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Current Views on the Treatment of Periprosthetic Fractures

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Abstract
At the present stage of human development there is a demographic trend towards an increasing proportion of elderly and senile people. The number of cases of senile osteoporosis, the most significant complication of which is low-energy fractures of the proximal femur, is also increasing in correlation with this indicator. Pertrochanteric fractures of the hip account for 20-36% of this pathology. This type of injury is steadily increasing worldwide and has now reached 1.7 million people per year.

Keywords: hip fracture, transversal hip fractures, traumatology.

Introduction: There are various classifications of transverse fractures in the literature, but the most widely used and accepted is the Swiss AO/ASIF classification. A 1 simple transverse fracture without dislocation, A2 multiple dislocated transverse fractures and A3 intervertebral fractures. The division of fractures into stable and unstable ones is also of great importance for the choice of treatment tactics [1, 4, p. 17]. The quality of medical care for the elderly and elderly with transversal fractures plays a socially significant role. The high mortality rate (14-38.8%) and complications (16-40.1%) occurring in the first year after injury make the problem of finding an optimal method of treating vertebral injuries an urgent task in modern traumatology [1, 5].

The lack of unified protocols for treatment of patients with pertrochanteric fractures and high rate of adverse outcomes in the postoperative period put us

The aim of the literature review is to illustrate the current views on the treatment of patients with this pathology.

Introduction. Each new patient admitted to a trauma hospital with a transverse fracture requires immediate therapy; therefore, the attending physician is faced with the question of choosing the

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optimal tactic for the management of the patient. A wide range of treatment methods, from conservative application of coximal plaster casts to placement of continuously upgrading metal fixation devices, requires a physician to make a complex and rapid assessment of a set of factors determining the consolidation outcome, such as general condition of the patient, age, gender, weight, presence and degree of associated diseases, stability of the fracture and its localization, equipment of the medical institution with necessary facilities, including EOP devices, whether

A generally accepted tactic for the treatment of pertrochanteric fractures is surgery [6, 7]. However, traumatologists often encounter absolute contraindications to surgery in their practice. Conservative treatment is then the only option.

The anatomic feature of the vertebral region, which has a good blood supply to the cancellous substance and the presence of periosteum, as well as the absence of marked displacement of fracture fragments and their large contact area at the fracture allow successful conservative treatment for this injury [8]. For vertebral fractures without dislocation, conservative treatment consists of immobilisation with a coxial plaster cast or a derotational plaster cast for 2.5 to 3.5 months. This method of treatment, although easy to use, has several disadvantages: prolonged immobilisation of adjacent joints and muscles with a plaster cast leads to hypo- and atrophy and the development of contractures. In addition, the plaster cast tends to weaken its fixation effect during wear, which can lead to secondary displacement of fragments [8, 9].

Conservative treatment with skeletal traction is now possible. The injured limb is placed on a standard Böller splint. After passing the Kirschner wire through the tuberosity of the tibia or the epicondyle of the femur, the limb is placed in abduction position. A weight of 6-10 kg is then added individually. The priority for the entire duration of the immobilisation is to prevent pressure sores and to prevent infection from entering the wound canals. After 6-8 weeks, the skeletal traction is removed and the hip joint is radiographed. The next phase of treatment is either a coxial cast or functional treatment. Only when the consolidation of the fracture zone is evident in the control radiographs, the patient is allowed to use partial and then full load on the limb [9]. Functional treatment is performed either on a Bellaire splint or using a splint with a removable hammock under the tibia. A cord secured to the foot is thrown over the splint block and the shin is released from under the hammock several times a day. The patient is able to adjust the tension of the cord himself, thus performing passive movements in the knee and hip joints. Gradually the patient is allowed to perform active movements, and after 2.5-3 months the functional treatment is discontinued. This method of treatment of pertrochanteric fractures is considered to be the most optimal from a medical point of view, because by the time the patient transfers to crutches, joint movements are restored to a satisfactory extent, which reduces the risk of contractures and muscle atrophy [8, 9]. However, the total period of immobilization for patients undergoing conservative treatment reaches 2.5 months or

