

Clinical and Functional Outcomes of Proximal Fibular Osteotomy on Varus Deformity and Medial Compartment Knee Osteoarthritis

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Abstract

Background: In Low and Middle Income Countries (LMIC), there is an alternative surgical procedure of Proximal Fibular Osteotomy (PFO) has developed for osteoarthritis of knee joint. It is simple, safe and affordable. PFO helps relief pain in almost all patients.

Methodology: We retrospectively analysed 38 patients who underwent PFO in our hospital during the period from August to October 2018. Inclusion criteria are patient with moderate to severe symptoms of the knee with grade 2 knee OA on radiographs. Clinical data, Visual Analogue Scale score (VAS score) and American Knee Society Score (AKSS score) were recorded. Patients were followed up at 6 weeks, 12 weeks, and 6 months postoperatively.

Results: 38 patients (38 knees) were included in this study out of which 6 knees (L=2, R=4) were of males and 32 knees (L=11, R=21) were of females. The mean age was 52.4 years. The average preoperative VAS score, KSS clinical and functional score was 7.89 ± 1.01 points (range from 4 to 9 points), 47.23 ± 11.05 points (range from 26 to 90 points) and 45.85 ± 16.62 points (range from 0 to 90 points), respectively. At 6 months, the mean visual analogue scale scores significantly decreased to 2.74-2.34 postoperatively. There was significant improvement in the average postoperative KSS clinical and functional scores which is 67.11 ± 10.09 points (range from 31 to 94 points) and 65.67 ± 12.22 points (range from 22 to 100 points), respectively. The ratio of the knee joint space (medial/lateral compartment) increased from an average of 0.38 ± 0.12 preoperatively to 0.56 ± 0.13 postoperatively.

Conclusion: The PFO is a promising surgical option in countries that lack financial and medical resources.

Keywords: Proximal fibular osteotomy (PFO); Knee osteoarthritis (OA); Low and middle income countries (LMIC); VAS score; KSS score

Introduction

Osteoarthritis (OA) of knee joint is a common disease that causes significant disability. The global prevalence of radio graphically confirmed symptomatic knee OA in 2010 was estimated to be 3.8%. It was higher in females (4.8%) than in males (2.8%) [1]. In the USA, 33.6% people aged more than 65 years were found to have osteoarthritis of knees [2]. In south Asian region the prevalence of OA of knees is 1.8% in males and 3.1% in females [1]. With the aging of the world's population, especially in Low & Middle Income Countries (LMIC), the number of people living with knee OA is anticipated to increase substantially over coming decades. Conservative management is suggested for most patients in the outpatient setting [3]. Total Knee Arthroplasty (TKA) is the main surgical alternative in the developed countries with focus on developing patient-specific surgical instrumentation for knee arthroplasty, post-operative supervised exercise programs, and other potentially expensive healthcare modality. However, TKA is expensive and complex, and some patients need a second knee revision after the first surgery [4,5]. In the LMIC, lacking of appropriate healthcare infrastructure or inability to fund expensive treatment of arthroplasty for osteoarthritis can hardly afford to benefit from such advanced method. Although, High Tibial Osteotomy (HTO) is the first-choice treatment for young patients with osteoarthritis of the medial compartment of the knee, there are some potential disadvantages after surgery [6-9] such as non-union of the osteotomy. Therefore, there is a growing need for Proximal Fibular Osteotomy (PFO) in LMIC, since it is simple, safe and affordable. PFO may delay or replace TKA in a subpopulation of patients with knee osteoarthritis and pain relief after surgery occurs in almost all patients.

In the present study, we assessed the short-term clinical and functional outcomes of PFO in terms of pain relief and improvement of joint function among 38 patients operated in our hospital.

Materials and Methods

Patients with primary medial compartment knee osteoarthritis who had an indication for PFO were admitted to our hospital from August to October, 2018 and were analysed retrospectively in this study. Patients with moderate to severe symptoms of the knee over Kellgren and Lawrence (KL grade) grade 2 on radiographs were included in the study [10]. The exclusion criteria were patients with posttraumatic arthritis, congenital deformities of the lower extremity, rheumatoid arthritis, septic arthritis, history of ligament or meniscus injury and significant abnormality of the lateral compartment.

