COMPARATIVE ANALYSIS OF THE RESULTS OF TREATMENT OF PATIENTS WITH FEMORAL NECK FRACTURES

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The aim of our study is to analyze the results of surgical treatment of patients with femoral neck fractures in groups using osteosynthesis with a developed monolateral spoke-rod device and a bundle of spokes with their fixation in the Ilizarov apparatus.

Keywords: *femoral neck, fracture, osteosynthesis with a bundle of spokes, monolateral spoke-rod device, errors, complications, treatment results.*

СРАВНИТЕЛЬНЫЙ АНАЛИЗ РЕЗУЛЬТАТОВ ЛЕЧЕНИЯ ПАЦИЕНТОВ С ПЕРЕЛОМАМИ ШЕЙКИ БЕДРЕННОЙ КОСТИ

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Целью нашего исследования является проанализировать результаты хирургического лечения пациентов с переломами шейки бедренной кости в группах с использованием остеосинтеза разработанным монолатеральным спицево-стержневым устройством и пучком спиц с их фиксацией в аппарате Илизарова.

Ключевые слова: *шейка бедренной кости, перелом, остеосинтез пучком спиц, монолатеральное устройство "спица-стержень", ошибки, осложнения, результаты лечения.*

Femoral neck fractures occupy the third place in elderly and senile patients, second only to fractures of the radius and humerus, and account for up to 70% of all injuries of the proximal femur [1]. At the same time, industrial and especially road traffic injuries due to increased speeds on the roads leads to an increase in the number of damages hip necks in young and middle age groups [2]). Mortality in femoral neck fractures within a year after injury reaches 36%, which is associated with decompensation of concomitant diseases at the time of injury, which occurs in most patients (65% of cases) [4]. A decisive role in

ensuring the survival of patients, their medical and social rehabilitation belongs to the activation of patients in the early stages after adequate osteosynthesis or hip replacement [5]. Despite the rapid development of endoprosthetics in recent decades, osteosynthesis is still the main surgical method for the treatment of femoral neck fractures [6, 7], which is currently widely covered in scientific and patent literature [8-10]. Until recently, the development of new methods of treatment of patients with hip fractures remains relevant. To improve the results of treatment, we have previously developed a monolateral spoke-rod device for osteosynthesis of femoral neck fractures. This device allows you to in a given direction, insert fixation elements (spokes and compression rod) into the bone and ensure compression at the junction between the fragments and their stable fixation. The results of treatment were encouraging.

Material and methods. 87 patients with femoral neck fractures treated at the regional hospital in 2020 to 2022 were under observation. To analyze the effectiveness of treatment of patients with hip fractures, depending on the treatment method used, the patients were divided into 2 groups: group I — osteosynthesis of the femoral neck with a bundle of spokes was performed to the victims with their fixation in the Ilizarov apparatus (64 patients), and in 26 cases, fixation and unloading of the hip joint was performed by the Ilizarov apparatus; group II — for osteosynthesis of the femoral neck the developed monolateral spoke-rod device was used (23 patients), in 6 cases the hip joint was fixed and unloaded by the Ilizarov apparatus, indications for which in patients of both groups were pronounced osteoporosis of the femur, increased body weight.

The operations were performed using a set for transosseous osteosynthesis according to G.A. Ilizarov.

In two groups of patients, the following were studied: duration of surgery, duration of osteosynthesis, complications and treatment results (in terms of one year after dismantling the clamps) using a modified scale.

The developed monolateral spoke-rod device was used as follows.

During the operation, after the closed reposition of bone fragments of the proximal femur by traction along the axis with retraction and internal rotation, two screw rods 12 were carried out on the orthopedic table in the area of the large trochanter and the middle third of the femur, which were attached to the support 1 using threaded bushings 11. By rotating the threaded rods 4, 10, the support 1 was installed

parallel to the femur. After that, the guide 17 was installed in the middle hole of the bar, and a spoke 14 was inserted into the through channel 18 of the guide 17 before insertion into the femoral head. Produced radiography of the EOP of the proximal femur in direct and axial projections. Then the angular and linear deviation of the spokes from the axis of the femoral neck was calculated. The spoke 14 was removed and, taking into account the radiographs, the support was shifted 1 by means of threaded rods 4 and 10 to the required angular and linear values. After correcting the position of the support 1, the

guide 17 was gradually inserted into the upper and lower holes 13 and spokes were gradually carried out through the through channel 18 of the guide 17 14. Through the hole 20, a compression rod-screw 21 with nuts 23, 24, 25 was inserted into the bone fragments, washers 22 were installed. Spokes 14 were controlled The EOP was removed from the proximal fragment using a drill. To compress the bone fragments, the nut 23 was unscrewed and nuts 24 and 25 (lock nut) were tightened. The fact of compression was determined using EOP. Spokes 14 were immersed with a drill into the proximal bone fragment. Then the guide 17 was installed in the following holes 13 and the spokes 14 were fixed with bolts 15.