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more, which significantly delays the early full activation of patients. Given the fact that the main contingent receiving this injury is elderly and old people, their prolonged forced position increases the probability of complications in 70-75% of cases: the development of bedsores, thromboemboli, hypostatic pneumonia, and decompensation of somatic diseases is possible. This complicates the further rehabilitation period, increases the need for constant inpatient care, and decreases the bed turnover in the trauma hospital [9, 10]. With an increase in occupational and especially road traffic injuries, the number of young adults with pertrochanteric fractures of the femur is increasing. In patients under 60 years of age, this injury is most often complicated by avascular necrosis, ineffective consolidation and significant limb shortening [9].

Despite unfavourable statistics on the results of conservative treatment, some orthopaedic traumatologists note this method of treatment as the most preferable for those under 60 years of age. A foreign metal structure placed in the peri-implantation area causes mechanical damage and avascular necrosis in the reimplantation area. This method increases the risk of osteosynthesis failure after 3-4 weeks due to bone destruction around the metal and the formation of diastasis between the fragments. Younger individuals without significant health problems, with adequate prevention of thromboembolism and bedsores, are able to tolerate prolonged immobilisation with conservative treatment without surgical intervention. However, the lack of an evidence base and necessary research in the treatment of periprosthetic fractures in young people with conservative treatment puts it into question against a high risk of possible complications.

Thus, due to the high complication rate of conservative therapy and lethal outcomes (from 33.7% to 71% according to different authors), surgery is currently the only widely used treatment tactic for periprosthetic fractures. The conservative approach is only feasible when surgery is contraindicated [12-14].

Surgical treatment

Surgical treatment is the primary treatment for patients with periprosthetic fractures. Only surgical treatment can ensure precise repositioning of the fragments and their secure fixation. In addition, the ability to perform surgery early after injury reduces the risk of complications, promotes early activation of the patient and greatly facilitates the postoperative period. However, due to the lack of a unified protocol and surgical tactics for the treatment of patients with vertebral fractures, osteosynthesis of periprosthetic fractures is still at the stage of improvement and refinement of the available osteofixators [10, 15, 16]. Currently, there are the main areas of osteosynthesis available to varying degrees in trauma hospitals: 1) extramedullary osteosynthesis; 2) intramedullary minimally invasive osteosynthesis with cervical-medullary gamma-rod and PFN-construction; 3) compression-distraction osteosynthesis with external fixation devices; 4) primary hip arthroplasty [6, 8].

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Extraarticular osteosynthesis of pertrochanteric fractures using external fixators is used very rarely and mainly against the background of polytrauma and a pronounced pathological process in the hip joint (deforming arthrosis, osteoporosis, pseudarthrosis) [8].

The widely used extramedullary osteosynthesis includes fixation of fragments by means of plates. This type of osteosynthesis is constantly being improved, but at the moment the 'gold standard' for many orthopaedic traumatologists is the use of DHS construction, which combines the fixation properties of the extramedullary plate and the dynamic properties of the femoral screw. The positive properties of this metal fixator (minimal trauma, the ability to select the required degree of compression in the fracture zone, reliable design allowing early activation, no need for high-tech equipment) make the DHS design a priority when choosing treatment tactics for unstable periprosthetic fractures [17].

Many researchers in the field of traumatology and orthopaedics are developing and improving new metal structures and useful models for osteosynthesis, including the DHS design. Significant attention has been paid to the use of different modifications of diaphyseal pads in combination with derotation and neck screws in different variants, which can improve the characteristics of osteosynthesis, including its strength [18].

For stable transverse fractures without dislocation, an L-shaped plate with angular stability can be used. The choice of the plate angle is based on the degree of valgification that occurred during the fracture and depends on the stability of the bone fragments. A 95° angle plate is used for stable transversal fractures and a 130° angle plate is used for fractures with acetabular separation of the acetabulum. However, this technique is now very rarely used [8].

