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Randomized controlled study of proximal fibular osteotomy (PFO) with or without trabeculotomy in early osteoarthritis (OA) knee

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ABSTRACT

Background: This study was conducted to evaluate and compare the clinical and functional outcome of OA knee patients treated with proximal fibular osteotomy with or without trabeculotomy.

Materials and Methods: This was a randomized controlled study amongst patients of osteoarthritis knee for a period of 1 year on patients with early osteoarthritis of knee. All patients were randomly allocated into two groups; group 1 patients were managed using PFO with trabeculotomy whereas group 2 patients were managed with proximal fibular osteotomy alone. All the patients were followed up post operatively at 15 days and at 2, 6 and 12 months post operatively. At each follow up patients were assessed for presence of Pain using Visual analogue scale. Also functional outcome was assessed using WOMAC.

Results: In present study, patients of two groups were comparable in their base line characters ($p > 0.05$). Post operatively, mean VAS score and WOMAC score improved significantly in both the groups, the improvement was significantly higher in group 1 as compared to group 2 at all the follow up ($p < 0.05$).

Conclusion: Proximal fibular osteotomy with or without trabeculotomy can be used effectively as a promising tool for management of cases with early osteoarthritis of knee. It is safe, effective, and cost effective surgical technique for pain relief and improving functional outcome. PFO with trabeculotomy yields better results in terms of clinical as well as functional outcome as compared to PFO without trabeculotomy.

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1. Introduction

Osteoarthritis is one of the most common form of arthritis and leading cause of disability among elderly age group population.¹ Osteoarthritis has been characterized as a chronic degenerative disease which is progressive in nature and is associated with joint pain, stiffness as well as deformity.² It may be of two types i.e. primary and secondary. Primary osteoarthritis occurs in older age of people and is age related whereas secondary osteoarthritis results from underlying pathology such as due to accidental injuries or secondary to pre- occurring diseases.²

According to National Health Portal, Government of India, osteoarthritis is a major cause of disability in elder group of population worldwide.³ World Health Organization estimates that about 9.6% males and 18% females aged 60 years and above are suffering from symptomatic osteoarthritis worldwide. The most common symptom being limitations in movement observed in 80% patients whereas about 25% cannot perform their major daily activities of life.^{4,5} As per National health Portal, Government of India, osteoarthritis is the second most common rheumatological problem affecting 22% to 39% population in India.³

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The standard surgical modality in patients with osteoarthritis knee is total knee arthroplasty (TKA), which apart from relieving pain, also improve mobility and joint functions. But Total knee replacement is an expensive procedure and few patients may require second knee revision after the first surgery.^{6,7} Alternative treatment modality for such patients include high tibial osteotomy (HTO), but it is associated with certain disadvantages and could be done in young patients with medial compartment involvement.^{8,9} In general, the most commonly reported complications are cortical hinge fractures (29.4%), symptomatic implant, loss of correction (10%), surgical site infections (2%), nonunion or delayed union (1.2%), and peroneal nerve injury (6%).^{8,9}

Recently, a minimally invasive procedure i.e. proximal fibular osteotomy (PFO) has been proposed for management of patients with osteoarthritis of knee. Zhang YZ et al (2015)⁷ reported that PFO helps in relieving pain and improve joint functions in patients of knee osteoarthritis. This procedure has gained importance worldwide as it is less expensive and require minimal rehabilitation than other procedures like HTO, UKA, and TKA.¹⁰ Osteotomy of proximal part of fibula leads to weakening of lateral fibular support, and thus correcting the varus deformity and shifting the stresses from medial compartment to posterolateral compartment. Hence it yields satisfactory clinical as well as functional recovery.¹⁰ PFO has been associated with lower rate of complications as well as early recovery. However, the most common complication following PFO include injury to common peroneal nerve. Thus it has been emphasized to have protection of peroneal nerve during the surgery.¹¹

As proximal fibular osteotomy as a management technique for knee osteoarthritis is relatively new and novel procedure, and various literature have proven its effectiveness in the management of medial compartment arthritis of the knee.