The presence of a compression rod in this device made it possible to carry out, in all cases, metered supported compression at the junction of the fragments. In the process of fixation, in order to stimulate osteogenesis in the fracture zone, dosed removal of the diafixing spokes from the femoral neck was carried out.

All patients were admitted to the clinic for treatment 3-6 days after the injury. Operations in patients of both groups were performed under spinal anesthesia, on skeletal extension and after closed manual reposition of bone fragments. From the second day, the patients became more active, with the help of an instructor Physical therapy students were trained to walk using additional means of support with a gradually increasing load on the operated limb, and began to develop movements in adjacent joints.

In group I, there were 39 men (61%), 25 women (39 %). Of the 64 patients, 51 (79.5%) were aged 30-59 years, 13 patients (20.5%) were 60-76 years old. Group II patients had 17 men (74%), 6 women (26 %). Of the 23 patients, 13 (56.5%) were aged 30 to 60 years, 10 patients (43.5%) were over 60 years old.

Subcapital femoral neck fractures were most common in patients of both groups (42.2 and 74.0%, respectively), then transcervical (39.1 and 13.0%, respectively) and basal (18.7 and 13.0%, respectively). According to the classification of femoral neck fractures according to the degree of displacement of bone fragments, the most

common fractures were Gorden II–III st. (87.5% in victims I (56 people) and 100.0% in victims II (27 people) groups). According to the Powell classification, vertically unstable fractures were found in both groups in 28 patients.

Statistical processing of the obtained results was carried out by the method of variational statistics with the calculation of the arithmetic mean (M), the error of the arithmetic mean (m). To compare two independent samples by the level of the trait, a nonparametric statistical criterion was used — the Mann-Whitney U-test. The critical level of significance when testing statistical hypotheses was assumed to be $p<0.05$.

Results. When comparing the duration of operations, it was revealed that in group II patients it was 1.4–1.5 times less than in group I patients. The duration of fixation of bone fragments in patients with grade III displacement corresponded to 90±6 (group I) and 76±4 days (group II) (there was a decrease in the index in group II patients by 1.2 times). The

duration of inpatient treatment was 91±12 and 76±9 days, respectively, in patients of the first and second groups with II degree of displacement of bone fragments (a decrease in the indicator in patients of group II in 1.2 times) and with the III degree of displacement — 114 ± 7 and 37 ± 11 days, respectively (a decrease of 3 times). In patients Group II with III degree of displacement of bone fragments (by Garden) compared to this indicator, in group I patients with a fracture angle of 30-50 ° (according to F. Pauwels), the duration of the operation was less in 1.6 times, the duration of osteosynthesis — 1.2 times, the duration of inpatient treatment was reduced by 3 times; with a fracture angle of more than 50 ° (according to F. Pauwels), the duration of surgery was 1.2 times less, the duration of osteosynthesis — 1.3 times, the duration of inpatient treatment was reduced by 1.8 times. All the differences according to the Mann–Whitney criterion were reliable.

Depending on the anatomical localization of the fracture in patients of group II compared with patients of group I:

-with subcapital fracture, the following were reduced: the duration of surgery by 1.6 times, the duration of osteosynthesis by 1.3 times, the duration of inpatient treatment by 2 times (the differences are significant);

-with a transcervical fracture, the duration of surgery was reduced by 1.3 times, the duration of osteosynthesis and the duration of inpatient treatment were also reduced by 1.3 times and 2.8 times, respectively (differences according to the Mann–Whitney criterion were not reliable);

-with a basal fracture, the duration of the operation did not differ significantly, the duration of osteosynthesis was reduced by 1.2 times (the difference is not significant), the duration of inpatient treatment was also reduced by 2.2 times (the difference is significant).