Since the 1980s and up to now, metal osteosynthesis with the intramedullary GN construct, the cervical-medullary gamma-nail, has been actively used. The gamma-nail is significantly stronger than the DHS construct, allowing early activation of the patient with dosed load on the limb as early as day 6 of the postoperative period [1, 8]. At the beginning of the 21st century, the treatment of pertrochanteric fractures received a new stage of development due to the emergence of highly effective intramedullary metal structures for closed submerged osteosynthesis - Proximal Femoral Nail (PFN) [8]. PFN and GN fixators can stabilise any fracture of type A1, A2, A3 (AO/ ASIF) whose fracture line starts from the apical region and reaches the middle third of the femur. The sliding effect of the neck screw of these designs allows the use of metal fixators against the background of severe senile osteoporosis, while retaining the possibility of early activation, which significantly reduces the risk of postoperative complications and improves quality of life [1, 19, 20]. Despite their proven efficacy, these osteosynthesis techniques have limitations due to the lack of adequate facilities and experienced staff, especially in medical institutions outside of major urban centres.

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The use of modern techniques and metal fixators for osteosynthesis of periprosthetic fractures, unfortunately, does not exclude a rather high percentage of complications (on average, from 20% to 40% according to different authors), the causes of which are untimely initiated or incorrect treatment, application of early inadequate load on the operated limb, decompensation of associated pathologies, individual bone regeneration capabilities of the body, etc. Therefore, the search for new treatment methods still remains an open question, and in foreign practice, there is a tendency to replace osteosynthesis with an alternative treatment option - primary arthroplasty [1, 21].

Primary hip arthroplasty

Despite the prevalence of primary arthroplasty in the treatment of femoral neck fractures, the use of total joint replacement for pertrochanteric fractures remains an open question and requires a number of studies. Numerous foreign works devoted to arthroplasty for acetabular injuries have been actively studied by our compatriots. However, in most cases, hip arthroplasty is currently performed in patients with consequences of proximal femoral injuries, such as posttraumatic coxarthrosis, and to a lesser extent in fresh periprosthetic fractures. However, endoprosthetics for femoral neck fractures is already very widespread and the use of endoprostheses for periprosthetic fractures is becoming more widespread every year. This technique eliminates the possibility of aseptic necrosis and significantly improves the quality of life of the patient in the postoperative period [13].

Although many authors point to the undeniable advantage of arthroplasty over other osteosynthesis techniques, its use is possible only with strict indications, including age over 60 years and pre-existing pathological processes in the hip joints (marked osteoporosis, osteoarthritis, previous trauma, false joints of the proximal femur) [2,4].

In pertrochanteric fractures, as in femoral neck fractures, two techniques are used: cemented and uncemented. The wide range of endoprostheses on the endoprosthesis market poses a difficult choice for hospitals and professionals: which prosthesis is the best for the clinical case, taking into account the price-performance ratio? When selecting the prosthesis components, only an individual approach must be taken into account: the shape of the metal cup must be suitable for the patient's acetabulum, the optimal anchoring of the components in the bone must be considered, and the prosthesis components must not cause a pronounced reaction to the foreign implant. Currently, endoprostheses with different parameters, both pelvic and femoral, are widely used by several dozen manufacturers [2,3].

Conclusions: Having analyzed the literature of Russian and foreign authors, we can conclude that treatment of transverse hip fractures is an important and urgent problem of modern traumatology and orthopedics. Whichever method to restore the integrity of the trochanteric zone is chosen, the main task is to activate patients early after high-quality stable osteosynthesis has been performed. Conservative treatment, which causes a high percentage of postoperative complications, remains the

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method of choice only when there are absolute contraindications to surgical intervention. Osteosynthesis with the use of various metal fixators, which are constantly being improved, is the main method of treatment of injuries in the trochanteric region. As international practice shows, primary hip arthroplasty may become a promising method for treatment of patients with transversal fractures in the near future, which significantly improves the patient's quality of life in the early stages of the postoperative period. Eliminating the shortage of state programmes, equipping the material and technical base of medical institutions, and quality training of medical staff are also important areas in solving the problem of poor outcomes of peroneal fracture osteosynthesis**.**

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