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High Fibular Osteotomy in Management of Medial Compartment Osteoarthritis of the Knee

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ABSTRACT

Background: Osteoarthritis of the knee is a prevalent form of joint disease that can result in debilitating pain and limited movement. **Objectives:** This study aimed to know the better management of medial compartment osteoarthritis with varus deformity. **Patients and Methods:** This clinical trial was conducted at Orthopedic Surgery Department, Zagazig University through the period from January 2019 to June 2022. Twenty-four cases of medial compartment knee osteoarthritis were included in this study, all of which had proximal fibular osteotomy (PFO). The mean age of the included cases was 56.6 years.

Results: In this study, American Knee Society (AKS) scores showed a significant increase ($p < 0.001$) from 41.6 ± 5.4 preoperatively up to 80.6 ± 2.6 at 12th month postoperatively. There was significant decrease in visual analogue scale from 8.4 ± 1.6 pre-operation to 1.5 ± 0.8 at 12th month post-operation.

Conclusion: Patients with medial compartment knee osteoarthritis often find relief from their symptoms and an increase in their quality of life following a proximal fibular osteotomy.

Keywords: Osteoarthritis, Proximal fibular osteotomy, High fibular, Medial compartment.

INTRODUCTION

High tibial osteotomy (HTO) can be substituted with a proximal fibular osteotomy (PFO) [(1)]. To correct medial compartment osteoarthritis, a surgical treatment is performed. PFO is preferable to HTO in several ways [(2)]. Primarily, the surgical method is easy to understand and implement. For another, it requires no internal fixation and only a small incision. The time needed to get back to normal following surgery is less than it would be with HTO. Additionally, HTO complications might be a significant problem, further diminishing prognosis [(3)].In contrast, PFO rarely causes any adverse outcomes [(4)]. Similar to HTO, PFO can correct the lower extremity and alleviate KOA symptoms. Fibular osteotomy is based on the premise of non-uniform settlement, even though the primary purpose of HTO is to rectify alignment [(6)]. Owing to osteoporosis, the tibial plateau appears to have sunk dramatically. Plateau settlement is uneven due to the fibula's supporting role, with the medial plateau settling more noticeably than the lateral plateau. When this happens, the medial plateau becomes much flatter than the lateral plateau and the foot becomes varus deformed. The primary pathological alterations in KOA are cartilage and meniscus degradation, which are brought on by a shift in the mechanical axis of the joint **[(6, 7)].** This study aimed to get insight into the optimal treatment for varus deformity and medial compartment osteoarthritis.

PATIENTS AND METHODS

Our study comprised 24 patients hospitalized to Zagazig University with primary medial compartment knee osteoarthritis and indication for PFO between January 2019 and June 2022.

Inclusion criteria: Patients with moderate to severe knee symptoms, radiographic KL grade 3 or 4 according to **Kellegran and Lawrence [(8)]**, age 20 years or older, isolated medial compartment arthritis, at least 2 mm medial joint space on weight-bearing X-rays, body mass index (BMI) less than 32, and varus less than 20 are candidates for knee arthroscopic surgery.

Exclusion criteria: Patients under the age of 20 years, those with varus greater than 20 degrees, bi- or tricompartmental arthritis, severe obesity with bone-on-bone showing on weight-bearing X-rays, rheumatoid arthritis, post-traumatic arthritis, congenital deformities of the lower limb, joint infection, and a history of ligament or meniscus injury. All admitted patients were assessed in terms of their clinical condition, radiological findings, and functional status.

Pre-operative:

Gender, age, duration of symptoms, and severity grades were all included in the clinical data collected. The latter contained a VAS and a Knee Society scores, radiographic evaluation (plain x-ray both knee AP view standing position, lat. View, skyline view, Ap in 45°, CT if needed and MRI if needed).

Surgical technique:

Patients were supine on a standard radiolucent orthopaedic table while under spinal anesthesia. The tourniquet on the lower limb was inflated. The fibular head was located to prevent damage to the common peroneal nerve. The patient's fibula was cut open about 3–5 cm laterally at its top. The fibula was exposed when the fascia was cut along the septum between the peroneus and soleus muscles. The fibula was sawed off around 6-10 cm below the head. After the incisions were

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made, standard saline sutures were used to join the various layers of muscle, fascia, and skin back together.

