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THE ROLE OF ARTHROSCOPY IN SURGICAL TREATMENT OF TIBIAL PLATEAU FRACTURES

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Abstract. *This article presents the advantages and effectiveness of arthroscopy in the surgical treatment of tibial plateau intra-articular fractures. Between 2019 and 2024, 134 patients aged 19–75 years were observed at the Republican Specialized Scientific and Practical Medical Center of Traumatology and Orthopedics. Patients were divided into three groups, and treatment outcomes with different methods were compared. Osteosynthesis under arthroscopic control allowed precise repositioning of bone fragments, correction of soft tissue damage, maximum restoration of the articular surface, earlier rehabilitation, and superior functional outcomes. Economic analysis demonstrated that the arthroscopic method was 4.9–13.9 times more effective than conventional approaches and enabled average savings of 2,000,000 UZS per surgical procedure.*

Keywords: *tibial plateau, intra-articular fracture, arthroscopy, osteosynthesis, economic efficiency.*

Introduction. In recent years, as a result of scientific and technical progress and the rapid penetration of urbanization into daily life, various impacts have increasingly led to injuries of the musculoskeletal system, including fractures of bones at different localizations. Among these, intra-articular fractures of the proximal tibia belong to the category of severe injuries of the lower extremities. Proximal tibial fractures account for 2–5% of all bone fractures and 6–12% of all intra-articular fractures. In most cases, the treatment outcomes of proximal tibial intra-articular fractures are unsatisfactory, manifested by malunion of bone fragments, knee joint instability, limb axis deformity, joint contracture, and the development of deforming osteoarthritis. Therefore, developing new treatment methods and improving existing ones for this pathology remains highly relevant.

These fractures are often observed in both high-energy injuries (road traffic accidents) and low-energy injuries (falls from height onto the limb axis). Adequate diagnosis and treatment of such fractures allow restoration of lower limb function (range of motion, strength, stability) and help minimize the risk of osteoarthritis development.

Study Objective. To evaluate the outcomes of patients with tibial plateau fractures treated with both traditional and modern minimally invasive methods, in order to demonstrate improved treatment efficacy and reduction of complications.

Materials and Methods. The clinical study included a total of 134 patients aged 19–75 years. Among them, 103 (76.9±3.64%) were men and 31 (23.1±3.64%) were women. It was observed that men were injured 3.32 times more often than women, which was explained by their higher activity levels.

Additionally, 38.1±4.19% (n=51) of the patients were permanent residents of rural areas, while 61.9±4.19% (n=68) were from urban areas. Thus, a 1.62-fold difference in distribution by place of

residence was due to a higher incidence of trauma in city dwellers, explained by the urbanization-related increased risk of injuries.

The research was carried out during 2019–2024 at the Republican Specialized Scientific and Practical Medical Center of Traumatology and Orthopedics. All patients were diagnosed with intra-articular fractures of the proximal tibia.

Patients were divided into 3 representative groups according to treatment method and outcomes:

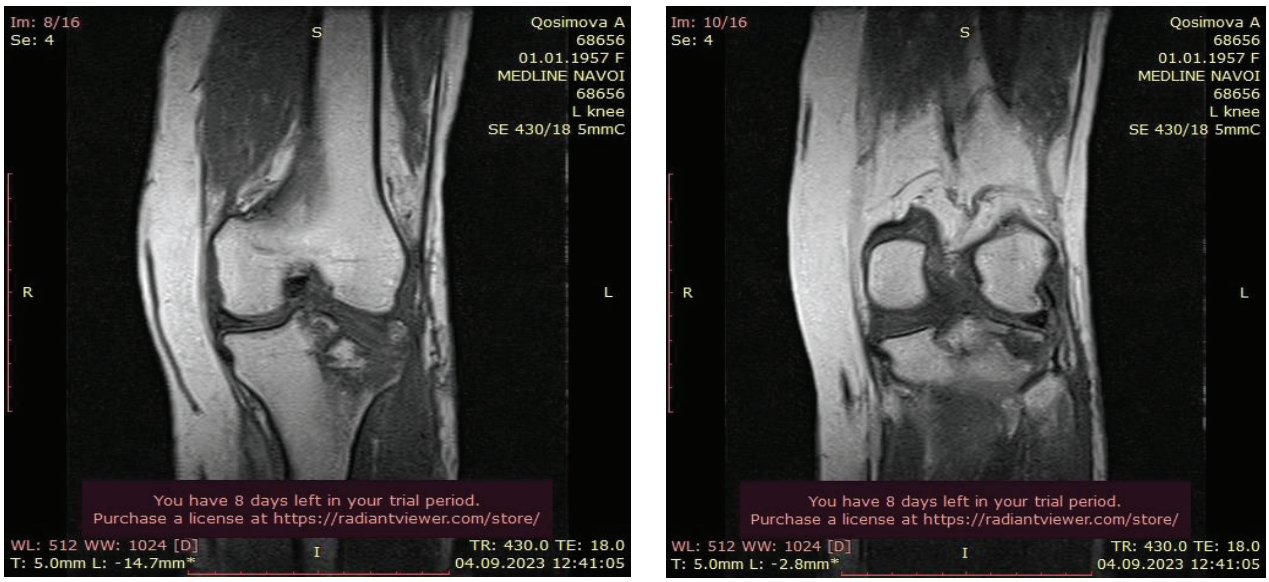
- **Group 1 (main group):** patients treated using the recommended method, n=41.
- **Group 2 (comparison group):** patients treated with traditional methods, n=36.
- **Group 3 (control group):** patients with old proximal tibial intra-articular fractures treated traditionally, n=57.

