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CONSERVATIVE TREATMENT OF OSTEOARTHROSIS OF THE KNEE JOINT

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Goal. *To improve the results of complex treatment of patients with posttraumatic knee chondropathy by intraarticular administration of platelet-enriched plasma.*

Material and methods. *The study examined the treatment results of 55 patients who had suffered various knee injuries, with an arthroscopically verified diagnosis of "posttraumatic chondropathy". Intraarticular administration of platelet-rich plasma was used in the complex treatment of 31 patients with post-traumatic cartilage defects of the knee joint. The control group consisted of 24 patients with posttraumatic chondropathy. In the treatment of which platelet-rich plasma was not used. To determine the effectiveness of treatment, in addition to clinical research methods, the KOOS (Knee injury and osteoarthritis outcome score) scale was used before, 2 and 6 months after the course of treatment.*

Results. *The study showed that, after 6 months, patients undergoing a course of intraarticular administration of platelet-enriched plasma were characterized by significantly higher values of subscales "Symptoms"; "Daily activity" ($p<0.01$); "Sports, active recreation" ($p<0.01$); "Quality of life" ($p<0.010.01$) and the final value on the KOOS scale ($p<0.01$) compared with patients in the control group. We have not identified any side effects or complications when using this treatment method.*

Conclusion. *The use of platelet-rich plasma for intraarticular administration can significantly improve the functional state of the knee joint and the quality of life of patients with posttraumatic chondropathy. This technique is modern, effective, easy to use and promising in the treatment of this pathology.*

Key words
knee joint, posttraumatic chondropathy, platelet-rich plasma

The knee joint is the largest joint in the human body. Since it experiences significant static and dynamic mechanical stress, and has a complex anatomical structure, various injuries to the knee joint of various authors, they account for 50-70% of all injuries to the musculoskeletal system [1].

Posttraumatic chondropathy (chondromalacia) is characterized by the

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presence of hyaline cartilage defects of varying depth, localization and area in patients who have suffered knee injury. The incidence of this pathology varies from 51 to 66% according to arthroscopy data [2].

Hyaline cartilage has unique biomechanical properties and is able to withstand significant mechanical loads that occur during movements [3]. However, when damaged, it has an extremely limited potential for spontaneous regeneration. This is due to the low ability of chondrocytes to proliferate, their insufficient mobility and the lack of vascularization of the intercellular matrix [4].

Since even small defects of articular cartilage can cause persistent limitation of knee joint function, induce early development and progression of gonarthrosis [5,6], the treatment of patients with posttraumatic chondropathy is an urgent problem of modern traumatology and orthopedics.

Surgical methods occupy a special place in the complex treatment of cartilage defects [7]. Among them, surgical techniques aimed at stimulating reparative processes at the expense of bone marrow cells of the subchondral layer are widely used. They provide for antegrade and retrograde tunneling of the subchondral bone, micro-fracturing, and "debridement".

Various types of osteochondral autotransplantation and autogenous chondrocyte transplantation are also used to replace articular cartilage defects. However, in most cases, the newly formed tissue has the character of fibrocartilage or fibrous tissue, which differs significantly from normal cartilage and is not able to fully perform its functions [8]. Conservative methods of treating hyaline cartilage damage (the use of physiotherapy techniques, nonsteroidal anti-inflammatory drugs, hyaluronic acid preparations, etc.) have a short-term clinical effect. Many medications have a symptomatic effect and do not slow down the processes of further cartilage degeneration [9].

Considering the above, improving the effectiveness of treatment of patients with post—traumatic chondropathy of the knee joint is an important and urgent task for orthopedic traumatologists.

In recent decades, tissue engineering and cell therapy have taken an increasingly strong position in clinical medicine. In this regard, the possibility of using platelet-rich plasma (OTP) in the treatment of patients with injuries of the musculoskeletal system and their consequences is currently of great interest [10].

The presence of plasma clot formation products and platelet growth factors in OTP, which ensure the processes of regeneration and hemostasis, are the basis for its use. OTP contains not only growth factors (PDGF — platelet growth factor, TGF-0 — transforming growth factor, EGF — epithelial growth factor, VEGF — vascular

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endothelial growth factor), but also adhesive molecules (fibrin, fibronectin and vitronectin) necessary for migration, cell adhesion and stimulation of collagen synthesis.

OTP also contains cytokines with anti-inflammatory effects that stimulate repair and anabolic processes in damaged tissues [11]. Since OTP is derived from the patient's own blood, its use does not involve the risk of parenteral transmission of infections such as HIV or hepatitis. The use of OTP does not cause hyperplastic processes, carcinogenesis or tumor growth. Growth factors are not mutagens and do not block the feedback mechanisms of tissue repair and regeneration processes [12].

