SURGICAL TREATMENT OF PATIENTS WITH OSTEOARTHRITIS OF THE KNEE JOINTS

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Summary

Introduction. Osteoarthritis affects 7% of the world's population. The number of affected people worldwide increased by 48% from 1990 to 2019. At the initial stages of knee osteoarthritis treatment, conservative treatment and corrective osteotomies are used. Corrective osteotomies in the area of the knee joint have shown excellent results for the treatment of limited arthrosis with a predominant lesion of the medial part of the joint in relatively young patients. However, despite the good results reported in the literature, patient satisfaction usually deteriorates over time, and some inevitably require further treatment with total knee arthroplasty in cases of progression of osteoarthritis.

The aim of the study. On the basis of a retrospective analysis of surgical treatment of patients with osteoarthritis of the knee joints, justify the differentiated use of surgical interventions.

Materials and methods. The article considers a differentiated approach to peri-articular osteotomies and primary endoprosthesis in gonarthrosis, in particular, in the focus of the endoprosthesis selection algorithm, based on related factors, such as the stage of the disease, the patient’s age, and the presence of concomitant complications, including the presence or absence of aseptic necrosis, contractures, instability ligamentous apparatus and defects of the condyles of the tibial bone. 391 knee joints were operated on in 383 patients.

Results. In general, good results were obtained in 65% (210 people) of endoprosthetics. The patients felt well, did not feel pain, did not limp, the range of motion was restored within normal limits, there was no deformation of the joint, the axis of the limb was correct, the joint was stable. Satisfactory results were obtained in 35% (114 people), the patients felt well, did not feel pain, moderate lameness remained, range of motion was limited to no more than 800, there was no joint deformation, the axis of the limb was correct, the joint was stable. No unsatisfactory results were obtained.

Conclusions. The developed differentiated approach to operative treatment of patients with osteoarthritis of the knee joints allowed to obtain 65% good and 35% satisfactory results. The prospect of further development in this direction continues due to the improvement of the design of endoprostheses and the technique of surgical intervention.

Key words: deforming osteoarthritis, knee joint, osteotomy, total arthroplasty

INTRODUCTION

Osteoarthritis affects 7% of the global population, more than 500 million people worldwide, with women disproportionately affected by the disease. The number of people affected globally increased by 48% from 1990 to 2019 [1, 2]. In the initial stages of treatment of knee osteoarthritis, conservative treatment and corrective osteotomies are used. Corrective knee osteotomies have shown excellent results in the treatment of limited arthritis with predominant effect on the medial part of the joint in relatively young patients. However, despite the good results reported in the literature, patient satisfaction usually deteriorates over time, and some patients inevitably require further treatment with total knee arthroplasty (TKA) in cases of advanced osteoarthritis [3]. For the treatment of late-stage knee OA, joint replacement is considered safe, well accepted and cost-effective [4]. According to the Web of Science (WoS) and the Science Citation Index (SCIE), from 2010 to 2019, the number of publications on the use of total knee arthroplasty for the
Treatment of gonarthrosis totalled 8631, meaning that this problem is actively discussed in the world literature [5]. The number of knee replacements in Germany is growing. From 150,504 in 2008 to 169,334 in 2017. Along with total knee arthroplasty, unicomponent ( unicompartmental ) arthroplasty is also used [6]. Out of 1053 total knee arthroplasty operations (mean age 66.9 years (SD 8.8); 58.6 % women), 78.1 % had good treatment results [7]. Due to the high effectiveness of total knee arthroplasty, it is increasingly used in younger patients. [8]. Kurtz et al. found that in 2006, the percentage of patients younger than 65 years who underwent primary TKA increased to 40 % of the total number of TKAs performed [9]. Despite the large number of factors that determine the effectiveness of arthroplasty, a multicentre study noted that differences in patient selection did not correspond to the frequency of revision interventions, but instead were due to subjective factors influencing treatment [10]. This emphasises the need for a differentiated approach to the choice of surgical treatment in patients with knee osteoarthritis.

THE AIM OF THE STUDY

On the basis of a retrospective analysis of surgical treatment of patients with osteoarthritis of the knee joints, to substantiate the differentiated use of surgical interventions.