Postoperative care and follow up:

Intravenous antibiotics were administered for three days, followed by oral antibiotics for five days. All of the sutures were removed out on day 12 after surgery. Then, radiological parameters were assessed and recorded using postoperative weight bearing X-rays. Patients' VAS and knee society scores were recorded at 1, 3, and 12 months after treatment.

Ethical consent:

An approval of the study was obtained from Zagazig University Academic and Ethical Committee. Every patient signed an informed written consent for acceptance of participation in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis:

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for Social Sciences) version 22 for Windows® (IBM SPSS Inc., Chicago, IL, USA). Data were tested for normal distribution using the Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Chi square test (χ^2) was used to calculate difference between two or more groups of qualitative variables. Quantitative data were expressed as mean ± SD (Standard deviation). Independent samples t-test was used to compare between two independent groups of normally distributed variables (parametric data). P value ≤ 0.05 was considered significant.

RESULTS

Twenty-four patients were recruited in the study. Eight knees (males) were examined (L=2 and R=6), and there were 16 total knees (L=2 and R=14) were females. In our research, we found that right knee injuries were more prevalent among females. The patients' ages varied widely, from 39 to 62, with a mean of 51.33 years. The patients' BMIs varied from 25 to 29, with 27.2 kg/m^2 being the mean. There were 6 cases of grade II osteoarthritis, 15 cases of grade III, and 3 cases of grade IV. Symptoms often lasted anywhere from 21 months to 39 months on average (mean = 29.36 months). All patients complained of severe knee pain, especially after prolonged periods of standing or engaging in vigorous physical activity, as well as a restricted range of motion in both knees and a varus deformity. Medial compartment joint space narrowing and sclerosis around the femorotibial joints were seen on preoperative AP radiographs of the affected knees. **(Tables 1, 2).**

Table (1): demographic characteristics of patients

All patients (n= 24)				
		Mean ± SD	**Minimum**	**Maximum**
Age (years)		51.33 ± 4.50	39.00	62.00
BMI		27.2 ± 3.21	25	29
Gender	**Male**	8 (33.3%)		
	Female	16 (66.7%)		
Osteoarthritis grade		**II**	6 (25%)	
		III	15 (62.5%)	
		IV	3 (12.5%)	
Side		**Right**	20 (83.3%)	
		Left	4 (16.7%)	

Table (2): Medical history of osteoarthritis in the studied patients:

All patients (n= 24)			
	Mean ± SD	**Minimum**	**Maximum**
Duration of complain (months)	29.36±6.4	21	39
Presence of neurovascular affection	1 (4.2%)		
Limited range of knee motion	24 (100%)		
Presence of varus deformity	24 (100%)		
Severe knee pain	24 (100%)		
X-ray finding (AP view)	Knees revealed narrow medial compartment joint space and sclerosis around the femorotibial joints.		

VAS is a self-report measure by patient himself, which ranged preoperatively from 7 to 9 with a mean of 8.4 ± 1.6 points, after 3 months postoperatively ranged from 4 to 8 with a mean of 5.3 ± 1.4 and after 6 months from 3 to 5 with a mean of 3.9 ± 1.3, and after 12 months postoperatively ranged from 0 to 2 points with a mean of 1.5 ± 0.8 (**Table 3)**.

Table (3): Preoperative and follow-up values of VAS score:

VAS score			All patients (n= 24)
	Mean ± SD	Minimum	Maximum
Pre-operative	8.4 ± 1.6	7	9
3 months	5.3 ± 1.4	4	8
6 months	3.9 ± 0.82	3	5
9 months	2.6 ± 0.52	2	4
12 months	1.5 ± 0.33	0	2
P value	<0.001		

Knee society score: is the sum of clinical knee score and function score, which showed improvement from preoperative 30 to 50 with a mean of 41.6 ± 5.4 points, 3 months postoperatively ranged from 42 to 64 points with a mean of 52.2 ± 4.6 points and after 12 months postoperative ranged from 71 to 91 points with a mean of 80.6 ± 2.6 points (**Table 4).**

Table (4): Preoperative and postoperative follow-up values of Knee Society score:

AKS score	All patients (n= 24)		
	Mean ± SD	Minimum	Maximum
Pre-operative	41.6 ± 5.4	30	50
3 months	52.2 ± 4.6	42	64
6 months	69.4 ± 4.8	55	78
9 months	75.4 ± 3.7	63	84
12 months	80.6 ± 2.6	71	91
P value	<0.001		

Table (5) displayed the results of before and postoperative radiographic measures. After the full period of follow-up, the average functional task ability (FTA) and lateral joint space were 180.3° ± 1.6° and 7.5 ± 1.1 mm, respectively compared to pre-operative readings. These numbers were much significantly lower (*P*<.001). Contrary to what was shown on preoperative radiographs, both the lateral and medial joint spaces had narrowed after surgery.

