

SURGICAL TREATMENT OF KNEE JOINT OSTEOARTHRITIS

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ABSTRACT

The article reports on the effectiveness of various types of surgical interventions for gonarthrosis in the system of staged treatment of patients with osteoarthritis of the knee joint. The first group consisted of 23 patients who underwent arthroscopic revision, debridement of the knee joint with subsequent corrective osteotomy of the tibia or femur due to gonarthrosis. The second group consisted of 22 patients who underwent unicompartmental endoprosthesis of the knee joint due to gonarthrosis. The third group consisted of 47 patients who underwent total knee arthroplasty. As a result of surgical treatment of patients with osteoarthritis of the knee joint, it was established that arthroscopy, debridement followed by corrective osteotomy give a good effect and help prepare the joint for further endoprosthetics. Single-compartmental endoprosthesis is the operation of choice for patients with an isolated lesion of only one of the knee joints, enabling to preserve enough high level of physical activity. Whereas total endoprosthesis of the knee joint in patients with gonarthrosis III - IV stages allows to achieve positive treatment results in 93.2% of patients and is an effective surgical intervention that allows to significantly reduce the pain syndrome, improve the function of the knee joint and thereby improve the quality of life in this category of patients.

Keywords: osteoarthritis of the knee joint, differential approach, surgical method of treatment, arthroscopic revision, debridement, corrective osteotomy, single compartmental arthroplasty, total arthroplasty

INTRODUCTION

Gonarthrosis (deforming arthritis, osteoarthritis, degenerative arthritis, or hypertrophic arthritis) is a poly-etiological degenerative-dystrophic disease, specific of articular cartilage damage, subchondral and metaphyseal bone layers, synovial membrane, ligaments, capsule, muscles, accompanied by the formation of bone-cartilage enlargements and expressed by pain and restricted mobility in an involved joint [1,2].

By its prevalence, the osteoarthritis of the knee (OA) leads the group of arthrosis-associated joint diseases. By severity, it takes the second place, right after coxarthrosis. One out of five people on the planet suffers from gonarthrosis. Most prone are persons after 40 years old, and women fall ill twice as regular, as men. Statistically, 7-22% of people worldwide have gonarthrosis [3,4].

Despite the experience collected in gonarthrosis surgery, continuous improvement of constructions, tools, and implantation methods, different complications still occur in 3-12% of the cases after surgery [5,6,7,8]. Among the complications, the most frequent are surface and deep purulence (0.2 to 9%), aseptic instability of prosthesis components.

Having explored the literature, we failed to find any objective criteria or system to predict the clinical progression of gonarthrosis, enabling to ensure a differentiated approach to the treatment, to determine an optimal surgical method for the patients with knee OA and to define optimal treatment tactics on earlier stages of the disease, before gross damage to the anatomy and functions appears [9].

The **objective** is to study the efficiency of different types of surgical treatment of gonarthrosis within a system of stage-by-stage knee osteoarthritis management.

MATERIALS AND METHODS

Selection and retrospective analysis of case histories and radiograms of the patients (n=92) with II-IV stages of gonarthrosis with sub-compensated clinical-functional manifestations, who underwent hospital treatment at the clinic of the SU The Institute of Traumatology and Orthopaedics of the NAMS of Ukraine and trauma care department at Kyiv City Clinical Hospital No. 7 from 2011 till 2017 and had different types of surgeries to their knee.

The patients were subdivided into three groups, Table 1:

Group	1	2	3
	Sex, men/women	Sex, men/women	Sex, men/women
	10/13	8/14	23/24

Table 1 - patients according to their age and surgical treatment applied.

The 1st group includes the patients with gonarthrosis managed using arthroscopic revision, knee joint debridement followed by a corrective osteotomy of femoral or tibia bones. There were 23 people.

The 2nd group consists of 22 patients with gonarthrosis treated by a unicondylar knee arthroplasty (UKA).

The 3rd group comprises 47 patients who underwent total knee arthroplasty (TKA).

For uniformity of groups, we used the following selection criteria:

1. age - under 60;
2. no systemic disease;
3. high initial level of activity;
4. no expressed deformities to axes of an extremity (over 20°);
5. gonarthrosis in the period of sub-compensated clinical-functional expressions.

