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Modern approach to the choice of tactics for the treatment of femoral fractures in patients with associated injury

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Abstract---The work is based on the results of treatment of 233 patients with femoral injuries in concomitant trauma. Males predominated 65.4%. As a result of a road traffic accident, 61.4% of the victims were injured. The most common combination was a concomitant craniocerebral injury, and a fracture of the femur - 42.5%, multiple fractures of the limbs - 16.3% and with polytrauma - 15.0%. In 76.8% of cases, at the time of hospitalization, the condition of patients (ISS: 11.7–22.8). In 202 patients, in 88.7% of cases, in the treatment of femoral fractures, a surgical method was used - osteosynthesis. We have developed a tactic for the treatment of hip injuries, which was based on the severity of the condition and the severity of the injury. It was fundamental that all hip fractures should be stabilized using surgical methods in the early period of traumatic disease. Surgical interventions should be performed after the elimination of the dominant pathology, or after stabilization of hemodynamics. The method of fixation depends on the severity of the condition of the victims: with a stable or conditionally stable condition of the victims (IIS - 11-16 points), submersible intra-, extramedullary osteosynthesis was used; in decompensated (IIS - 17-36 points) - the least traumatic methods of transosseous osteosynthesis.

Keywords---concomitant injury, hip fracture, severity of injury, severity of condition, osteosynthesis.

Introduction

Modern injuries are characterized by a significant increase in the severity of injuries, the vast majority of which acquires a multiple, combined, and often combined character, accompanied by a significant violation of the vital functions of the body, the difficulty of diagnosis, and the complexity of treatment. In the general structure of injuries, the proportion of combined and multiple injuries is 5–12% [2,3,10]. Despite close attention to this problem around the world, mortality remains high. Associated injury, according to WHO, ranks third in terms of overall mortality (up to 40%), and among men aged 18-40 is the main cause of death. Permanent disability is 25-45% [1,5].

An increase in the proportion of injuries from high-energy impacts in the structure of injuries has led to the emergence of a large number of patients with polysegmental fractures of the lower extremities. These injuries are hard tolerated by the victims, deprive them of the ability to move independently for a long time and are one of the main "sources" of unsatisfactory outcomes in the treatment of injuries of the musculoskeletal system [6,11,14]. Unsatisfactory outcomes in the treatment of patients with such injuries are explained not only by the severity of anatomical disorders and the general condition in the acute period, but also by the choice of treatment tactics, method and volume of surgical interventions, mainly on the extremities [12].

This is especially true for hip fractures. If in the treatment of a hip fracture, a specialist faces a number of problems - the shock potential of the injury, immobility of the patient, the traumatism of surgical interventions, the high risk of complications at all stages of treatment, then in patients with concomitant trauma and fractures of the femur, the importance of these problems doubles, which dictates field of in-depth study of this problem [7,8,9,13]. The treatment of this group of patients, despite the latest advances in medicine, is a complex, but at the same time unresolved and priority problem of modern traumatology. All this indicates the need to create improved optimal tactics for the treatment of this contingent of victims.

Objective of the study: to improve the results of surgical treatment of patients with femoral fractures in concomitant trauma by introducing improved treatment tactics based on the use of modern technologies.

Material and Method

The work is based on the results of treatment of 233 patients with injuries of the femur with a combined injury, who were treated at the Republican Scientific Center for Emergency Medical Care and its Bukhara branch in the period 2017-2020. Among the patients, males predominated - 152 (65.4%), women were 81 (34.6%). The patients were aged 18 to 60 years. The majority are persons of the most able-bodied age up to 45 years. As a result of a traffic accident, 143 (61.4%) victims were injured, 40 (17.2%) - when falling from a height (catatrauma), the other 50 (21.4%) victims were injured by other circumstances. Taking into account combinations of damage to the anatomical and functional area of the femoral fracture, the patients were divided into 7 groups (Sokolov V.A., 2006[11]).

As can be seen from the presented table 1, the most common combination was a combined craniocerebral injury, and a fracture of the femur - 42.5%, multiple fractures of the limbs - 16.3% and with polytrauma - 15.0%.

