VOLUME - 11, ISSUE - 08, AUGUST - 2022 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Orthopaedics

A PROSPECTIVE STUDY OF PROXIMAL FIBULAR OSTEOTOMY IN YOUNG PRIMARY MEDIAL OSTEOARTHRITIS KNEE AND ITS CLINICAL, FUNCTIONAL AND RADIOLOGICAL OUTCOME.

Pravin Jayram Gore* — Senior Resident, Department of Orthopedics, Government Medical College, Akola, Maharashtra, India. *Corresponding Author

Rohit Bhurre — Senior Resident, Department of Orthopedics, Government Medical College and Hospital, Nagpur, Maharashtra, India.

Satyajeet Jagtap — Associate professor, Department of Orthopedics, Government Medical College and Hospital, Nagpur, Maharashtra, India.

Nilesh Shravan Sakharkar — Assistant professor, Department of Orthopedics, Government Medical College and Hospital, Nagpur, Maharashtra, India.

ABSTRACT

Background: Osteoarthritis (OA) commonly known as wear and tear arthritis. While it can occur even in young people, the chance of developing osteoarthritis rises after age 45. Proximal fibular osteotomy (PFO) for young patients of OA knee joint is turning out to be an emerging concept with promising results. The aim of our study was to evaluate clinical, radiological and functional outcomes of PFO in young patients of primary medial compartment osteoarthritis of knee joint. **Method:** Total 13 patients (20 knees) with moderate to severe primary osteoarthritis of knee joint, who underwent PFO, were enrolled. Clinical data, Visual Analogue Scale score (VAS), Knee Society Score (KSS), Medial Knee Joint Space (MJS) and Femorotibial Angle measurements (FTA) were recorded. Patients were followed up at one, three, six months and yearly, postoperatively. **Results:** 20 knee joints PFO. The mean VAS scores significantly decreased from 8.25 preoperatively to 2.21 at 12 months postoperatively. In most of patients, significant medial pain relief was observed after PFO. Mean KSS at preoperative stage was 44.15, which was improved to 77 at 12 months postoperatively, which further suggests improvement in knee joint functions. There was noteworthy increase in Mean joint space postoperatively (1.17) as compared to preoperative stage (0.34). Mean FTA reduced from 182.64 degrees preoperatively to 178.61 at final follow up. **Conclusion:** Our study shows that PFO remarkably causes pain relief and improves knee functions with increase in MJS and slight correction of varus deformity in young patients with primary osteoarthritis of knee joint.

KEYWORDS : Osteoarthritis, Proximal fibular osteotomy, Knee joint, Radiological, Femorotibial angle

INTRODUCTION

Primary osteoarthritis (OA) of knee joint is one of the most prevalent chronic degenerative disabling conditions. It commonly affects people above 60 years of age, but can be seen in young population too. Usually, females (13%) are more affected than males (10%). [1,2]

Total Knee Replacement (TKR) and High Tibial Osteotomy (HTO) are two most popular methods for surgical treatment of OA of knee joint. TKR and HTO are complex, major surgical procedure and technically more demanding than PFO (Proximal Fibular Osteotomy). There by, in patients with medical comorbidities and in young generation PFO is more suitable. [3,4,5]

MATERIALS AND METHODS

After obtaining Institutional Ethical Committee approval and written informed consent from all the patients. This prospective study was conducted in 13 patients of either sex, age >45 years who presented with moderate to severe primary osteoarthritis of knee joint (grade two to four as per Kellgren Lawrence classification) in the outpatient Department of Orthopedics during a period of 18 months. Patients who were willing for surgical intervention after failed conservative treatment were also included. Patients with post traumatic osteoarthritis of knee, inflammatory joint diseases, post infectious joint diseases, history of previous knee joint surgery or fractures around knee joint, knee with valgus deformity, morbid obesity, patients who were not willing for surgical intervention and regular follow up were excluded from the study.

A detailed clinical history was taken. General and systemic examination was done. Demographic details of patient were noted and all routine blood investigations were done. Patients with clinical suspicion of primary osteoarthritis of knee joint were subjected for radiographs of knee joint with full weight bearing in erect position, both anteroposterior and lateral views. Diagnosis of primary osteoarthritis was confirmed on radiographic findings.