Good results were obtained when using OTP in the field of maxillofacial surgery. OTP is used in the treatment of long-term non-healing, infected skin wounds, trophic ulcers, diabetic foot. OTP is also widely used in traumatology, orthopedics and sports medicine in the treatment of enthesopathies, rotator cuff injuries, atrophic false joints, large bone cysts and associated pathological fractures, finger injuries with skin and soft tissue defects [13].

In recent years, researchers have obtained good results when using OTP in the treatment of osteoarthritis and related cartilage defects of articular surfaces [14]. The results of these studies suggest that OTP has chondroprotective properties, improves regeneration processes in cartilage tissue.

The aim of the study is to improve the results of complex treatment of patients with posttraumatic chondropathy of the knee joint using intraarticular administration of platelet-rich plasma.

Material and methods

The BMMC Clinic of Traumatology and Orthopedics analyzed the results of the examination of 55 patients of both sexes who were under treatment, who were diagnosed with post-traumatic chondropathy of the knee joint.

All patients underwent arthroscopy of the knee joint after a standard clinical and X-ray examination according to a generally accepted protocol with an assessment of the localization and depth of damage to articular cartilage according to the Outerbrige classification. During arthroscopy, concomitant damage to the internal structures of the knee joint (menisci, cruciate ligaments), if any, was eliminated. All patients underwent debridement of the cartilage defect zone (cervical chondroplasty), microfracturing or tunneling of the subchondral bone as indicated. In the postoperative period, all patients received medication (NSAIDs, chondroprotectors), physiotherapy (PMP on the joint area) and physical therapy.

In addition to complex treatment, 31 patients of both sexes (the study group)

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underwent a course of intraarticular injection of OTP in the postoperative period. In the postoperative period, OTP was not administered to patients of the control group (24 people).

The criteria for exclusion from the study and control groups were as follows: the age of patients less than 18 or more than 50 years; the presence of radiological or arthroscopic signs of gonarthrosis; the presence of systemic connective tissue diseases in patients.

OTP was obtained from the venous blood of the patient immediately before use. 20 ml of blood was taken from the cubital vein with a sterile solution of sodium citrate in a ratio of 9 to 1. The resulting mixture was centrifuged at a separation factor of 450 g for 15 minutes in compliance with the rules of asepsis. After centrifugation, 1.4-1.6 ml of OTP was taken from a platelet-rich plasma layer using a syringe and an injection needle. The platelet count was performed in each OTP sample. The procedure of intraarticular injection of OTP was performed in a dressing room.

The knee joint area was treated with an antiseptic solution for external use. The skin and underlying soft tissues in the area of the planned puncture of the joint were infiltrated with a solution of local anesthetic (2% lidocaine solution — 2 ml). The puncture was performed in the position of bending the knee joint at an angle of 90 degrees at a point located 1 cm below the level of the lower pole of the patella and at a distance of 0.5 cm medial or lateral to the patella's own ligament. Immediately before the administration of OTP, platelet activation was performed by mixing OTP with 0.2 ml of 10% calcium chloride solution. After the procedure, an aseptic bandage was applied to the knee joint. The course of treatment consisted of 3 injections, which were carried out with an interval of 7 days.

In addition to clinical research methods, the KOOS (Knee injury and osteoarthritis outcome score) scale was used to determine the effectiveness of treatment before arthroscopy, 2 and 6 months after the course of treatment.

The normality of the distribution of the data obtained as a result of the study was checked using the Shapiro-Wilk criterion. Data with a distribution other than normal were presented in the form of medians and percentiles. The data were compared before and after treatment using the Wilcoxon test. The Mann-Whitney U-test was used to assess the differences between the groups in terms of quantitative characteristics. The qualitative characteristics were compared using x2 (with Yates correction if necessary). $P<0.05$ was taken as the level of statistical significance. Statistical analysis was performed using the program STATISTIC 6.0

Results and their discussions

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The age of the patients in the study group was 27 (25-34) years. The age of patients in the control group was 30 (24-37) years. 71% of the patients in the study group were male, 29% were female. In the control group, 79.2% were men, 20.8% were women. There were no significant differences in gender and age structure in patients of the study and control groups ($p>0.05$). In 58.3% of patients of the control group (35.5% of the study group), full-layer defects of knee cartilage (chondromalacia 3-4 art.) were revealed during arthroscopy. Isolated cartilage defects of the medial condyle of the femur and patella prevailed in both groups. There were no significant differences between the groups in the structure of the post-traumatic knee joint and the time elapsed from the moment of injury to arthrostopia of the knee joint ($p>0.05$). The baseline level of subscale values and the final score on the KOOS scale also did not significantly differ in patients of the study and control groups (Table No. 1).

