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EFFECT OF EARLY PATIENT ACTIVATION ON BONE MINERAL DENSITY DYNAMICS DURING OSTEOSYNTHESIS OF FEMORAL NECK FRACTURES

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A B S T R A C T

Objective: the effect of early activation of patients on the dynamics of bone mineral density during osteosynthesis of femoral neck fractures using an external fixation rod and wires.

Materials and methods. 52 patients with fractures of the proximal femur participated in the study. The age of the patients participating in the study was from 22 to 92 years. According to the AO classification (2018), the nature of the cracks was distributed as follows: A1 -14; A2-5; Type A3-2, B1-4; B2-8 and B3-19. The control group included 34 patients who underwent osteosynthesis using wires, and the main group included 18 patients who underwent osteosynthesis using the external fixator rod developed by us. The dynamics of changes in bone mineral density were evaluated by ultrasound osteodensitometry (SONOST-2000, Korea) and were conducted in healthy limbs 1-2 and 4 months after device removal, and after 9 and 12 months, the results were the same compared to one.

Results. In comparison groups of patients with femoral neck fractures using a crutch device, BMD values recovered 1.12 times more in the main group than in the control group at 4 months, which is an effect on the reparative regeneration of bone fragments and early recovery of the patients' ability showed to work.

Conclusion. With early activation of patients with femoral neck fractures, BMD remains within normal values and is restored 1.12 times more during osteosynthesis with external fixator compared to osteosynthesis with wires.

K E Y W O R D S

Femoral neck fracture, bone mineral density, osteosynthesis, rod apparatus.

Introduction

Osteoporosis is characterized by low bone mass, impaired bone quality, and decreased bone strength. Osteoporosis and related fractures are serious health problems. An osteoporotic fracture occurs worldwide every 3 seconds, and from the age of 50, one in two women and one in five men will experience a fracture in their lifetime [4]. Low bone mineral density (BMD) has been proven to be one of the risk factors for fracture [10, 11]. In osteoporosis, the loss of bone mass occurs gradually, the lack of mineralization of bone tissue increases over several years, which is not noticed by a person. Decreased bone mass is a characteristic of the elderly and the elderly. However, the initial background of the bone mass formed in a person under the age of 25-30 is of great importance, which reaches "peak bone mass"; In conditions of low peak bone mass and constant physiological bone loss (about 1% per

year), the risk of developing osteoporosis increases progressively from the age of 40 and especially after menopause in women. If the loss of BMD is 1% per year, the loss of bone mineral density may reach 40% over the next 40 years [9]. In the absence of special studies, the diagnosis of osteoporosis is made late, often only after the development of a fracture. The most severe type of osteoporotic fractures - femoral neck - it is necessary to know the risk factors for osteoporosis, the most important of which is BMD. The social importance of osteoporosis is related to its complications - fractures of the vertebrae and bones of the peripheral skeleton, which increase disability and death in elderly patients, as well as increase the costs of treatment and care of this category of patients [2].Patients with changes in bone mass after a fracture, manifested by a decrease in BMD, should be carefully monitored by a doctor for timely comprehensive treatment to prevent the potential risk of further fractures [5, 7].In many countries of the world, the task of improving the treatment of fractures of the proximal end of the femur, which leads not only to high mortality rates, but also to social adjustment, is being carried out. Therefore, it is important to elucidate the underlying patterns of BMD change after fracture of the proximal end of the femur.

Objective: the effect of early activation of patients on the dynamics of bone mineral density during osteosynthesis of femoral neck fractures using an external fixation rod and wires.

Materials and methods. From July 2016 to December 2019, 52 patients who were treated with a fracture of the proximal end of the femur in the emergency traumatology department of the multidisciplinary clinic of the Tashkent Medical Academy participated in the study. 31 of them are men, 21 are women.The age of the patients participating in the study was from 22 to 92 years. According to the mechanism of injury: traffic accidents - 18 patients, domestic injuries were observed in 22 patients, and 12 patients were injured during production. According to the AO classification (2018), the nature of the cracks was distributed as follows: A1 -14; A2-5; Type A3-2, B1-4; B2-8 and B3-19.To study BMD over time, depending on the type of osteosynthesis, patients were divided into 2 groups: control and the main group. The control group included 34 patients who underwent closed osteosynthesis with Ilizarov wires, and the main group included 18 patients who underwent osteosynthesis using an external fixator rod device developed by us (FAP No. 01180, 22.02.2017).The dynamics of changes in bone mineral density were evaluated by ultrasound osteodensitometry (USDM), (SONOST-2000, Korea). The level of skeletal mineralization was evaluated by the speed of sound (SOS), which represents the speed of ultrasound in bone tissue, m/s, and depends on its elasticity and density.Broadband ultrasound attenuation (BUA) was also taken into account, which describes the loss of ultrasound propagation intensity in the absorption medium, dB / MHz and the number, size and spatial direction of trabecular bone tissue. Ultrasound densitometry (quantitative ultrasound QUS) has shown certain possibilities in the screening evaluation of the quality of bone tissue.Ultrasound osteometry of the petrous bone allows to assess both the bone density and the state of the architecture, which characterizes the strength of the bone. The method allows obtaining MS data on bone density with simultaneous assessment of bone structure and elastic properties. In this case, sound SOS speed, m / s, calcium content, elasticity, bone architecture and broadband ultrasound attenuation BUA, dB / MHz, which reflects not only the density of bone tissue, but also the condition from bone trabeculae.The combination of SOS and BUA with the help of software allows calculation of total bone quality index (BQI), T- and Z-criteria. The study is easy to perform, safe and cheaper compared to x-

ray methods with much higher sensitivity and specificity. In 1994, the WHO decided to evaluate the results of densitometry in adults using the T-score index.

