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To study the radiological outcome of proximal fibular osteotomy in management of severe medial compartment OA knee

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Abstract

Background: Knee osteoarthritis is a chronic, progressive disease with accompanying joint pain, stiffness and deformity. Osteoarthritis is the most common cause of disability in the older population. Disability is caused by pain and limitations in mobility. The disease involves mechanical, osseous, genetic, and environmental factors. Osteoarthritis (OA) of the knee is the commonest form of OA. It occurs commonly in the medial compartment. Varus deformities of the knee, characterized by a femorotibial axis of less than 180° on full-leg standing AP radiographs and narrowed medial joint space, are common in patients with knee OA and affect 74% of patients with idiopathic OA. In healthy knees, medial compartment bears 60-80% of the load.,High tibial osteotomy and total knee arthroplasty are the two main methods used for treating osteoarthritis of the knee. Although high tibial osteotomy (HTO) is the first-choice treatment for young patients with osteoarthritis of the medial compartment of the knee. **Aim & Objective:** 1. To assess the effect of proximal fibular osteotomy in relieving pain and functional improvement in patients of osteoarthritis knee.2. To study the radiological outcome of proximal fibular osteotomy in management of severe medial compartment OA knee. **Methods:** Prospective Observational Study,Study setting: Tertiary care center. Study duration: from…to…..Study population: The study population included all patients with Medial compartment osteoarthritis admitted at a tertiary care center. **Sample size:** 30 **Results:** majority of cases were found in 56-65 years age group 16 (53.33%) cases followed by in 46-55 years age group 11 (36.67) and 30-45 age group found 3 (10%) cases. majority of study cases were Females contributing 19 (63.33%) and Males 11 (36.67%). majority of study cases Presented with KL Grade III e.g. 20 (66.66%) and 10 (33.34%) cases with KL Grade II. Majority of cases VAS was (8-9) 10 cases, followed by 9 cases had a VAS 7, moderate pain VAS (4-6) was found in 7 cases and 4 cases reported mild pain VAS (1-3). Majority of cases reported Moderate pain (4-6) e.g 11, followed by Mild pain (1-3) in 10 cases, 5 cases with Severe pain (7) and 4 cases reported Very Severe pain (8-9) **Conclusions:** Most of study cases Presented with KL Grade III. There is statistically significant association between KL Grade III medial compartment Osteoarthritis of knee with gender.Lateral FTA Pre-operative value 183.80 ± 2.57, Post-operative value 182.60 ± 1.94, Final follow-up value 182.60 ± 1.76, Joint space ratio Pre-operative value 0.28 ± 0.03, Post-operative value 0.27 ± 0.03, Final follow-up value 0.27 ± 0.03.

Keywords: Osteoarthritis KL Grade,VAS, HKA angle

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Introduction

Knee osteoarthritis is a chronic, progressive disease with accompanying joint pain, stiffness and deformity. Osteoarthritis is the most common cause of disability in the older population. Disability is caused by pain and limitations in mobility.[1] The disease involves mechanical, osseous, genetic, and environmental factors.[2] Osteoarthritis (OA) of the knee is the commonest form of OA. It occurs commonly in the medial compartment.[1]

Varus deformities of the knee, characterized by a femorotibial axis of less than 180° on full-leg standing AP radiographs and narrowed medial joint space, are common in patients with knee OA and affect 74% of patients with idiopathic OA.[3] In healthy knees, medial compartment bears 60-80% of the load4, High tibial osteotomy and total knee arthroplasty are the two main methods used for treating osteoarthritis of the knee. Although high tibial osteotomy (HTO) is the first-choice treatment for young patients with osteoarthritis of the medial compartment of the knee.[5]

High tibial osteotomy is a relatively difficult procedure and has occasional complications, including neurovascular injury, iatrogenic fracture and nonunion.[6,7] Though total knee arthroplasty corrects alignment, relieves pain, and improves function.

it may not be the treatment of choice in relatively younger, active patients or patients with moderate OA.[8] TKA is expensive and complex, and some patients need a second knee revision after the first surgery.[9,10] The global prevalence of radiographically confirmed symptomatic knee OA in 2010 was estimated to be 3.8%.

