Original Article
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Minimally Invasive Arthroscopic Treatment of Patients with Medial Epicondylitis

Marsel R. Salikhov [1], Dmitry A. Shulepov [1], Oleg V. Zlobin [1], Nadezhda N. Dmitrieva [2], Ali I. Midaev [1]

[1] *Vreden National Medical Research Center of Traumatology and Orthopedics, St. Petersburg, Russia*

[2] *St. Mary Magdalene Children's City Hospital No. 2, St. Petersburg, Russia*

Abstract

Background. There is not enough research on the topic of arthroscopic treatment of medial epicondylitis. Topographic studies are needed to justify surgical approaches with minimal trauma to the medial collateral ligament and ulnar nerve. ***The aim of the study*** was to optimize the arthroscopic treatment of medial epicondylitis and evaluate its clinical effectiveness based on the results of the topographic and anatomical study. ***Materials and Methods.*** The material for the topographic and anatomical study was 12 «fresh» anatomical preparations of the human elbow joint, of which 6 were taken from female cadavers, and 6 — from men. The features of the structure and topography of the elbow medial collateral ligament were studied, and the safety and effectiveness of arthroscopic approaches to the elbow for the flexor carpi radialis release were determined. A prospective cohort comparative study was performed, which included 70 patients. Two comparative groups were formed. In the group I (35 patients) surgical treatment was carried out by the open method. The group II included 35 patients who underwent minimally invasive surgical treatment using arthroscopic technique. The results were evaluated by Mayo Elbow Perfomance Score (MEPS) and VAS before surgery and 1, 6, and 9 weeks after. ***Results***. Functional results in 9 weeks: group I — 81.77 (95% CI 81.13; 82.41); group II — 92.66 (95% CI 91.61–93.70) points. The average score for VAS in the same period: group I — 34.30 (31.89–36.68) points; group II — 1.5 (0.46–2.45) points. ***Conclusion.*** The safe zone is located above the midline of the humeroulnaris joint by 2 (1.0–3.2) mm. The risk of the medial ulnar collateral ligament anterior bundle injury is minimal in this area. Treatment of patients with the medial epicondylitis according to the developed arthroscopic technique can significantly improve the patients functional state and quality of life.

Key words: medial epicondylitis, golfer's elbow, arthroscopy, flexor carpi radialis, medial ulnar collateral ligament, ulnar nerve.

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✉ *Marsel R. Salikhov*; e-mail: virus-007-85@mail.ru

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Background

Medial epicondylitis, also known as "golfer's elbow", was first described by G. J. Morris in 1882 [1]. Etiology and pathogenesis of medial epicondylitis includes microtraumatization, degeneration of the pronator teres and flexor carpi radialis. This disease occurs, as a rule, in people aged 40-60 years and affects men and women equally [2]. Medial epicondylitis is characterized by pain in the attachment area of the forearm flexors common tendon base to the medial condyle of the humerus and occurs in patients whose activity is associated with repetitive flexion and pronation of the forearm. Similar loads are found in sports such as golf, baseball, tennis, fencing and swimming [3]. Despite the historical name of the pathology under consideration, for the most part, the cause of pain is not playing golf at all, but professions associated with hard, cyclically repetitive actions requiring movements in the forearm, wrist, hand and fingers [4].

Medial epicondylitis in most cases respond to conservative treatment, which consists in reducing physical load on the injured limb, wearing relief braces, anti-inflammatory pharmacotherapy (nonsteroidal anti-inflammatory drugs) and physical therapy aimed at increasing the strength and elasticity of the damaged tendon [4]. The results of the performed cohort prospective studies have shown that these methods remain effective only in the next 3-6 months. [5, 6]. If the symptoms of the disease persist, despite conservative treatment for 3 months or more, surgery is recommended, which, as a rule, is performed by an open method [7].

Arthroscopic surgical treatment has number of advantages over open surgery, such as less trauma to soft tissues, which allows for early rehabilitation, as well as the possibility of diagnosing concomitant intraarticular pathology [8].

