analysis enables evaluation and comparison of the treatment approach's effectiveness with similar clinical cases and published research on chronic osteomyelitis management, particularly in cases with regional soft tissue deficiency and associated complications.

First, we should emphasize that the principles of two-stage radical treatment for chronic osteomyelitis - where residual bone cavity grafting following necrotic sequestrectomy achieves sustained remission — were previously established in studies by our department and clinic staff [8]. The critical importance of the initial debridement stage is supported by Anikin et al. (2022), who described multi-stage surgical management of chronic gunshot-induced calcaneal osteomyelitis involving sequestrectomy and wound defect reconstruction. Their findings regarding radical surgical debridement and adequate drainage requirements align with our results [7].

The soft tissue reconstruction strategy in tissue-deficient areas deserves particular attention. Moscow colleagues have successfully employed partially de-epithelialized sural flaps for tibial distal third osteomyelitis treatment, confirming the efficacy of local tissue transfer techniques [9]. Vorotnikov et al. (2022) further demonstrated the clinical effectiveness of locoregional perforator island flaps for soft tissue coverage, which correlates with our reconstructive approach [10].

The external fixation application for stabilized debrided bone fragments represents another crucial aspect. Ivanov (2009) highlighted the role of external fixation in managing open fractures and chronic osteomyelitis, especially in polytrauma patients [4]. Comparable outcomes were reported in international studies where combined external fixation and soft tissue reconstruction prevented limb amputation in severe extremity injuries [5].

Conclusion

This clinical case demonstrates the efficacy of a combined surgical approach for managing chronic, recurrent osteomyelitis complicated by deep trophic ulcers. The treatment protocol—incorporating radical surgical debridement, external fixation, and local tissue reconstruction —aligns with contemporary management strategies for such complex cases and is supported by existing literature evidence.

Three key findings emerge:

· isolated application of any single surgical modality would inevitably lead to disease recurrence and potential limb loss;

· the staged multidisciplinary approach addresses all pathological components (infection control, bone stabilization, soft tissue coverage).

This algorithm shows particular clinical value for complex cases, featuring:

· significant soft tissue deficiency;

· high recurrence risk;

· multiple previous surgical interventions.

The protocol warrants consideration in clinical practice, especially for complicated presentations where conventional treatments prove inadequate. Its success underscores the importance of combining radical infection control measures, mechanical stabilization and vascularized tissue reconstruction as interdependent therapeutic pillars in refractory osteomyelitis management.

Конфликт интересов

Не указан.

Рецензия

Все статьи проходят рецензирование. Но рецензент или автор статьи предпочли не публиковать рецензию к этой статье в открытом доступе. Рецензия может быть предоставлена компетентным органам по запросу.

Conflict of Interest

None declared.

Review

All articles are peer-reviewed. But the reviewer or the author of the article chose not to publish a review of this article in the public domain. The review can be provided to the competent authorities upon request.

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