Under all aseptic precautions, subarachnoid block anesthesia was given and patient were made to lie in supine position, pneumatic tourniquet was used for hemostasis and bloodless surgical field. Using Henry's posterolateral fibular approach, approximately five centimeters incision was taken over posterolateral aspect of proximal third of leg, five to seven centimeters distal to the fibular head, (Figure 1a). Subcutaneous tissue dissection was done and inter-muscular plane between peroneus longus, peroneus brevis and soleus muscle identified (Figure 1b). Curved forceps and spikes used to retract the muscles and soft tissues, to expose the underlying fibula. Subperiosteal dissection was performed. Broad, curved osteotome was placed medial to fibula to avoid damage to the soft tissue injury due to sharp drill used for multiple drill holes. A two to three centimeters long segment of fibula was removed, six to ten centimeters distal to fibular head, with the help of osteotome and hammer. Thorough wound wash given with 0.9% normal saline and broken fibular ends were examined for profuse bleeding, and if present, were sealed with bone wax. Direct subcutaneous tissue closure was done without closing underlying muscle fascia. Skin closure was done and sterile dressing applied (Figure 1c).

After early postoperative observation care, patients were shifted to ward. Routine broad spectrum intravenous antibiotics and analgesics were given postoperatively for 3 doses. Twenty four hours later, patients were assessed for pain relief by Visual Analogue Scale (Clinical outcomes). As postoperative pain subsided patients were motivated for walking without any support. Further, functional assessment by Knee Society Score (Functional outcomes), radiographic MJS and FTA measurements were done in erect position. For

Radiological outcomes, anteroposterior radiograph of operated knee joints were done. All patients were discharged on second postoperative day with oral antibiotics and analgesics for 5 days. Suture removal was done on 12th to 14th postoperative day. Patients were called for follow up at one, three, six months and yearly thereafter. At follow up visits, patients were evaluated for VAS, KSS, MJS and FTA except at one month FTA was not evaluated (Figure 2 and 3).

Figure 1: a) Incision of proximal fibular osteotomy, b) Inter-muscular plane identification, c) after skin closure of surgical incision

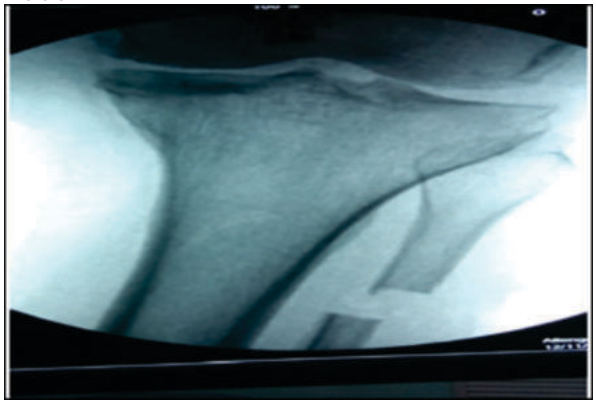
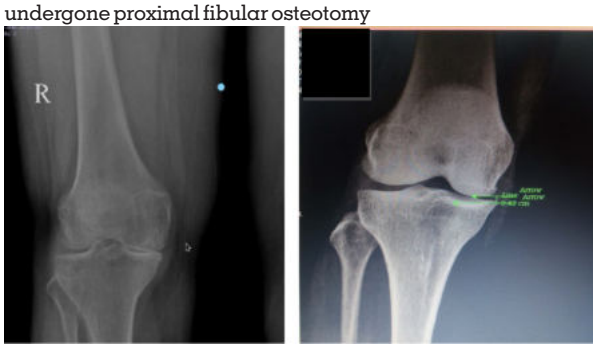


Figure 2: Immediate postoperative C- arm image of patient undergone proximal fibular osteotomy



(a) (b)

Figure 3: (a) Pre-operative X-ray showing AP view of radiographs right knee joint with reduced medial knee joint space; (b) Post-operative X-ray showing AP radiograph of knee joint after PFO showing increased medial joint space.

RESULTS

During the study period, total 13 patients (11 females and two males) with primary osteoarthritis of knee joint were operated for PFO. Out of 11 female patients, nine were operated for unilateral PFO and two patients were operated for bilateral PFO. Both male patients were operated for bilateral PFO. Each operated knee joint was considered as individual case and labeled as P1, P2,….P20. Out of 20 operated knee joints (16 females and four males) for PFO, six patients were operated for bilateral knee joints, four were right and other four were left knee joints. Maximum patients were in the age group of 56 years or more (40%), followed by less than 50 years (35%) and remaining 25% between 51 to 55 years of age group as shown in table1.

