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Proximal Fibular Osteotomy (PFO) for Medial Compartment Osteoarthritis of Knee with Varus Deformity - Preliminary Report

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Abstract

Introduction: Proximal fibular osteotomy (PFO) is a surgical procedure to treat osteoarthritis involving the medial compartment of knee. PFO provides pain relief and delays the progression of degenerative changes.

Patients and Methods: The present study included assessment radiological and functional outcomes of proximal fibular osteotomy in medial knee osteoarthritis. Three consecutive patients who underwent PFO were followed retrospectively.

Results: Medial pain relief was observed in all patients after PFO. Radiographs of the weight-bearing lower extremity showed an average increase in the medial knee joint space postoperatively compared with preoperatively.

Conclusion: PFO is a simple, safe, and fast surgical procedure to relieve pain and achieving improvement in knee function and it is a promising alternative for osteoarthritis of the medial compartment of the knee, for patients who cannot undergo or it necessary to delay total knee arthroplasty because of certain medical comorbidities. It may also constitute an alternative in developing countries because of their financial and healthcare delivery limitations.

Keywords: Proximal fibular osteotomy; Knee Osteoarthritis; Pain; High tibial osteotomy; Arthroplasty

Introduction

Osteoarthritis [OA] of the knee is a chronic, progressive degenerative disease with accompanying joint pain, stiffness, and deformity [1,2], with an incidence of 30% in the population elder to 60 years [3]. High tibial osteotomy (HTO) and unicompartmental knee arthroplasty (UKA) are well-established treatments for medial knee osteoarthritis (OA) [4].

As arthroplasty is associated with serious postoperative challenges, joint preserving procedures have become popular and appropriate for young and active patients [5,6]. Patients with unicompartmental OA of the knee can be treated with a correction osteotomy. Corrective osteotomy works by transferring the load bearing from the pathologic to the normal compartment of the knee. High tibial osteotomy (HTO) is the preferred treatment for osteoarthritis involving medial compartment of the knee in young patients (<60 years of age), with isolated medial osteoarthritis, with good range of motion and without ligamentous instability [7,8]. However, HTO is an excessive surgical action for mild varus deformity as the surgical procedure is technically demanding, needs long rehabilitation period, with serious potential complications including nerve and vascular injuries [9-12].

Proximal fibular osteotomy (PFO) is a surgical procedure emerging as a modality to treat osteoarthritis involving the medial compartment of knee specially in countries that lack financial and medical resources [13]. PFO provides pain relief and delays the progression of degenerative changes, hence delays knee replacement.

Proximal fibular osteotomy (PFO) evolved from the observations of Dr. L Prakash in the prison, where he found a dramatic relief in symptoms of medial compartment arthritis of the knee in patients who had been involved in prison riots and fractured their proximal fibulae when the guards beat the prisoners with their lathi (staff) below the knees, resulting in a fractured fibula in many cases [14]. The first suggestion that fibulectomy results in a decrease in the medial compartmental

pressure and an increase in the lateral compartmental pressure was reported by Yazdi et al. [15,16] in 2014.

The use of PFO for the management of knee osteoarthritis has been reported in the literature, only recently since 2015 [17-19]. The popularity of PFO in the Eastern world (China and India etc.) is perhaps due to the fact this procedure is simpler, less expensive and requires lesser rehabilitation than the alternative procedures like High Tibial Osteotomy (HTO), Unicompartimental Knee Arthroplasty (UKA), and Total Knee Arthroplasty (TKA). The objective of the present study is evaluated the results of PFO in osteoarthritis involving the medial compartment of the knee joint, in terms of pain relief, and radiological improvement.

Patients and Methods

The present study included assessment radiological and functional outcomes of proximal fibular osteotomy in medial knee osteoarthritis. Three consecutive patients who underwent PFO were followed retrospectively (mean age, 69.3 years; age range, 48–81 years; 3 female).

Inclusion criteria

- Age of patient 45 years or older.
- Unilateral medial compartment OA with moderate to severe symptoms of the knee over Kellgren and Lawrence (KL grade) grade 2 on radiographs [20] associated with genu varum deformity.
- Body mass index less than 25.

