

Clinico- Functional Outcome Assessment of Proximal Fibular Osteotomy for Management of Medial Compartment Osteoarthritis of the Knee

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Abstract

Aim: The purpose of this prospective study was to prove the promising outcomes of proximal fibular osteotomy in treatment of medial compartment knee osteoarthritis.

Material & methods: A prospective observational study including 100 patients in the Department of Orthopaedics, JNKTMCH, Madhepura, Bihar, India for the period of 1 year. The following clinical parameters were used: VAS, KSS, KFS. The following radiological parameters were used: MJS, LJS, HKA Angle. post-operative physiotherapy protocol was followed. Discharge was planned based on patients comfort and mobility that was usually on day 4 or 5. They were followed up at 6 weeks, 3 months, 6 months, 9 months and 12 months.

Results: In the present study, most of the patients belonged to 50-60 years age group. In the present study, there were 40 males and 60 females, with male to female ratio 2:3 approximately. The mean age of patients was 50.72 year (age range = 40-70 years). In this study patients included who has BMI>30 and most of patients lie in between 25 to 29.9 BMI i.e. most of them fall in overweight category. Osteochondral defect was found in all cases with various grade, 54 (54%) knees with grade 1, 28 (28%) knees with grade 2, 15 (15%) knees with grade 3 and 3 (3%) cases with grade 4. Average visual Analogue scale (VAS) score significantly decreased from 8.24 pre-operatively to 3.252 in 1 year of follow up. Knee society score improved from 44.26 pre-operatively to 72.78 in 12 month of follow up. Knee function score improved pre-operatively 48.52 to 76.54 in 12 month of follow up. Medial joint space increased from 1.64 pre-operatively to 3.58 in 12 month of follow up. Lateral joint space decreased from 6.64 pre-operatively to 5.34 in 12 months follow up. The correction of alignment Hip knee ankle angle (HKA) after PFO was seen after 12 months.

Conclusion: Proximal fibular osteotomy [PFO] is a simple, safe and affordable surgery to reduce pain and improve joint function and the medial compartment space in medial compartment osteoarthritis of knee joint. It may be a promising alternative surgery in most developing countries because of their financial and healthcare delivery limitations that may be used as an alternative surgery for patients of osteoarthritis knee who cannot undergo.

Keywords: PFO, knee osteoarthritis, medial compartment

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Introduction

Osteoarthritis (OA) is a polyarticular chronic degenerative disease of multifactorial etiology, and the most common joint to be afflicted is the knee [1] A community-based study that involved people above 40 years of age from five different states of India reported the prevalence of the condition to be 28.7% [1] OA of the knee joint is associated with advanced age, higher body mass index (BMI), female sex, and a sedentary lifestyle. A study that included individuals above 60 years of age in the USA has estimated the prevalence of radiographic changes consistent with OA of the knee to be 37%. [2]

The same study reported a prevalence of 12% for symptomatic OA of the knee. The lifetime risk of developing symptomatic knee OA has been reported to be 44.7% . [3] The severity of OA of the knee is classified as per the Kellgren-Lawrence (KL) grading, which categorizes it into five grades. [4] An important feature of OA of the knee is the compartment-specific narrowing of the joint space, which is associated with clinical manifestations of the disease. [5] Osteoarthritis (OA) of the knee joint is a chronic, degenerative problem often associated with pain involving the affected joint, decreased range of motion, and deformity. [6] Symptomatic

OA affected about 3.8% of the world population according to estimates in 2010, with higher involvement in women (4.8%) as compared to men (2.8%). [7] OA of the knee joint affects about half of the population over the age of 60 years and mainly women, as it is mostly because of osteoporosis as a result of decreased bone mineral density. [8]

There are multiple options for the management of knee joint OA, both conservative and surgical. Conservative options for OA of the knee include analgesics, physical therapy, intra-articular injections of steroid or platelet rich plasma, and visco supplementation agents [9-12] Surgical options include high tibial osteotomy and total knee arthroplasty, the main treatment options for OA of the knee. [13] High tibial osteotomy is a technically demanding procedure and has specific problems associated with it, such as neurovascular injury, iatrogenic fracture, and non-union. [14-15]

Thus, the purpose of this prospective study was to prove the promising outcomes of proximal fibular osteotomy in treatment of medial compartment knee osteoarthritis.