The elaborated work tables considered the following anamnesis and radiological findings: name, case history code, home address, sex, age, time since the beginning of the disease, profession, concomitant somatic pathologies, clinical and radiological examinations, surgical treatment.

The research involved the results collected before the operation and 6 months to 5 years after it. For the assessment, we applied a Knee Society Scores [10], where the excellent result ranges from 85 to 100 scores, good - 70-84 scores, satisfactory - 60-69 scores, and poor one has less than 60 scores, respectively.

For calculations, we applied the database of examining patients with knee osteoarthritis, created with a table of Microsoft Excel-2003, the statistical package of the same software application, and Statistica - 6

INDICATIONS, CONTRAINDICATIONS, AND ADVANTAGES OF DIFFERENT METHODS

Indications for an arthroscopic revision, debridement followed by a corrective osteotomy, a unicondylar knee arthroplasty are shown in Table 2

Indications	Relative indications	Absolute contraindications
Age under 60	Age after 60	Rheumatoid arthritis
Deforming arthritis, 2-3 stages	Deforming arthritis, 2-3 stages	
No patella-femoral arthritis	Moderate patella-femoral arthritis	Patella-femoral arthritis, 3rd stage

Varus, valgus < 15°	Instability of ACL, PCL	Arthritis of a joint's contra lateral area
Insulated arthrosis, 2-3 stages	Insulated arthrosis, 3-4 stages	Manifested osteoporosis (T < -2,5 SD)
Range of motions > 100°	Range of motions >90°	Restricted flexion > 25°
BMI < 30	BMI 30-40	BMI > 40
Stable knee joint, intact ligaments	Aseptic necrosis of medial condyle of a femur	Impaired reparative osteogenesis
Intact knee tendons	Restricted flexion > 15°	Infectious diseases of the joint

Table 2 – indications, relative indications, and absolute contraindications associated with arthroscopy, corrective osteotomy, unilateral knee arthroplasty

Indications for total knee arthroplasty:

- deforming arthritis of various etiology, causing functional distortions with its development;
- traumas of different origin to knee joints and surrounding tissues resulting in its deformities and impaired functions;
- an autoimmune process associated with producing antibodies affecting bone tissue (rheumatoid arthritis);
- aseptic necrosis of one or both lateral condyles of a femur;
- infectious diseases harmful to articular surfaces, for instance, psoriasis;
- distorted metabolism;
- disorders followed by oncologic processes around the knee.

The contraindications against surgical treatment were generalized for all the groups:

1. Decompensated cardiovascular disease;
2. Impaired kidney function;
3. Hepatic insufficiency;
4. Decompensated diabetes mellitus;
5. Mental disorders of a patient, leading to emotional bursts and uncontrolled activity of movements;
6. Young age, when the musculoskeletal system is immature;
7. Morbid obesity;
8. Local contraindications;
9. Skin infection and areas of chronic inflammation around the knees;
10. Thrombosis and thrombophlebitis.

RESULTS AND DISCUSSION

The patients included into the groups for the analysis were almost similar in their age and sex. The average age of the patients was 49.2 ± 11.9 years old.

To study the results of surgical treatment, we examined the patients before surgery, then 6, 12, 24, 26 months, and 76 patients (82.6%) in 60 months after the operation (Table 3).

Groups	0	6 months	12 months	24 months	36 months	60 months
1/scores	66.3±7	79.5±9	85.7±7	87.2±6	84.5±4	77.1±11
2/scores	63.2±10	88.4±11	89.2±5	88.6±7	83.9±3	–

3/scores	57±9	91.1±8	90.3±11	87.6±10	84.6±14	85.2±12.2
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Table 3 – Clinical assessment of the surgical outcomes according to the Knee Society Scores.

In the 1st group, we analysed the outcomes of 23 patients. Due to gonarthrosis accompanied with axial deformities they underwent arthroscopy and corrective osteotomies around the knee joint. 19 (82.6%) patients obtained their treatment in two steps: first was the arthroscopy, and that – the corrective osteotomy, during the same anaesthesia.

Upon the background of generally positive results after corrective osteotomy while arthroscopic intervention (debridement), besides solution to an important diagnostic and treatment task, we had reliably better results (Table 4) according to KSS scale; observation periods – 3 months ($p = 0.004479$) and 6 months ($p = 0.001538$).