Exclusion Criteria

- Age of patient less than 45 years.
- Patients in which both medial and lateral compartments of knee are involved.
- Body mass index (BMI) more than or equal to 25 (overweight).
- Patients with High Tibial Osteotomy or history of any intra-articular injection.
- OA involving lateral or bilateral knee compartment, and genu valgus deformity.
- Rheumatoid arthritis, posttraumatic arthritis, congenital deformities of the lower extremity, joint infection, history of ligament or meniscus injury and significant abnormality of the lateral compartment.

Preoperative and Postoperative knee Weightbearing Radiographs

Preoperative and postoperative weightbearing radiographs were obtained in all patients to analyze the alignment of the lower extremity and the ratio of knee joint space (medial/lateral compartment). Ratio of knee joint space (medial/lateral compartment): The medial joint space was determined by a vertical line (A) between two horizontal lines (C and D) that were drawn from the lowest point of the medial condyle of the femur and medial plateau of the tibia, respectively. The lateral joint space was determined by a vertical line (B) between two horizontal lines (E and F) that were drawn from the lowest point of the lateral condyle of the femur and lateral plateau of the tibia, respectively. The ratio of the knee joint space (medial/lateral) was determined by the ratio of A/B (Figure 1).

Figure 1: Measurement of ratio of knee joint space (see Patients and Methods Section).

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Knee Pain Assessment: Knee pain was assessed using a Visual Analogue Scale (VAS).

Surgical Technique

The patients were placed in the supine position under regional anaesthesia. An approximately 6-cm longitudinal incision was made over the lateral skin of the proximal fibula at a site 4-7 centimeters away from the fibular head, to prevent the peroneal nerve injury and to achieve good pain relief after PFO, exposing the fibula between the peroneus muscle and soleus muscle and PFO was performed by removing a 2- to 3-cm length of fibula. Full weight bearing and free mobilization were allowed postoperatively. Knee pain assessment and postoperative knee weightbearing radiographs were recorded (Figure 2).

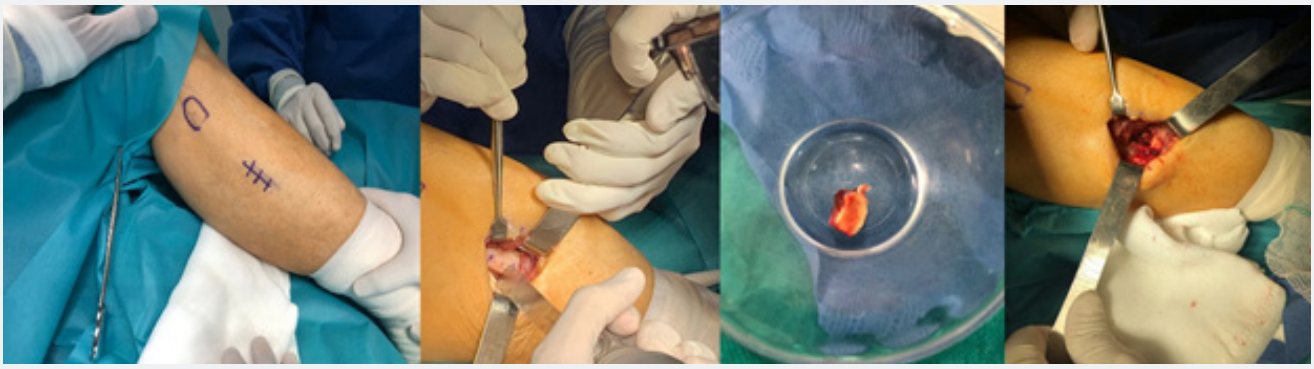

Figure 2: Surgical steps of proximal fibular osteotomy.

Results

All patients who were followed for a minimum of 4 months. The mean duration of follow-up was 13.38 months (range, 4–10 months). Medial pain relief was observed in all patients after PFO. The mean visual analogue scale scores significantly decreased from 8.33 preoperatively to 2.33 postoperatively. Radiographs of the weight-bearing lower extremity showed an average increase in the medial knee joint space postoperatively compared with preoperatively. The mean ratio of the knee joint space (medial/lateral compartment) improved significantly from 0.3 preoperatively to 0.7 postoperatively (Figure 3).

