



FUNCTIONAL OUTCOME OF PROXIMAL FIBULAR OSTEOTOMY FOR MEDIAL COMPARTMENT KNEE OSTEOARTHRITIS

Orthopaedics

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ABSTRACT

Background: Proximal fibular osteotomy is the new treatment option for medial compartment knee joint osteoarthritis. **Objectives:** To evaluate the functional outcomes of patients with knee osteoarthritis after proximal fibular osteotomy; and to assess the improvement of medial joint space by radiological evidence. **Methods:** This was a prospective analytical study conducted at a tertiary level healthcare facility between January 2020 and October 2022. The assessments included use of visual analogue scale (VAS), Kellgren lawrence classification and Tegner Lysholm Knee Scoring system. **Results:** The study enrolled a total of 50 participants. The mean (SD) age of the study participants was 61.3 years (4.8). We found that the VAS scores (MD -1.81, 95% CI -2.03 to -1.59), Tegner Lysholm knee scoring scale scores (MD 37.50, 95% CI 35.96 to 39.04), femorotibial angle (MD -1.66, 95% CI -3.04 to -0.28), medial joint space (MD 2.30, 95% CI 2.01 to 2.59), medial and lateral compartment joint space ratio (MD 0.10, 95% CI 0.01 to 0.19) significantly ($p < 0.05$) improved postoperatively. The improvement was higher among patients less than 60 years of age and among males. **Conclusion:** Proximal fibular osteotomy helps in reducing the pressure on the medial compartment of the knee and relieving the medial knee pain.

KEYWORDS

Osteoarthritis, Proximal fibular osteotomy, Knee pain, Kellgren lawrence classification, Tegner Lysholm Knee Scoring system

INTRODUCTION

Osteoarthritis is the most prevalent type of arthropathy and the leading cause of functional limitation and disability (1, 2). This degenerative, progressive joint condition is characterised by the gradual loss of articular cartilage and remodelling of the bone beneath (3, 4). The Global Burden of Disease estimates document a consistent increase in number of prevalent cases of osteoarthritis, increasing to 527.81 million (2019) from 247.51 million (1990) – this translates to age standardized prevalence rate of 6,348.25 cases per one lakh population (95% CI 0.11%, 0.14%) in 2019 (5, 6). According to research, 16.05% of individuals in low- and middle-income countries have osteoarthritis (95% CI: 12.55 to 19.89) (7). The regional analysis showed the prevalence of osteoarthritis to be 16.4% (95% CI 11.60 to 21.78%), 15.7% (95% CI 5.31 to 30.25%) and 14.2% (95% CI 7.95 to 21.89%) in South Asia, East Asia and Pacific, and in Sub Saharan Africa.(7)

Importantly, it has been documented that 13.0% of elderly (more than or equal to 60 years of age) develop symptomatic knee osteoarthritis (8). The prevalence of symptomatic knee osteoarthritis was reported to be 14.6% overall in a systematic review and meta-analysis (which included 21 studies) released in 2020 (9). Another study highlighted that symptomatic knee osteoarthritis occurs in 15.0% of adults more than 55 years of age.(10, 11) However, to understand the overall burden radiographic incidence should also be considered. Literature evidence shows the radiographic incidence of knee osteoarthritis to be over 80.0% among individuals more than 75 years of age.(12, 13)

Medial compartmental osteoarthritis is a form of osteoarthritis that affects only one part of the knee - the medial compartment, which is located near the middle of the knee on the inner side (14). The lateral compartment and the patellofemoral joint are comparatively spared.(15) Usually for medial compartment osteoarthritis, the treatment of choice is the total knee replacement or arthroplasty (because of poor results, arthroscopic debridement has fallen out of choice).(16, 17) However, there has lately been a trend towards unicompartmental knee replacement and high tibial osteotomy. One other alternative is the knee joint distraction (18, 19). The novel treatment option for osteoarthritis of the medial compartment of the knee joint is proximal fibular osteotomy. (20, 21)

Against this background, Our goal was to evaluate the practical results of proximal fibular osteotomy for medial compartment knee osteoarthritis. The study's objectives were to investigate the functional

outcome of proximal fibular osteotomy as a new pain relief surgery; to assess the functional outcome of patients with knee osteoarthritis after proximal fibular osteotomy; and to assess the improvement of medial joint space based on radiological evidence.

