



OUR EXPERIENCE IN TREATMENT OF FEMORAL PSEUDARCHY AFTER INTRAMEDULLARY OSTEOSYNTHESIS WITH A BLOCKING PIN (CASE REVIEW)

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Abstract

Based on a clinical example, a retrospective analysis of surgical treatment of diaphyseal fractures of the femur was carried out. The results of treatment of fractures of the diaphysis of the femur indicate the need for the use of blocked intramedullary osteosynthesis according to strict indications. Minimally invasive method of stable fixation of fragments does not disrupt the blood supply and preserves the hematoma in the area of the fracture of bone nutrition. Incorrect and late dynamization of the fixator and, as a consequence, the lack of contact between the fragments lead to a slowdown in fusion.

Keywords: osteosynthesis, fracture, femur, pseudoarthrosis.

Introduction

Femoral shaft fractures are one of the most common and significant injuries to the bones of the extremities. The frequency of these injuries has remained high in recent years [2,5]. In the structure of femoral injuries, shaft fractures are diagnosed in almost 20% of cases [3,9]. These fractures are especially common in victims with multiple and combined injuries. The quality of life and subsequent ability to work of victims directly depend on technically correct and timely surgical treatment of femoral shaft fractures. At the same time, the frequency of various complications can vary from 5 to 35% [6,9].

Since the beginning of the 21st century, the intramedullary locking pin has been actively used in the treatment of femoral shaft fractures. Due to its low invasiveness and good functional results in the postoperative period, this method has become the gold standard for the treatment of such fractures. The use of this method in surgical treatment significantly reduces soft tissue trauma during surgical access, eliminates the need for external immobilization, allows for stable, strong fixation, and reduces





the time of surgery. Locked intramedullary osteosynthesis (BIOS) allows for early patient activation and rehabilitation measures from the first days after surgery, which significantly reduces the risk of complications in the postoperative period [12,13].

Intramedullary osteosynthesis is a surgical method that provides comfortable conditions for fracture healing and stimulates bone callus formation. When creating relative stability, micromobility in the fracture zone stimulates reparative osteogenesis, especially in comminuted fractures [8]. Locking intramedullary nails help restore axial displacement and bone length in comminuted fractures. They help regulate the distribution of external load [2]. However, the use of intramedullary osteosynthesis may be accompanied by various complications, such as delayed consolidation of fragments, fracture, and migration of fixators (screws and rods). The main reasons for delayed consolidation, according to Gaiko G.V. et al. [3], are unsatisfactory reposition with diastasis remaining between the fragments and a complete lack of axial load on the limb for 4-6 months after osteosynthesis. In this case, untimely dynamization of the blocked pin may prove ineffective, which may lead to a repeat operation.

The aim of the study is to analyze complications when using intramedullary osteosynthesis with blocking using a clinical case as an example.

Objectives: 1. To show the advantage of performing intramedullary osteosynthesis of the femur with blocking.

2. To evaluate the role and sequence of dynamization in fracture consolidation using a clinical case as an example.

3. To analyze complications when applying cerclage with osteosynthesis in the treatment of femur fractures.

Clinical case. Patient K., 53 years old, was injured on November 24, 2021, as a result of a traffic accident. He was admitted with the diagnosis: "Closed large-comminuted fracture of the left femur in the middle third with displacement of fragments." He was delivered by ambulance to the traumatology department of the district united multidisciplinary hospital of the Guzar district of the Kashkadarya region.

On the 6th day, the patient was transferred to the traumatology department of the Republican Specialized Scientific and Practical Medical Center of Traumatology and Orthopedics.

After appropriate preparation of the victim, on the 3rd day, open intramedullary osteosynthesis of the femur was performed with a cerclage and a pin with locking (Fig. 1). The wounds healed by primary intention, the sutures were removed on time. On the day of discharge (12th day after injury, 14th day after surgery), the patient was recommended to walk with support on crutches with a dosed load of up to 30 kg on





the injured limb for 3 months from the date of surgery. 19 weeks after surgery, the patient contacted a private clinic in Karshi complaining of discomfort and pain in the left thigh area under load and at rest.



Fig. 1. Postoperative radiographs.

The radiograph (Fig. 1) shows a slowly consolidating fracture in the middle third of the left femur under MOS conditions with a pin and cerclage loop locking. Diastasis between the femur fragments, periosteal bone reaction. On April 26, 2022 (5 months after the injury), the patient underwent pin dynamization in order to form interfragment compression and stimulate the osteogenesis process. The patient was shown continued activation. Three months after dynamization, signs of hypotrophic pseudoarthrosis formation were determined. Considering the timing of the surgical intervention and the lack of clinical and radiographic data on fracture healing, the following operation was performed in the trauma department of the Kamashinsky Multidisciplinary United Medical Center: removal of the cerclage loop, direct reposition of the fracture, reaming of the pseudoarthrosis zone with Ilizarov wires according to Beck and additional fixation with crossing Ilizarov wires (Fig. 2). The wounds healed by primary intention without signs of inflammation.