The combination of arthroscopy and corrective osteotomy allows obtaining positive effect of surgery in shorter terms. Arthroscopy is expedient before extra-articular surgery, in patients with 2-3 stage of gonarthrosis, upon existence of axial deformities to visualize the character of intra-articular disorders and surgical elimination of the pathologic conditions. Corrective osteotomies shall not be treated only as an independent method, but as a method to prepare the joint to further implantation of prosthesis upon conditions of normal anatomical interrelations.

Figure 1.

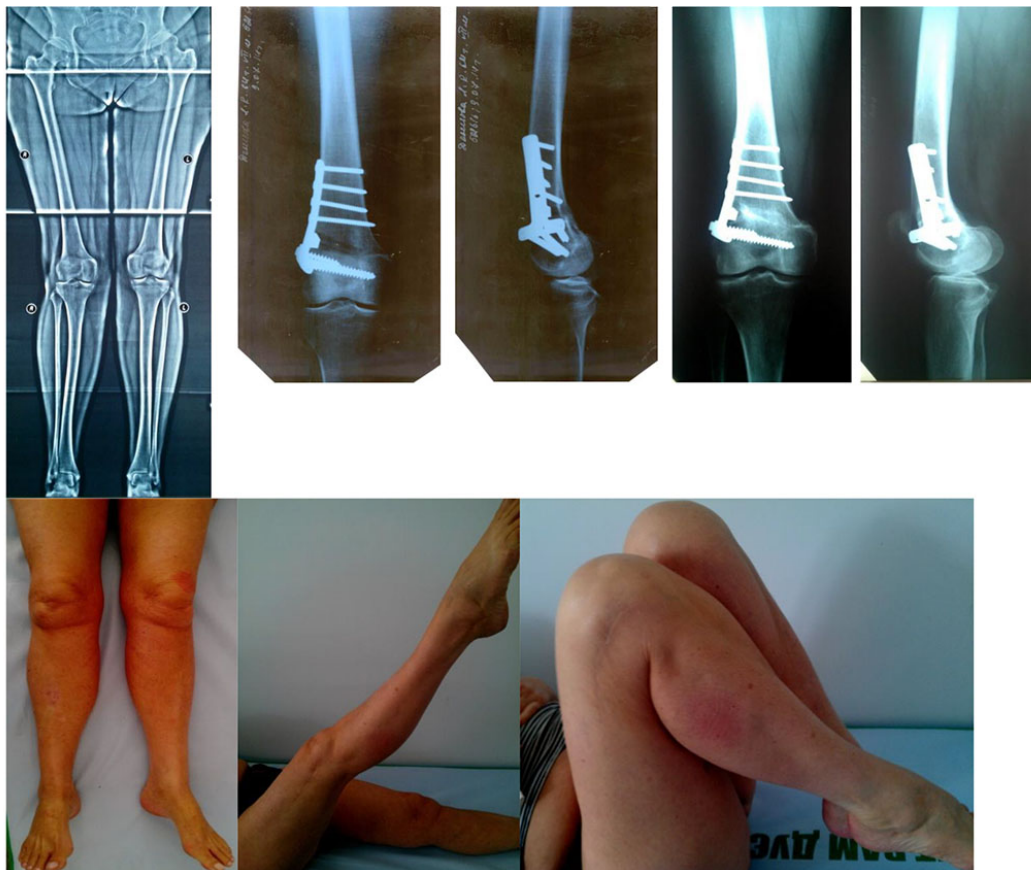


Figure 1. X-ray images of the knee before and after surgery. Functions of the right lower limb 18 months later.

A PATIENT D., 65 YEARS' OLD

Diagnosis: bilateral gonarthrosis, 2-3 stage, with a values deformity of the right knee joint; degenerative damage to both meniscuses of the right knee.

The patient claimed for pain in her right knee; she admits herself ill over five years. From time to time, she got conservative treatment and sanatorium and spa, although without significant improvement.

The patient obtained an arthroscopic revision to her knee, debridement, corrective osteotomy of the femur, and metal osteosynthesis with a T-shaped plate. Eighteen months later, she expressed no claims, the range

of motions in her knee was full, and we extracted the metal fixators. The result of the treatment was excellent (KSS – 86).

