

## **OUR EXPERIENCE OF TREATMENT OF FEMOR FRACTURES BY THE METHOD OF INTRAMEDULAR LOCKING OSTEOSYNTHESIS.**

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**ABSTRACT.** Fractures of the femur are one of the causes of acute traumatic disease, the pathogenesis of the development of which combines mechanical destruction of the musculoskeletal segment, loss of biomechanical balance and general somatic changes characteristic of traumatic shock. The treatment of these fractures is effective in the algorithm of the development of the disease - fixation of fragments, restoration of the length and axis of the segment with minimal surgical aggression, relief of the pathophysiological syndrome, including its biochemical component.

**KEYWORDS:** Fracture of the femur, intramedullary blocking osteosynthesis.

### **INTRODUCTION**

Fractures of the femur are one of the causes of acute traumatic illness, the pathogenesis of which combines mechanical destruction of the musculoskeletal segment, loss of biomechanical balance, and general somatic changes characteristic of traumatic shock [1, 8, 11]. Treatment of these fractures is effective in the algorithm for the development of the disease - fixation of fragments, restoration of the length and axis of the segment with minimal surgical aggression, relief of the pathophysiological syndrome, including its biochemical component [2, 6, 9]. The incidence of diaphyseal femoral fractures is about 2.5% of skeletal injuries and about 20% of all femoral fractures. According to Salminen S.T. et al. (2000) fractures of the femoral shaft are on average 9.9 per 100 thousand population per year.

As a rule, diaphyseal fractures of the femur occur as a result of mechanical impact of great force [3, 7, 12]. Indeed, in the structure of the mechanism of trauma among our patients up to 80% of cases, the occurrence of a fracture of the femoral shaft occurs in road traffic accidents, the main mechanism of injury in which is the direct effect of a highly kinetic traumatic agent. As a result of the indirect mechanism of injury, including falling from a height (kata injury), femoral fractures occurred in 7% of cases. Fractures of the femoral shaft are accompanied by extensive destruction of soft tissues, severe pain and blood loss. These factors cause the frequent development of traumatic shock, which requires fixation of fragments in a complex of resuscitation measures in an emergency.

Fractures in elderly and senile people, as a rule, are aggravated by severe concomitant pathology and age-related decrease in antimicrobial resistance, and are considered as a serious injury that suddenly confuses the patient to bed, depriving him of his usual way of life, which in the shortest possible time turns into a serious general disease leading to a sharp deterioration in the quality of life [4, 10]. The frequency of postoperative purulent complications after closed blocking intramedullary osteosynthesis does not exceed 1.5%, nonunion of fractures - 5% [5, 13].

Nevertheless, blocking intramedullary osteosynthesis is distinguished by the complexity of the surgical technique and closed reduction of bone fragments. Anatomical and biomechanical features of the femur, displacement of bone fragments due to muscle retraction, physiological curvature of the bone and various morphological changes in the fracture zone create significant difficulties in achieving reduction of fragments. This leads to a lengthening of the operation time, intraoperative blood loss, the risk of damage to the neurovascular bundle, splitting of the walls of the bone tube, the development of fat embolism syndrome (FES) and a worsening of the patient's condition. Thus, it is impossible to foresee the numerous difficulties of the surgical technique of intramedullary osteosynthesis of diaphyseal fractures of the femur, but it is necessary to remember about them and master the methods of implementing the planned operation. For this, it is necessary to carry out preoperative planning, which includes an assessment of the general condition of the patient, the study of the features of the mechanism of injury, morphology of the fracture. The result of preoperative planning is the choice of tactics for intraoperative reduction of bone fragments and the method of osteosynthesis.

**The purpose of our study.** Evaluation of the effectiveness of the use of intramedullary blocking osteosynthesis in fractures of the femur

## **MATERIALS AND METHODS**

In the period from 2015 to 2021, the method of intramedullary blockage osteosynthesis was used in the treatment of 252 patients with fractures of the femur. The average age of the patients was  $42.1 \pm 12.7$  years (from 18 to 90 years). 171 men, 80 women. Isolated hip fractures were noted in 231 patients. Open fractures were observed in 10 victims. Most of the injuries were represented by simple types of fractures (A1-B1) without severe soft tissue injuries. Surgical interventions were performed  $6.9 \pm 9.3$  days after injury (from 0 to 60 days). We used metal structures manufactured by Irene (China) - 90 cases, ChM (Poland) - 162. The duration of the interventions was from 25 to 55 minutes (average 36 minutes). Reoperations associated with re-insertion of distal locking screws were performed in two patients. Residual axial deviations of the main fragments exceeding  $5^\circ$  were observed in 21 patients (5.1%). A shortening of the injured limb by more than 1 cm was observed in four patients. Long-term results of treatment in the period from 6 months to 1 month were studied in 141 patients (56%). Most patients showed good functional and radiological results. Infectious complications were observed in 3 patients (2.1%). Delayed consolidation of fractures was observed in 16 patients (11.3%).