Table 1 : Distribution Of Patients According To Age In Years

Age (Years)	No. of cases	Percentage
48	01	5.0
49	06	30.0
51	01	5.0
52	03	15.0
53	01	5.0
56	05	25.0
58	02	10.0
60	01	5.0

In almost all patients, medial pain relief was observed after PFO. There was declining trends in mean VAS from preoperative initial stage to subsequent follow up visits as shown in table 2 and figure 4.

Table 2: Comparison Between VAS At Preoperative Stage And Different Interval Of Time Period During Follow Up.

VAS	Mean	Range	P value
Preoperative Initial stage	8.25±0.63	7-9	-
Immediate after post-operation	4.6±0.88	3-6	0.0001
After 1 month	3.55±0.69	2-5	0.0001
After 3 months	2.7±0.73	2-4	0.0001
After 6 months	2.21±0.79	1-4	0.0001
After 12 months	2.21±0.91	1-4	0.0156

VAS: Visual Analogue Scale Score

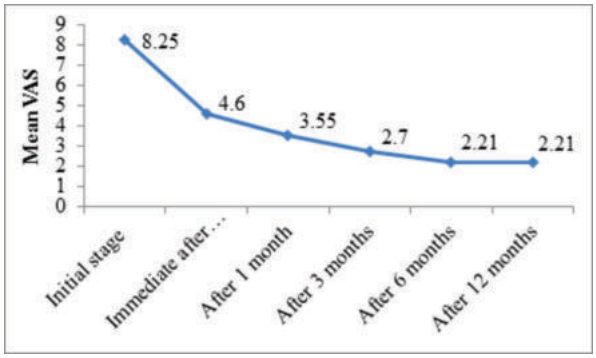


Figure 4: Declining Trends In Mean VAS From Preoperative Initial Stage To Subsequent Follow Up Visits

PFO led to significant improvement in knee joint functions, assessed by KSS which showed noteworthy increase in mean KSS at different follow up visits as shown in table 3.

Table3: Comparison Between Mean KSS At Initial Preoperative Stage And During Follow Up At Different Time Intervals

KSS	Mean	Range	P value
Initial preoperative stage	44.15±2.3	40-48	
Immediate after post-operation	51.7±3.81	44-58	0.0001
After 1 month	57.95±3.98	50-64	0.0001
After 3 months	64.75±3.19	56-68	0.0001
After 6 months	73.05±3.09	66-76	0.0001
After 12 months	77±1.91	74-80	0.0156

KSS: Knee Society Score

Almost all patients had significant increase in MJS postoperatively (mean=1.17) as compared to preoperative stage (mean= 0.34) as depicted in figure 5.

Mean FTA preoperatively was 182.64 degrees which gradually changed postoperatively to 178.61 at final follow up in patients with longest follow up (Table 4). Other patients with short follow up had slight decrease in angle with minimal

realignment of varus deformity.

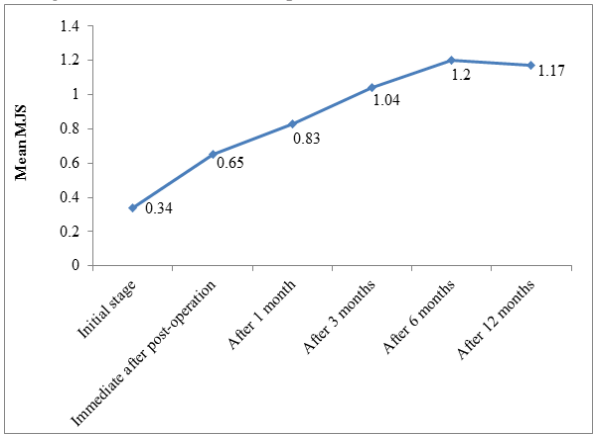


Figure 5: Increasing Trends In Mean Medial Joint Space Postoperatively

Table 4: Comparison Of Mean FTA At Initial Stage And Different Interval Of Time Period.

FTA	Mean	Range	P value
Initial stage	182.64±1.45	180-186	-
After 3 months	179.17±1.72	174-182	0.0001
After 6 months	178.08±1.47	174-179.5	0.0001
After 12 months	178.61±0.65	178-179.5	0.0156

FTA: Femorotibial Angle

In present study, one patient developed persistent swelling of leg which was resolved over a period of three weeks with conservative treatment, one patient developed hyperpigmentation of operative scar and three patients developed transient Extensor hallucis longus (EHL) weakness with altered sensations over dorsum of foot which resolved over a period of six weeks to three months. No incidence of postoperative infection, gaping of sutures and instability of knee joints noted.