Random selection was applied in dividing patients into groups, ensuring representativeness. The groups differed only by treatment method; all other parameters (age, sex, place of residence, type of injury, hospital conditions) were identical.

Results. In the main group, 40 patients (97.6%) underwent surgery, of whom 31 (75.6%) had arthroscopy, and 27 (65.9%) underwent osteosynthesis with spongious screws using the proposed method. In group 2, osteosynthesis with the Ilizarov apparatus was performed in 20 patients (55.6%). In group 3, 49 patients (85.96%) underwent surgery, including 7 patients (12.28%) with the Ilizarov apparatus and 36 patients (63.16%) treated with combined surgical methods using an external fixation device.

The average age of patients was 44.07 years in the main group, 47.72 years in group 2, and 48.37 years in group 3. All patients successfully underwent surgical interventions.

Clinical Case 1. Patient N., 66 years old (case history No. 6230), was admitted to the clinic 8 days after sustaining an injury from falling from a height, resulting in trauma to the left leg. Initially, the patient sought care at a local polyclinic, where X-ray examination revealed a “fracture of the lateral plateau of the left tibia with satisfactory alignment,” and a plaster cast was applied. However, due to persistent pain, the patient came to our clinic and underwent additional MRI (image a) and MSCT (image b) examinations. According to these investigations, the diagnosis was established as: “fracture of the lateral plateau of the left tibia with displacement and partial tear of the anterior horn of the lateral meniscus.”



a- images.



v-images.

Subsequently, the patient underwent surgery under arthroscopic control. A partial meniscectomy of the anterior horn of the lateral meniscus was performed, followed by reduction of the lateral plateau under arthroscopic guidance, and osteosynthesis was carried out using spongious screws (images c–d).



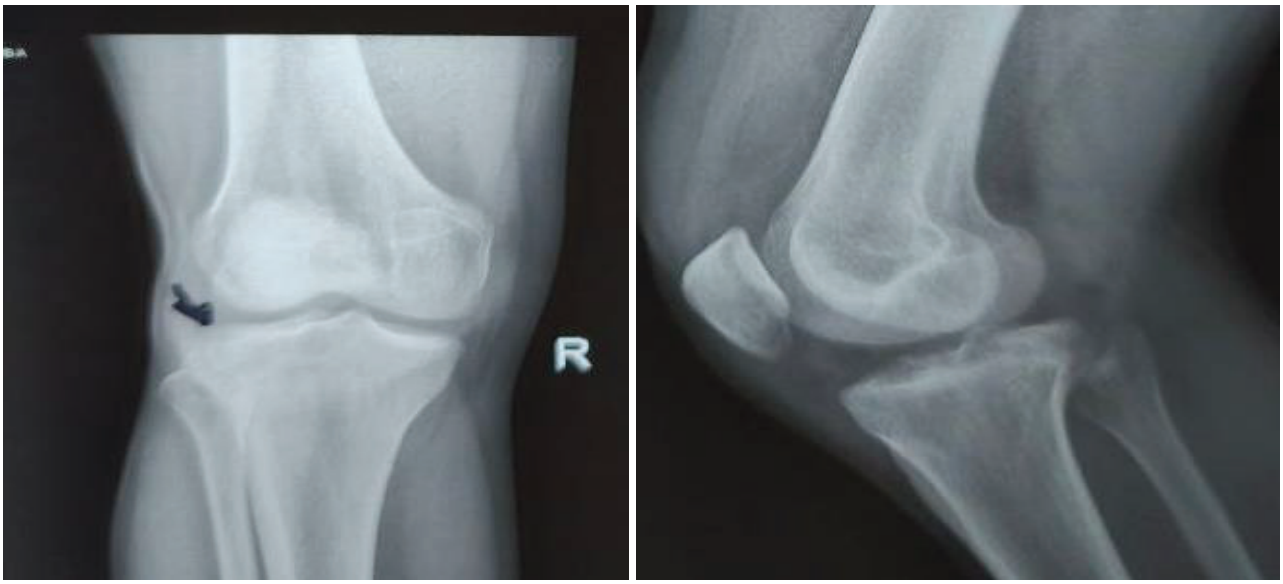
c- images.