Currently, in the domestic and foreign literature, one can find single works devoted to the treatment of medial epicondylitis by arthroscopic method. There are not enough anatomical studies that show that the release of the forearm flexors common tendon can be performed using arthroscopic technique with minimal traumatization of the medial collateral ligament and ulnar nerve [9]. Therefore, additional studies are needed to optimize the methods of arthroscopic treatment of patients with medial epicondylitis.

The aim of the study was to optimize the technique of arthroscopic treatment of patients with medial epicondylitis of the humerus and evaluate its clinical effectiveness based on the results of topographic and anatomical examination.

Material and Methods

Topographic and anatomical examination

The material for the study was 12 "fresh" anatomical preparations of the human elbow joint, of which 6 were withdrawn from female and 6 — male individuals. The height of women during life was 163±4,4 cm, men 178±5,4 cm (p>0,05).

In the process of precision preparation of the unfixed anatomical material of the elbow joint, the features of the zones of attachment of the forearm flexors common tendon to the distal humerus were isolated and studied. The most interesting were the pronator teres and the flexor carpi radialis. The features of the structure and topography of the elbow joint medial collateral ligament were also studied, which is important when releasing the flexors of the forearm. The safety and effectiveness of existing arthroscopic approaches to the elbow joint to perform the release of the flexor carpi radialis were determined.

Clinical study

A prospective cohort comparative study was performed, which included 70 patients treated at the Vreden Center from 2017 to 2019. Two comparison groups were formed. Group I included 35 patients whose surgical treatment was carried out by the open method.

Males predominated in this group (25 or 71.4%). The age of the patients ranged from 30 to 60 years (Me 40; 25th percentile - 35; 75th percentile - 55). Group II included 35 patients whose surgical treatment was performed minimally invasive using arthroscopic techniques. In this group, as well as in the first, males predominated (29 or 82.9%). The age of the patients ranged from 33 to 58 years (Me 40; 25th percentile - 35; 75th percentile - 54). The distribution of patients by age and gender is shown in table 1.

Patients of both groups unsuccessfully underwent conservative therapy for 3 months, including nonsteroidal anti-inflammatory drugs, wearing a bandage, physical therapy, corticosteroid injections, shock-wave therapy, platelets-rich plasma injections.

Diagnostics

In the study of all groups patients, the following clinical signs were revealed:

- local pain during palpation of the medial condyle;
- pain that increases when performing bends and rotations with a load;
- positive reverse Cozen test;
- a positive symptom of the "golfer's elbow".

MRI was used as the additional research method (Fig. 1).

Table 1

Distribution of patients by gender and age

Group	Gender		Age, years		
	m	f	30–40	41–50	51–60
I, *n* = 35	25 (71%)	10 (29%)	21 (60%)	2 (5,7%)	12 (34,3%)
II, *n* = 35	29 (83%)	(6 17%)	21 (60%)	2 (5,7%)	12 (34,3%)