DISCUSSION

In the present study, most of the patients were in the age groups of 56 to 60 years. 80% patients were females and 20% were male, suggesting prevalence of knee osteoarthritis more in females than in males, which is in favor of study done by Verma et al [6] and Misra et al. [7] All patients had complaints of moderate to severe knee joint pain, restricted range of motions, with worsening of symptoms on physical activity and relief with rest. Patients had these complaints for two to four years and had trial of almost all conservative modalities of treatment, with no or minimal relief. In erect position, AP radiographs of knee joint depicted narrowing of medial knee joint space, osteophytes, sclerosis of femorotibial articular surfaces. All these patients underwent PFO. The average duration of unilateral PFO was around 25 minutes.

The history of PFO has been ambiguous. As with most other concepts, the technique appears to have evolved over time through multiple attempts, failures, and improvement. Prakash and Dhar,[8] Hara et al [9] first used PFO with high tibial osteotomy in 1994. The next interesting and more important aspect of the procedure is the mechanism by which it acts. There are various mechanisms proposed which individually or collectively contribute to the outcomes of PFO procedure. This includes the theory of non-uniform settlement, the too-many cortices theory, slippage phenomenon, the concept of competition of muscles, dynamic fibular destabilization theory and ground reaction vector readjustment theory. However, the exact mechanism by which PFO works is believed to be based on the principle of nonuniform settlement. Ying-Ze Zhang proposed theory of non-uniform settlement of tibial plateau, playing a key role in the development of osteoarthritis of knee joint. He also explained about the mechanism of pain relief and mechanical realignment resulting due to proximal fibular osteotomy. [10]

According to study of non-uniform settlement of tibial plateau, fibula is tubular cortical bone with high bone density as compared to proximal tibia which is mainly composed of cancellous bone with large weight bearing area without any bony barrier on medial side. It results in non-uniform settlement of proximal tibia, as lateral tibial plateau is supported by rigid, tubular, cortical fibula and no support for medial tibial plateau. This shifts the mechanical axis, aggravating weight bearing in the medial plateau, resulting in articular cartilage degeneration and knee varus deformity. [10]

In present study, majority of patients had significant pain relief immediately after PFO which continued to improve and some patients even reported no pain at the last follow-up. The mean VAS scores significantly decreased from 8.25 preoperatively to 2.21 at 12 months postoperatively. These results are comparable with study done by Wang et al, who found significant relief of medial joint pain post PFO with the mean VAS improving from a preoperative value of 8.02±1.50 to a postoperative value of 2.74±2.34.[5] Vashisht et al, reported in his study that mean preoperative NRS value of 8.45±0.68, improving to 0.45±0.68 postoperatively.[11] In present study, preoperative (44.15±2.3) and postoperative mean KSS values (77±1.91) clearly indicates role of PFO in functional improvements (i.e. walking, sitting cross leg, squatting etc.) in primary osteoarthritis of knee joints. However, radiographic assessment of outcome measures was done on the basis of erect radiographic AP view of knee joint, MJS and FTA were calculated at each follow up visits. Almost all patients had significant increase in MJS postoperatively as compared to preoperative stage. Another radiographic outcome assessed was FTA which is the lateral angle between anatomical axis of femur and tibia at knee joint. In patients with primary osteoarthritis of knee joints, patients had varus malalignment with increased FTA which was slightly changed into valgus direction and decreased postoperatively. Thus, PFO improved the axial alignment of the lower extremity in patients with varus malalignment. These findings correlated well with the previous studies.[3,11]

PFO is a suitable surgical option for primary osteoarthritis of knee joint in most developing countries that lack financial and medical resources.[5, 12] The basic principles for the success of PFO in primary osteoarthritis knees are proper patient selection, efficient planning, safe intraoperative technique and early functional rehabilitation. Unloading of the individual involved medial compartment should be the goal of this procedure.[13] Though PFO is safe procedure but it can lead to some complications if done through poor surgical technique. This includes -persistent swelling of leg, occurred in two patients which was due to inflammatory oedema, relieved with crepe bandage, limb elevation, ice fomentation, anti-inflammatory medications over a period of three weeks. Hyperpigmentation of operative scar - Transient Extensor hallucis longus (EHL) weakness occurred in three patients which was of power 3/5, probably due to transient neuropraxia of lateral popliteal nerve occurred during retraction of soft tissues. Altered sensations over dorsum of foot occurred in three patients. Transient EHL weakness and altered sensations over dorsum of foot occurred probably due to overstretching of common peroneal nerve resulting in transient neuropraxia which recovered over a period of six weeks to three months with methyl cobalamin, pregabalin supplements and aggressive physiotherapy.