The number of platelets in the OTP samples was 1030000/ml (1017000; 1105000), which confirms the proper quality of the product obtained by us during the centrifugation of the patient's blood.

As a result of treatment, both in the study and in the control group, there was a significant improvement in subscale values and the final value on the KOOS scale ($p<0.01$). However, 2 months after treatment, patients in the study group were characterized by significantly higher values of the subscales "Symptoms" ($p<0.01$); "Sports, active recreation" ($p<0.01$); "Quality of life" ($p<0.01$) and the final value on the KOOS scale ($p<0.01$) compared to with patients of the control group. 6 months after the course of treatment, significant differences between the groups remain, although there is a tendency to increase the values of indicators of the functional state of the knee joint in patients of both groups (table). There are also statistically significant differences in the values of the indicators of the "Daily activity" subscale (the study group is characterized by higher indicators). We did not identify any adverse reactions and complications in patients during the course of intraarticular administration of OTP.

Discussion

The problem of post-traumatic chondropathy of the knee joint is relevant all over the world. The presence of even an isolated cartilage defect in the patient (absence of concomitant damage to the menisci and cruciate ligaments) leads to the development and progression of gonarthrosis after 5-6 years [5;p.89]. The frequency of unsatisfactory outcomes of both conservative and surgical methods of treatment of this pathology remains quite high.

The use of intraarticular injection of OTP in order to improve the regeneration

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of damaged hyaline cartilage in the treatment of patients with post-traumatic chondropathy of the knee joint is a modern, effective and promising technique. The absence of any side effects and complications during the administration of OTP indicates the safety of its use in clinical practice. Since OTP is a derivative of the patient's own blood, the risk of parenteral transmission of infections is excluded.

The use of a single-stage blood centrifugation protocol and a conventional laboratory centrifuge for obtaining OTP avoids significant material costs associated with the purchase of specialized equipment and consumables. All this, along with the ease of implementation, allows us to recommend this treatment method for use not only in specialized trauma departments of hospitals, but also in outpatient practice.

However, given the relatively small number of patients studied and the duration of follow-up, it is necessary to further study the effectiveness of intraarticular injection of OTP in the treatment of patients with post-traumatic chondropathy of the knee joint.

Table No. 1

Basic values on the KOOS scale and the dynamics of their changes during treatment

Group	Subscale indicators and final score on the KOOS Me scale (25th percentile, 75th percentile)			
Comprehensive treatment +	Subscales	Before treatment	2 months after treatment	t 6 months after treatment
OTP	Pain Symptoms Daily Activity Sports, Outdoor activities Quality of Life KOOS	63,9 (52,8; 86,1) 67,9 (50; 82,1) 77,9 (51,5;91,2) 25,0 (10,0; 70,0) 37,5 (31,3; 56,3) 57,7 (40,3; 74,5)	88,9 (86,1;94,4) 89,3 (82,1; 96,4) 91,2 (77,9; 95,6) 75,0 (70,0; 85,0) 81,3 (75; 81,3) 85,4 (79,9; 90,3)	91,7 (88,9; 94,4) 89,3 (85,7; 92,9) 92,6 (85,7; 92,9) 75,0 (75,0; 80,0) 75,0 (75,0; 81,3) 86,0 (82,3; 86,9)

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Comprehensive	Боль	61,1 (51,4; 73,6)	88,9 (81,6; 91,7)	90,3 (87,5; 93,1)
treatment	Symptoms Daily	62, (57,1; 71,4)	71,4 (71,4; 75)	80,4 (75,0; 85,1)
	activity Sports,	60,3(51,5; 67,6)	83,1 (77,9; 91,9)	86,0 (81,6; 89,7)
	active recreation	25,0(17,5; 42,0)	45,0 (35,0; 52,5)	57,5 (45,0; 67,5)
	Quality of life	46,7 (34,4; 50)	56,3 (43,8; 56,3)	65,6 (56,3; 71,9)
	KOOS	49,8(46,6; 59,7)	68,5 (65,4; 71,6)	77,2 (69,0; 78,9)

Conclusions:

1. The use of OTP in the treatment of post-traumatic hovdropathy is an effective and safe technique that can significantly improve the indicators of the functional state of the knee joint and the quality of life of patients.

2. For a comprehensive assessment of the effectiveness of intraarticular administration of OTP in the treatment of posttraumatic chondropathy of the knee joint, further clinical and experimental studies are advisable.

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