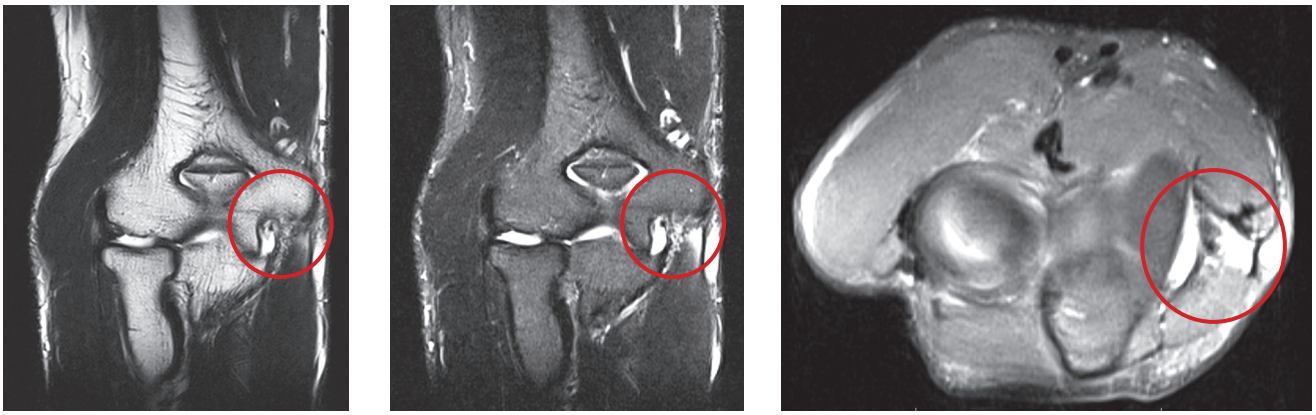

Fig. 1. Elbow joint MRI with signs of the humerus medial epicondylitis. The red line highlights the damaged tendon of the flexor carpi radialis

Surgical technique

Group I. A skin incision in the area of the medial condyle of the humerus identified the tendon part of the pronator teres and flexor carpi radialis, after which, withdrawing the tendon of the pronator teres, proximally performed the release of the flexor carpi radialis in the area of insertion to the humerus. Then, with the help of a curette, the area of the articular surface of the pronator teres was treated in the area of its insertion to the medial condyle of the humerus from in-

flamed detritus. The wounds were sutured in layers. The limb was fixed with bandage until the stitches were removed.

Group II. The surgery was performed through the anterior lateral and proximal medial arthroscopic ports in the patient's lateral decubitus position (Fig. 2).

During arthroscopy of the elbow joint, a three-millimeter 30-degree arthroscopic optics was used through an anterior lateral approach, which can be called optical by its functionality. After visualization of the medial condyle of the humerus area under the control of a camera and using a needle, a point was outlined for the formation of the proximal medial instrumental port. After the formation of the approach, the first stage was the fenestration of the joint capsule. A high-frequency ablator and a shaver were used to perform this goal. After isolating the flexor carpi radialis tendon, its complete intersection was performed (Fig. 3).

In group II, we performed arthroscopic diagnostics, which helped to identify additional capsular ligamentous or intraarticular pathology in 15% of patients who were subsequently excluded from the study.

Results assessment

In patients of both groups, the severity of pain syndrome was assessed using a 100-point visual analog pain scale (VAS). The Mayo Elbow Perfomance Score (MEPS) [10] was used to evaluate the function of the elbow joint in the preoperative period, 1, 6 and 9 weeks after surgery.

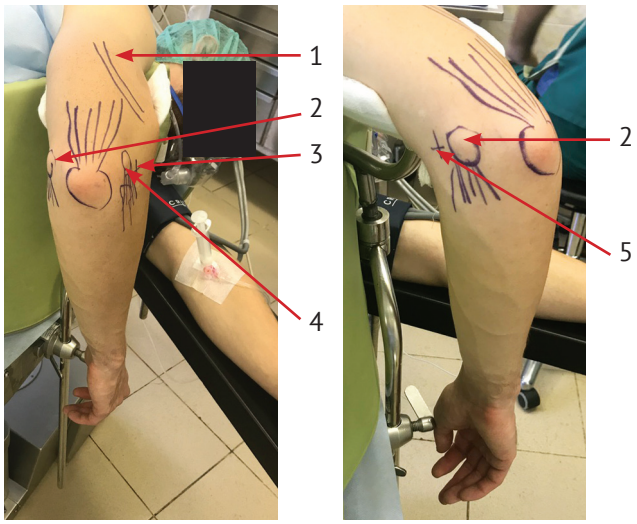

Fig. 2. Positioning of the second group patient with marking of the arthroscopic portals (patient in the lateral decubitus position):
1 — radial nerve;
2 — medial epicondyle of the humerus;
3 — anterolateral portal;
4 — lateral epicondyle of the humerus;
5 — proximal medial portal