Fracture fusion in group I patients was achieved in 40 (62.5%) patients. Among the complications in this group of patients there were: non—fusion and formation of a false joint - in 21 cases (32.8%), aseptic necrosis of the femoral head was observed in 3 (4.7%) cases, hip ankylosis joints — in one (1.6%) case, fractures and migration of spokes into the joint cavity and pelvis (3 patients, 4.7%), cutting of spokes from the femoral head in 3 (4.7%) cases. A total of 61 complications were identified.

In the II group of patients, non-fusion of the fracture was detected in one case (in a 64-year-old patient). Complications in this group of patients were found in 6 cases: inflammation of soft tissues near the spokes, moderate secondary displacement of bone fragments (the patient fell on the area of the operated limb during osteosynthesis) and a fracture of the spokes.

The results of treatment of patients are analyzed in two groups, depending on the degree of displacement of bone fragments, the angle of the fracture, its anatomical localization.

In group I, 32 (50%) patients had good results, and 7 had satisfactory results. (10.9%) cases, unsatisfactory — in 25 (39.1%) cases, which was due to non-fusion of the bone, aseptic necrosis of the head and ankylosis of the hip joint. It was revealed that with an increase in the degree of displacement of bone fragments and the angle of fracture, the number of negative treatment results increases. Localization of the fracture femoral neck did not affect the results of treatment.

In group II, good results were achieved by 20 (87%) patients, satisfactory — in 2 (8.7%) cases, unsatisfactory — in one (4.3%) case. Localization of femoral neck fracture during osteosynthesis with a monoliteral spoke-rod device did not affect the result of treatment. The unsatisfactory result was due to the early removal of the device (on the 49th day of osteosynthesis) due to inflammation of the soft tissues near the spokes. The patient is referred for hip replacement. In this group of patients, the degree of displacement of bone fragments, the magnitude of the fracture angle and the localization of the fracture femoral necks did not affect the results of treatment.

Discussion. Despite the invention of about 130 different fixators for osteosynthesis, the percentage of unsatisfactory results of functional rehabilitation of patients ranges from 18 to 80%. The fundamental contradiction of osteosynthesis is that small structures do not provide stable fixation, while large ones destroy bone fragments and disrupt blood supply. In addition, it is known that stable fixation of bone fragments, necessary for the primary fusion of a fracture, is provided only by pressure and contact between they are used in compression osteosynthesis. Most implants create a single-stage inter-fragment compression during surgery. It stops after a single episode of overload with the destruction of bone tissue in the area of its contact with the implant.

To a certain extent, these contradictions are smoothed out by the developed monolateral spoke-rod device, which allows combining small dimensions in one design, preserving the integrity of bone fragments and the necessary rigidity of fixation. In addition, it allows for dosed supportive compression for the entire period of treatment.

Comparative analysis of treatment results patients with femoral neck fractures showed that the use of the developed monolateral spoke-rod device is accompanied by a decrease in the number of complications by 4 times compared with osteosynthesis with a bundle of spokes and their fixation in the Ilizarov apparatus. At the same time, the positive results of treatment are 95.7%, while with osteosynthesis by Ilizarov apparatus — 60.9%.

The disadvantage of the technique of transosseous osteosynthesis by the Ilizarov apparatus was the lack of dynamic compression and stable fixation between fragments, which was expressed in the visualization on radiographs of the gap between the bone fragments and the deformation of the spokes (16 patients, 25%), The performance of these operations required good practical and theoretical training of the surgeon.

When using a monolateral spoke-rod device for osteosynthesis of the femoral neck (group II patients), compared with osteosynthesis with a bundle of spokes (group I

patients), it was revealed reduction of the duration of surgical treatment (in 1.3–1.6 times). In our opinion, the early discharge from the hospital of group II patients can be indirectly explained by a decrease in the number of errors and complications in which additional manipulations were performed and inpatient treatment continued.

Conclusion. Osteosynthesis of femoral neck fractures with a monolateral spoke-rod device of the proposed design allowed in 95.7% of cases to obtain positive results of treatment of victims, while fastening bone fragments with a bundle of spokes with their fixation in the Ilizarov apparatus — only in 60.9%. This indicates that the developed device provides high reliability of fixation of bone fragments. Comparative analysis has shown that the use of a monolateral spoke-rod device is accompanied by a 4-fold decrease the number of complications associated with insufficient rigidity of fixation and lack of inter-fragment compression.

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