International Journal of Orthopaedics Sciences

E-ISSN: 2395-1958
P-ISSN: 2706-6630
IJOS 2020; 6(1): 1210-1213

www.orthopaper.com
Received: 24-11-2019
Accepted: 27-12-2019

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Evaluation of efficacy of proximal fibular osteotomy in predominantly medial compartment osteoarthritis of knee for pain relief and improvement in medial joint space of the knee

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DOI: https://doi.org/10.22271/ortho.2020.v6.i1p.1986

Abstract
Background: Osteoarthritis [OA] of the knee is a chronic, progressive degenerative disease with accompanying joint pain, stiffness, and deformity. Varus deformities of the knee, characterized by a femorotibial axis of less than 180° on full-leg standing AP radiographs and narrowed medial joint space, are common in patients with knee OA. 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.
Method: We have taken 30 patients coming to our orthopaedic OPD with predominantly medial compartment OA knee at Mahatma Gandhi Medical College & Hospital. Preoperative and postoperative weight-bearing and whole lower extremity radiographs were obtained to analyse the alignment of the lower extremity and the knee joint space. Knee pain was assessed using a visual analogue scale, and knee ambulation activities were evaluated using the American Knee Society score preoperatively and postoperatively.
Result: The preoperative KSS score was 53.56±4.606 while postoperatively it was 72.16±8.07. The preoperative KSS score was 42.16±14.72 while postoperatively it was 72.23±9.98 at functional score. Preoperatively the mean VAS score was 7.53 which significantly decreased to 3 in the postoperative period. We also noted decrease in the femoro-tibial angle from preoperative (182.73±1.79) to postoperative period (178.23±2.09) whereas in the medial joint space it was increased from 1.69±0.96 mm to 3.43±1.21 in the postoperative period.
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.

Keywords: Proximal fibular osteotomy, American knee society score, Femoro tibial angle

Introduction
Osteoarthritis [OA] of the knee is a chronic, progressive degenerative disease with accompanying joint pain, stiffness, and deformity [1]. Osteoarthritis is a common joint disease, with an incidence of 30% in the population elder to 60 years [2]. The disease involves mechanical, osseous, genetic, and environmental factors [3]. Varus deformities of the knee, characterized by a femorotibial axis of less than 180° on full-leg standing AP radiographs and narrowed medial joint space, are common in patients with knee OA and affect 74% of patients with idiopathic OA [4]. In healthy knees, the medial compartment bears 60% to 80% of the load as the mechanical axis is more frequently medial to the centre of the knee joint [5].
The forces across the knee joint are not transmitted equally between the medial and lateral compartments during walking. The load on the medial compartment is greater than that on the lateral compartment [6]. Consistently higher loads on the medial compartment have been shown to result in degenerative changes of the articular cartilage. This imbalance in the load distribution may explain the higher prevalence of medial compartment involvement (75%) reported in subjects with knee OA relative to the lateral compartment (25%). Furthermore,

with disease progression, increased mechanical load and damage to the medial side of the knee joint has been associated with increasing knee varus alignment, further loading the medial compartment. In medial compartment osteoarthritis due to shifting of the weightbearing on the medial side of the knee due to varus will result in more cartilage destruction and subsequently varus deformity.

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.

Material and Method

We have taken 30 patients coming to our orthopaedic OPD with predominantly medial compartment OA knee at Mahatma Gandhi Medical College & Hospital. Preoperative and postoperative weight-bearing and whole lower extremity radiographs were obtained to analyse the alignment of the lower extremity and the knee joint space. Knee pain was assessed using a visual analogue scale, and knee ambulation activities were evaluated using the American Knee Society score preoperatively and postoperatively. Institute ethics committee approval was obtained before start of the study. Written and informed consent was obtained from all participants before enrolment into the study.

Sample size: 30 patients were taken for our study.

Selection criteria

Inclusion criteria

Knee pain with difficulty walking due to medial compartment osteoarthritis of Knee joint.

Exclusion criteria

1. Genu valgus
2. Severe osteoarthritis knee with both compartment involvement
3. Previous H/O associated major fractures of tibia/femur ipsilateral
4. Inflammatory joint disease of knee
5. Previous major operations for fractures
6. Malignant tumours

Surgical technique

The patient was positioned supine on the operating table following administration of spinal anaesthesia.

Area to be operated was washed with betadine scrub, then painted with betadine and finally covered with sterile draping. The tip of fibular head was marked with a skin marking pen, and the appropriate downward distance measured.

A lateral fibular incision, approximately 5cm was used for the procedure. Skin and subcutaneous tissue were cut. The incision should be a little more than twice the length of the resected segment.

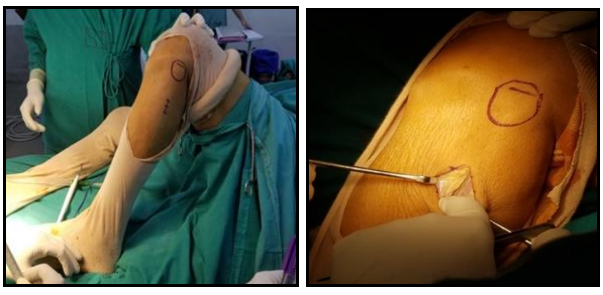

Fig 1: Left Skin markings of incision (right) Skin incision for PFO

- The fibular periosteum was now exposed by separating the peroneus longus and soleus. The periosteum was incised in line of skin incision, and a 1 to 2 cm piece of fibula resected with a narrow blade oscillating saw.