Subchondral decompression (trabeculotomy) for management of knee osteoarthritis is not new and has been known since 1975.¹² It has been documented that segmental resection in combination with decompression can relieve symptoms better of osteoarthritis as well as improve the joint function.¹³ Subchondral decompression has been documented to reduce the intraosseous pressure, improve venous drainage, thereby increase the difference in arteriovenous pressure and improve nutritional supply of the bone. Subchondral decompression with osteotomy can relieve pain as segmental drilling will help in relieving pressure. Also the drilling is helpful in development of collateral circulation by its effect on opening of capillary beds. Thus, venous stasis associated with osteoarthritis is also relieved.¹⁴ Literature regarding comparison of effectiveness of PFO with and without trabeculotomy is scarce. It was hypothesized that adding trabeculotomy with PFO is more effective than only PFO alone. The present

facility based study was thus conducted at tertiary care centre to evaluate and compare the the functional outcome of OA knee patients treated with proximal fibular osteotomy with or without trabeculotomy.

2. Objectives

1. To compare the pain in cases of OA knee treated with proximal fibular osteotomy with or without trabeculotomy.
2. To compare the functional outcome of OA knee patients treated with proximal fibular osteotomy with or without trabeculotomy.

3. Materials and Methods

The present study was conducted as a randomized controlled study amongst patients of osteoarthritis knee at Department of Orthopaedics, People's College of Medical Sciences and Research Centre and People's Hospital Bhopal for a period of 1 year

i.e. from 1st February 2019 to 31st January 2020. All the patients diagnosed as a case of early osteoarthritis of knee with Kellgren's grade I, II, III and belonging to age group of less than 60 years were included in the study whereas patients with post traumatic knee OA, inflammatory joint disease, local infection, poor skin condition, any bone pathology and co-morbid conditions like diabetes mellitus were excluded from the study.

After obtaining ethical clearance from Institute's Ethical committee, written consent was obtained from all the patients. The study enrolled a total of 30 patients presenting with osteoarthritis of knee fulfilling the inclusion criteria. All the selected patients were then randomly allocated into two groups using random number tables, each group consisting of 15 patients. Participants of group 1 were managed using Proximal fibular osteotomy with trabeculotomy whereas participants of group 2 were managed with proximal fibular osteotomy alone.

3.1. Surgical technique

In both the groups, surgery was conducted under spinal anesthesia without a tourniquet. The tip of fibular head was marked with a pen to measure appropriate distance, following which incision was given on skin and subcutaneous tissues. The fibular periosteum was exposed by separating the peroneus and soleus muscles. The periosteum was incised in line of skin incision, and a 1.5 to 2 cm piece of fibula resected with a narrow blade oscillating saw and the distance from fibular head to the proximal cut was 6 to 9 cm. This was done so as to remove the fibular cortex and convert knee to a balanced joint. The resection was high for correction of mechanical axis but not too high so as to avoid damage of lateral popliteal nerve. The steps were same in both the groups. However the patients

of group 1 were further subjected to trabeculotomy. The wound was washed, closed in layers and a light compression bandage given. The patients were mobilized immediately postoperatively within a few hours.

3.2. Follow-up

All the patients were followed up post operatively at 15 days (at this stage sutures were removed), and further at 2, 6 and 12 months post operatively. At each follow up patients were assessed for presence of Pain using Visual analogue scale. Also functional outcome was assessed using Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC).

3.3. Statistical analysis

Data was compiled using Ms Excel and analysed using SPSS 20 software. Data was grouped and expressed as frequency and percentage whereas numerical data was expressed as mean and standard deviation. Chi square test, unpaired t test and ANOVA was used to compare findings between 2 groups. P value

<0.05 was considered statistically significant.

4. Results

The present study was conducted on 30 patients with osteoarthritis of knee which were randomly allocated into 2 groups.

The mean age of patients in group 1 was 52.3±5.6 years whereas mean age of patients of group 2 was 53.1±6.2 years. Majority of participants in both the groups were females. In present study, patients of two groups were comparable in their base line characters (p>0.05).Table 1

Mean VAS score pre operatively was 7.61±1.46 and 7.12±1.33 in group 1 and group 2 respectively and the observed difference was statistically insignificant, i.e. the two groups were comparable (p>0.05). However, post operatively, mean VAS score improved significantly in both the groups, the improvement was significantly higher in group 1 as compared to group 2 at all the follow up (p<0.05).Table 2