Several limitations to this study must be noted. First, although the short-term results are encouraging, the follow-up time was relatively short, small sample size and whether these outcomes will remain unchanged at a longer follow-up time is

unclear. Therefore, a longer follow-up study is required to test the effectiveness of this procedure as an alternative treatment option. Moreover , long term side effects of PFO on other joints of the lower extremity, such as the hip and ankle, remains unknown. Therefore, the biomechanics of pain relief, increase in the medial joint space and correction of alignment in patients who have undergone PFO need further study in detail. Finally, the absence of a control group is another important limitation of this study.

CONCLUSION

Proximal fibular osteotomy is a simple, safe, effective surgical modality of treatment in young patients with primary osteoarthritis of knee joint and causes remarkable pain relief with functional improvement. There is significant increase in medial knee joint space with minimal correction of alignment. Properly carried out PFO in carefully selected patients of primary osteoarthritis of knee joint can be as effective as High tibial osteotomy and can delay need for total knee replacement in future. Proximal fibular osteotomy is a safe, short procedure which can be done in patients with medical comorbidities and in patients who are not suitable or not willing for major procedures like HTO or TKA.

Criteria For Inclusion In Authors List:

1) Substantial contributions to conception and design, acquisition of data or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content and (3) final approval of the version to be published.

Statement :

Above study has been read and approved by all the authors and the requirements for authorship as stated earlier in this document have been met, and each author believes this manuscript represents honest work.

REFERENCES

1. Heidari B. Knee osteoarthritis prevalence, risk factors, pathogenesis and features: Part I. Caspian journal of internal medicine. 2011;2(2):205.
2. Vincent KR, Conrad BP, Fregly BJ, Vincent HK. The pathophysiology of osteoarthritis: a mechanical perspective on the knee joint. PM R. 2012;4(5 Suppl):S3-S9.
3. Laik JK, Kaushal R, Kumar R, Sarkar S, Garg M. Proximal □bular osteotomy: Alternative approach with medial compartment osteoarthritis knee – Indian context. J Family Med Prim Care 2020;9:2364-9.
4. Yang ZY, Chen W, Li CX, Wang J, Hou ZY, Gao SJ, Wang F, Li JD, Hao JD, Chen BC, Zhang YZ. Medial compartment decompression by fibular osteotomy to treat medial compartment knee osteoarthritis: a pilot study. Orthopaedics. 2015;38(12):e1110-4.
5. Wang X, Wei L, Lv Z, Zhao B, Duan Z, Wu W, Zhang B, Wei X. Proximal fibular osteotomy: a new surgery for pain relief and improvement of joint function in patients with knee osteoarthritis. Journal of International Medical Research. 2017;45(1):282-9.
6. Verma RK, Agrawal A. To study the functional outcomes of PFO in osteoarthritis kee. International Journal of Contemporary Medical Research 2020;7(3):C1-C3.
7. Misra RK, Batra AV. Clinical and Functional Outcomes of Proximal Fibular Osteotomy on Varus Deformity and Medial Compartment Knee Osteoarthritis. J Arthritis 2019; 8: 281.
8. Prakash L, Dhar SA. Proximal fibular osteotomy: biomechanics, indications, technique, and results. Orthopedics. 2020;43(6):e627-e631.
9. Hara M, Ogata K, Nomiyama H, et al. New technique and results of fibular osteotomy in the proximal neck region in HTO. OrthopTraumatol Surg Res. 1994;43(4):1380-1382.
10. Zhang YZ. Innovations in orthopedics and traumatology in China. Chinese medical journal. 2015; 128(21):2841.
11. Vashisht A, Menwal G, Bhatnagar R. A clinico-radiological evaluation of functional outcome of proximal fibular osteotomy for medial compartment knee osteoarthritis: a new emerging technique. Int J Res Orthop2020;6:515-20.
12. Shah RK, Paudel SR and Kalawar RPS. Role of Proximal Fibular Osteotomy in Medial Joint Osteoarthritis of Knee. Austin J Orthopade&Rheumatol. 2018; 5(3): 1071.
13. Hofmann S, Lobenhoffer P, Staubli AE, Heerwaarden RJ. Osteotomies of the knee joint in patients with monocompartmental arthritis. Der Orthopäde 2009;38(8):755-69.