Table (5): Preoperative and Final Follow-up Radiological Measurement Values:

Measurement	All patients (n= 24)	
	Pre-operative	Final Follow-up
Femorotibial angle	183.6°±1.0°	180.3°±1.6°
Lateral joint space, mm	13.8±1.4	7.5±1.1
P value	<0.001	<0.001

DISCUSSION

Another study handling the same perspective, the median age of 47 participants was 63.96 (range: 48-78) years [(4)]. Also, a study included 30 cases with medial compartment osteoarthritis with average age of 48.4 years (range: 42 – 54) [(9)].

Included cases had a mean body mass index of 27.2 kg/m^2 (range: 24-32).The average body mass index of participants in a recent study was 27.38 kg/m^2 [(10)].

In the present study, we included 16 females and 8 males. Another study included 46 females and 32 males with medial compartment knee osteoarthritis [(11)].

Regarding the KL grade of osteoarthritis in the included cases of our study, 6 cases had grade II (25%), 15 cases had grade III (62.5%), and 3 cases (12.5%) had grade IV disease. **Liu and his colleagues** [(12)] reported that KL grading revealed 17 grade 2 knees (15.32%), 47 grade 3 knees (42.34%), and 47 grade 4 knees (42.34%).

In this study, 20 cases (83.3%) had right sided disease, whereas the remaining cases (4 cases–16.7%) had left sided disease. In another study, 25 cases (65.78%) had a right sided disease, while the left side was affected in 13 cases (34.21%) [13].

The average duration of patients' complaints was recorded as during history taking in the present study to be 29.36 ± 6.4 months. On examination, genu varus deformity was present in all cases. According to another study, the mean age was 59.45 ± 8.82 years (range, 43–86 years), and the mean duration of disease was 6.57 ± 5.37 years (range: 0.1–25 years) [12].

Regarding medial joint space changes in this study, there was significant increase in the the mean value ($p < 0.001$). Another study found that postoperatively, the medial joint space was increased ($p < 0.001$). Spreading out from1.2 ± 0.7 mm to 4.5 ± 1.1 mm. Similarly, postoperative imaging revealed consistent narrowing of the lateral joint space. From 7.2 ± 1.2 mm to 5.2 ± 1 mm ($P < 0.001$) [11]. Research on 110 patients followed for 2 years found that proximal fibular osteotomy significantly improved the radiographic appearance and function of the affected knee joint and provided long-term pain relief [2].

In this study, AKS scores showed a significant increase ($p < 0.001$) after scheduled follow up visits. In a different study, the mean scores for the AKS's knee and function subscales were 44.41 and 41.24, respectively. They considerably improved after surgery, reaching 69.02 and 67.63 points, respectively [4]. Bo **Liu *et al.*** [12] studied 84 patients with 111 knees affected by medial compartment arthritis. The preoperative KSS (Knee society score) and functional scores were 49.14 ± 10.95 and 44.97 ± 17.1, respectively, while the postoperative scores were 67.77 ± 11.08 and 64.66 ± 13.12. Fifty-one knees had a satisfactory clinical outcome, while 77 knees improved significantly.

VAS score showed significant reduction ($p < 0.001$) after surgery. It decreased through follow up visits. It was reported that all patients experienced medial pain relief following PFO. After surgery, the average score on a visual analogue scale dropped from 8.02 to 2.74 [4]. According to another study, the average preoperative VAS was 6.9, whereas the average VAS in the postoperative period was 2.1 ($p = 0.005$) [9].

The small sample size, short duration of follow-up, and lack of a control group were all drawbacks of our research. Whether or not PFO's positive benefits are long-lasting requires a more extensive follow-up period.

CONCLUSION

Medial compartment knee osteoarthritis patients who have a proximal fibular osteotomy (PFO) typically get significant pain relief and functional improvement after surgery.

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