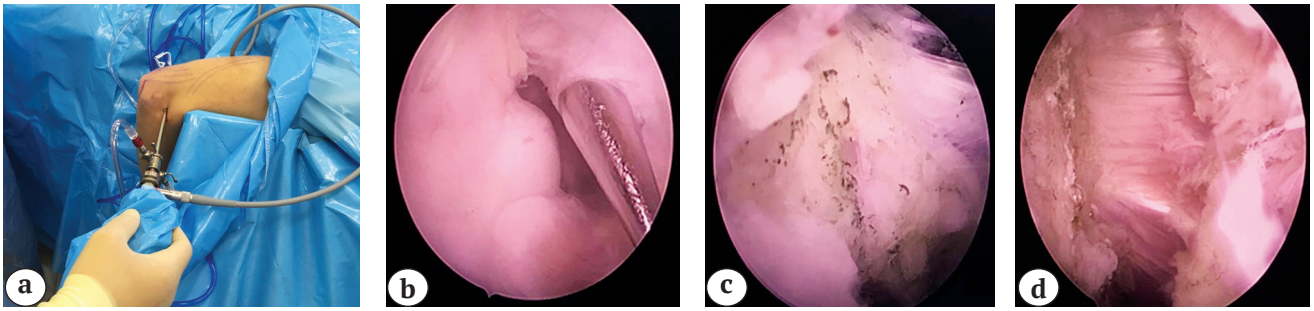

Fig. 3. The main stages of flexor carpi radialis arthroscopic release in patient with medial epicondylitis:
a — arthroscopic optics mounted in the anterolateral portal;
b — visualization of the humerus medial epicondyle with the medial proximal portal formation;
c — detection of the flexor carpi radialis tendon part after the joint capsule resection with radiofrequency monopolar ablator and shaver;
d — release of the flexor carpi radialis with a basket forceps

Statistical analysis

Data processing was carried out on a computer using specialized program Past 306, followed by the construction of visual boxplots and tables.

For the data obtained in the clinical part, the normality of the distribution of indicators was checked using the Shapiro–Wilcoxon criteria. For normally distributed indicators, the average values, standard deviation and 95% confidence interval are presented, the t-criterion for independent samples was used to compare the groups. The dynamics of the indicators was evaluated using the t-test for dependent samples. For indicators that are not normally distributed, descriptive characteristics were represented by the median and the upper and lower quartile. Statistical comparisons on the VAS scale, the MEPS functional questionnaire, and the duration of surgical treatment in patients of both groups were carried out using the nonparametric Mann–Whitney criterion. The dynamics of these indicators were evaluated using the Wilcoxon criterion.

Results

Topographic and anatomical study

During the precision study of the anatomical structure and topography of the flexors common tendon, special attention was paid to the flexor carpi radialis and the medial ulnar collateral ligament (Fig. 4). It was determined that the contact zone of this tendon with the medial epicondyle of the humerus is located above the median brachial line by 2 (1-3,2) mm, Me (25th percentile; 75th percentile), in close proximity to the anterior bundle of the medial ulnar collateral ligament and the ulnar nerve.

Some features of the structure and attachment of the medial collateral ligament (MCL) were revealed. First of all, the MCL is the main static stabilizer of the elbow joint in case of valgus deviations and consists of three bundles: anterior, posterior and transverse. When performing the release of the flexor carpi radialis, the anterior bundles of the MCL is at maximum risk of damage. This is due to the very close location of the attachment zones of the flexor carpi radialis and the anterior bundle of the MCL on the medial condyle of the humerus, as well as their close contact with each other throughout the structural fibers (Fig. 5).

We recommend the following algorithm for arthroscopic treatment of patients with medial epicondylitis: 1) formation of anterolateral and proximal medial arthroscopic ports; 2) resection of the capsule of the elbow joint in the projection of the flexor carpi radialis tendon part; 3) release of the flexor carpi radialis between the tendons of the pronator teres and the palmaris longus muscles. At the same time, it is important to be in a safe zone, which was determined as a result of the anatomical and topographic part of the study.