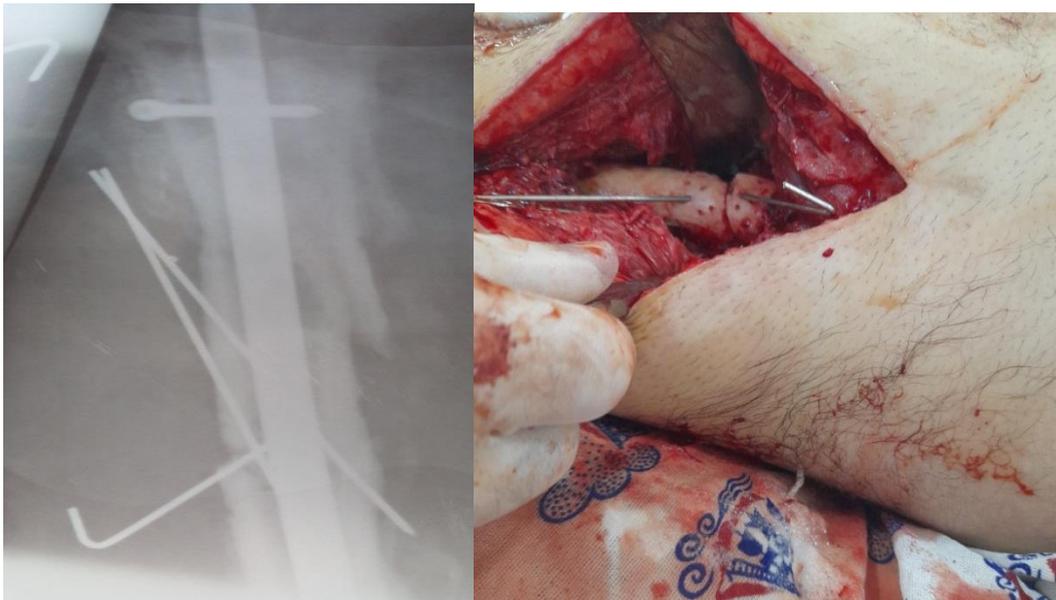


Fig. 2. Radiographs after removal of the cerclage wire and tunneling of the fracture site and fixation with pins.

Recommended: walking with support on crutches with a dosed load. X-ray control was performed 2, 5 and 7 months after tunnelization.

On the control radiographs of 03/21/2022 (7 months after reosteosynthesis and 16 months after the injury), inflammation of the postoperative wound was observed, on the control radiograph there were no signs of consolidation.

In 2022, in the trauma department of the Samarkand United Multidisciplinary Medical Center, a repeat operation was performed to remove the intramedullary blocking rod and pin and sequesterectomy with the application of an external rod apparatus (Fig. 3).

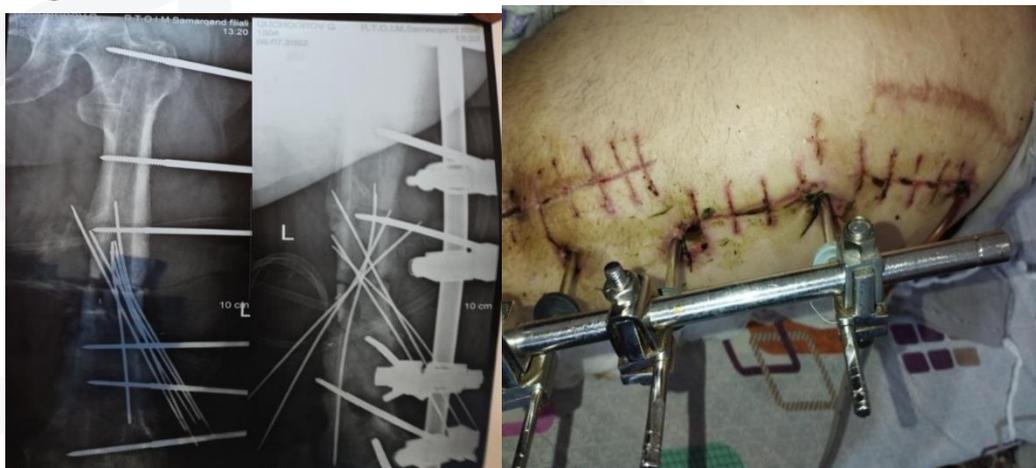


Fig. 3. On control radiographs from 03/21/2023, 7 months after reosteosynthesis and 16 months after the injury, no signs of consolidation were observed.