In the 2nd group, we studied results of treatment in the patients with 2-3 stage of gonarthrosis (according to the selection criteria), who underwent a unicondylar knee arthroplasty. The total number of the patients cured made 22 persons, 16 (72.7%) of them had their limb axis properly preserved, while in 6 (27.3%) cases, the surgical treatment took place upon conditions of a changes axis. We compared their results within 36 months.

A unicondylar knee arthroplasty showed significantly better results upon conditions of a regular lower limb axis (Table 4), compared to the same upon axial deformities during the observation periods of 12 months ($p = 0.009986$), 24 months ($p = 0.000347$), 36 months ($p = 0.000004$).

Figure 2.

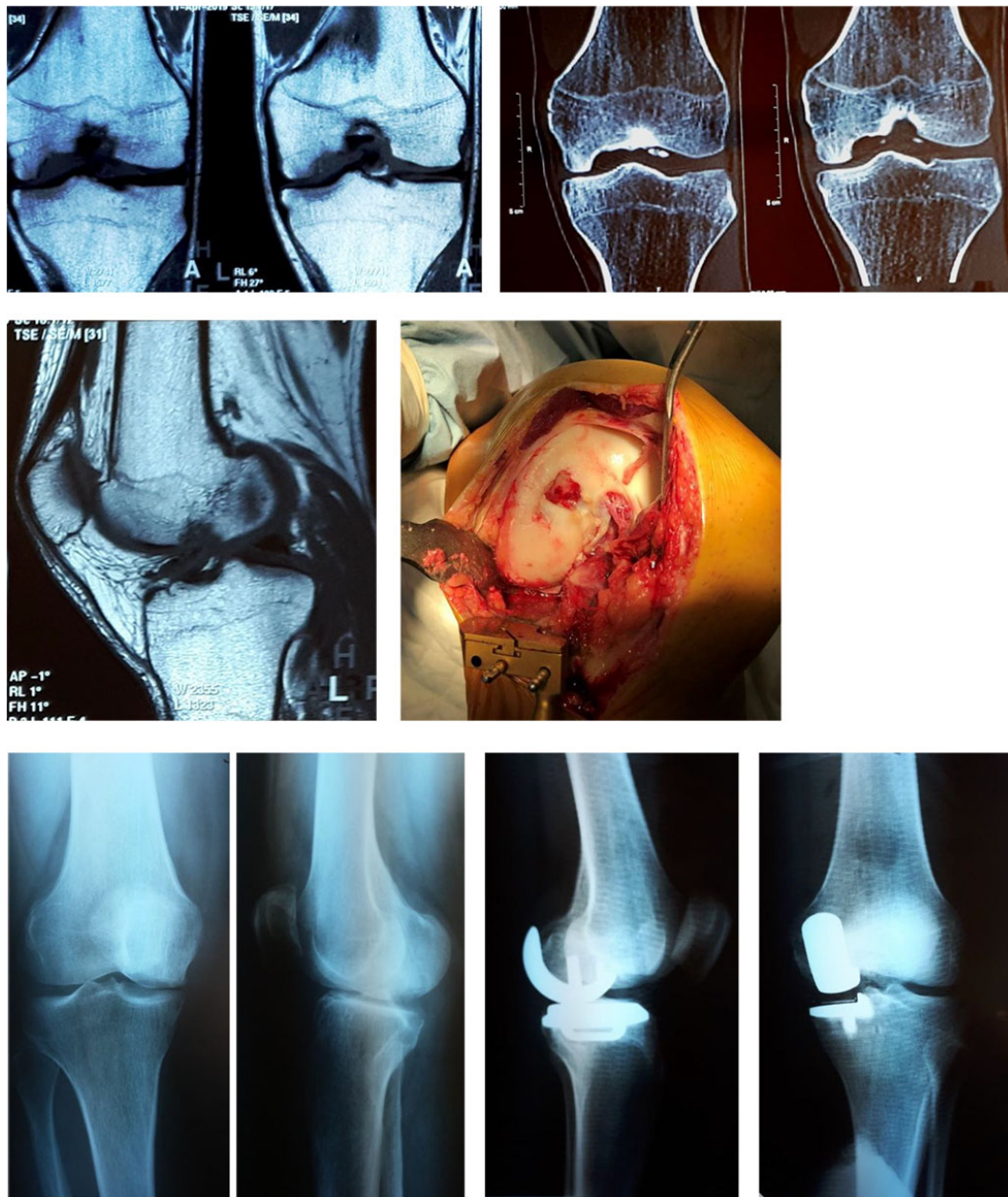


Figure 2. MRI, CT of a knee, intraoperative photo of a defect of medial femoral condyle and X-ray image of the lower limb after the unicondylar arthroplasty.