Clinical data was divided into gender, age, duration of disease and grading systems. We used Visual Analogue Scale score (VAS score) and American Knee Society Score (AKSS score), which consisted of both clinical score and function score [11]. KSS major is calculated by measuring factors such as pain, stability and range of motion. Further, the function score includes measuring activities of the patient. Patients were followed up at 6 weeks, 12 weeks, and 6 months postoperatively. The VAS, KSS clinical and functional scores were obtained at preoperatively and postoperatively at 6 months follow up.

In this study, both pre-operative and post-operative weight-bearing

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AP radiographs of the affected knee were taken. Joint space width of both the compartments were compared in pre and post-operative radiographs.

Statistical analysis was performed using Microsoft Excel. Our data variables were expressed as the mean \pm SD. The study was approved by the Ethical Committee.

Surgical Technique

Proximal fibular osteotomy was executed by the same surgical team. Under the epidural anaesthesia, patient in the supine position, the pneumatic tourniquet was used for haemostasis, and the exposure was done using fibular posterolateral approach (Figure 1).

Exposure of the subcutaneous tissues was done and then intermuscular space between the peroneus longus and brevis and soleus muscle was found. Using curved forceps separation of layers was done until the proximal fibula followed by subperiosteal dissection. Soft tissues along the fibular medial surface were protected using two broad osteotomes. A micro-oscillating saw was used to cut a 2 cm long fibula 6-10 cm away (Figure 2) from the fibular head and then 0.9% sodium chloride solution was used to wash it off thoroughly. Bone wax was used to seal the broken ends to reduce bleeding and pain.

Negative pressure suction drain tube was placed and then removed within 24 hours. The pneumatic pump was used to avoid lower limb venous thrombosis, and lower limb physiotherapy was directed.

Results

A total of 38 patients (38 knees) were included in this study out of which 6 knees (L=2, R=4) were of males and 32 knees (L=11, R=21) were of females. There was a female preponderance seen in our study with the right knee being more commonly affected. The age of the patients ranged from 46 to 59 years with the mean age being 52.4 years.

The average preoperative VAS score, KSS clinical and functional score was 7.89 ± 1.01 points (range from 4 to 9 points), 47.23 ± 11.05 points (range from 26 to 90 points) and 45.85 ± 16.62 points (range from 0 to 90 points), respectively (Figure 3).

There was a noticeable medial pain relief seen in all patients after PFO. At 6 months, the mean visual analogue scale scores significantly decreased to 2.74-2.34 postoperatively. There was significant improvement in the average postoperative AKSS clinical and functional scores which is 67.11 ± 10.09 points (range from 31 to 94 points) and 65.67 ± 12.22 points (range from 22 to 100 points), respectively (Figure 3).

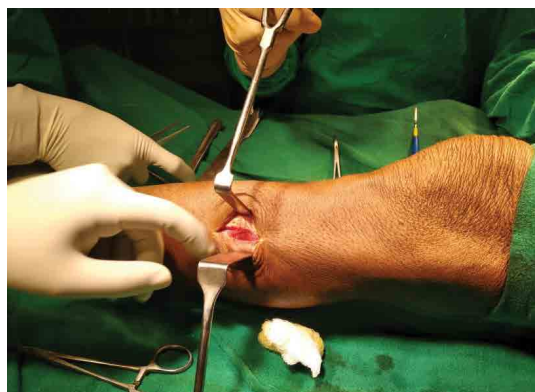


Figure 1: Surgical Exposure using Fibular Posterolateral approach.



Figure 2: Fibular Osteotomy done approximately 6-10 cm (around four finger breadth) from fibular head.

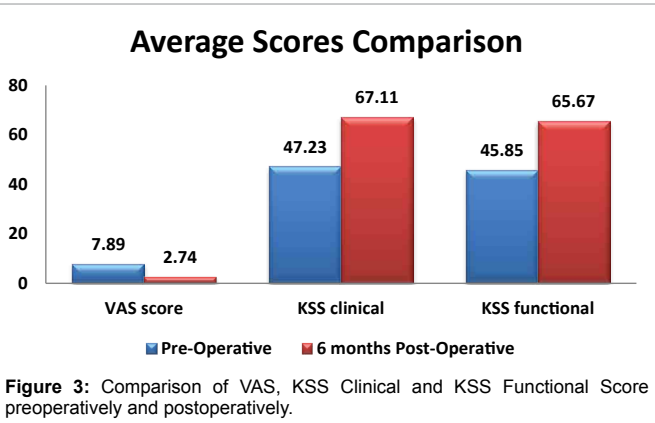


Figure 3: Comparison of VAS, KSS Clinical and KSS Functional Score preoperatively and postoperatively.