MATERIALS AND METHODS

The study was based on the results of 383 patients with osteoarthritis of the knee joint who were treated in the clinic of orthopedics and traumatology of adults of the Institute of Traumatology and Orthopedics of the Academy of Medical Sciences of Ukraine. A total of 391 knee joints were operated on in 383 patients. The majority of patients were women (81.7 %) and respectively 18.3 % were men.

The patients underwent the following surgical interventions: suprapatellar corrective osteotomy of the tibia, suprapatellar valgus osteotomy of the femur in combination with knee arthroscopy, suprapatellar osteotomy of the femur, unicompartmental arthroplasty, total knee arthroplasty, both with and without preservation of the posterior cruciate ligament (PCL), total knee arthroplasty with the use of tibial and, in some cases, femoral lengtheners (LCCK), and all-knee prostheses by hinge type.

For varus deformities of the knee joint up to 10° caused by tibial axis disruption, in patients under 60 years of age with satisfactory range of motion, suprapatellar corrective osteotomy of the tibia was performed using autografts from the iliac crest (Fig. 1).

In the presence of degenerative meniscal damage or fatty body hypertrophy on MRI, which was clinically manifested by flexion contracture or joint block, corrective tibial osteotomy was supplemented with arthroscopic intervention. Five patients were operated on using this technique.

In deformities of the knee joint area, in patients under the age of 60, with a satisfactory range of motion caused by a violation of the femoral axis, manifested by a change in the baso-femoral angle, we performed a suprapatellar corrective osteotomy of the femur using a stable-functional MOS (Fig. 2).

In cases where gonarthrosis was complicated by aseptic necrosis of the medial femoral condyle, in patients under the age of 60, we performed unicompartmental prosthetics with preservation of the knee joint ligamentous apparatus (Fig. 3).

Surgical intervention in patients with stage IV gonarthrosis, when the flexion contracture in the knee joint did not exceed 10 degrees, in the absence of sagittal deformity, we performed total arthroplasty, with preservation of the posterior cruciate ligament (Fig. 4).

In cases where the flexion contracture in the knee joint exceeded 10 degrees or there was a sagittal deformity, patients underwent total arthroplasty without preservation of the ACL, using the extramedullary technique and cement fixation of the components (Fig. 5).
During some surgical interventions, we encountered difficulties associated with a significant frontal deformity of the knee joint (up to 200) due to a defect in the medial or lateral tibial condyle. In order to restore the limb axis and to prevent a large resection of the proximal tibia, which significantly weakens the capsular ligamentous apparatus of the knee joint and leads to its destabilisation, we performed a resection on the surface of the tibial template at the level of the defect, which was replaced with bone cement when the defect did not exceed 5mm. (Fig. 6).

This made it possible to do with minimal extraction of tibial condyle bone tissue and achieve good results in restoring joint function.

In cases where the size of the tibial condyle defect exceeded 5 mm, we performed arthroplasty with a tibial extension using the augments of the appropriate size (Fig. 7).

In patients with a tibial condyle defect combined with a femoral condyle defect, as well as with incomplete collateral ligament capacity, an endoprosthesis with femoral and tibial extensions (LCCK) was implanted (Fig. 8a, 8b).
In cases of complete failure of the lateral stabilisers of the knee joint, patients underwent knee arthroplasty with a one-piece hinge type prosthesis. (Fig. 9).

The principal requirements for knee arthroplasty were the restoration of the biomechanical axis of the limb and biomechanically correct implantation of components. The articular surface of the patella was replaced only in cases of significant osteoporosis.

In the early postoperative period, adequate medication analgesia was used, infectious complications were prevented by prescribing broad-spectrum antibiotics for 5-7 days; low-molecular-weight heparin was administered for three weeks after the intervention. Active and passive movements in the joint were started 1-2 days after surgery. After arthroplasty, patients were recommended to walk with crutches with a load of 25% of body weight on the operated limb for 3-4 days, and after two months, patients were transferred to full load of the operated limb. Patients after corrective osteotomies were allowed to load the operated limb in the presence of radiological signs of fusion of fragments.