MATERIAL AND METHODS

This was a prospective analytical study conducted at a tertiary level healthcare facility (Aarupadai Veedu Medical College and Hospital, Puducherry) between January 2020 and October 2022. Patient aged 35 to 80 years presenting with knee pain and functional limitation to the department of Orthopaedics, with medial compartment osteoarthritis of the knee and failure of treatment with conservative non-operative treatment modalities including lifestyle modifications were included in the study through consecutive sampling. The study excluded patients with both medial and lateral compartments of knee involvement, patients with High Tibial Osteotomy (HTO), patients with infectious pathology, malignant tumours, pain other than early osteoarthritis and valgus knee deformity.

The minimum required sample size was computed considering medial joint space mean difference to 0.6. Assuming 95% confidence and 80% power the sample size was estimated to be 50. A predesigned, semi structured, pretested questionnaire was administered – included demographic data, illness history (present and past), clinical examination and details of investigations – were recorded. Radiographic grading of knee osteoarthritis was done using Kellgren lawrence classification. Tegner Lysholm Knee Scoring system was used. Routine preoperative investigations were done for the surgery.

Surgical Procedure

Under spinal anaesthesia and patient in supine position parts painted and draped. Prophylactic intravenous antibiotics was given prior to the incision. A sandbag was applied under the ipsilateral gluteal region to keep the lower limb in slight internal rotation. A tourniquet was applied and inflated. The caput fibulae were palpated, a 5-7 cm longitudinal incision was over the proximal fibula, the skin and subcutaneous tissues were reflected on either side and deep fascia was incised in the line of skin incision. A plane was formed between the peroneus and soleus muscles, then subperiosteally were stripped. The fibula was then exposed. About 2 to 3 cm long cuff resection from shaft of fibula at a level 6 to 10 cm from caput fibulae was performed with a oscillating saw to perform the cut ends of fibula. It was then sealed with bone wax. Wound was irrigated and closed in layers.

The length of hospital stay was one week. Knee range of motion exercises were initiated following full weight bearing ambulation depending upon the tolerance of the patient. Follow up was done to minimum of six month.

Data was collected from 50 participants, uploaded to Microsoft Excel, and analyzed using Stata v16. Numbers and percentages were used to present descriptive analysis. Chi square tests and paired or dependent 't' tests of significance (two-sided) were used to test for association. The univariate odds ratio (OR) and mean difference (MD) were calculated, along with the 95% confidence interval. Variables with p 0.05 were considered significant.

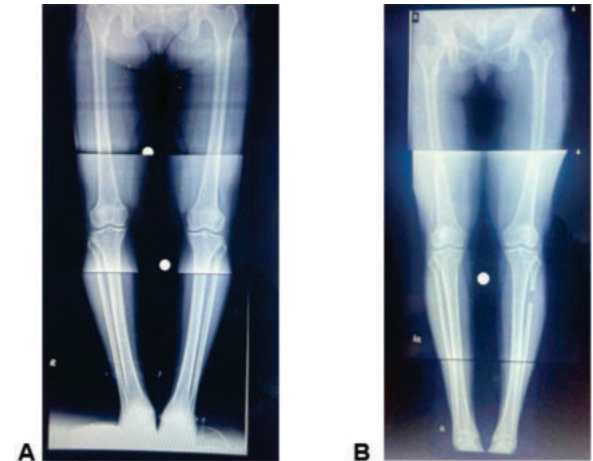


Figure 1: Shows The (a) Pre-operative And (b) Post-operative X-ray

RESULTS

The study enrolled a total of 50 participants. The mean (SD) age of the study participants was 61.3 years (4.8). The study enrolled a total of 28 males (56.0%) and 22 females (44.0%). Among the participants enrolled, 21 (42.0%) had osteoporosis and 29 (58.0%) had no osteoporosis. Based on Kellgren Lawrence classification, none of the participants included in the study had Grade 1 radiographic grading. However, 3 (6.0%) participants had Grade 2, 32 (64.0%) participants had Grade 3, and 15 (30.0%) participants had Grade 4 changes (Table 1).

Table 1: Distribution Of Study Variables

Variables		N = 50 n (%) or mean (SD)
Age (in years)		61.3 (4.8)
Age (in years)	35 to 50	8 (16.0)
	51 to 65	19 (38.0)
	66 to 80	23 (46.0)
Gender	Male	28 (56.0)
	Female	22 (44.0)
Side of involvement	Right alone	28 (56.0)
	Left alone	22 (44.0)
Osteoporosis	Present	21 (42.0)
	Absent	29 (58.0)
Radiographic grading*	Grade 1	0 (0.0)
	Grade 2	3 (6.0)
	Grade 3	32 (64.0)
	Grade 4	15 (30.0)

JSN, Joint space narrowing; SD, Standard deviation

The mean (SD) visual analogue scale scores significantly reduced in the post operative period compared to preoperative period (MD -1.81, 95% CI -2.03 to -1.59; p<0.001) (Table 2). The scores further reduced significantly in the post operative period at three (4.37 (0.77)) and six (3.43 (0.56)) months (Figure 2).