Table 1
Distribution of patients by groups

Group	Combination damage	Qty (%)
I	TBI + hip	99 (42,5%)
II	Chest + hip injury	12(5,2%)
III	Abdominal injury + thigh	17 (7,3%)
IV	Spinal injury + hip	11(4,7%)
V	Pelvic and acetabular trauma + hip	21(9,0%)
VI	Multiple fractures of limb bones	38(16,3%)
VII	Polytrauma damage to two or more anatomical regions in combination with hip fractures	35 (15,0%)
Total		233 (100%)

Determining the severity of the condition was of great importance when choosing the tactics of treating all injuries in concomitant trauma. Along with hemodynamic and laboratory parameters, we used anatomical criteria, in particular, the InjurySeverityScore (ISS) scale [1,6] (Table 2.)

Table 2
Characteristics of the victims depending on the severity of mechanical damage

Characteristics of affected groups	Affected groups			Qty (%)
	Moderate injuries	Heavy Damage	Extremely severe damage	
Number of victims, abs. (%)	73 (31,3%)	106 (45,5%)	54 (23,2%)	233 (100%)
ISS scores (M±σ)	11,7± 0,9	22,8± 0,3	35,7±0,7	26,0±0,4

As can be seen from the table, in 179 patients, in 76.8% of cases at the time of hospitalization, the condition of the patients allowed performing stabilizing operations for damage to the musculoskeletal system. Limb fractures were characterized according to the most widely used AO/ASIF classification in the world. To determine the nature of open fractures, we used the Gustilo-Anderson classification [13]. In our study, hip fractures were observed in 233 patients, who had 253 fractures (Table 3.).

Table 3
Localization and type of femoral fracture in patients with concomitant trauma

Level Hip injuries	Fracture type (AO)			Total, number (%)
	A	B	C	
Upper third	24	15	8	47 (18,6)
middle third	55	41	10	106 (41,9)
lower third	16	26	19	61 (24,1)

Fractures of the proximal femur	8	13	18	39 (15,4)
Total, number (%)	103 (40,7)	95 (37,5)	55 (21,8)	253 (100)
Closed	82	84	49	215 (84,9)
open	21	11	6	38 (15,1)

Both femurs were broken in 20 victims. Closed injuries prevailed, and by localization, fractures of the middle third of the femur. Most of all there were complex fractures of type B and C - 150 (59.3%). A special group in terms of tactics and methods of treatment consisted of patients with fractures of the proximal femur - 39 (15.4%) people.

In 202 patients, in 88.7% of cases, in the treatment of femoral fractures, a surgical method was used - osteosynthesis. According to the timing of osteosynthesis of the hips, the patients were divided into two groups - the first group - 104 (51.5%), early osteosynthesis was performed up to 3 days, and the second group - 98 (48.5%) surgical intervention was performed at a later date - late osteosynthesis.

Results

Surgical intervention was performed after the elimination of the dominant pathology, immediately after surgical interventions on the organs of the abdominal and thoracic cavities, the skull, or after stabilization of hemodynamics. We developed a tactic for the treatment of hip injuries, which was based on the severity of the condition and the severity of the injury. It is fundamental that all hip fractures should stabilize in the early period of traumatic disease, in the presence of objective conditions, before the development of complications. The method of fixation depends on the severity of the condition of the victims: in a stable or conditionally stable condition of the victims (IIS-11-16 points; shock - I-II degree), submersible intra-, extramedullary osteosynthesis was used; in decompensated (IIS - 17-36 points; shock - III-IV degree) - the least traumatic method of extrafocal transosseous osteosynthesis. The latter method was often used in an abbreviated form, i.e. the main task was fixation of the damage, in a state of moderate distraction, without reposition.

In most patients, the method of closed reposition with intramedullary osteosynthesis with pins was used, external osteosynthesis with plates was used mainly for closed fractures of the femur at the level of the lower third, and transosseous osteosynthesis with external fixation devices was performed for complex comminuted fractures of the femur at the level of the lower third and with extensive damage to soft tissues (Table 4.).