It was higher in females (4.8%) than in males (2.8%).[11] In the USA, 33.6% people aged more than 65 years were found to have osteoarthritis of knees.[12] In south Asian region the prevalence of OA of knees is 1.8% in males and 3.1% in females.[11] Osteoarthritis of knee is a degenerative joint disease and one of the leading causes of disability in India with prevalence of about 28%.[13]

Proximal fibular osteotomy (PFO) is an alternative treatment to high tibial osteotomy (HTO).[14] It is a surgical procedure for medial compartment knee osteoarthritis (KOA). Compared to HTO, PFO has several advantages.[15] First, the surgical technique is simple and easily performed.

Second, it is less invasive with a very short incision, requires limited tissue dissection and no internal fixation is implanted. The postoperative recovery period is also shorter than with HTO. In addition, the complications associated with HTO can be a major problem that contributes to a poor prognosis.[16,17] In contrast, PFO is associated with few complications.[19] Similar to HTO, PFO can relieve the symptoms of KOA with realignment ofthe lower extremity.

Aim & Objective: 1. To assess the effect of proximal fibular osteotomy in relieving pain and functional improvement in patients of osteoarthritis knee. 2. To study the radiological outcome of proximal fibular osteotomy in management of severe medial compartment OA knee.

Material And Methods

Study design: Prospective Observational Study,**Study setting:** Orthopedics Department of tertiary care centre. **Study population:** The study population included all patients with Medial compartment osteoarthritis admitted at a tertiary care center. **Source of data:** All patients with Medial compartment osteoarthritis admitted at a tertiary care center such cases were included in the study.

Inclusion criteria:

1. Patients with moderate to severe symptoms of the knee over Kellgren and Lawrence (KL grade) grade 2,3 on radiographs

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2. Medial compartment osteoarthritis with significant symptoms of medial joint pain.
3. Age 30-65 years
4. Knee pain unresponsive to conventional medical treatments for at least three months.

Exclusion criteria:

1. Patients not willing for diagnostic and surgical procedure
2. Pregnancy
3. Patients with rheumatoid arthritis, posttraumatic arthritis, congenital deformities of the lower extremity, joint infection, history of ligament or meniscus injury and significant abnormality of the lateral compartment
4. Symptomatic co-morbid disease that limited walking more than knee pain limited walking (diabetic neuropathies, inflammatory arthritis, foot ulcers or sores);
5. Valgus knee (hip-knee-ankle angle>180 degrees) or any other condition (such as hip or ankle surgery, cerebral palsy, etc) affecting lower limb function.
6. Tricompartmental arthritis
7. Fixed flexion deformity greater than 15 degrees.
8. Varus deformity greater than 15 degrees

Sample Size: With reference to study by **Rao et al. (2018)[20]** He found that the KSS function score improved to 77 post operatively.

Formula for sample size = 4* P* Q / L2

Where P = 77% ,**Q** = 100 -77 = 23, **L** = Allowable error = 20% (Absolute error)

Sample size = 4 * 77 * 23 / 237.16=29.88. **Sample size Rounded to** = 30

Approval for the study: Written approval from Institutional Ethics committee was obtained beforehand. Written approval of Orthopedics department and other related department was obtained. After obtaining informed verbal consent from all patients with Medial compartment osteoarthritis admitted to orthopedics department of tertiary care centre such cases were included in the study.

Study Procedure:

After obtaining approval from ethics committee and with written and informed consent this prospective study including 30 patients of either sex will be initiated. All patients included in this study will be investigated thoroughly with

- Routine blood investigation
- Preoperative and postoperative weight-bearing and whole lower extremity radiographs was obtained to analyze the alignment of the lower extremity and ratio of the knee joint space (medial/lateral compartment).
- Knee pain was assessed using a visual analogue scale, and knee ambulation activities was evaluated using the Oxford new scoring system.
- The overall functional score was evaluated using International Knee Documentation Committee (IKDC) questionnaire, Hospital for Special Surgery (HSS) Knee score.
- Radiological factors included was hip-knee-ankle angle (HKA angle), Femorotibial angle, KL grade, joint space width of both compartments and settlement value. The HKA angle was measured on stitched images of total length lower extremities and all other measurements was made on weight-bearing AP radiographs. Complete blood analysis was posted for surgery after anesthetic fitness.