Results

The analysis of the densitometry results of the calcaneus in patients with fractures of the lower extremities revealed the disruption of the bone architecture and the presence of microdamages in the late stages, which is confirmed by the decrease in the broadband attenuation of BUA ultrasound as a decrease in heel strength.

In the main group, we obtained the following results during surgical treatment using rod devices (Table 1). We based our normalized BMD results on data from healthy limb BMD values. On the first day, the results of ultrasound examination for lower extremity injuries were detected in 12 (66.7%) patients in the main group; In the control group, normal values were determined in 25 (73.5%).After 4 months, after examination in the main group, 12 out of 16 (75%) patients were found to be close to the norm, 1 (6.25%) patient had osteopenia, 3 (18.75%) had osteoporosis , in the control group, 30 patients were examined at 4 months, and normal indicators were observed in only 20 (66.7%) patients, osteopnea 3 (10%), osteoporosis in 7 (23.3%) patients.

This is due to the fact that most of the patients were in a forced position, that is, the injured limb was immobilized.

In the main group, 14 patients came to the examination at 9 months, and 12 (85.8%) patients had normal BMD indicators, osteoporosis and osteopenia - 1 (7.1%) patient respectively, BMD data after 12 months approached normative values in 13 (92.9%) patients, osteopenia was observed in 1 (7.1%) patient, despite the prescription of biostimulants.In the control group of 28 patients, 22 patients (78.6%) returned to standard values, 4 patients (14.3%) had osteoporosis, and 2 patients (7.1%) had osteopenia. In the 12th month of follow-up, 22 out of 26 patients (84.6%) had normal parameters, 2 (7.7%) had osteopenia, 2 (7.7%) had osteoporosis.Changes in osteopenia and osteoporosis indices of the healthy limb were observed over time in both groups. In the group of patients with femoral neck fracture who used the crutch device, BMD values were restored 1.12 times more in the main group than in the control group within 4 months, which is an effect on the reparative regeneration of bone fragments and the early recovery of the patients' abilities showed to work.Discussions. Osteosynthesis using bundles of wires, although it has advantages due to its minimally invasiveness and inconsistency of performing the operation compared to external osteosynthesis plates and installation of ANF, but has its disadvantages: does not provide rigid stability, requires external immobilization, which requires a long time to restrict the movement of the injured limb and the patient himself, and this in turn affects the BMD of the skeletal system.

Table No. 1. Dynamics of UDPC of patients in the compared groups

Mineral density degree	After admission				4 month			
	Main group Healthy Limb n=18		Control group Healthy Limb n=34		Main group n=16		Control group n=30	
	abc	%	abc	%	abc	%	abc	%
Norm T-score-1SD and more	12	66,7	25	73,5	12	75	20	66,7
Osteopenia T-score -1 to -2.5 SD	5	27,8	7	20,6	3	18,75	7	23,3
Osteoporosis T-score-below - 2.5 SD	1	5,5	2	5,9	1	6=,25	3	10
Mineral density degree	9 month				12 month			
	Main group n=14		Control group n=28		Main group n =14		Control group n=26	
	abc	%	abc	%	abc	%	abc	%
Norm T-score-1SD and more	12	85,8	22	78,6	12	85,8	22	84,6
Osteopenia T-score -1 to -2.5 SD	1	7,1	4	14,3	1	7,1	2	7,7
Osteoporosis T-score-below - 2.5 SD	1	7,1	2	7,1	1	7,1	2	7,7

Bone fracture as a result of prolonged absence or reduced bone load can lead to BMD impairment, the consequences of which are serious, delayed consolidation and formation of pseudoarthrosis can be observed in 10-15% of cases [3, 7].According to A.S. Allakhverdiev and Yu P. Soldatov [1], fixation of bone fragments with a single handle and their fixation in 95.7% of cases allows one-sided pin-rod osteosynthesis of femoral neck fractures. Ilizarov apparatus - only 60.9%. This once again proves that during osteosynthesis of femoral neck fractures, the set of wires is not enough for stable fixation and there is no interfragmental compression.The use of external devices allows early activation of patients with fractures of the femoral neck and optimizes reparative regeneration of bone fragments, and BMD values are maintained within normal values [8]. The proposed rod apparatus for osteosynthesis of the proximal end of the femur is accompanied by minimal bone damage, which optimizes reparability regeneration of bone fragments due to the stable fixation of bone fragments, it allows early activation of patients, and static load on damaged limbs prevents osteoporosis, reduces the likelihood of developing secondary complications, and helps to improve the quality of life of patients.

Conclusion:

Thus, early activation of femoral neck fracture patients BMD remains within normal values and is restored 1.12 times more during osteosynthesis using an external fixation device compared to osteosynthesis with wires.

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