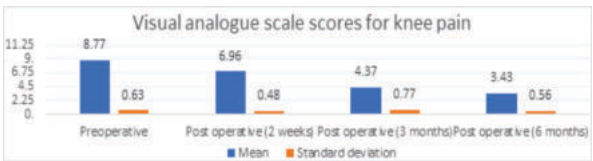


Figure 2: Visual Analogue Scale Scores For Knee Pain

The mean (SD) Tegner Lysholm Knee Scoring Scale scores significantly increased in the post operative period compared to preoperative period (MD 37.50, 95% CI 35.96 to 39.04; p<0.001). The scores further increased significantly in the post operative period at three (96.18 (3.56)) and six (97.56 (3.48)) months (Figure 3).

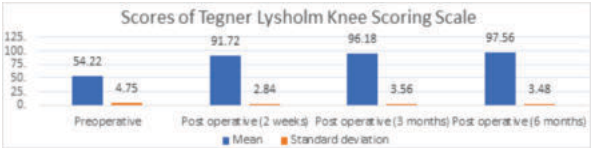


Figure 3: Scores Of Tegner Lysholm Knee Scoring Scale

The mean (SD) femorotibial angle (in degrees) reduced significantly in the post operative period compared to preoperative period (MD -1.66, 95% CI -3.04 to -0.28; p = 0.019). The pre and post operative difference between medial joint space was 2.30 (95% CI 2.01 to 2.59) at p<0.001. The pre and post operative difference between medial and lateral compartment joint space ratios was 0.10 (95% CI 0.01 to 0.19) at p = 0.025. We found a statistically insignificant difference in genu varum deformity (in degrees) between the preoperative and post operative periods (MD -0.86, 95% CI -2.57 to 0.85). We found that the visual analogue scale scores significantly reduced in the post operative period among participants less than 60 years of age (MD -1.88, 95% CI -2.13 to -1.61; p<0.001) and participants more than or equal to 60 years of age (MD -1.74, 95% CI -3.85 to -1.29; p<0.001) in comparison with the preoperative period. However, the reduction was greater among participants less than 60 years of age in comparison with those more than or equal to 60 years of age (Table 2).

Table 2 : Comparing Outcomes Of Interest Preoperatively And Post Operatively, By Age Groups

Outcome variables	Age less than 60 years	Age more than or equal to 60 years	
	OR (95% CI) or MD (95% CI)	p value	OR (95% CI) or MD (95% CI)
Visual analogue scale (VAS)	-1.88 (-2.13 to -1.61)	< 0.001*	-1.74 (-3.85 to -1.29)
Tegner Lysholm Knee Scoring Scale	53.0 (41.96 to 64.12)	< 0.001*	21.0 (13.79 to 30.63)
Tegner Lysholm Knee Scoring Scale was not used as an outcome variable as all the study participants (n = 50) with either poor or fair scores improved after intervention (good or excellent).			
Femorotibial angle	-1.79 (-3.47 to -0.22)	0.031*	-1.53 (-2.93 to -0.16)
Medial joint space	2.35 (2.00 to 2.57)	< 0.001*	2.25 (1.89 to 2.59)
Medial and lateral compartment joint space ratio	0.14 (0.07 to 0.23)	0.019*	0.06 (0.01 to 0.15)
Genu varum deformity	-0.79 (-2.37 to 0.94)	0.647	-0.93 (-2.18 to 1.29)

The Tegner Lysholm Knee Scoring Scale scores significantly increased in the post operative period among participants less than 60 years of age (MD 53.0, 95% CI 41.96 to 64.12; p<0.001) and participants more than or equal to 60 years of age (MD 21.0, 95% CI 13.79 to 30.63; p<0.001) in comparison with the preoperative period. However, the increase was much greater among participants less than 60 years of age in comparison with those more than or equal to 60 years of age.

Similarly, the reduction in femorotibial angle and increase in medial and lateral compartment joint space ratio was much greater among participants less than 60 years of age in comparison with those more than or equal to 60 years of age.