Clinical study

The results on the MEPS scale before and after 1, 6 and 9 weeks after surgical treatment of patients of both groups are summarized in Table 2. Functional results 9 weeks after surgery in patients of group II were evaluated as excellent (90%) and good (10%). The results of group I patients were assessed as good (100%) in the absence of excellent.

The assessment of pain syndrome in patients of both groups indicates a pronounced and persistent decrease in pain in the long-term period compared with the preoperative period. In group II patients, pain 9 weeks after surgery was less expressed than in group I patients (Table 3).

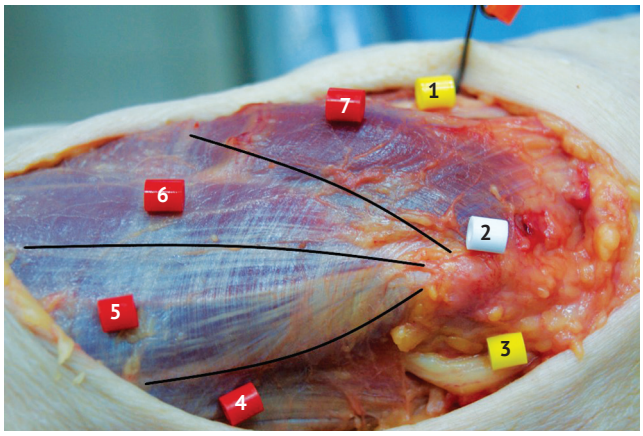

Fig. 4. Topography of the forearm flexors (right elbow joint, view from the medial surface of the forearm). The black lines correspond to the intermuscular borders:
1 — median nerve;
2 — medial epicondyle of the humerus;
3 — ulnar nerve;
4 — flexor carpi ulnaris;
5 — palmaris longus muscle;
6 — flexor carpi radialis;
7 — pronator teres

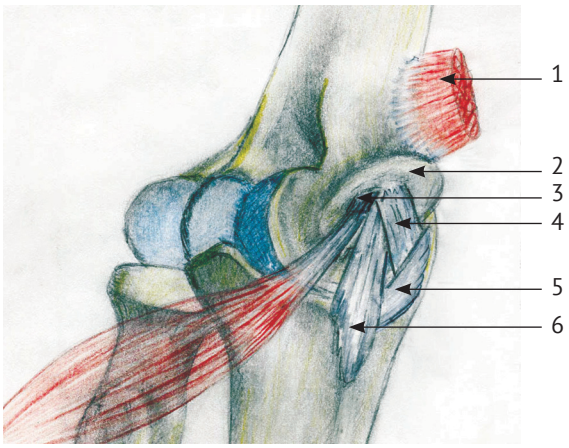

Fig. 5. The flexor carpi radialis attachment to the humerus medial epicondyle and the medial collateral ligament of the elbow joint topography (right elbow joint, front view 75° turn):
1 — pronator teres;
2 — medial epicondyle of the humerus;
3 — flexor carpi radialis;
4 — posterior bundle of the medial collateral ligament;
5 — transverse bundle of the medial collateral ligament;
6 — anterior bundle of the medial collateral ligament

Table 2

Evaluation of functional results on the MEPS scale before and after 1, 6 and 9 weeks after surgical treatment, points

Meaning	Observation period							
	Before surgery		after 1 week.		after 6 weeks.		after 9 weeks.	
	I group	II group	I group	II group	I group	II group	I group	II group
Median (25th percentile; 75th percentile	54 (52;56)	54 (54;56)	70 (65;75)	75 (74;77)	75 (75;78)	79 (79;80)	82 (80;83)	94 (93;94)
Average value (95% CI)	54,69 (53,62; 55,75)	55 (53,98; 56,02)	70,46 (68,69; 72,22)	75,34 (74,51; 76,18)	75,8 (75,03; 76,57)	78,54 (77,95; 79,13)	81,77 (81,13; 82,41)	92,66 (91,61; 93,70)
p (comparison I и II групп)	0,6955		0,0001		0,0001		0,0001	

