

ALTERNATIVE TREATMENT OF GONARTHROSIS: PROXIMAL FIBULAR OSTEOTOMY

Andreja Gavrilovski¹, Aleksandra Gavrilovska Dimovska², Marko Spasov¹,
Hristijan Kostov¹, Igor Merdzanoski Igor¹, Kire Jonoski³, Simon Trpeski¹

¹ University Clinic of Traumatology (TOARILUC), Skopje, RN Macedonia

² University Clinic of Neurosurgery, Skopje, RN Macedonia

³ General Hospital Borka Taleski, Prilep, RN Macedonia

Corresponding author: Andreja Gavrilovski, gavrilovskia@yahoo.com

ABSTRACT

Introduction: Gonarthrosis is arthrosis of the knee joint, a chronic non-inflammatory disease manifested by progressive destruction of the intra-articular cartilage, accompanied by abnormal formation of the bones form the joint, changes in the synovial membrane and synovial fluid. Gonarthrosis is the most common type of arthrosis. Gonarthrosis can be treated conservatively and operatively. Among well-established surgical options for the treatment of medial gonarthrosis are high tibial osteotomy (HTO), unicompartmental knee arthroplasty (UKA), and total knee arthroplasty (TKA). Proximal fibular osteotomy (PFO) or superior partial fibulectomy is a relatively recent procedure proposed to reduce knee pain in patients with medial compartment.

Aim: Our study aims to demonstrate an alternative treatment for gonarthrosis with proximal fibular osteotomy and reduced knee pain in patients with medial compartment osteoarthritis of the knee.

Materials and methods: At the Department of Orthopedics and Traumatology at J.Z.U "Borka Taleski" Prilep in the period from 2018 to 2021, 14 cases were treated, of which 11 were female and 3 were male. All patients were aged between 62 and 82 years with a mean age of 71.3 years. Patients had a severe degree of gonarthrosis (III/IV) according to Kellgren-Lawrence classification. Arthroscopy was performed in 2 patients. The fibula osteotomy was 7 cm away from the fibular head, with 1 cm resected bone fragment from the fibula.

Results: The average duration of the surgery was 30 minutes. Patients were followed up on the 7th day, first month, 3 months and 6 months after surgery. The final evaluation of function was done after 6 months by examining the active and passive movements of the knee joint. In all 14 patients we have excellent results with pain reduction, improvement of movement and quality of life.

Conclusion: Proximal fibular osteotomy is an option for medial compartment osteoarthritis of the knee. Current literature is limited to small case series which report good outcomes in pain reduction, including the correction of varus deformity in medial gonarthrosis. Further studies are needed to determine the place of the PFO in the medial gonarthrosis management algorithm before it can be recommended for routine clinical use.

Keywords: Gonarthrosis, alternative treatment, proximal fibular osteotomy

INTRODUCTION

Gonarthrosis is a degenerative chronic non-inflammatory disease manifested by progressive destruction of the intra-articular cartilage, accompanied by abnormalities of the bones that form the joint and additionally, changes in the synovial membrane and synovial fluid. Gonarthrosis is the most common type of arthrosis. The reported prevalence of radiographic and symptomatic gonarthrosis of the knee in the elderly over 60 years of age is estimated at 37%. Risk factors for the occurrence of gonarthrosis are the aging of the population, obesity, previous trauma to the knee joint and female gender.

A clinical diagnosis is established by the appearance of pain in the knee that is expressed during activity of the knee and decreases with rest, and it is characteristic that the pain increases during the day. Radiographic diagnosis is established by classification according to Kellgren and Lawrence [1]. It should be, however, noted that the presence of a radiographic diagnosis does not mean the presence of symptomatology.

Gonarthrosis can be treated conservatively and operatively. Conservative treatment can consist of: local and external NSAID for pain syndrome, chondroprotectors, which can slow down the progression of gonarthrosis, weight reduction, movement exercises followed by physiotherapy (electrophoresis, pulse therapy, ultrasound, magnetic therapy, etc.), intra-articular injections of corticosteroids, which are used in extreme cases with unbearable prolonged pain with frequent relapses, severe synovitis, which do not stop with conventional non-steroidal drugs, intra-articular injections of hyaluronic acid and intra-articular application of PRP.

Operative treatment options are the established surgical options for the treatment of medial gonarthrosis are high tibial osteotomy (HTO), unicompartmental knee arthroplasty, and total knee arthroplasty (TKA). In our study, patients were treated with proximal fibular osteotomy. Proximal fibular osteotomy (PFO) or superior partial fibulectomy is a relatively recent procedure proposed to reduce knee pain in patients with medial OA and is being undertaken by an increasing number of orthopedic surgeons.