A PATIENT H., 37 YEARS' OLD

Diagnosis: Deforming arthritis of the left knee, 3rd stage. Aseptic necrosis of the left femoral medial condyle; left knee contracture; pain syndrome.

The patient reports periodical pain in his left knee, its intensity increasing gradually during the six recent

months, slight restriction of motions.

Treatment was the unicondylar arthroplasty of the left knee. Six months later, the patient walks without any additional support, mentions the absence of pain. Knee range of motions was 5/0/165°. The result of treatment was excellent (KSS – 90).

The unicondylar arthroplasty to a medial femoral condyle as a method of treatment for 2-3 stage gonarthrosis is an efficient measure bringing its positive results within the observation period, up to 36 months. The condition thereof is to preserve the lateral part of the joint and its ligament system. The best results of unicondylar arthroplasties were in patients with the regular axis of their lower limb. The worse results had patients with the axis of their lower limb distorted.

We examined the nearest results of the unicondylar knee arthroplasty in all n=44 patients within 36 months. The results were excellent in 5 (11.4%) cases, good – in 24 (54.5%), satisfactory – in 12 (27.3%), and poor – in 3 (6.8%).

The patients with good results had mostly had 3rd stage deforming arthritis with their range of motion restricted insignificantly (from 5° to 20°), with the joint deformity absent or expressed slightly (*varus* or *valgus*, 10–15°), and 1-2 stage of knee instability (Fig.3).