Table 3

Assessment of pain syndrome according to VAS before and after 1, 6 and 9 weeks after surgical treatment

Meaning	Observation period							
	Before surgery		after 1 week.		after 6 weeks.		after 9 weeks.	
	I group	II group	I group	II group	I group	II group	I group	II group
Median (25th percentile; 75th percentile	70 (60; 80)	70 (60; 80)	50 (50; 60)	40 (30; 50)	40 (40; 50)	10 (10; 20)	30 (30; 40)	0 (0; 0)
Average value (95% CI)	71,43 (67,88; 74,98)	69,71 (66,23; 73,20)	55,14 (52,21; 58,07)	40,57 (37,69; 43,45)	45,43 (42,88; 47,98)	14 (12,29; 15,71)	34,29 (31,89; 36,68)	1,5 (0,46; 2,45)
p (comparison I и II групп)	0,5607		0,0001		0,0001		0,0001	

The duration of the surgery in the group of patients treated by arthroscopic method was reduced by 50% - 43.03±1.49 minutes (group I), 26.00±0.99 minutes (group II) (p = 0.0001).

Discussion

Medial epicondylitis of the humerus is less common than lateral epicondylitis. The occurrence of this nosology in the population is 9.8-20% [11]. However, its frequency has recently been increasing due to the constantly increasing physical requirements for the upper limb in sports, as well as an increase in the number of labor-intensive activities against the background of an aging population [12].

The surgical method of treating patients with medial epicondylitis is indicated for persistent pain syndrome against the background of unsuccessful conservative therapy for three months. In high-level athletes, surgical treatment can be performed without waiting for the effectiveness of conservative therapy [13].

Open methods of treatment allow to obtain good functional results [13, 14, 15, 16]. So, in one of the studies, the authors reported the results of dissection of the tendon through mini-incisions performed in 41 patients with medial or lateral epicondylitis after 6 months of unsuccessful conservative treatment. The severity of pain syndrome on the VAS scale in the preoperative period was 5.36 at rest, 6.44 - during daily activities and 8.2 - during sports or professional activities. After surgery, these indicators improved to 0.3; 1.46 and 2.21, respectively [17].

T.N. Alexandre et al. reported the results of tendon release using anterolateral and anteromedial arthroscopic ports in medial epicondylitis. The study included 7 patients (5 men and 2 women). The average age at the time of surgery was 50 years (36-67 years). The average duration of the disease before surgery was 2 years (from 6 months to 4 years). The average duration of follow-up was 17 months (6-48 months). The average functional result on the DASH scale was 17 points (14-25), and the severity of pain according to VAS 2 points (1.5–3). No significant complications were observed after the arthroscopic procedure. Improvement was observed in all patients [18].

The use of the surgical technique proposed by us, including the release of the flexor carpi radialis tendon through the anterior lateral

and proximal medial approaches, provided successful results in the treatment of patients with medial epicondylitis. Functional result of treatment after 9 weeks according to the MEPS scale using the arthroscopic method, it was evaluated as excellent - the average value was 92.66 (95% CI 91.61-93.70) versus 81.77 (81.13; 82.41) in patients who were treated by the open method. The proposed method also demonstrates reduction in pain.

Arthroscopy of the elbow joint is a technically complex procedure and suggests potential advantages over open methods of treatment for epicondylitis. According to the world literature, much attention has been paid to the treatment of patients with lateral epicondylitis of the humerus [20-25]. However, studies on arthroscopic treatment of patients with medial epicondylitis are extremely rare.

One of the arthroscopic method advantages is the opportunity to begin early rehabilitation, since patients who underwent arthroscopic release of the flexor carpi radialis have minimal postoperative pain. This practice leads to an earlier return to work [26].