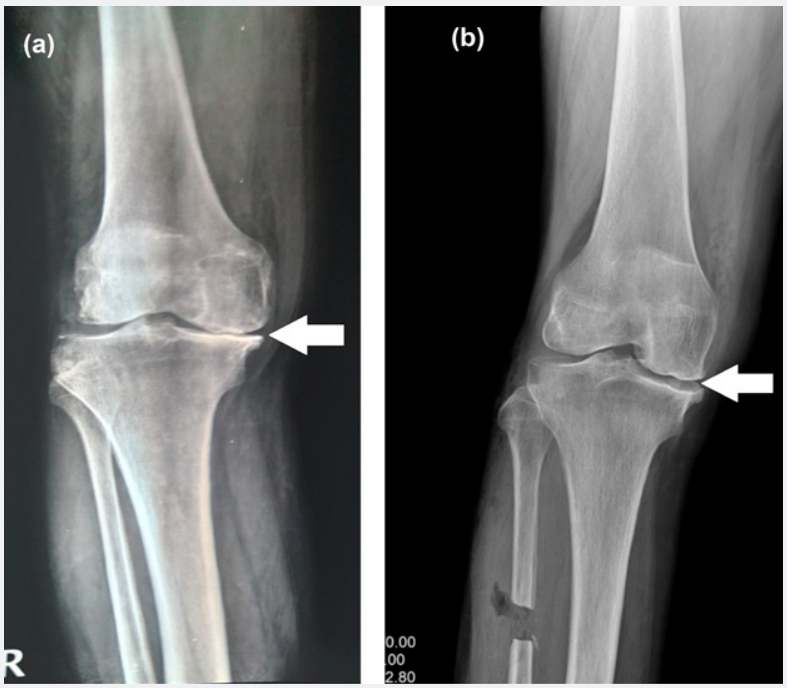

Figure 3: Improvement in the joint space ratio (medial/lateral compartment) after PFO. (a) Preoperative image. (b) Postoperative image.

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Discussion

Origin of proximal fibular osteotomy is related to the observations of Dr. L Prakash [13] and later the first suggestion that fibulectomy results in a decrease in the medial compartmental pressure and an increase in the lateral compartmental pressure was reported by Yazdi et al. [15,16] in 2014. The use of PFO for the management of knee osteoarthritis has been reported in the literature since 2015 [16-19]. From this date the proximal fibular osteotomy has gained popularity specially in the Eastern world (China and India etc.) due to the fact this procedure is a simple, safe, fast and a suitable surgical option because does not require insertion of additional implants and become an alternative treatment method for osteoarthritis of the medial compartment of the knee, especially for patients who cannot undergo High Tibial Osteotomy (HTO), Unicompartimental Knee Arthroplasty (UKA) or Total Knee Arthroplasty (TKA) because of medical comorbidities.

The most important findings in the present study included significant pain relief immediately after PFO and an increase in the medial joint space, although the mechanism is unclear. One possible explanation of why PFO relieves pain and improves the joint space is that it removes the fibula support that may cause genu varus and it may rebalance or redistribute the load on the lateral and medial tibia plateau after surgery. Another possible mechanism is nonuniform settlement as proposed by Yang et al. it is explained that the lateral support provided to the osteoporotic tibia by the fibula–soft tissue complex may lead to nonuniform settlement and degeneration of the plateau bilaterally, which may cause the load from the normal distribution to shift farther medially to the medial plateau, consequently leading to knee varus and aggravating the progression of medial compartment osteoarthritis of the knee joint [18].

Conclusion

In summary, our preliminary data demonstrate that PFO is a simple, safe, and fast surgical procedure to relieve pain and achieving improvement in knee function. However, several limitations to this study must be noted. First, although the short-term results are encouraging, the follow-up time was relatively short, and finally the absence of a control group is another main limitation. PFO may be a promising alternative surgery for osteoarthritis of the medial compartment of the knee, especially for patients who cannot undergo or it necessary to delay total knee arthroplasty because of certain medical comorbidities. It may also constitute an alternative in developing countries because of their financial and healthcare delivery limitations.

Declaration of conflicting interests

The authors declare that there is no conflict of interest.

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