AIM OF THE STUDY

The aim of our study is to demonstrate the functionality of proximal fibular osteotomy as an alternative treatment for gonarthrosis in all age groups and both sexes.

MATERIALS AND METHODS

The study was conducted at the Department of Orthopedics and Traumatology at the "Borka Taleski" Prilep in the period from 2018 to 2021. When determining the degree of gonarthrosis, the Kellgren and Lawrence classification was used [1].

According to the classification according to Kellgren and Lawrence, radiographic damage to the knee joint is graded in four degrees, namely: [Fig. 1]

- grade 0 (none) - definite absence of X-ray changes of osteoarthritis;
- grade 1 (suspicious) - suspicious narrowing of the joint and possible initial osteophytes;
- grade 2 (minimal) - definitive osteophytes and possible narrowing of the joint;
- grade 3 (moderate) - moderate multiple osteophytes, definite narrowing of the joint and some sclerosis and possible deformation of the bone ends;
- grade 4 (severe) - large osteophytes, significant narrowing of the joint, severe sclerosis and definite bone deformity;

In our study, the age range of included patients is between 62 and 82, with a mean age of 71.3 years. All included patients are grade 3 and 4 according to Kellgren and Lawrence classification [1]. All patients underwent preoperative MRI.

Patients were treated with either spinal or local anesthesia in the supine position. Before performing the osteotomy, a diagnostic arthroscopy was performed in all participants, during which a defect of the articular cartilage of the medial condyle of the femur or tibia in the knee (ICRS/Outerbridge grade III/IV cartilage lesions) was recorded [2]. In our study, patients were treated with proximal fibular osteotomy.

Proximal fibular osteotomy is the removal of a 1 cm segment of the fibula 7-8 cm from the head of the bone by accessing it through the inter-muscular space between the extensor digitorum longus and peroneus longus/brevis under local or spinal anesthesia. The surgical approach should primarily be influenced by the course of the common peroneal nerve and efforts to mini-

mize the damage to the nerve or its branches [8]. Therefore, the plane of dissection to approach the fibula and the zone of the resected fibula are of primary importance. The average duration of the intervention was about 30 min. The fibula osteotomy site was 7 cm below the fibular head. We also resected about 1 cm bone fragment from the fibula.

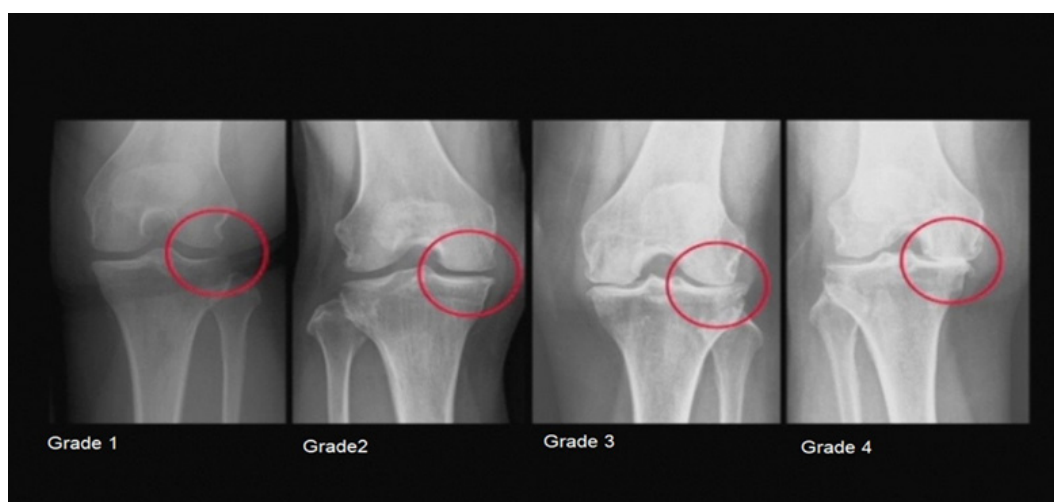


Figure 1. *Kellgren and Lawrence classification*



Figure 2. *Preoperative and postoperative radiographs-AP views of two different patients*

RESULTS

In our study, a total of 14 cases were treated with proximal fibular osteotomy, of which 11 were women and 3 were men. Patients ranged in age from 62 to 82 years. The mean age was 71.3 years. The patients had a severe degree of gonarthrosis.