Materials & Methods

A prospective observational study including 100 patients in the Department of Orthopaedics, JNKTMCH, Madhepura, Bihar, India for the period of 1 year. The following clinical parameters were used: VAS, KSS, KFS. The following radiological parameters were used: MJS, LJS, HKA Angle. post-operative physiotherapy protocol was followed. Discharge was planned based on patients comfort and mobility that was usually on day 4 or 5. They were followed up at 6 weeks, 3 months, 6 months, 9 months and 12 months.

Inclusion Criteria:

1. Patients with osteoarthritis of that confined mainly to the medial compartment with a varus deformity not exceeding 12 degrees.
2. Patients in the age group 40 to 70.
3. All patients has been treated conservatively for more than a year without success prior to the proximal fibular osteotomy.

Methodology

Pre-operative data was collected that includes name, age, sex, any other comorbid conditions, Type of surgery proposed, choice of anaesthesia & written informed consent was obtained from the participants.

Post-operative data was collected which included duration of hospital stay(days)& any complications like - pulmonary complications, UTI, DVT, CVS complications, Prosthetic failure, wound infection (superficial/deep), pressure sores and others.

The functional outcome parameters were time taken to regain full weight bearing(wks.), relief of symptoms like pain which was assessed by VAS (visual analogue scale), Knee Society Score and Knee Function Score and return to normal daily activities (days). The patients were followed diligently and all the clinical as well as radiological parameters were observed and noted down. These parameters allowed us a comparison between the pre-operative and post-operative state.

The following clinical parameters were used:

1. VAS (Visual Analogue Scale)
2. Knee Society Score (KSS)
3. Knee Function Score (KFS)

The following radiological parameters were used:

1. Medial joint space (MJS)
2. Lateral joint space (LJS)
3. Hip-Knee-Ankle (HKA) Angle

Medial joint space was determined by a vertical line 'A' between two horizontal lines(C&D), that were drawn from the lowest point of the medial condyle of the femur and medial plateau of the tibia respectively. Lateral joint space was determined by a vertical line 'B' between two horizontal line (E&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 was determined by ratio of A/B.

Operative Procedure:

Procedure of Proximal Fibular Osteotomy

Under spinal anaesthesia with full aseptic and antiseptic precautions patient was lie down in supine position and bolster placed behind ipsilateral hip to keep the limb in internal rotation. Painting and drapping was done. An approximately five centimetre longitudinal incision was made over the posterolateral part of skin over the proximal part of the leg and fibula was exposed between the peroneus (longus and brevis) muscles and soleus muscle. Proximal fibular osteotomy was performed by removing approximately 1-2 cm length of fibula at a distance of 6-10cm below the fibular head with the help of a drill bit and corticotome. We need to be very cautious about common peroneal nerve injury. Wound was closed in layer, dressing was done and crepe bandage applied.

Postoperative Care: - All participants had undergone a routine post-operative physiotherapy protocol. From day one, in-bed exercises and mobility was advised. Next day, out of bed mobility with the help of a walker was allowed with full weight bearing with the aid of a physiotherapist. The vacuum drain was usually not required in many

cases but in few cases where it was required, it remained in place for 24 hours and was then removed. On days 3 wound dressings was changed. Discharge was planned based on patients comfort and mobility, that was usually on day 4 or 5. They

were followed up at 6 weeks, 3 months, 6 months, 9 months and 12 months.