Figure 4: Preoperative and Postoperative X-rays of right knee.

Postoperative weight bearing radiographs of the lower extremities showed an average increase in the medial knee joint space as compared to the preoperative weight bearing radiographs (Figure 4). There was a significant improvement in the ratio of the knee joint space (medial/lateral compartment) from an average of 0.38 ± 0.12 preoperatively to 0.56 ± 0.13 postoperatively.

Discussion

In PFO, the load of the knee joint is transferred from the medial plateau to the lateral plateau, and the distal femoral mechanical axis is rearranged to relieve the lateral soft tissue tension of the knee joint and

remove KOA symptoms [12]. Some studies show that this procedure leads to low intra-osseous pressure and relieves pain [13]. The aim of fibular osteotomy is to ensure protection of the peroneal nerve and to achieve accurate fibular osteotomy height and length. Performing fibular osteotomy in an area 4-7 cm away from the fibular head lowers the risk of peroneal nerve injury and produces satisfactory curative effects after operation [14]. Under the PFO procedure, a minimum of 10 mm piece of fibula is removed six to nine cm below the fibular head which relieves the medial compartment pressure and realigns the knee. It is suggested that the distance from fibular head tip should be closest to the knee joint, without any damage to the lateral popliteal nerve. The measurement should be 6 cm below in 5 feet tall, 7 cm in 5.5 feet, and 8 cm in six feet tall patients [15].

The exact mechanism of the effectiveness of PFO is unclear. One theory suggests that PFO removes the fibula support that may cause genu varus that helps relieve pain and improve joint space. Further, PFO may restructure the load on the lateral and medial tibia plateau after surgery, which is supported by the theory that fibula supports one-sixth of the body weight [15]. There are clinical, biological and biomechanical advantages to PFO for potential pre-arthroplasty patients with early knee OA [16].

In Canada, there was a cadaveric study held with an aim to find the effects of PFO on knee joint, tibia strain and ankle pressures. This research stated that PFO reduces pain and improves function by decreasing the pressure on the medial compartment of the knee in patients with knee osteoarthritis [17].

A study by Zhang et al. [5] in 2015 presented a group of 38 patients with early OA and compared their preoperative and postoperative scores using VAS, WOMAC and Oxford Knee Scores. According to their findings the VAS Score improved from 7 pre-operatively to 2.58 in the 20th week post-operative follow up. Our study also reported the same trend with the VAS score improving from 7.89 preoperatively to 2.74 in their 6 month postoperative follow up. Therefore, our results directly support their inference that PFO improves joint function and relieves pain in knee osteoarthritis.

A study by Yang et al. [18] demonstrated that PFO is a fast, safe, simple and affordable surgery to relieve pain and improve joint function and the medial joint space in knee osteoarthritis. PFO may be seen as a likely substitute in many LMICs due to their financial and healthcare limitations. Also it is a promising alternative for those patients that cannot undergo TKA due to certain medical comorbidities. This could potentially be a temporary fix for these patients as they can still undergo TKA in the future if need be.

The most remarkable findings in our study were the pain relief and an increase in the joint space on the medial aspect. Despite the follow up period being shorter than usual with upto 6 months, we found that majority of our patients felt noticeable pain relief immediately after PFO and then felt a continual improvement in pain, axial alignment and function over the follow up period with 3 patients reporting no pain in their 6 month follow up. Therefore, PFO can possibly become a promising alternative treatment for osteoarthritis of the medial compartment of the knee, especially in countries that have financial limitations or healthcare limitations and in patients that cannot undergo TKA due to medical comorbidities. As compared to TKA or HTO, PFO is fast, safe, simple, affordable and minimally invasive surgery that does not require insertion of additional implants.

There were certain noteworthy limitations to our study. First, the follow-up period was relatively short and whether these findings would

sustain in the long term cannot be predicted. Thus, a longer follow-up study is necessary. Second, the exact mechanism of the effectiveness of PFO is unclear. Lastly, our study did not have any control group.

Conclusion

The PFO is a promising surgical option in countries that lack financial and medical resources. As compared to TKA or HTO, the PFO is a simple, safe, fast and affordable surgery that does not require insertion of additional implants leading to less complications and a shorter recovery period. Currently short term results from a few reporting centres suggest that PFO would be a suitable procedure for early OA knees. However, a prospective study with longer follow up periods focussing on pre-surgical and post-surgical gait analysis is necessary to evaluate whether the beneficial effects of PFO are sustained over a period of time.

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