According to the Kellgren-Lawrence classification [1], all subjects were grade III or IV. Before surgery, all subjects were treated with conservative, non-surgical methods. 4 patients were operated under spinal anesthesia, while 10 patients were operated under local anesthesia. Diagnostic arthroscopy was performed in two patients. Average duration of the surgery was 30 minutes. The fibula osteotomy site was below 7 cm from the fibular

head, we resected about 1 cm bone fragment from the fibula. Postoperatively no complications were observed in any patient. In all 14 patients we have excellent results with reduction of pain, improvement of movement and quality of life.

DISCUSSION

The first reported article that fibulectomy results in a decrease in medial compartment pressure and an increase in lateral compartment pressure was by Yazdi et al. [3] in 2014. They examined joint reaction forces through cadaveric knees after fibulectomy for other reasons, e.g., fibular resection due to nonunion of a tibial fracture, resection of a fibular tumor, taking a fibular graft, etc. Together with periarticular osteotomies of the knee they discovered that this may have a protective

effect by reducing pressure over the knee joint. The word "settlement" is borrowed from the field of architecture where the phenomenon of gradual sinking after the construction of a structure is seen [7]. The bone density of the fibula was found to be higher than the medial tibial plateau [9]. With osteoporosis, the support of the fibula by the lateral tibial plateau does not allow the lateral side to "settle" creating a varus deformity. This is called non-uniform settlement. When the medial side "settles down", there is lateral sliding of the femoral condyle medially during walking and sports which exacerbates the uneven distribution due to excessive loads on the medial side. [Fig 3.]

The explanation is that when this fibula support is removed with a PFO, the lateral side "settles down," and the loading on the proximal tibia is evened out and leads to correction of the varus knee deformity, thereby relieving symptoms and reducing deformity.[6] [Fig.4]

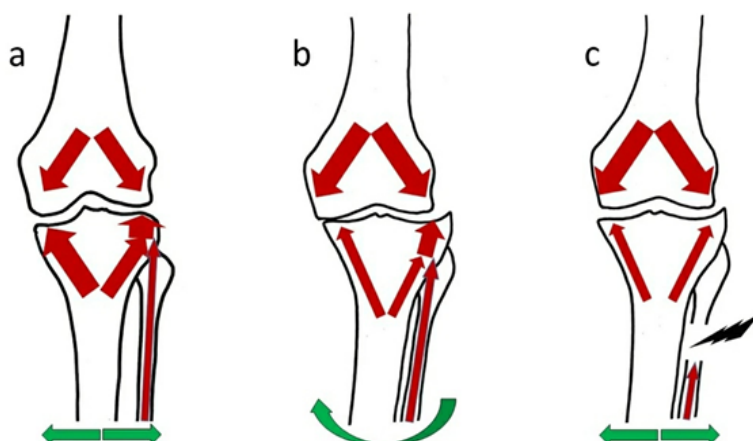


Figure 3. Illustration demonstrating non-uniform settlement on the medial aspect and the "too-many cortices" laterally. Downward arrows depict the load exerted on the knee joint. Upward arrows depict load bearing by the medial and lateral condyles of the tibia and the fibula. *a* normal knee, *b* varus knee and *c* after proximal fibular osteotomy (PFO) [6]

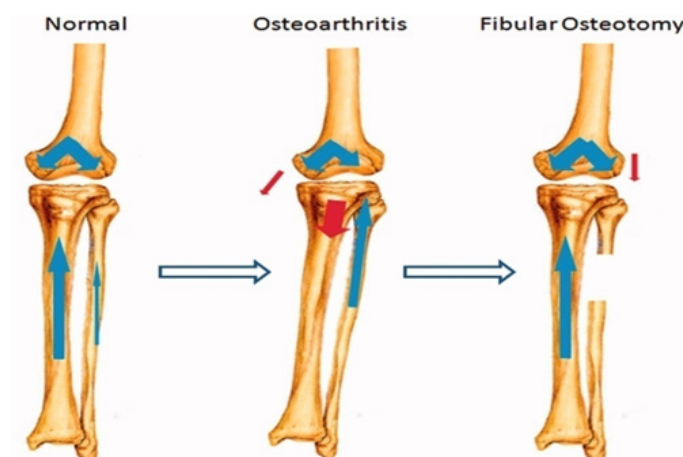


Figure 4. Explanation of the mechanism of Proximal Fibular Osteotomy (PFO)

Huang et al. [4] suggested that there is muscle competition between biceps femoris and peroneus after high fibular osteotomy. They found that muscle activity increased in the long head of the biceps femoris and decreased in the peroneus longus on the operated side immediately after high fibular osteotomy. This explained the immediate improvement of the HKA angle from more varus to more neutral alignment immediately after the high fibular osteotomy. This finding is significant and explains the immediate pain relief after surgery because the correction of the HKA angle from a straightened uneven distribution is not expected to be apparent immediately after fibular resection.

