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Original Research Article

Role of Proximal Fibular Osteotomy (PFO) in the Management of Medial Compartment Osteoarthritis of 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 36 patients in Department of Orthopaedics, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India for one 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 12months.

Results: In the present study, most of the patients belonged to 50-60 years age group. In the present study, there were 12 males and 20 females, with male to female ratio 2:3 approximately. The mean age of patients was 51.68 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, 20(50%) knees with grade 1, 12(30%) knees with grade 2, 6(15%) knees with grade 3,and 2 (5%) cases with grade 4. Average visual Analogue scale (VAS) score significantly decreased from 8.20 pre-operatively to 3.256 in 1 year of follow up. Knee society score improved from 45.25 pre-operatively to 71.77 in 12 month of follow up. Knee function score improved pre-operatively 49.50 to 75.55 in 12 month of follow up. Medial joint space increased from 1.62 pre-operatively to 3.56 in 12 month of follow up. Lateral joint space decreased from 6.68 pre-operatively to 5.38 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.

Introduction

Knee osteoarthritis (OA) is a chronic, slow progressive degenerative disease result from the biological degeneration of cartilage in synovial joint with accompanying joint-pain ,stiffness, and deformity. [1] The disease involves mechanical, osseous, genetic, and environmental factors. [2] Knee varus deformities commonly seen in medial compartment knee osteoarthritis (OA) characterized by a mechanical femorotibial axis of less than 1800 on full-leg standing AP radiographs and decreased medial joint space and affect 74% of patients with idiopathic knee osteoarthritis (OA). Clinically knee osteoarthritis (OA), or joint failure, is a very heterogeneous condition, but is the end result of biochemical and mechanical insult that exceeds the joint's ability to repair itself.

Medial compartment knee arthritis is more common because the load is distributed along the mechanical axis, which is generally medial to the centre of the knee. The large forces experienced in the medial compartment during typical bipedal activities such as walking and running. If overweight, a variety of interventions by physical therapists, exercise, oral or topical pain medications such as non-steroidal anti-inflammatory drugs, intraarticular corticosteroid and other injections, arthroscopic knee surgery, knee replacement and osteotomy.

High tibial osteotomy can be a technically demanding procedure and may result in complications, including neurovascular injury, iatrogenic fracture, and nonunion. [3,4] The lateral support provided to the osteoporotic tibia by the fibula-soft tissue complex may lead to the non-uniform settlement and degeneration of the plateau bilaterally. [5,6] This may result in the load from the normal distribution shifting father medially to the medial plateau and consequently lead to knee varus, aggravating the progression of medial compartment OA of the knee joint. Using this logic, we have performed a proximal fibular osteotomy to relieve the increased loading force the medial compartment for treatment of medial compartment OA of the knee joint.

Proximal fibular osteotomy (PFO) is a surgical procedure for medial compartment knee osteoarthritis. In proximal fibular osteotomy 2-3 cm long section of fibula was resected 6 to 10 cm below the fibular head. Proximal fibular osteotomy can significantly improve both the radiographic appearance and function of the affected knee joint and also achieve long-term pain relief. It brings dramatic relief in pain and increase in medial compartment knee joint space after operation that lead to increase in joint function and mobility after PFO. This procedure may be an alternative treatment to high tibial osteotomy (HTO) for medial compartment knee osteoarthritis (OA). Proximal fibular osteotomy (PFO) is indicated in early-stage medial compartment knee osteoarthritis (OA). [7]

Mechanism of proximal fibular osteotomy is when a patient underwent to proximal fibular osteotomy, the muscle attached to the proximal fibula such as Soleus and Peroneus. Therefor lateral knee joint space become narrow to counteract knee varus deformity resulting from load bearing. Thereby reducing the pressure on medial compartment of knee and relieving the patients medial compartment knee pain. 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 36 patients in Department of Orthopaedics, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India for one year

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.

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 centimeter 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 perfomed by removing approximately 1-2 cm length of fibula at a distance of 6-10cmbelowthefibular 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 4or 5. They were followed up at 6 weeks, 3 months, 6

months, 9 months and 12months.