Operative Procedure: The length of fibular segment resected is 1.5 to 2 cm, and the distance from fibular head is 6 to 9 cm. The idea here is to cut the two fibular cortices, converting the knee to a more balanced joint, with unicortical support on either side, allowing correction of mechanical axis. The resection should be high enough to cause a mechanical axis shift, but yet not high enough to damage the lateral popliteal nerve. The size of the resected segment, and its distance from fibular head depends on the patients height, and while shorter patients

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had a 1.5 cm segment resected 6 cm below fibular head, tall patients had a 2 cm resection, some 8 to 9 cm below. The surgery performed under spinal anaesthesia, without a tourniquet. The tip of fibular head marked with a skin marking pen, and the appropriate downward distance measured.

Skin, and subcutaneous tissue are cut. The incision should be a little more than twice the length of the resected segment. The fibular periosteum is now exposed by separating the peroneus and soleus. The periosteum is incised in line of skin incision, and a 1.5 to 2 cm piece of fibula will be resected with a narrow blade oscillating saw.

Wound wash given closed in layers, and a light compression bandage given. Cases performed as a day care surgery and patients mobilized as soon as possible. Patients on follow up evaluated using radiographs and clinical scores enumerated above. All preoperative and postoperative and follow up (2 weeks, 2 months,6 months) radiographs and scores compared.

Results and observations

The present prospective observational study was done among 30 Medial compartment osteoarthritis cases admitted in orthopedics department of tertiary care centre during study period.

Table 1: Distribution of cases according to age (N=30)

Age in years	Frequency	Percentage
30-45	3	10%
46-55	11	36.67%
56-65	16	53.33%
Total	**30**	**40 (100%)**

The above table shows Distribution of cases according to age (N=30) majority of cases were found in 56-65 years age group 16 (53.33%) cases followed by in 46-55 years age group 11 (36.67) and 30-45 age group found 3 (10%) cases.

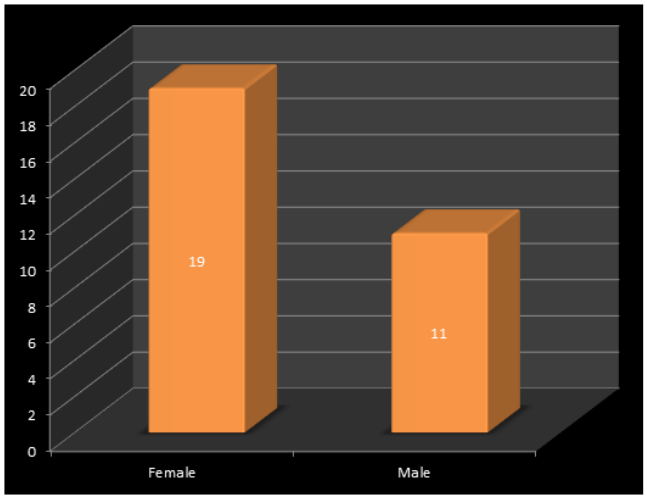

Figure 1: Distribution of cases as per sex (N=30)

Above Figure shows Distribution of cases as per sex (N=30) majority of study cases were Females contributing 19 (63.33%) and Males 11 (36.67%).

Table 2: Distribution of cases according to Kellgren and Lawrence grade (N=30)

Kellgren and Lawrence Grade	Frequency	Percentage
KL Grade II	10	33.34%
KL Grade III	20	66.66%
Total	**30**	**30 (100%)**

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Above table shows Distribution of cases according to Kellgren and Lawrence grade (N=30) majority of study cases Presented with KL Grade III e.g. 20 (66.66%) and 10 (33.34%) cases with KL Grade II.