Table 4
Treatment of hip fractures in patients with concomitant injuries

Type of fracture Osteosynthesis	A.		B.		C.		Total, number (%)
	Close.	Open.	Close.	Open.	Close.	Open.	
Intramedullary BIOS	36	7	52	6	35	3	139 (68,8)
Nakostny	8	3	9	-	5	-	25 (12,4)
Transosseous (with a rod apparatus)	-	-	3	1	5	2	11 (5,4)
Osteosynthesis of the proximal femur (compression screws, plate)	8	-	9	-	3	-	20 (9,9)
Amputation at the level of the femoral segment	-	-	-	1	-	6	7 (3,5)
Total, qty	52	10	73	8	48	11	202 (100)

According to the timing of hip osteosynthesis, the patients were divided into two groups - the first group A., early osteosynthesis was performed up to 3 days, the second group B, surgical intervention was performed at a later date - late osteosynthesis (Table 5). In diaphyseal fractures of the femur at the level of the upper, middle third, intramedullary osteosynthesis with pins was most often used as a stabilization of the damage. Intraosseous osteosynthesis was performed with titanium structures, which had sufficient strength, indifference to the effects of biological media, which ensured reliable fastening of fragments for a long time.

Table 5
Timing and methods of hip osteosynthesis in concomitant trauma

Osteosynthesis Timing Operations	Intramedullary	Bones	Transosseous	Osteosynthesis Proxim femur	Amputation	Total
Group A up to 3 days.	76	9	6	8	5	104
Group B later than 3 days.	63	16	5	12	2	98
Total	139	25	11	20	7	202

The choice of anesthetic aid depended on the volume of surgical intervention, the state of hemodynamics, and the age of the victims. In the presence of indications for performing diagnostic and therapeutic interventions on the organs of the

abdominal and thoracic cavities, with unstable hemodynamics and advanced age, preference was given to endotracheal anesthesia. With stable hemodynamics and delayed surgical interventions, spinal or epidural anesthesia was the method of choice.

The position of the patient on the operating table also depended on the extent of the surgical intervention, the level of the fracture, and the presence of concomitant injuries. In case of isolated fractures of the femur, surgery was performed with the patient in the healthy side position; in case of bilateral fractures of the hips, concomitant injuries of the chest, abdomen, pelvic bones, and lower leg, patients were operated on in the supine position, using a roller in the lumbar region and turning the operating table in the frontal plane.

The main method of 68.8% stabilization of fractures in diaphyseal localization was intramedullary osteosynthesis with pins. Moreover, in 61.5% of cases, we managed to perform osteosynthesis using a closed method. The BIOS system was used as an implant in 78 (58.1%) cases, in the rest of the cases traditional Küntscher pins were used. In order to prevent complications and reduce the trauma of surgical intervention, in 88.9% of cases we performed osteosynthesis without reaming the bone marrow canal. Osteosynthesis with plates was performed for fractures at the level of the lower third of the femur and the distal end of the femur. In case of comminuted fractures of the femur at the level of the distal end, open fractures with extensive damage to soft tissues, gunshot fractures, and in severe condition of the victims, transosseous osteosynthesis was used using pin and rod external fixation devices.

Depending on the tasks set, two types of module of external fixation devices were used: in case of a severe decompensated state of the victims - a simplified module, in a stable state - a complete arrangement of the device. Considering that the passage of crossed wires through the proximal fragment is associated with certain difficulties, we used a combination of wires and rods. The rod was screwed from the outside into the metaphyseal part of the femur, its end protruding from the outside of the thigh, and fixed with the arc of the Ilizarov apparatus. Stabilization of bone fragments was further enhanced by threaded rods above and below the fracture line through the bone diaphysis. In case of fractures of the distal end of the femur, an additional ring was placed at the level of the upper third of the leg. The rings on the thigh and lower leg were connected to each other by rods with hinges, in a bent position of the knee joint at an angle of 170-160 degrees.

Clinical example

Patient M., 16 years old. (case history No. 25618/2861) was injured as a result of an accident. Diagnosis: Polytrauma. ZTCHMT. Brain injury. Closed fracture of the right pubic and ischial bones with a satisfactory standing of bone fragments. Closed double comminuted fracture of the upper third of the right femur and the middle third of the left femur with a mixture of bone fragments. Bruised wounds of the left zygomatic region and dorsal surface of the right foot. Traumatic shock II stage, IIS-18 points (Fig. 1.)

