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Original Research Article

Proximal fibular osteotomy in medial OA knee

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ABSTRACT

Background: Osteoarthritis (OA) of the knee is an emerging cause of morbidity and indirect mortality encountered by the clinician. Failure to respond to conservative management is common and surgery is the usual outcome. Total Knee arthroplasty (TKA) and Unicompartmental knee arthroplasty (UKA) have displayed dependable results but are demanding surgeries with a limited lifespan. High tibial osteotomy (HTO) corrects the alignment of the limb and improve knee function but is associated with a series of complications and difficult conversion. Recent studies on Proximal Femoral Osteotomy (PFO) in medial OA of the knee proclaim much relief in pain and correction of limb alignment. We conducted a prospective interventional study to evaluate the functional and radiological outcome of PFO in medial OA knee.

Materials and Methods: 18 patients (30 knees) of medial OA knee with Kellgren Lawrence (KL) grade 2 and 3 disease underwent PFO after written informed consent and institutional review board clearance. The patients were followed up at 3 months, 6 months and 1 year and Femoro-Tibial angle (FTA), Visual Analogue Score (VAS), Knee injury and Osteoarthritis Outcome score (KOOS) and Oxford Knee Score (OKS) were documented pre-operatively and at each follow up.

Result: The mean age in our study was 64 years. The mean VAS score was 6.86 pre-operatively while 3-month VAS was 6.96 and its 12 month value was 7.26 The mean pre-operative OKS was 34.26 which decreased to 33.36 at 3 months and 32.26 at 12 months. The mean pre-operative KOOS was 52.99 while it was 51.88 at 3 months and worsened to 50.98 at the final follow up. The mean FTA pre operatively was 182.96 degree and at 1 year follow up it deteriorated to 183.26 degree. 3 patients (10%) informed paresthesias and weakness in the foot which resolved on medical management.

Conclusion: We did not observe relief in pain and function after PFO. The limb alignment did not improve at 1 year follow up. The authors conclude that more evidence needs to be gathered before validating PFO as an established treatment modality in medial OA knee.

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1. Introduction

Osteoarthritis (OA) of the knee is one of the most common diagnosis encountered in any orthopaedic clinic. Not only is its incidence on the rise, recent studies have found a strong correlation between symptomatic OA knee and pre-mature deaths owing to cardiac and other causes.¹ Life style modification, Physical therapy, Pharmacotherapy

and local injections are first line treatment modalities failing which surgery is inevitable. Total Knee Arthroplasty (TKA) is an established modality with reliable results but comes with a limited survival and a wide array of complications. Its cost constraints and need of adaptation to a new lifestyle makes it unpopular particularly in the Indian subcontinent. Unicompartmental Knee Arthroplasty (UKA) is a novel and promising alternative in managing medial OA knee but requires vigilant case selection to achieve satisfactory results. Progression to tri-compartmental

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arthritis, dislocation, aseptic loosening, polyethylene wear, infection and persistent pain may necessitate revision surgery adding to patient dissatisfaction.² High tibial osteotomy (HTO) is known to shift the weight bearing axis laterally and decrease the burden on the knee alleviating degeneration and triggering regeneration.³ It however needs a slow and tiresome rehabilitation and is known for complications like fracture, compartment syndrome, thromboembolic episodes, non-union and difficult conversion to TKA.⁴ Proximal Fibular osteotomy (PFO) has gained consideration as an alternative in management of medial OA knee lately. Excision of a segment of fibula has been found to reduce pressure on the medial compartment of the knee and decrease the overall pressure on knee hypothesizing improvement in pain.⁵ Studies propagating a non-uniform settlement of the tibial plateau⁶ due to an additional support by the fibula have been a driving force in considering PFO as an effective possibility in OA knee. With this background, we conducted a prospective interventional study to evaluate the outcome of PFO in managing medial OA of the knee.