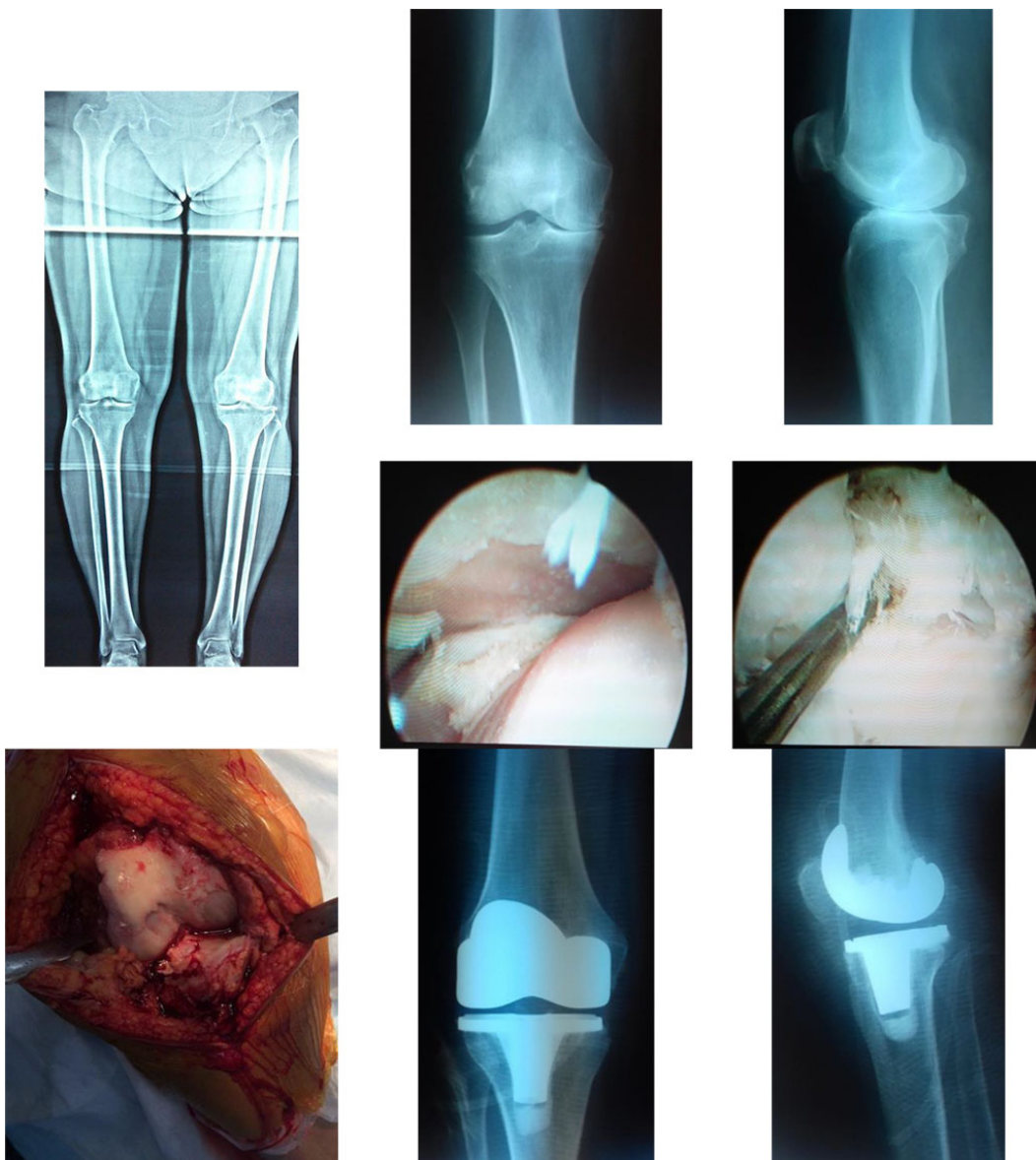


Figure 3. X-ray images before and after total knee arthroplasty. An intraoperative image (the defect of the medial femoral condyle).

A PATIENT D., 58 YEARS' OLD

Diagnosis: bilateral gonarthrosis, 2-3 stage, with a right knee varus deformity; flexion contracture of the right knee - 15°.

The patient complains of constant pain in her right knee feeling ill over three years. During the recent 4-5 months, she started to notice the worsening of her conditions. The patient had undergone total arthroplasty of her right knee. Twelve months later, she claimed for slight periodical pain after a durable physical load; the range of motion of the knee is full. The result was good (KSS – 84).

A satisfactory result of total knee arthroplasty is mostly associated with a restricted range of motions of the knee. Before the surgery: diagnosed the 4th stage of the disease with flexion and extension contractures, expressed varus deformity of a knee (over 20°), and instability of the capsular-ligament system. The pain syndrome in the area of a patella-femoral articulation and the popliteal fossae caused the restriction of the motions in the knee after total knee arthroplasty. Besides, most patients fail to complete a full rehabilitation course, and it impairs functional recovery of the joint and the extremity as a whole.

Surgical wound complications occurred in 4 (4.34%) cases, in 1 (1.17%) case led to the development of deep purulence, further removal of components of the prosthesis, and long consequent treatment.

Results of the arthroplasty upon conditions of the regular low extremity axis is significantly better (Table 4) compared to other methods of surgical treatment to axial deformities, the observation period – up to 5 years ($p = 0.001252$).

Observation period	Corrective osteotomy	Unicondylar arthroplasty	Total arthroplasty
Before the operation	0.582644	0.074429	0.984393
3 months after the operation	0.004479*	0.000662*	0.000269*
6 months after the operation	0.001538*	0.373217	0.000929*
12 months after the operation	0.602679	0.009986*	0.449011
24 months after the operation	0.351049	0.000347*	
36 months after the operation	0.272727	0.000004*	0.913468
60 months after the operation			0.001252*

Table 4 – Results of a hypothesis test on the equality of medians using Mann-Whitney criteria upon the presence of axial deformities.

So, total knee arthroplasty in patients with severe anatomical and morphological changes upon 3-4 stage deforming arthritis allows us to achieve positive outcomes in the remote period in 93,2% of patients. At that, the patients with less expressed pathological changes in knee structures show the best functional results.

CONCLUSIONS

1. If indications are determined correctly, alternative organ-preserving surgical interventions (arthroscopy, debridement followed by corrective osteotomy) have a good effect and help to prepare a joint to further arthroplasty.
2. The patients with preserved lower limb axis show the best results.
3. Unicondylar arthroplasty is a method of choice for the patients with insulated damage to only one area of their knee, and allow preserving a high level of physical activity.
4. Total knee arthroplasty in patients with 3-4 stage gonarthrosis is an efficient surgical technique to reduce pain syndrome and to improve the functional characteristics of a knee and the quality of life.

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