Operated 2 hours after admission, simultaneously by two teams: open intramedullary osteosynthesis of the right femur with a CITO pin, fixation of the

pelvic bones with an external rod device, closed reposition, fixation of the left femur with a wire-rod device for external fixation (Fig. 2). Duration of surgery - 1 hour 30 minutes. The postoperative period proceeded smoothly, the wounds healed by primary intention, on the 12th day he was discharged for outpatient treatment (Fig. 3.). After 45 days the patient is activated, after 2 months. the device has been dismantled. Conducted a course of rehabilitation treatment. A year later, the patient's condition is satisfactory, there are no complaints, the patient returned to his previous studies.

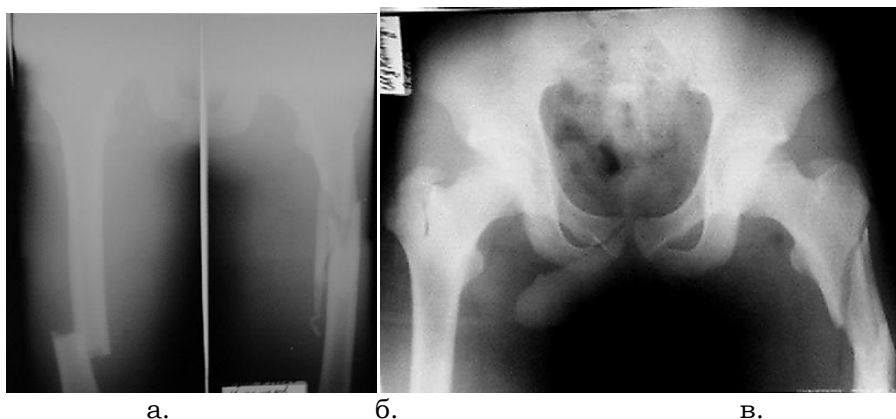
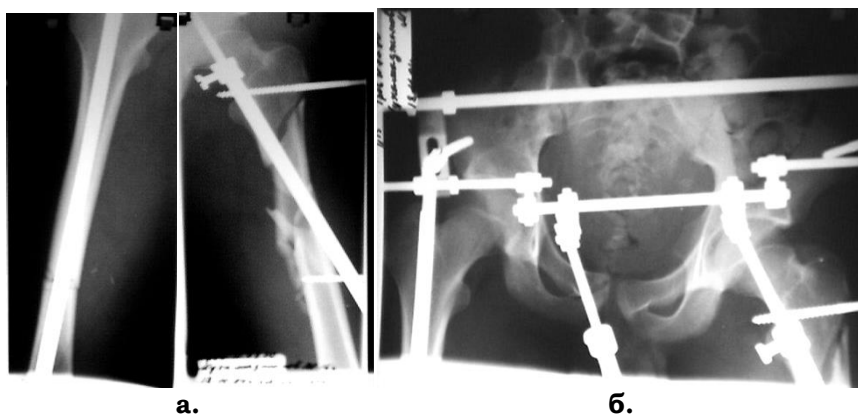


Fig.1 X-ray of the patient M. upon admission

- a. Fracture of the middle third of the left femur with a mixture of bone fragments
- b. Double comminuted fracture of the upper third of the right femur with a mixture of bone fragments in. Fracture of the right pubic and ischial bones.



Rice. 2. X-ray of the patient M. after surgery

- a. SPO of open intramedullary osteosynthesis of the right femur with a CITO pin
- b. SPO of closed reposition with fixation of the left femur with a wire-rod device



Rice. 3. Patient M. on the 2nd day after the operation.

Thus, restoring the anatomy and function of the femur of the knee and hip joints without surgical treatment of fractures in most patients with concomitant trauma is impossible. The fundamental position is that all hip fractures should stabilize in the early period of traumatic disease (in the presence of objective conditions), before the development of complications.

The arguments in favor of this tactic were:

- prevention of respiratory distress syndrome, fat embolism, thromboembolism, sepsis;
- the compensatory mechanisms of the victims are in the most optimal state, before the development of typical manifestations of a traumatic disease;
- the possibility of creating conditions for early mobilization, which will facilitate the process of care at the stage of removing the victims from a critical condition;
- the possibility of a full-fledged excursion of the chest and diaphragmatic breathing;
- reduction of pain syndrome and decrease in the consumption of analgesics;
- no contamination of the skin with hospital microbes.

There are much fewer arguments against early osteosynthesis:

- in the absence of complete stabilization of the condition of the victims;
- difficulties in planning the operation due to the high risk of possible complications;
- Insufficient logistical and professional support during duty.

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