We found that the visual analogue scale scores significantly reduced in the post operative period among males (MD -1.98, 95% CI -2.78 to -1.93; p<0.001) and females (MD -1.64, 95% CI -2.45 to -0.84; p = 0.037) in comparison with the preoperative period. However, the

reduction was greater among males in comparison with females.

The mean difference (MD) in preoperative and post operative Tegner Lysholm Knee Scoring Scale scores was 60.0 (95% CI 45.03 to 69.38; $p < 0.001$) and 15.0 (95% CI 5.45 to 27.28; $p = 0.022$) among males and females respectively. Though the scores increased significantly ($p < 0.05$) among males and females, the increase was much higher among males in comparison with females.

The other findings were – significant reduction in femorotibial angle among males; and increased medial joint space among males.

DISCUSSION

Literature evidence highlights that osteoarthritis of the knee is the most common form of arthropathy resulting in pain and limited functionality. The age of the patient, grade or stage of osteoarthritis and presence or absence of osteoporosis decides the choice of treatment. The treatment options include high tibial osteotomy and total knee arthroplasty. In this context, proximal fibular osteotomy is a relatively new procedure. In this procedure the loading force is shifted to the lateral side with correction of varus deformity. This is made possible by reducing the support to the lateral half of tibial plateau. This provides pain relief and improves functionality. However, to objectively measure to outcomes of proximal fibular osteotomy medial and lateral joint space ratio, femorotibial angle, condyle plateau angle, settlement value, absolute medial and lateral joint space values can be used.

The present study found that visual analogue scale (VAS) scores, Tegner Lysholm knee scoring scale scores, femorotibial angle, medial joint space, medial and lateral compartment joint space ratio significantly improved postoperatively among patients, 35 to 80 years old, presenting with medial compartment osteoarthritis and operated using proximal fibular osteotomy. Similar literature available show that following proximal fibular osteotomy, there is improvement in numerical rating scale (NRS) score and verbal descriptor/rating scale score, femorotibial angle, medial joint space narrowing and American knee scoring scale scores (22). Similar evidence has been documented in nonrandomized studies, retrospective studies, cross-sectional studies and prospective cohort studies. In a cross sectional study it was found that following proximal fibular osteotomy among patients with medial compartment knee osteoarthritis, there was significant improvement in American knee society scores (KSS) and visual analogue scale scores in the postoperative period, at postoperative 6 weeks and postoperative 9 months (23). A recent study documented that after proximal fibular osteotomies in patients with medial compartment knee osteoarthritis there was significant improvement in Western Ontario and McMaster Universities Osteoarthritis (WOMAC) scores.(24)

According to the study, patients with medial compartment osteoarthritis who underwent proximal fibular osteotomy surgery and were older than 60 years of age experienced significant postoperative improvements in their visual analogue scale (VAS) scores, Tegner Lysholm knee scoring scale scores, femorotibial angle, medial joint space, and medial and lateral compartment joint space ratio. When compared to patients who were at least 60 years old, the improvement was much greater in patients who were under that age.

The gender-disaggregated analysis reveals that patient outcomes for both male and female patients improved in terms of visual analogue scale (VAS) scores, Tegner Lysholm knee scoring scale scores, femorotibial angle, medial joint space, and medial and lateral compartment joint space ratio. However, the improvement was much higher among male patients in comparison with females – the visual analogue scale (VAS) scores, Tegner Lysholm knee scoring scale scores and medial joint space was significant for females, but the improvement was lesser compared to males; femorotibial angle, medial and lateral compartment joint space ratio were insignificant.

The better improvement among male patients and those less than 60 years of age may be attributed to better compliance with postoperative exercises provided by the healthcare provider.

The study is not without limitations. Firstly, the absence of a comparative group. For medial compartment knee osteoarthritis, we could have contrasted the effectiveness of proximal fibular osteotomy with other widely used treatment options, such as total knee

replacement. Secondly, we could have captured the perspectives of patients undergoing proximal fibular osteotomy in qualitative terms. Thirdly, the follow up of the patients could have been longer.

CONCLUSION

Proximal fibular osteotomy significantly improves visual analogue scale (VAS) scores, Tegner Lysholm knee scoring scale scores, femorotibial angle, medial joint space, and medial and lateral compartment joint space ratio in patients (35 to 80 years old) presenting with medial compartment osteoarthritis of the knee. Male patients and those under the age of 60 showed the most significant improvements.

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