On 29.10.24, the patient was hospitalized in the trauma department of the Republican Specialized Scientific and Practical Medical Center of Traumatology and Orthopedics on the basis of a preferential order with the diagnosis: “Post-traumatic pseudoarthrosis of the middle lower third of the left femur. Post-traumatic chronic osteomyelitis in remission. Shortening of the left lower limb by 4 cm.” The patient underwent a repeat operation: Resection of the pseudoarthrosis and re-osteosynthesis with an intramedullary locking rod in a retrograde manner (Fig. 4).



Fig. 4. Radiographs of the patient before and after surgery.

Discussion

In case of diaphyseal fractures of the femur, if possible under the control of an EOP using a traction repositioning orthopedic table, it is necessary to perform a closed reposition of the fragments, and then insert an appropriate type and size of implant for closed intramedullary osteosynthesis of the femur

The main tasks of osteosynthesis are to restore the length, axial relationships and rotation.

Reposition can be performed by direct and indirect impact on the fragments. In this case, reposition is carried out using various techniques using a roller, a stand, joysticks and is controlled using an EOP [5]. Reaming of the medullary canal is an optional stage of the intramedullary osteosynthesis operation of the femur. When reaming, it is possible to install a pin of a larger diameter, as well as to ensure a stronger and more stable fixation. In the treatment of patient K., a pin used for fixation of diaphyseal fractures of the femur (antegrade femoral pin) was used, which allows neutralization of almost all degrees of freedom of both fragments due to the length of its load-bearing



part. The choice of the blocking method after the introduction of the pin depended on the type of fracture.

During treatment, it may be necessary to dynamize the nail to stimulate fusion. Currently, it is preferable to first perform distal and then proximal nail blocking. This allows for intraoperative monitoring and correction of residual displacements in length and rotation. In case of diastasis of fragments, the nail is fed with a hammer (the "reverse strike" method), which leads to convergence of bone fragments [11].

The use of cerclage wire is recommended to increase the overall stability of the structure, improve the quality of reposition and distribution of the load of the intramedullary nail. However, the use of cerclage sutures on the femoral diaphysis is associated with a large number of complications, the main ones being aseptic instability and deep suppuration associated with bone devitalization [11]. The use of cerclage can also lead to insufficient fracture reposition and migration of the torn wire. The installation of a cerclage wire involves the removal of the hematoma and periosteum in the fracture zone; the wire compresses large and periosteal blood vessels, disrupting the blood supply to the damaged bone segment, which prevents fracture healing [10]. Static blocking eliminates the possibility of rotational displacements and displacements along the length; full loading is impossible before the formation of bone callus. Static blocking of intramedullary rods promotes resorption of bone tissue at the ends of fragments, which increases the likelihood of non-union, formation of a pseudoarthrosis and diastasis [9]. To avoid these complications, timely dynamization should be performed within 6-8 weeks after surgery [6]. After removal of the locking screw, the bone fragments come closer together under load, creating conditions for the formation of bone callus. In the absence of a bone tissue defect in the fracture zone, consolidation of the diaphyseal fracture should occur no later than 4 months after the fracture. Otherwise, we speak of delayed consolidation. Frequent causes of non-union are inadequate stabilization, poor reposition with diastasis between the fragments, impaired blood supply and lack of axial load. After more than 8 months, a pseudoarthrosis can be diagnosed [4,14]. The operation for pseudoarthrosis should include 3 main stages [4]: • "refreshing" the fracture area; • precise reposition and tight fixation of bone fragments; • biological stimulation of regeneration using bone grafting.

The first stage of the operation using an intramedullary rod with transverse blocking with screws includes isolation of the pseudoarthrosis zone, subsequent opening and reaming of the medullary canal with marginal resection of the ends of the fragments to healthy bone tissue and their adaptation. At the second stage, an intramedullary rod is inserted into the medullary canal and locked with screws in the metadiaphyseal





areas. The case we described shows that a long-term absence of a full functional load on the damaged segment not only worsens the peripheral blood supply, but also leads to persistent muscle atrophy, as well as contractures in the adjacent joints of the damaged limb. Even if the fracture heals, a patient with such disorders will require long-term rehabilitation [4].

Conclusions

1. Intramedullary osteosynthesis with locking rods (antegrade, retrograde) in a less invasive way ensures stable fixation of fragments without disrupting the blood supply, and preservation of the hematoma in the fracture area and uniform distribution of the axial load.
2. Fixation of fragments by open reposition with removal of the hematoma at the fracture site leads to skeletonization of fragments with further development of a pseudoarthrosis.
3. Incorrect and late dynamization of the fixator and, as a consequence, the lack of contact between the fragments lead to a violation of fracture consolidation.

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