2. Materials and Methods

This prospective interventional study was conducted at a large tertiary care center in central India between September 2017 and September 2019. It involved 30 knees (18 patients) with medial compartment OA grade 2 and 3 as per Kellgren Lawrence (KL) grading presenting with pain and disability not resolving with conservative management. The study was approved by the ethics committee and institutional review board and a written informed consent was sought from each patient authorizing clinical and radiological examination as well as surgical intervention. Patients with inflammatory joint disease, valgus knees and post traumatic oa were excluded. Detailed clinical examination and documentation of data was done by the same investigator in terms of age, sex, duration of illness, comorbidities, deformities and range of movement of the knee. Visual Analogue Score (VAS) for pain, Knee injury and Osteoarthritis Outcome score (KOOS) and Oxford Knee Score (OKS) of the affected knee were documented before surgery. Weight bearing AP and lateral view x-rays of the involved knee were taken (Figure 1) and the Femoro-tibial angle (FTA) was noted.

The surgery was done in supine position under spinal anesthesia with a tourniquet applied to the involved side. A skin marking pen was used to mark bony points and the length of fibula to be excised. The incision was kept around 4-5 cm long, roughly twice as long as the length of the fibula to be excised. A plane was made between peroneus and soleus and the fibular periosteum was incised. A 1-2 cm piece of fibula was resected with K-wire and osteotome around 10-12 cm below the head of fibula depending on the patients height. The wound was copiously irrigated and closed in layers and a light compression bandage was given.

The duration of surgery and blood loss was noted. The patients were mobilized full weight bearing with the help of walker within few hours of surgery. Strengthening of quadriceps, hamstrings, gastro-soleus complex along with ankle and knee rom exercises were started promptly. The walking aid was withdrawn in the next 48 hours. Check dress was done at 48 hours and patient was allowed to go home. Suture removal was done at 2 weeks.

Patients were asked to follow up at 3 months, 6 months and 1 year after the surgery. Antero-posterior and lateral weight bearing radiographs were taken and the FTA, VAS score, KOOS and OKS were noted at each follow up (Figures 1 and 2). Statistical analysis was done by using SPSS software version 20. Repeated measures ANOVA test was applied for VAS score, KOOS and OKS whereas paired t-test was done for FTA and p values were calculated. A value of <0.05 was considered significant.

3. Results

A total of 18 patients (30 knees) were operated out of which there were 11 females and 7 males, showing a female preponderance in the study. The current study did not evaluate the functional outcome of PFO in males and females or different grades of osteoarthritis separately.

Mean age in our study was 64 years. The mean duration of surgery was 34 minutes. The average blood loss was 33ml. The same was estimated by Gauze Visual Analogue method.⁷ The mean FTA pre operatively was 182.96 degree and at 1 year follow up it deteriorated to 183.26 degree which was statistically insignificant using the paired t test ($p>0.05$). The mean VAS score was 6.86 pre-operatively while 3-month value of VAS was 6.96 and 12 month value of VAS was 7.26. The mean pre-operative OKS was 34.26 which decreased to 33.36 at 3 months and 32.26 at 12 months. The mean pre-operative KOOS was 52.99 while it was 51.88 at 3 months and worsened to 50.98 at the final follow up (Table 1). The worsening of VAS, OKS and KOOS were statistically significant using the ANOVA test ($p<0.05$). 3 patients had paresthesias and weakness in the foot corresponding to the distribution of Common Peroneal Nerve (CPN) which resolved on medical management. All three resolved completely at 6 weeks, therefore electro-diagnostic studies were not considered. No surgical site infections were noted. No patient underwent any other procedure till the last at follow up.