Qin et al. [5] in their prospective study of 67 PFOs found that significant clinical improvement after surgery was proportional to the amount of distalization of the fibula and the angle of inclination of the proximal tibio-fibular joint. The authors hypothesized that after PFO, the proximal fibula was no longer subjected to the compressive forces of weight transfer from the distal fibula. However, muscles attached to the proximal fibula, such as the soleus and peroneus longus, pulled the fibular head in a distal direction, and the stretching force was simultaneously transmitted from the fibular head to the lateral femoral condyle, thereby narrowing the lateral knee joint space. This theory was supported by the finding that the greater the distal displacement of the fibular head, the better the correction of the varus deformity and the more significant improvement in symptoms.

CONCLUSION

PFO is an enticing treatment option for medial gonarthrosis. The current research is restricted to small case series that demonstrate favorable pain reduction results, such as correction of varus deformity in medial gonarthrosis. Before PFO may be suggested for routine therapeutic usage, more research is needed to determine its role in the management algorithm of medial compartmental OA.

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Резиме

АЛТЕРНАТИВЕН ТРЕТМАН НА ГОНАРТРОЗА: ПРОКСИМАЛНА ФИБУЛАРНА ОСТЕОТОМИЈА

Андреја Гавриловски¹, Александра Гавриловска Димовска², Марко Спасов¹,
Христијан Костов¹, Игор Мерџановски¹, Кире Јоноски³, Симон Трпески¹

¹ Универзитетска клиника за трауматологија (ТОАРИЛУЦ), Скопје, РС Македонија

² Универзитетска клиника за неврохирургија, Скопје, РС Македонија

³ Општа болница „Борка Талески“, Прилеп, РС Македонија

Вовед: Гонартрозата претставува артроза на зглобот на коленото и се манифестира како хронична неинфламаторна болест со прогресивно уништување на интраартикуларната 'рскавица, придружена со абнормално формирање на коските на зглобот на коленото, промени во синовијалната мембрана и во синовијалната течност. Гонартрозата е најчест тип артроза. Гонартрозата може да се третира конзервативно и оперативно. Меѓу добро етаблираните хируршки опции за третман на медијална гонартроза се високата тибисјална остеотомија (ВТО), уникондиларната артропластика на коленото (УКА) и тоталната артропластика на коленото (ТКА). Проксималната фибуларна остеотомија (ПФО), или проксимална парцијална фибулекттомија, е релативно нова процедура предложена како алтернативен хируршки третман за намалување на болката во коленото кај пациентите со медијална гонартроза.

Цел: Нашата студија има цел да демонстрира алтернативен третман за гонартроза со проксимална фибуларна остеотомија, а со тоа и намалена болка во коленото кај пациентите со остеоартритис на медијалниот компартман на коленото.

Материјали и методи: На одделот за ортопедија и трауматологија при ЈЗУ „Борка Талески“ – Прилеп, во периодот од 2018 до 2021 година, се лекувале 14 случаи, од кои 11 женски и 3 машки. Пациентите биле на возраст меѓу 62 и 82 години, со просечна возраст од 71,3 години. Пациентите имале тежок степен гонартроза (III/IV) според класификацијата Келгрин-Лоренс. Артроскопија беше направена кај 2 пациенти. Остеотомијата на фибулата беше оддалечена 7 cm од фибуларната глава, со ресециран коскен фрагмент од 1 cm од фибулата.

Резултати: Просечното времетраење на операцијата беше 30 минути. Пациентите беа следени на 7-миот ден, на 3 месеци и на 6 месеци по операцијата. Конечната евалуација на функцијата беше направена по 6 месеци, со испитување на активните и на пасивните движења на зглобот на коленото. Кај сите 14 пациенти имаме одлични резултати со намалување на болката, подобрување на движењето и на квалитетот на животот.

Заклучок: Проксималната фибуларна остеотомија е алтернативна хируршка опција при остеоартритис на медијалниот компартман на коленото. Тековната литература е ограничена на мали серии случаи, кои покажуваат добри резултати во намалувањето на болката, вклучително и корекција на варус деформитетот кај медијалната гонартроза. Потребни се дополнителни студии за да се утврди местото од ПФО за третман медијална гонартроза пред да може да се препорача за рутинска клиничка употреба.

Клучни зборови: гонартроза, алтернативен третман, проксимална фибуларна остеотомија