Results

Table 1: Patient details

Age (in years)		No. of cases (%)
30-40		0
40-50		33 (33)
50-60		39 (39)
60-70		28 (28)
Sex		
Males		40 (40)
Females		60 (60)
BMI	Weight status	No. of patients (%)
Below 18.5	Under weight	0
18.5 -24.9	Normal	19 (19)
25.0-29.9	Overweight	55 (55)
30.0 and above	Obese	26 (26)
Side		No. of cases (%)
Right		42 (42)
Left		32 (32)
Bilateral		26 (26)
Osteochondral defect grade		No. of knees (%)
Grade 1		54 (54)
Grade 2		28 (28)
Grade 3		15 (15)
Grade 4		3 (3)

The majority of the patients in this research were in the 50–60 age range. There were 40 men and 60 women in the current research, or an estimated male to female ratio of 2:3. Patients ranged in age from 40 to 70 years old, with a mean age of 50.72 years. Patients with BMIs above 30 were included in this

research; the majority of these patients fell into the overweight group, with most of them having BMIs between 25 and 29.9. A total of 54 (54%) knees with grade 1, 28 (28%) knees with grade 2, 15 (15%) knees with grade 3, and 3 (3%) instances with grade 4 had osteochondral defects.

Table 2: Average Visual Analogue Scale (VAS) score, Average Knee Society Score, Average knee function score, average Medial Joint Space, average Lateral Joint Space, average Hip Knee ankle angle (HKA)

Time	Avg. VAS score
Pre-op	8.24
1 mo follow up	5.65
2 mo follow up	4.56
6 mo follow up	3.77
12 mo follow up	3.252
Time	KSS score
Pre-op	44.26
12 mo follow up	72.78
Time	KSS score
Pre-op	46.24
12 mo follow up	71.74
Time	KFS score
Pre-op	48.52
12 mo follow up	76.54
Time	MJS
Pre op	1.64
12 months follow up	3.58
Time	LJS

Pre OP	6.64
12 months follow up	5.34
Time	HKA
Pre OP	168.22
12 months follow up	174.96

After surgery, the average visual analogue scale (VAS) score dropped dramatically from 8.24 to 3.252 in the first year of follow-up. After surgery, the knee society score increased from 44.26 to 72.78 throughout the 12-month follow-up period. After surgery, the knee function score increased from 48.52 to 76.54 throughout the 12-month follow-up period. After surgery, the median joint space rose from 1.64 to 3.58 throughout the 12-month follow-up period. In the 12-month follow-up, lateral joint space dropped from 6.64 pre-operatively to 5.34. After a year, the Hip Knee Ankle Angle (HKA) alignment was corrected after PFO.

Discussion

The most prevalent cause of impairment among the elderly is osteoarthritis. Pain and movement restrictions lead to disability. The primary surgical option for this patient group is total knee arthroplasty (TKA), which attempts to reduce pain and enhance joint function and mobility. TKA is costly and intricate, and some patients need a second knee revision after the first procedure. [16,17] For young individuals with osteoarthritis of the knee's medial compartment, high tibial osteotomy (HTO) is the preferred course of therapy; nonetheless, there are some possible side effects after the procedure. [18,19]

The novel therapy for medial compartment knee joint OA is proximal fibular osteotomy. While medial compartmental arthritis was previously treated with high tibial osteotomy and unicompartmental arthroplasty, both procedures have drawbacks and major complications [20], such as infection, deep vein thrombosis (DVT), inadequate correction, intraarticular fractures, damage to the peroneal nerve, compartment syndrome, and stiffness in the knee. On the other hand, internal fixation failure, deformity recurrence, and delayed union or nonunion are late consequences of this operation. [21] The literature on PFO in medial compartment OA of the knee still lacks significant and clear proof. A successful result from a fibular osteotomy depends critically on its proper execution, including the length of the fibular chunk excised, the precise height from the fibular head, and the protection of the peroneal nerve. The risk of damage to the peroneal nerve is reduced when fibular osteotomy is performed at a distance of around 4-7 cm from the fibular head. [22] Yang et al. performed a study on 110 patients with medial compartment arthritis that were followed for over

two years. [23] The mean age of patients was 51.68 year (age range = 40-70 years).