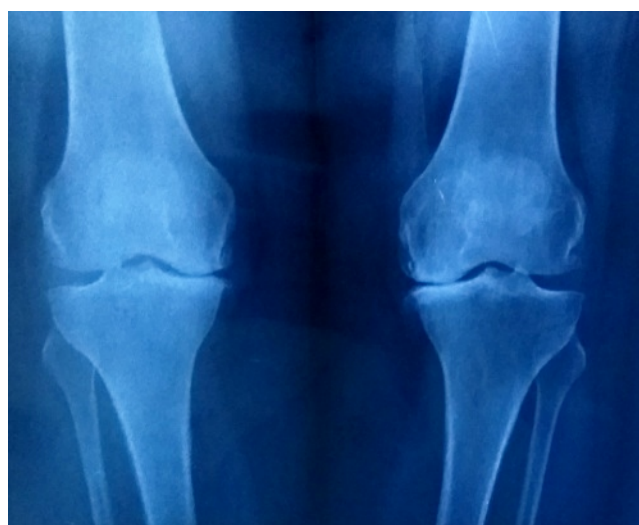
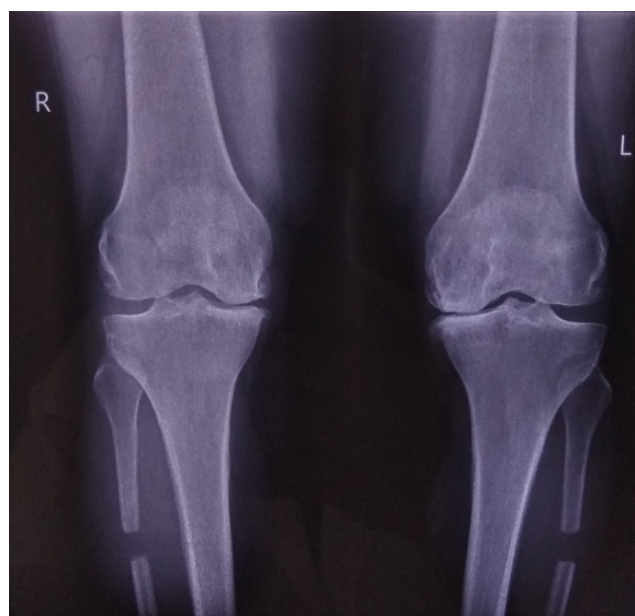
4. Discussion

PFO has gained much attention in the recent past as a potential alternative to osteotomy and arthroplasty in management of medial compartment OA knee. The ease of performance, avoidance of implants, limited cost constraints, preservation of the natural knee, early rehabilitation and low risk of infection makes it appealing

Table 1: Pre-operative and post-operative data of VAS, functional scores and FTA.

Outcome	Pre-operative	Postoperative- 3 months	Postoperative- 12 months	F-value	p-value
VAS Score (Mean)	6.86	6.96	7.26	4.506	0.015 (Significant)
Oxford Knee Score (Mean)	34.26	33.36	32.26	77.706	<0.0001 (Significant)
Knee Injury and Osteoarthritis Outcome Score (Mean)	52.99	51.88	50.98	141.734	<0.0001 (Significant)

Outcome	Pre-operative	Post Operative -12 months	t- value	p- value
Femoro - Tibial Angle (Mean)	182.96 ⁰	183.26 ⁰	1.863	0.072 (Insignificant)

**Fig. 1:** Pre-operative X-Ray AP view of both the knees of a patient showing medial OA of the knee**Fig. 2:** Follow up x-ray after surgery at 1 year of the same patient

procedure for the surgeon as well as patient. Yang et al⁸ followed 110 patients for 2 years in a pilot study and evaluated them on the basis of FTA, KSS and VAS Score. They observed improvement both in radiological parameters as well as functional scores. They concluded that PFO has a role in weakening of the lateral structural support of the knee which eventually corrects varus deformity. This in-turn affects the line of weight bearing across the knee more laterally and unloads the medial painful side. Their study however did not have a control group. Wang et al⁹ observed good medial pain relief in 47 patients of PFO and documented opening up of the medial joint space in weight bearing x-rays in their patients. Their follow up was nonetheless longer than in our study and the reported benefit was at 13.38 months after surgery. However, since only 8 of the 47 patients in their study showed improvement in alignment in weight bearing x-ray the authors were uncertain if their hypothesis of non-uniform settlement of