Table 3: Distribution of cases according to VAS Preoperatively (N=30)

VAS Preoperatively	Frequency	Percentage
Mild (1-3)	4	13.33%
Moderate (4-6)	7	23.33%
Severe (7)	9	30%
Very Severe (8-9)	10	33.34%

The above table shows Distribution of cases according to VAS Preoperatively (N=30) Majority of cases VAS was (8-9) 10 cases, followed by 9 cases had a VAS 7, moderate pain VAS (4-6) was found in 7 cases and 4 cases reported mild pain VAS (1-3).

Table 4: Distribution of cases according to VAS Post operative follow up at 6 Months (N=30)

VAS Post operative follow up at 6 Months	Frequency	Percentage
Mild (1-3)	10	33.34%
Moderate (4-6)	11	36.67%
Severe (7)	5	16.67%
Very Severe (8-9)	4	13.33%

The above table shows Distribution of cases according to VAS Post operative follow up at 6 months (N=30) Majority of cases reported Moderate pain (4-6) e.g 11,followed by Mild pain (1-3) in 10 cases, 5 cases with Severe pain (7) and 4 cases reported Very Severe pain (8-9)

Table 5: Association of KL Grade III medial compartment Osteoarthritis of knee with gender

Gender	KL Grade III Medial compartment Osteoarthritis				
	Present	Percentage	Absent	Percentage	Total
Male	4	36.36%	7	63.64%	11(36.66%)
Female	16	84.21%	3	15.79%	19(63.34%)
Total	**20**	**66.66%**	**10**	**33.34%**	**30(100%)**

The Chi-square statistic value = 7.177, p-value is 0.007384. The result is significant at $p < .05$. Inference: There is statistically significant association between KL Grade III medial compartment Osteoarthritis of knee with gender.

Table 6: The pre-operative, post-operative and final follow-up values of radiological parameters like Lateral FTA and joint space ratio (N=30)

Parameters	Pre-operative value	Post-operative value	Final follow-up value
Lateral FTA	183.80 ± 2.57	182.60 ± 1.94	182.60 ± 1.76
Joint space ratio	0.28 ± 0.03	0.27 ± 0.03	0.27 ± 0.03

The above table shows the pre-operative, post-operative and final follow-up values of radiological parameters like Lateral FTA and joint space ratio (N=30)

Lateral FTA Pre-operative value 183.80 ± 2.57, Post-operative value 182.60 ± 1.94, Final follow-up value 182.60 ± 1.76, Joint space ratio Pre-operative value 0.28 ± 0.03, Post-operative value 0.27 ± 0.03, Final follow-up value 0.27 ± 0.03.

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Discussion

The present prospective observational study was done among 30 cases of medial compartment osteoarthritis of knee admitted in orthopedics department of tertiary care centre during study period.

Table No. 1: Distribution of cases according to age (N=30) majority of cases were found in 56-65 years age group 16 (53.33%) cases followed by in 46-55 years age group 11 (36.67) and 30-45 age group found 3 (10%) cases. Similar result observed in the study by Liu et al. (2018) [21] He reported that the average age was 59.45±8.82 years. Di Qin et al (2018) [22] He found that the Fifty-two patients mean age of 62.5 6.7 years.

Another study conducted by Sabir AB et al (2020) [23] He found that the Mean age was 48.4 (35–65) years. Yang ZY et al (2015) [24] He reported that the A total of 110 patients with an average age of 59.2 years. Huda N et al (2020) [25] He observed that the mean age was 58.30 years.

Figure No. 1: Distribution of cases as per sex (N=30) majority of study cases were Females contributing 19 (63.33%) and Males 11 (36.67%). Similar result observed in the study by Wang et al (2017) [26] He conducted a study on 47 patients Majority of their patients were females 35 and males were 12. Yang ZY et al (2015) [24] He reported that the A total of 110 patients, including 34 males and 76 females. Di Qin et al (2018) [22] He found that the Fifty-two patients, including 45 women and 7 men.