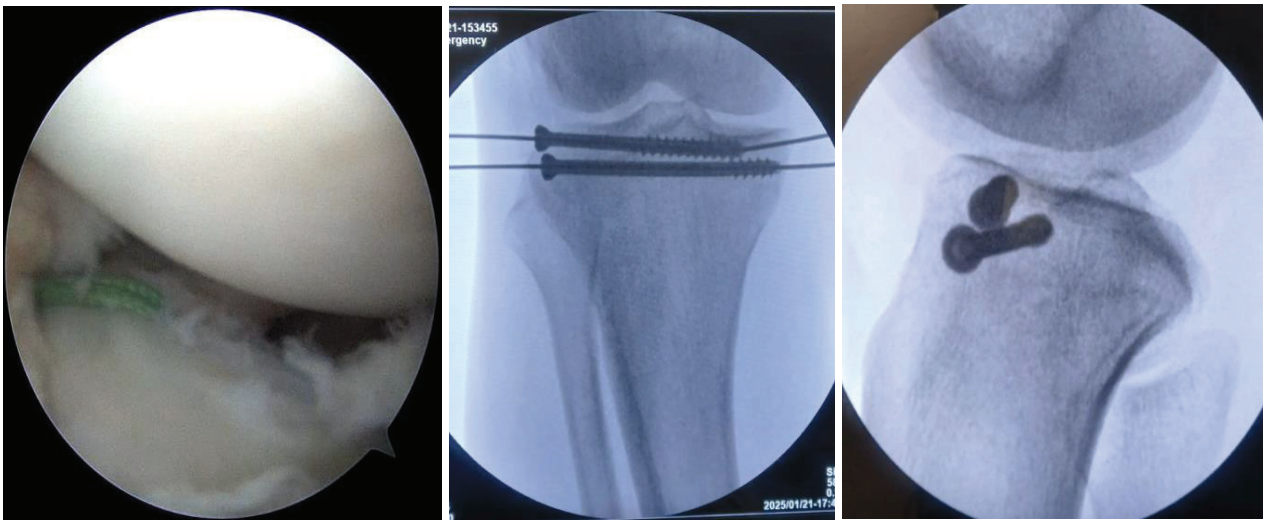
d- images.

Clinical Case 2 A 41-year-old patient (case history No. 9960) was admitted to the clinic 8 days after sustaining an injury to the right leg from a fall from height. Initially, the patient sought care at a local polyclinic, where X-ray examination revealed an *"intra-articular fracture of the lateral plateau of the right tibia with displacement of bone fragments."* A plaster cast was applied. However, due to persistent pain, the patient presented to our clinic, where additional X-ray (image e), MRI, and MSCT (image f) examinations were performed.

Based on the results of these investigations, the diagnosis was confirmed as: *"fracture of the lateral plateau of the right tibia with displacement and partial tear of the anterior horn of the lateral meniscus."* Under arthroscopic control, osteosynthesis of the lateral plateau of the right tibia was performed using spongious screws, and sutures were applied to the lateral meniscus of the right knee joint (image g).