Results

Table 1: Patient details

Age (in years)		**No. of cases**
30-40		0
40-50		10
50-60		13
60-70		9
Sex		
Males		12
Females		20
Total		32
BMI	**Weight status**	**No. of patients**
Below 18.5	Under weight	0
18.5 -24.9	Normal	6
25.0-29.9	Overweight	18
30.0 and above	Obese	8
Side		**No. of cases**
Right		13
Left		11
Bilaletral		8
Osteochondral defect grade		**No. of knees**
Grade 1		20
Grade 2		12
Grade 3		6
Grade 4		2

In the present study, most of the patients belonged to 50-60 years age group. In the present study, there were 12 males and 20 females, with male to female ratio 2:3 approximately. The mean age of patients was 51.68 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, 20(50%) knees with grade 1, 12(30%) knees with grade 2, 6(15%) knees with grade 3 and 2 (5%) cases with grade 4.

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. 20
1 mo follow up	5. 62
2 mo follow up	4. 54
6 mo follow up	3. 82
12 mo follow up	3. 256
Time	KSS score
Pre-op	45.25
12 mo follow up	71.77

Time	KSS score
Pre-op	45.25
12 mo follow up	71.77
Time	KFS score
Pre-op	49.50
12 mo follow up	75.55
Time	MJS
Pre op	1.62
12 months follow up	3.56
Time	LJS
Pre-OP	6.68
12 months follow up	5.38
Time	HKA
Pre-OP	169.21
12 months follow up	175.92

Average visual Analogue scale (VAS) score significantly decreased from 8.20 pre-operatively to 3.256 in 1 year of follow up. Knee society score improved from 45.25 pre-operatively to 71.77 in 12 month of follow up. Knee function score improved pre-operatively 49.50 to 75.55 in 12 month of follow up. Medial joint space increased from 1.62 pre-operatively to 3.56 in 12 month of follow up. Lateral joint space decreased from 6.68 pre-operatively to 5.38 in 12 months follow up. The correction of alignment Hip knee ankle angle (HKA) after PFO was seen after 12 months.

Discussion

Osteoarthritis is the most common cause of disability in the older population. Disability is caused by pain and limitations in mobility. Total knee arthroplasty (TKA), which aims to relieve pain and improve joint function and mobility, is the main surgical alternative in this patient population. However, TKA is expensive and complex, and some patients need a second knee revision after the first surgery. [8.9] Although high tibial osteotomy (HTO) is the first-choice treatment for young patients with osteoarthritis of the medial compartment of the knee, there are some potential disadvantages after surgery. [10,11]

Proximal fibular osteotomy is the new treatment option for medial compartment knee joint OA. Although high tibial osteotomy and unicompartmental arthroplasty were previously the treatment options for medial compartmental arthritis, both have their advantages and disadvantages and are associated with major complications [12], which include infection, deep vein thrombosis (DVT), insufficient correction, intraarticular fractures, peroneal nerve injury, compartment syndrome, and knee stiffness. In contrast, late complications of this procedure include delayed union or nonunion, deformity recurrence, and internal fixation failure. [13] There is still insufficient and inconclusive evidence in the literature on PFO in medial compartment OA of the knee. A correctly performed fibular osteotomy (in terms of accurate height from the fibular head, the length of the fibular chunk removed, and peroneal nerve protection) is paramount for a good outcome. Performing fibular osteotomy at the level of about 4-7 cm distal to fibular head decreases the risk of peroneal nerve injury. [14] Yang et al. performed a study on 110 patients with medial compartment arthritis that were followed for over two years. [15] The mean age of patients was 51.68 year (age range = 40-70 years).

Average visual Analogue scale (VAS) score significantly decreased from 8.20 pre-operatively to 3.256 in 1 year of follow up. Based on these results, there was a significant improvement in the function of the knee and relieving pain. [15] 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. [16]

Knee society score improved from 45.25 pre-operatively to 71.77 in 12 month of follow up. Knee function score improved pre-operatively 49.50 to 75.55 in 12 month of follow up. Medial joint space increased from 1.62 pre-operatively to 3.56 in 12 month of follow up. Lateral joint space decreased from 6.68 pre-operatively to 5.38 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 [15], Wang et al. [16] and Subash and Naidu. [17]

Due to the stress concentration in the medial compartment, cartilage was worn and degenerated under sustained pressure [18], 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. [19] 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. [20] 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 [21] 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. [22] 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. [23]

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

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. Proximal fibular osteotomy [PFO] may be a promising alternative surgery in most developing countries because of their financial and healthcare delivery limitations. It may be used as an alternative surgery for patients of osteoarthritis knee who cannot undergo.

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