The majority of the patients in this research were in the 50–60 age range. There were 40 men and 60 women in the current research, or an estimated male to female ratio of 2:3. Patients ranged in age from 40 to 70 years old, with a mean age of 50.72 years. Patients with BMIs above 30 were included in this research; the majority of these patients fell into the overweight group, with most of them having BMIs between 25 and 29.9. A total of 54 (54%) knees with grade 1, 28 (28%) knees with grade 2, 15 (15%) knees with grade 3, and 3 (3%) instances with grade 4 had osteochondral defects. After surgery, the average visual analogue scale (VAS) score dropped dramatically from 8.24 to 3.252 in the first year of follow-up. Based on these results, there was a significant improvement in the function of the knee and relieving pain. In a study conducted by Wang et al. on PFO for medial compartment, OA pain relief was observed in all patients after PFO; the mean VAS scores improved dramatically from 8.02 ± 1.50 preoperatively to 2.74 ± 2.34 postoperatively. [24]

Average visual Analogue scale (VAS) score significantly decreased from 8.24 pre-operatively to 3.252 in 1 year of follow up. Knee society score improved from 44.26 pre-operatively to 72.78 in 12 month of follow up. Knee function score improved pre-operatively 48.52 to 76.54 in 12 month of follow up. Medial joint space increased from 1.64 pre-operatively to 3.58 in 12 month of follow up. Lateral joint space decreased from 6.64 pre-operatively to 5.34 in 12 months follow up. The correction of alignment Hip knee ankle angle (HKA) after PFO was seen after 12 months. The results in our study were comparable to the studies conducted by other authors such as Yang et al [23], Wang et al. [24] and Subash and Naidu. [25]

Due to the stress concentration in the medial compartment, cartilage was worn and degenerated under sustained pressure [26], leading to medial space narrowing in patients with knee osteoarthritis [KOA]. The stress concentration might be associated with the non-uniform-settlement of the tibial plateau and the support of the fibula. [27] Therefore, after removal of the cause (referring to the PFO), patients' clinical symptoms could be improved to a large extent. Moreover, advanced medial space narrowing was related to the severity of the disease. [28] For patients with knee osteoarthritis [KOA] of great severity, it is difficult to achieve an excellent-to-good result of clinical

outcome, but there is more room for a significant improvement (KSS change >15).

In terms of functional evaluation, age, VAS score, KSS clinical and functional scores, HKA angle and settlement values were all independent factors affecting satisfactory functional outcome. For significant improvement of outcome, the results were similar. HKA angle reflected the changes in limb alignment [29] and patients with nearly normal HKA angles showed better outcomes in joint function, which might be because PFO could only partially correct the varus deformity of the tibial plateau. Studies have shown that patients with severe Knee osteoarthritis had varus deformity in the femoral condyle as well. [30] For these patients, PFO was unable to fully improve their varus deformity and prognosis. In addition, settlement value was taken as a factor to reflect the degree of nonuniform- settlement of the tibial plateau.

The higher the settlement value the more significant the effect of lateral fibula support and the better the outcome of PFO. Such findings suggested that PFO in the treatment of Knee osteoarthritis was closely related to the non-uniform settlement theory. Patients with higher settlement value undergoing PFO operation could be expected to obtain better functional outcome. Of the factors associated with the outcome of PFO, medial joint space, HKA angle and settlement value were objective factors and could be measured directly on X-ray films. Therefore, these factors were not subject to subjective impact, and thus suitable for prediction of a patient's postoperative recovery.

The limitations of this study were as follows. First, the sample size was relatively small. Second, the follow-up time was short, making us unable to determine the relationship between study factors and long-term postoperative outcome of PFO.

Conclusion

A straightforward, risk-free, and reasonably priced procedure for reducing pain, enhancing knee osteoarthritis medial compartment space, and improving joint function is proximal fibular osteotomy (PFO). Due to the budgetary and healthcare delivery constraints in most underdeveloped countries, proximal fibular osteotomy [PFO] may be a potential alternative treatment. For those with osteoarthritis in their knees who are unable to undergo surgery, this might be an option.

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