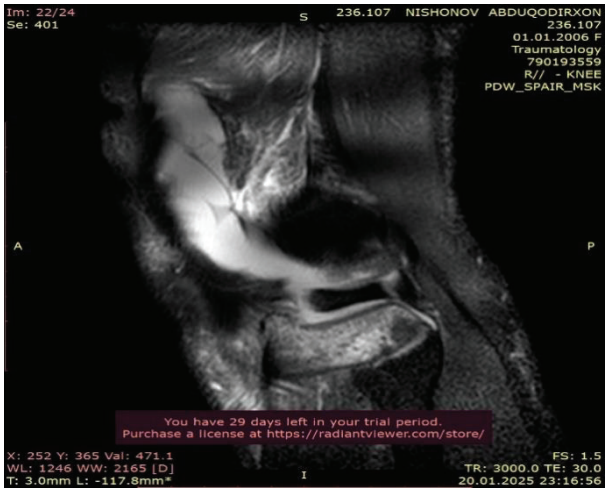


e- images.



f- images.





g- images.

Comparative Characteristics of the Recommended Treatment Method The comparative evaluation of the proposed method with other treatment approaches included the following parameters:

- Bone stability. In terms of achieving stability of bone fragments during the postoperative period, differences between the groups were identified (P>0.05).
- Mobilization time. Comparison of mobilization periods among the main, 2nd, and 3rd groups showed that 95% of patients in the main group began knee flexion–extension exercises and physiotherapy procedures 14 days after surgery. In the 2nd and 3rd groups, in 9.1% of cases, soft tissue changes and discomfort associated with external fixation devices significantly delayed mobilization (P<0.05).
- Radiographic results. In the majority of patients in the main group, maximum anatomical reconstruction was achieved. Radiographic differences among the groups were as follows (P>0.05).
- Functional outcomes. At 6 months post-surgery, patients in the 2nd and 3rd groups showed significantly lower functional outcomes and restoration of movement in the operated limb compared to the main group, due to the inability to fully monitor the intra-articular condition (P<0.05).

The distribution of patients by treatment methods and outcomes ensuring these results is presented in the table.

Discussion. The results of the study confirmed the hypothesis that in surgical treatment of intra-articular tibial plateau fractures, the more precisely the joint surface is restored through minimally invasive techniques, the better the soft tissue damage is eliminated, and the earlier joint motion is initiated, the higher the functional recovery of the joint will be.

The data obtained made it possible to understand the development of anatomical and biomechanical changes in the joint, depending on the extent of the surgical approach and the severity of changes in the articular surface.

Economic Efficiency. Economic efficiency was calculated on the basis of applying the proposed methodological recommendations in clinical practice. Unlike cost-minimization analysis, the comparative options here were characterized by greater or lesser but nonequivalent effectiveness.

As a result of the economic analysis, the *"cost-effectiveness"* ratio was obtained, calculated according to the formula recommended by Phillips S., Thompson G. (1999):

$X/C = (X_2 – X_1): (C_2 – C_1) \times 100$, where:

- X/C – cost-effectiveness ratio,
- X_1 and X_2 – total cost of the first and second interventions,

• C_1 and C_2 – effectiveness of the first and second interventions, expressed as the probability of desired and undesired outcomes,

• 100 – calculation coefficient.

When applying the recommended method for surgical treatment of tibial plateau intra-articular fractures, the analysis of economic efficiency showed the following cost per desired outcome:

X/C = (2,850,000 – 2,650,000): (85 – 75) × 100 = 200,000: 10 × 100 = 2,000,000 UZS.

Thus, the analysis demonstrated that using the recommended method for the diagnosis and treatment of tibial plateau intra-articular fractures provided an efficiency that was 4.9–13.9 times higher than that of traditional methods, with cost savings of **2,000,000 UZS per surgical procedure.**

Conclusions.

1. Performing surgery under arthroscopic control in tibial plateau fractures provides full visualization of bone fragments, soft tissue changes, and intra-articular conditions, ensuring accurate repositioning, maximum control, and minimally invasive intervention.

2. Advantages of arthroscopy include absence of postoperative skin scars, reduced risk of purulent complications, avoidance of prolonged plaster immobilization, and prevention of contractures restricting knee mobility.

3. Long-term follow-up of arthroscopic treatment outcomes revealed high results in 72.97% of cases, good results in 21.62%, and satisfactory results in 5.41%, confirming the high effectiveness of this method. This ensured early rehabilitation of patients and their return to work in a shorter time frame.

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