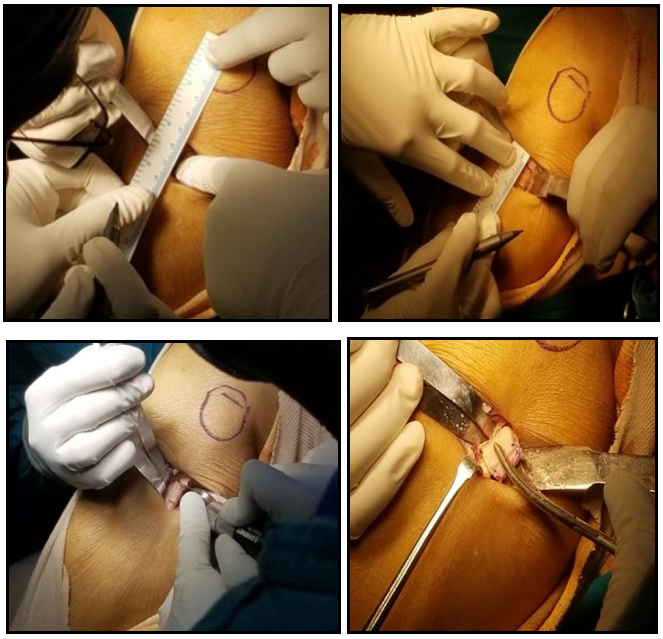

Fig 2: The periosteum was incised in line of skin incision, and a 1 to 2 cm piece of fibula resected with a narrow blade oscillating saw

Steps of surgical procedure of PFO

Wound was washed, closed in layers, and a light compression bandage given before the patient was shifted out of the operation theatre.

Fig 3: Resected fibular segement after PFO

Follow-up

Following suture removal at 2 weeks, all patients were followed in the outdoor patient department at 1st month and 6rd month and 1year.

On the final follow up at 1 year the Knee society Score (KSS), VAS, Femoro-Tibial angle (FTA), medial joint space and range of motion (ROM) were calculated for the operated knee as during the pre-op evaluation and were documented.

Results

Table 1: Comparison of VAS score in the study group

	Mean	Std. Deviation	P value
Pre op	7.53	0.93	0.001 (S)
Post op	3	1.7	

The mean VAS score preoperatively was 7.53 which significantly decreased to 3 in the postoperative period which showed statistically significant results in both pre operative and post operative study group. (p value=0.001).

Table 2: Comparison of KSS score in the study group

		Mean	Std. Deviation	P value
Knee score	Pre op	53.56	4.606	0.001 (S)
	Post op	72.4	8.07	
Function score	Pre op	42.16	14.72	0.001 (S)
	Post op	72.23	9.98	

The preoperative knee score was 53.56 which increased to 72.4 post operatively and the functional score also increased from 42.16 to 72.23. Both knee score and function score showed statistically significant results (p value=0.001).

Table 3: Comparison of Femoro-Tibial angle in the study group

	Mean	Std. Deviation	P value
Pre op	182.73	1.79	0.001 (S)
Post op	178.23	2.09	

The preoperative tibio femoral angle was 182.73° ± 1.79° which changed to 178° ± 2.00° post operatively which showed statistically significant results (p value=0.001).

Table 4: Comparison of Medial joint space in the study group

	Mean	Std. Deviation	P value
Pre op	1.69	0.96	0.001 (S)
Post op	3.43	1.21	

The medial joint space widened from 1.69 ± 0.96 mm to 3.43 ± 1.21 mm which showed statistically significant results (p value=0.001).

Table 5: Comparison of complication in the study group

	Frequency	Percent
EHL Weakness	1	3.3
Dorsal foot numbness	2	6.7
Nil	27	90
Total	30	100

Out of the study group, 90% patients did not have any complication while only 1 patient had EHL weakness and two of them had dorsal foot numbness.

Discussion

The PFO is a suitable surgical option in most Low- & Middle-Income Countries (LMICs) that lack monetary and medical resources. The PFO is affordable in the comparatively young patients with early medial joint arthritis. Thereby, PFO has emerged as an appropriate alternative to costly procedures like High Tibial Osteotomy (HTO) and Unicompartmental or total joint replacement (TKA) surgery in the Low- & Middle-Income Countries (LMICs). Compared with TKA or HTO, the PFO is a simple, safe, time saving surgery which is also affordable and does not require insertion of additional implants. Currently short term results from a few reporting centres suggest that PFO would be a suitable procedure for early OA knees.

The exact mechanism of the efficacy of PFO 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. The fibula supports one-sixth of the body weight; thus, PFO may rebalance or redistribute the load on the lateral and medial tibia plateau after surgery [7].

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.

The advantages of PFO over the other procedures is that it is a simple and safe procedure which is cost effective and easy to perform. It gives dramatic pain relief postoperatively and is associated with a shorter recovery time. If the procedure does not give good results in any situation then the field for performing a Total knee arthroplasty at a later stage is not altered at all.

Limitations

This study has its limitations, as it was not a comparative study and the sample size of the study was small. The small numbers, prospective nature and short-term follow-up were areas where future studies are required to seal the debate conclusively. Lastly, the 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.

1. PFO is a simple easy procedure for early medial compartment osteoarthritis of the knee and it causes a significant reduction in pain.
2. It is a relatively minor day care procedure which is less invasive than High Tibial Osteotomy or Unicompartmental arthroplasty.
3. Care should be taken to avoid Lateral Popliteal Nerve injuries.

Acknowledgement

The authors express their gratitude towards all study participants for their valuable time. Authors would like to extend their gratitude to the staffs of the department of Orthopaedics, Mahatma Gandhi Medical College and Hospital, Jaipur for their contributions and technical supports.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by institutional ethics committee

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