pain relief holds true. Utomo¹⁰ in a small sample size of 15 advance OA knees observed significant radiological improvement in terms of tibio-femoral angle and Joint Space ratio and functional recovery in terms of Oxford Knee Score and KOOS. They found a correlation between structural changes in the knee joint following surgery and functional recovery. Quin et al.¹¹ evaluated 52 patients of PFO for 36 months and found a correlation between the displacement of the fibular head vertically and the range of motion and function of the knee. Their study involved HSS Score and KL Score for functional recovery. Their hypothesis for improvement was based on the muscular forces acting across the lateral knee joint. Once the fibula is resected the muscles of the proximal fibula put tensile forces on the lateral femoral condyle and reduce the lateral joint space and increase the medial joint space. This overall

change in the forces, balance the abnormal stresses on the medial side and provide pain relief. Liu et al¹² evaluated 111 knees in 84 patients following PFO for a period of 12 months. At the last follow up they reported statistically significant difference in the FTA and Lateral joint space and reported opening up of the medial joint space too. The less severe the disease the more is the improvement in KSS after surgery, they concluded. They also found a close relation between settlement value and the outcome of PFO favoring the non-uniform settlement theory. Those patients who had a near normal HKA showed better results while patients with severe rigid varus did not show much improvement. This obviates the fact that PFO has lesser role in correcting the varus deformity in advanced OA. Zou et al¹³ compared the results of HTO and PFO and observed that the pain VAS, JOA score and FTA all showed significant improvement in the PFO group and the complication rate associated with this procedure was undeniably low. They acclaimed PFO over HTO in management of symptomatic OA of the knee. Prakash¹⁴ retrospectively evaluated 87 knee joints in 51 patients undergoing PFO during an 11 year period and reported much relief in knee pain and function. In his study the FTA and lateral Joint space showed much improvement at the annual follow up. Prakash believed that since medial part of the knee has only single cortex and much cancellous bone it tends to give way with age due to continued loading of the knee. On the other hand, the lateral knee has too many cortices owing to extra support by the fibula. Removing this support in turn balances the load on the knee more laterally minimizing medial pain and improving function.

In a recent study Huda¹⁵ followed 56 knees that underwent PFO for 1 year and perceived no pain relief and change in limb alignment at the final outcome. Although there was some relief in pain at 6 weeks, this relief did not sustain at the subsequent evaluations. This study is one of the few studies quoted in literature whose results match with those of our study. Although Huda reported some relief in pain at 3 months we did not find improvement at any follow up. In our study there was subtle increase in the mean FTA at the final follow up which suggests that PFO failed to decrease the varus angle and improve the alignment of the limb. The disease however progressed in the follow up period naturally worsening the pain and functional scores to a statistically significant value.

In our study 3 patients developed weakness and paresthesias in the distribution of the common peroneal nerve (10%) which resolved on medical management. This complication has been reported consistently by all the authors in the literature available to varying extent. Although most of these injuries improve, some patients land up into prolonged weakness and disability.^{1,4} The reason for weakness and paresthesias are attributed to proximity of the nerve in relation to the fibula where excision is desired. Use of a relatively liberal incision, avoidance of vigorous retraction, use of K wire and osteotomes instead

of high power saw have been listed as possible means to avoid injuring the nerves in the previous studies. There were no cases of surgical site infection in our study. No patient required transfusion in the post-operative period.

We believe that the mechanism of pain in OA of the knee is a complex interplay of not just a mechanical overload on the medial side in comparison to lateral side which PFO tend to address, but several other factors like synovial inflammation and effusions, bone marrow lesions and edema, capsular changes, ligamentous laxity and rigidity, impingement by osteophytes, weak and inflamed muscles around the knee and psychophysical factors. Furthermore, the change in the alignment of the knee after PFO is much less reliable and reproducible as compared to HTO which addresses the tibia directly and more close to the joint as compared to PFO which seems to be acting indirectly by reducing support on the relatively normal side. The theories hypothesized for opening up of the medial joint space and correction of limb alignment need further debate before applauding their effect on symptomatic medial OA knees.

Our study had no control group and a relatively small sample size. In light of our results we recommend more large multi-centric trials with larger sample size, before approving the validity of PFO an established tool in managing symptomatic medial OA knee patients.