The causes of failures after open surgical treatment of medial epicondylitis include incomplete release of the damaged tendon, missed concomitant capsular or ligamentous insufficiency and ulnar nerve neuropathy [27, 28]. The advantage of the proposed arthroscopic method of treatment is that it allows you to identify concomitant pathology and perform a complete removal of tissues with visual signs of degeneration with less surgical trauma.

There are many studies in the domestic and foreign literature devoted to the history of the disease and the results of comparing surgical treatment techniques, but only one of them carried out a clinical and anatomical justification of the arthroscopic method safety [29]. This may be due to the proximity of the ulnar nerve and medial collateral ligament (MCL) to arthroscopic approaches and the difficulty of manipulation in these areas, which together makes arthroscopic sanation in medial epicondylitis unsafe.

Our study is the first to describe not only the functional results of arthroscopic surgical treatment of medial epicondylitis, but also the stages of surgery, as well as techniques that allow to achieve excellent functional results and minimizing possible intraoperative complications. Arthroscopic sanation for medial epicondylitis can be performed while observing a safe distance from the ulnar nerve and the MCL, namely, when releasing the flexor carpi radialis between the tendons of the pronator teres and the palmaris longus muscles, it is important to be in the "safe" zone, which is located above the midline of the humeroulnaris joint. In this zone the risk of damage to the anterior bundle of the medial ulnar collateral ligament and the ulnar nerve is minimal.

All patients were satisfied with the surgery results, each of them were eventually able to return to their previous activities.

Limitation of study

The results of the study could be influenced by a small sample of patients and a relatively short follow-up period. Despite these limitations, we believe that the study is clinically significant.

Conclusion

Based on the data obtained in this study, it was determined that the treatment of patients with medial epicondylitis according to the developed arthroscopic technique can significantly improve the functional state of patients, which, in turn, improves their quality of life.

Publication ethics

The patients gave written informed consent to participate in the study.

Ethical expertise

The study was approved by the decision of the local ethics committee.

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AUTHORS' INFORMATION:

Marsel R. Salikhov — Cand. Sci. (Med.), Vreden National Medical Research Center of Traumatology and Orthopedics, St. Petersburg, Russia
e-mail: virus-007-85@mail.ru
https://orcid.org/0000-0002-5706-481X

Dmitry A. Shulepov — Cand. Sci. (Med.), Vreden National Medical Research Center of Traumatology and Orthopedics, St. Petersburg, Russia
e-mail: shulepov@front.ru
https://orcid.org/0000-0002-6297-0710

Oleg V. Zlobin — Vreden National Medical Research Center of Traumatology and Orthopedics, St. Petersburg, Russia
e-mail: zlo-oleg@yandex.ru
https://orcid.org/0000-0003-0769-8766

Nadezhda N. Dmitrieva — St. Mary Magdalene Children's City Hospital No. 2, St. Petersburg, Russia
e-mail: NadegdaNik86@gmail.com
https://orcid.org/0000-0002-7495-7281

Ali I. Midaev — Vreden National Medical Research Center of Traumatology and Orthopedics, St. Petersburg, Russia
e-mail: midaewali@gmail.com
https://orcid.org/0000-0003-1998-0400

Authors contribution:

Salikhov M.R. — the idea and design of the study, the treatment of patients, the collection and processing of material, the evaluation and interpretation of the data and the preparation of the text.

Shulepov D.A. — treatment of patients, material processing, evaluation and interpretation of the data obtained.

Zlobin O.V. — material processing, evaluation and interpretation of the data obtained.

Dmitrieva N.N. — material processing, evaluation and interpretation of the data obtained.

Midaev A.I. — treatment of patients, material processing, evaluation and interpretation of the data obtained.

All authors have read and approved the final version of the manuscript of the article. All authors agree to be responsible for all aspects of the work in order to ensure proper consideration and resolution of all possible issues related to the correctness and reliability of any part of the work.

Conflict of interest:

The authors declare that there is no conflict of interest.