Table No. 2: Distribution of cases according to Kellgren and Lawrence grade (N=30) majority of study cases Presented with KL Grade III e.g. 20 (66.66%) and 10 (33.34%) cases with KL Grade II. Similar result reported by Liu et al. (2018) [21] He reported that the According to KL grading, there were 17 knees of grade 2, 47 knees of grade 3, and 47 knees of grade 4.Another study conducted by Wang J et al (2019) [26] He reported that the Ninety-three knees of K-L grade I were categorized as non-knee OA, and 467 knees of K-L grades II-IV were categorized as knee OA.

Table No. 3: Distribution of cases according to VAS Preoperatively (N=30) Majority of cases VAS was (8-9) 10 cases, followed by 9 cases had a VAS 7, moderate pain VAS (4-6) was found in 7 cases and 4 cases reported mild pain VAS (1-3). Similar finding observe in the study by Wang et al (2017) [26] He conducted a study on 47 patients with mean VAS score decreased from 8.02 pre-operatively to 2.74 at final follow-up. Liu B et al (2018) [21] He found that the average preoperational VAS score were 7.08±1.41 points. Huda N et al (2020) [28] He observed that the VAS scores also showed significant improvement at 3 months, but not at 6 and 12 months follow-up. Yang ZY et al (2015) [24] He reported that the Mean VAS score and interquartile range were 2.0 and 2.0, significantly lower than the preoperative data (7 and 1.0, respectively; P<.001).

Table No. 4: Distribution of cases according to VAS Post operative follow up at 6 Months (N=30) Majority of cases reported Moderate pain (4-6) e.g 11,followed by Mild pain (1-3) in 10 cases, 5 cases with Severe pain (7) and 4 cases reported Very Severe pain (8-9). Similar result observed in the study by Deng XT et al (2021) [29] He revealed that the VAS scores of the curvature group and non-curvature group were 2.43 ± 0.88 vs 2.83 ± 0.94 at 6 months. Huda N et al (2020) [52] He observed that the VAS scores also showed significant improvement at 3 months, but not at 6 and 12 months follow-up. Yang ZY et al (2015) [24] He reported that the Mean VAS score and interquartile range were 2.0 and 2.0, significantly lower than the preoperative data (7 and 1.0, respectively; P<.001).

Table no.5: Association of KL Grade III medial compartment Osteoarthritis of knee with gender (N=30) There is statistically significant association between KL Grade III medial compartment Osteoarthritis of knee with gender.

Similar result observed in the study by Wang J et al (2019) [27] He reported that the significant association between KL Grade III medial compartment Osteoarthritis of knee with gender.

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Table no.6: The pre-operative, post-operative and final follow-up values of radiological parameters like Lateral FTA and joint space ratio (N=30) Lateral FTA Pre-operative value 183.80 ± 2.57, Post-operative value 182.60 ± 1.94, Final follow-up value 182.60 ± 1.76, Joint space ratio Pre-operative value 0.28 ± 0.03, Post-operative value 0.27 ± 0.03, Final follow-up value 0.27 ± 0.03.Similar result found in the study by Prakash (2019)[2] He found that the preoperative tibio-femoral angle was 181° ± 1.9° which changed to 178° ± 2.0°post operatively, while the medial joint space widened from 1.2 ± 0.7 mm to 4.5 ± 1.1 mm, both being statistically significant (P < .001). Likewise, the lateral joint space showed uniform reduction post operatively from 7.2 ± 1.2 mm to 5.2 ± 1 mm (P < .001).

Conclusions

Majority of cases were found in 56-65 years age group. Mostof study cases were Females.Most of study cases Presented with KL Grade III.Majority of cases VAS Preoperatively Score was (8-9).VAS Post operative follow up at 6 months Most of cases reported Moderate pain (4-6).There is statistically significant association between KL Grade III medial compartment Osteoarthritis of knee with gender.Lateral FTA Pre-operative value 183.80 ± 2.57, Post-operative value 182.60 ± 1.94, Final follow-up value 182.60 ± 1.76, Joint space ratio Pre-operative value 0.28 ± 0.03, Post-operative value 0.27 ± 0.03, Final follow-up value 0.27 ± 0.03.

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