RESULTS AND DISCUSSION

The operated patients were followed up from 1 to 9 years after surgery. To evaluate the results of treatment, we developed a scoring system for the functional status of the knee joint, which was supplemented by the Lecken algo-functional index [11]. Among the patients who underwent periarticular osteotomies, the results of surgical treatment were analysed in 67 patients with OAK. Women made up 75% (50 patients), men 25% (17 patients), the average age was 57±1.5 years in women and 55±1.5 years in men. In case of varus deformities of the knee joint caused by disruption of the tibial axis, which was manifested by a decrease in the baso-tibial angle, 59 patients underwent supracondylar
corrective osteotomy of the tibia. In case of deformities of the knee joint area caused by tibial axis disorder manifested by a change in the basofemoral angle, 8 patients underwent supracondylar resection corrective osteotomy of the femur. Good results were obtained in 72% (48 patients) and satisfactory results in 28% (19 patients). The results of periartricular corrective osteotomies in patients with gonarthrosis with axial deformities are presented in Table 1.

Table 1

<table>
<thead>
<tr>
<th>Result (points)</th>
<th>Periarticular osteotomy of the knee joint</th>
<th>Total (persons)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supraclavicular, persons (%)</td>
<td>Supraglottic, persons (%)</td>
</tr>
<tr>
<td>Good (21-17)</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>Lecken index (1-5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfactory (17-10)</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>Lecken index (6-8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsatisfactory (≥ 9)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lecken index (≥ 9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>59</td>
</tr>
</tbody>
</table>

The results of knee arthroplasty were analysed in 324 patients. When knee arthroplasty was performed with the system without preservation of the posterior cruciate ligament, 84% of patients had good results, and 16% of 113 patients had satisfactory results. In knee arthroplasty with preservation of the posterior cruciate ligament, good results were obtained in 54%, and satisfactory results in 46% of 183 patients with gonarthrosis. This is explained, in our opinion, by underestimation of knee joint flexion contracture at the stage of choosing an arthroplasty system (Table 2).

Table 2

<table>
<thead>
<tr>
<th>Result (points)</th>
<th>Knee joint prosthesis</th>
<th>Total (persons)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LPS, persons (%)</td>
<td>CR, persons (%)</td>
</tr>
<tr>
<td>Good (21-17)</td>
<td>95 (84 %)</td>
<td>98 (54 %)</td>
</tr>
<tr>
<td>Lecken index (1-5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfactory (17-10)</td>
<td>18 (16 %)</td>
<td>80 (46 %)</td>
</tr>
<tr>
<td>Lecken index (6-8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unsatisfactory (≥ 9)</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Lecken index (≥ 9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>113</td>
<td>183</td>
</tr>
</tbody>
</table>

When using a tibial extension for knee arthroplasty, a good result was obtained in 84% of patients using the LPS system and in 54% of patients using the CR system. This is due to the greater ability to correct varus deformity and flexion contracture when using the LPS system.

When using a tibial extension for knee arthroplasty, a good result was obtained in 100% of patients, and in all cases of arthroplasty with an all-knitted prosthesis, good results were obtained.

In general, good results were obtained in 65% (210 patients) of arthroplasties. The patients felt well, had no pain, no limping, the range of motion was restored within normal limits, there was no joint deformity, the limb axis was correct, and the joint was stable. X-ray examination revealed correct position of the endoprosthesis components, no signs of instability. Satisfactory results were obtained in 35% (114 patients), the patients felt well, had no pain, moderate limping, range of motion restriction of no more than 800, no joint deformity, correct limb axis, and stable joint. X-ray – the position of the endoprosthesis components is correct, no signs of instability were detected. No unsatisfactory results were obtained.

**CONCLUSIONS**

1. In case of varus deformities of the knee joint up to 10° caused by tibial axis disorder in patients under 60 years of age and satisfactory range of motion, it is advisable to perform supracondylar corrective osteotomy of the tibia.

2. In deformities of the knee joint area up to 15° caused by disruption of the femoral axis, manifested by a change in the basofemoral angle, in patients under the age of 60 years, and a satisfactory range of motion, it is advisable to perform a supracondylar corrective osteotomy of the femur.