5. Source of Funding

There was no source of funding.

6. Conflict of Interest

The author declares no conflict of interest.

References


1. Cleveland RJ, Alvarez C, Schwartz TA, Losina E, Renner JB, Jordan JM. The impact of painful knee osteoarthritis on mortality: a community-based cohort study with over 24 years of follow-up. *Osteoarthr Cartil.* 2019;27(4):593–602.
2. Kim KT, Lee S, Lee JI, Kim JW. Analysis and Treatment of Complications after Unicompartmental Knee Arthroplasty. *Knee Surg Relat Res.* 2016;28(1):46–54. doi:10.5792/ksrr.2016.28.1.46.
3. Sabzevari S, Ebrahimpour A, Roudi MK, Kachooei AR. High Tibial Osteotomy: A Systematic Review and Current Concept. *Arch Bone Jt Surg.* 2016;4(3):204–12.
4. Tunggal JA, Higgins GA, Waddell JP. Complications of closing wedge high tibial osteotomy. *Int Orthop.* 2010;34(2):255–61. doi:10.5792/ksrr.2016.28.1.46.
5. Yazdi H, Mallakzadeh M, Mohtajeb M, Farshidfar SS, Bagheri A, Givehchian B. The effect of partial fibulectomy on contact pressure of the knee: a cadaveric study. *Eur J Orthop Surg Traumatol.* 2014;24(7):1285–9. doi:10.1007/s00590-013-1381-0.
6. Dong TH, Chen W, Zhang F, Yin B, Tian Y, Zhang Y. Radiographic measures of settlement phenomenon in patients with medial compartment knee osteoarthritis. *Clin Rheumatol.* 2016;35:1573–8.
7. Algadiem EA, Aleisa AA, Alsubaie HI, Buhlaiah NR, Algadeeb JB, Alsneini H. Blood Loss Estimation Using Gauze Visual Analogue. *Trauma Mon.* 2016;21(2):e34131. doi:10.5812/traumamon.34131.
8. Yang ZY, Chen W, Li CX. Medial Compartment Decompression by Fibular Osteotomy to Treat Medial Compartment Knee

- Osteoarthritis: A Pilot Study. *Orthopedics*. 2015;38(12):1110–4. doi:10.3928/01477447-20151120-08.
9. Wang X, Wei L, Lv Z. Proximal fibular osteotomy: a new surgery for pain relief and improvement of joint function in patients with knee osteoarthritis. *J Int Med Res*. 2017;45(1):282–9. doi:10.1177/0300060516676630.
 10. Utomo DN, Mahyudin F, Wijaya AM, Widhiyanto L. Proximal fibula osteotomy as an alternative to TKA and HTO in late-stage varus type of knee osteoarthritis. *J Orthop*. 2018;15(3):858–61. doi:10.1016/j.jor.2018.08.014.
 11. Qin D, Chen W, Wang J. Mechanism and influencing factors of proximal fibular osteotomy for treatment of medial compartment knee osteoarthritis: A prospective study. *J Int Med Res*. 2018;46(8):3114–23.
 12. Liu B, Chen W, Zhang Q. Proximal fibular osteotomy to treat medial compartment knee osteoarthritis: Preoperational factors for short-term prognosis. *PLoS One*. 2018;13(5):e0197980. doi:10.1371/journal.pone.0197980.
 13. Zou G, Lan W, Zeng Y, Xie J, Chen S, Qiu Y. Early clinical effect of proximal fibular osteotomy on knee osteoarthritis. *Biomed Res*. 2017;28(21):9291–4.
 14. Prakash L. PFO-Proximal fibular osteotomy in medial compartment arthritis of the medial compartment of the knee with varus deformity. *EC Orthopedics*. 2019;10(5):315–21.
 15. Huda N, Islam MS, Kumar H, Pant A, Bishnoi S. Proximal Fibular Osteotomy for Medial Compartment Knee Osteoarthritis: Is It Worth? *Indian J Orthop*. 2020;54(Suppl 1):47–51. doi:10.1007/s43465-020-00160-0.

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