## **RESULTS AND DISCUSSION**

Long-term results of treatment were studied in 252 patients with fractures of the femur, operated with the method of intramedullary osteosynthesis by various methods. The results of treatment were assessed according to the scale we developed, in which we proposed to carry out a comprehensive assessment of segment recovery after surgical treatment of femoral fractures with intramedullary pins using 10 parameters. It is based on the criteria for assessing the restoration of the limb's

support ability. The assessment of changes in the amplitude of movements was carried out using biomechanical measurement of movement parameters.

The results of biomechanics and clinical analysis of movements were compared and evaluated in points (from one to three). A positive result of the quality of the balance function and a complete recovery of the parameters of the step cycle (3 points) were considered a good result. A satisfactory result was considered a positive result of the quality of the equilibrium function and a significant limitation of the recovery of the parameters of the step cycle, or a negative result of the quality of the equilibrium function and the complete recovery of the parameters of the step cycle (2 points). An unsatisfactory result was considered a negative result of the quality of the balance function and a significant limitation of the parameters of the step cycle (1 point). Long-term results were assessed using a three-point system (good, satisfactory and unsatisfactory).

A good result was considered the complete absence of pain syndrome under load on the operated limb, walking without additional support, lameness, full range of motion in the knee and hip joints, restoration of limb length, absence of angular deformity, presence of radiological signs of fracture healing, absence of biomechanical disorders, full restoration of working capacity, and patient satisfaction with the outcome of surgical treatment. A satisfactory result was considered the presence of a slight pain syndrome when loading the operated limb, walking without additional support, slight lameness on the operated limb, limitation of movement in the joints up to 15 °, shortening of the operated limb up to 2 cm, the presence of angular deformity of the operated segment up to 7 °, recovery 3 from 4 walls of the bone tube in the presence of a pin, violation of one parameter of biomechanical assessment of the supporting ability of the operated limb, partial disability, and doubtful patient satisfaction with the outcome of surgical treatment. Unsatisfactory results were characterized by the presence of constant pain syndrome when loading the operated limb, the use of additional support, preservation of lameness on the operated side, pronounced limitation of movements in the joints (more than 15 °), shortening of the operated limb over 2 cm, the presence of angular deformity of the operated segment over 7 °, restoration of only one wall of the bone tube, violation of all parameters of biomechanical assessment of the supporting ability of the operated limb, severe disability (disability of III or II group), and patient's dissatisfaction with the outcome of surgical treatment. The scale for assessing long-term results consisted of 30 points, where a total of 26-30 points was considered a good result, a satisfactory result - 18-25 and an unsatisfactory result - <18 points. For a more detailed analysis of the results of closed blocking intramedullary osteosynthesis of diaphyseal fractures of the femur, we studied the results in each of the groups of antegrade (in 83 patients) and retrograde osteosynthesis (in 33 patients). Good results were obtained with antegrade osteosynthesis in 71 patients (85%). Satisfactory results were obtained in 9 patients (11%).

Radiographs showed an angular deformity of the hip outward within 4-6 °. The operated limb was shortened by 0.5-1.5 cm. There were biomechanical disturbances in the quality of the balance function. In the remaining 3 patients (4%), the result was assessed as unsatisfactory. One patient has persistent pain, walking with bilateral support, lameness. Radiographs showed a fracture of the fixator, angular deformation of the fragments anteriorly by 6 °, and a hypertrophic pseudarthrosis. In 2 patients, complaints of constant pain in the fracture area, pronounced limitation of movement in the joints (more than 15 °) were revealed, radiographically - restoration of only one wall of the bone tube, the presence of biomechanical impairment of the supporting ability of the operated limb over 30%. Good results were obtained with retrograde osteosynthesis in 21 patients (64%). Satisfactory results were obtained in 7 patients (21%). In 2 of them, the radiographs showed an angular deformity of the hip outward within 6-8 °, the operated limb was shortened by 1-2 cm. There were biomechanical disturbances in the quality of the balance function. In 5 patients, intermittent moderate pain in the knee joint, walking with one additional support, limitation of movement in the knee joint to 15 °, shortening of the operated limb to 2 cm was noted.

In the remaining 5 patients (15%), the result was assessed as unsatisfactory. 2 patients had complaints of constant pain in the fracture area. The patients walked with a walker. On radiographs - angular deformation of the fragments to the inside up to 7 ° - hypertrophic pseudarthrosis. All patients noted dissatisfaction with the outcome of surgical treatment. In 3 patients, complaints of constant pain in the area of the fracture, limitation of movements in the knee joint exceeding 15 °, were revealed, radiographically - restoration of only two walls of the bone tube. There was a biomechanical impairment of the supporting ability of the operated limb in excess of 30%.

## CONCLUSIONS

1. Intramedullary osteosynthesis of the femur, both antegrade and retrograde, is an intraosseous splinting that provides control of reparative regeneration under conditions of rational blocking, depending on the location and morphology of the fracture.

2. A closed procedure of intramedullary osteosynthesis is possible with adequate methods of reduction of femoral fragments based on the patterns of their biomechanical behavior.

3. Analysis of clinical and radiological indicators of restoration of the function of the femoral segment and bone integrity showed good results in 236 (93%) patients, satisfactory in 13 (5%) and unsatisfactory results in 3 (2%) patients.

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