Functional outcome was assessed using WOMAC score. Mean WOMAC score in present study was comparable in both the groups preoperatively. However, post operatively, mean WOMAC score improved significantly in both the groups, the improvement was significantly higher in group 1 as compared to group 2 at all the follow up (p<0.05).Table 3

5. Discussions

Osteoarthritis knee is most commonly encountered joint disorder in orthopedic clinic and is associated with significant pain and immobility. There are multiple modes of treatment for knee osteoarthritis such as NSAIDs,

Table 1: Distribution according to Baseline characteristics of patients

Baseline characters	Group 1 (PFO +T)		Group 2 (PFO)		P value
	Frequency	Percentage	Frequency	Percentage	
Age group (years)					
≤40	2	13.3	1	6.7	
41-50	4	26.7	3	20	0.71
51-60	9	60	11	73.3	
Gender					
Male	5	33.3	7	46.7	0.46
Female	10	66.7	8	53.3	
Kellgren's grade					
I	3	20	4	26.7	0.70
II	5	33.3	3	20	
III	7	46.7	8	53.3	

Table 2: Comparison of Visual analogue scale between two groups

VAS	Group 1 (PFO +T)	Group 2 (PFO)	P value
Pre operatively	7.61±1.46	7.12±1.33	0.35
15 days	3.32±1.9	4.95±2.1	0.03
2 months	2.9±1.6	4.51±1.88	0.02
6 months	2.7±1.89	4.1±1.65	0.04
12 months	2.55±1.33	3.9±1.98	0.04
P value	0.001	0.001	

Table 3: Comparison of Functional outcome using WOMAC between two groups

WOMAC	Group 1 (PFO +T)	Group 2 (PFO)	P value
Pre operatively	80.65±17.8	78.3±16.2	0.71
15 days	48.7±14.5	59.9±15.3	0.04
2 months	44.6±14.7	57.3±14.9	0.02
6 months	43.4±15.2	55.7±17.8	0.04
12 months	42.25±14.8	53.99±16.3	0.04
P value	0.001	0.001	

intraarticular steroids, physiotherapy, TKA and PFO. The present study is unique to assess the pain and functional outcome following PFO with trabeculotomy as compared to those treated with PFO alone.¹⁵

The present study documented significant improvement in pain as well as functional outcome following PFO with or without trabeculotomy, however, the outcome were significantly better in cases treated with PFO with trabeculotomy as compared to those without trabeculotomy at all level of follow ups ($p < 0.05$). Though PFO has been emerged as a new technique for management of cases with early osteoarthritis, to relieve pain and improve function of joints as reported by Zhang et al. in 2015. However, the exact mechanism of PFO remains unknown, one theory suggest that PFO removes the fibula support that may cause genu varus; this help in pain relief and improve joint space.¹⁶ Proximal fibular osteotomy transfer the load of knee joint from the medial plateau to the lateral plateau, this is associated with rearrangement in distal femoral mechanical axis so as to relieve the lateral soft tissue tension of the knee joint and remove KOA symptoms.¹⁷

This was first kind of study to assess the effect of PFO with trabeculotomy. Various literature has compared PFO with other modality of treatment for osteoarthritis of knee. Liu Bo et al in their study documented clinical and functional outcomes in cases of osteoarthritis of knee following PFO of 111 knees of 84 patients. They documented satisfaction clinical outcome in 51 knees and 77 knees in the significant improvement group. In functional outcomes, 43 knees were in the satisfaction group and 76 knees in the significant improvement group.¹⁸ In another study by Zhang et al, the authors compared preoperative and postoperative scores using VAS, WOMAC and Oxford Knee Scores in 38 cases of osteoarthritis of knee. They documented significant improvement in VAS from 7 pre-operatively to 2.58 in the 20th week post-operative follow

up.¹⁹ Yang et al documented that PFO is a safe, simple and fast technique which is affordable and help in significant pain relief and early functional improvement.²⁰

6. Conclusion

Proximal fibular osteotomy with or without trabeculotomy can be used effectively as a promising tool for management of cases with early osteoarthritis of knee. It is safe, effective, and cost effective surgical technique for pain relief and improving functional outcome. PFO with trabeculotomy yields better results in terms of clinical as well as functional outcome as compared to PFO without trabeculotomy.

7. Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

8. Source of Funding

None.

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