3. In patients under 60 years of age with osteoarthritis of the knee joint of stage II–III with aseptic necrosis of the medial femoral condyle and preservation of the ligamentous apparatus, it is advisable to perform unicortyral arthroplasty.

4. In patients with stage IV gonarthrosis, whose flexion contracture in the knee joint did not exceed 10
degrees, it is advisable to perform total knee arthroplasty with preservation of the posterior cruciate ligament. In the presence of a flexion contracture in the knee joint of more than 10 degrees or sagittal deformity, it is advisable to implant an endoprosthesis without preserving the posterior cruciate ligament.

5. In the presence of a defect in one of the tibial condyles up to 5 mm, it is advisable to replace the defect with bone cement. In the presence of a defect in one of the tibial condyles greater than 5 mm, the use of appropriate sized augments and the use of an endoprosthesis with a tibial extension.

6. In patients with gonarthrosis, with significant damage to the ligamentous apparatus of the knee joint, namely the presence of a complete failure of the lateral stabilisers, it is advisable to perform total arthroplasty with an all-articular joint replacement.

7. The developed differentiated approach to surgical treatment of patients with osteoarthritis of the knee joints allowed to obtain 65% of good and 35% of satisfactory results.

FUNDING AND CONFLICT OF INTEREST

There is no conflict of interest in the article. There is no external source of funding for the article (the article is self-financed).

COMPLIANCE WITH ETHICAL REQUIREMENTS

The article complies with ethical norms in research.

REFERENCES

ОПЕРАТИВНЕ ЛІКУВАННЯ ХВОРИХ НА ОСТЕОАРТРОЗ КОЛІННИХ СУГЛОБІВ

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Вступ. Остеоартроз вражає 7 % населення планети. Кількість постраждалих людей у всьому світі з 1990 по 2019 рік зросла на 48 %. На початкових етапах лікування остеоартрозу колінного суглоба застосовують консервативне лікування та корегувальні остеотомії. Корегувальні остеотомії у ділянці колінного суглоба показали відмінні результати для лікування обмеженого артрозу із переважним ураженням медіальні частини суглоба у відносно молодих пацієнтів. Проте, незважаючи на добри результати, про які повідомляється в літературі, задоволеність пацієнтів зазвичай погіршується з часом, і деякі з них необхідно вимагають подальшого лікування з тотальним ендопротезуванням колінного суглоба у випадках прогресування остеоартрозу.

Мета дослідження. На основі ретроспективного аналізу хірургічного лікування хворих, на остеоартроз колінних суглобів, обґрунтувати диференційоване застосування оперативних втручань.

Матеріали та методи дослідження. У статті розглядається диференційований підхід до навколосуглобових остеотомій та первинного ендопротезування при гонартрозі, зокрема у фокусі алгоритму вибору ендопротеза, базуючись на супутніх факторах, таких як стадія захворювання, вік пацієнта та наявність супутніх ускладнень, в тому числі супутність або відсутність асептичного некрозу, контрактур, нестабільності з'єднавального апарату та дефектів виростків великокомілкової кістки. Було прооперовано 391 колінний суглоб у 383 хворих.

Результати. В цілому, добри результати отримані в 65 % (210 чол.) ендопротезувань. Пацієнти почували себе добре, не відчували болю, не накульгували, об’єм рухів відновлено в межах норми, деформація суглоба відсутня, вісь кінцівки правильна, суглоб стабільний. Задовільні результати отримані в 35 % (114 чол.), пацієнти почували себе добре, не відчували болю, зберігалось помірне накульгування, обмеження об’єму рухів не більше 800, деформація суглоба відсутня, вісь кінцівки правильна, суглоб стабільний. Незадовільних результатів не отримано.

Висновки. Розроблений диференційований підхід до оперативного лікування хворих на остеоартроз колінних суглобів, дозволив отримати 65 % добрих та 35 % задовільних результатів.

Ключові слова: деформуючий остеоартроз, колінний суглоб, остеотомія, тотальне ендопротезування