

Proximal fibular osteotomy: Alternative approach with medial compartment osteoarthritis knee – Indian context

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ABSTRACT

Context: Osteoarthritis knee is a common degenerative disorder for which various treatment modalities are available. Our aim was to evaluate the functional outcome and effectiveness of proximal fibular osteotomy (PFO) in patients who are unwilling to undergo total knee arthroplasty or high tibial osteotomy (HTO). **Aims:** To evaluate functional outcome of medial compartment osteoarthritis managed with PFO, clinically as well as radiologically in Indian study settings. **Settings and Design:** Study was done at the Department of Joint Replacement and Orthopedics, Tata Main Hospital, Interventional prospective cohort study. **Subjects and Methods:** Consecutive samples fulfilling study criteria were evaluated preoperatively with visual analogue scale (VAS) and preoperative functional status was assessed. The functional outcome was measured by pre- and postoperative VAS, Tegner Lysholm Knee score; X rays were used to measure pre- and postoperative “Medial joint space” and “Femoro-tibial angle (FTA).” **Statistical Analysis:** All the data were tabulated, and then analyzed with appropriate statistical tools “MedCalc. Chi-square test, test of significance and student paired and unpaired T-test were used. **Results:** There was a significant improvement in VAS score, Tegner Lysholm score postoperatively as compared to the pre-operative scores. FTA and medial joint space were also increased postoperatively. **Conclusions:** PFO is a good surgical alternative for medial compartmental osteoarthritis of the knee with an excellent functional outcome. A simple surgical procedure, non-requirement of specialized instruments, and low cost of surgery are some of the advantages for patients who do not want to undergo HTO or total knee replacement (TKR).

Keywords: Alternative to total knee replacement, alternative to unicompartmental knee replacement, cost-effective treatment in osteoarthritis knee, high tibial osteotomy, medial compartment osteoarthritis, osteoarthritis patients not willing for TKR, proximal fibular osteotomy

Introduction

Osteoarthritis of the knee is a common degenerative disorder encountered in a day to day practice. Most of the people in our setup take long-term nonsteroidal anti-inflammatory drugs (NSAIDs) to get relief from pain. According to the World Health Organization (WHO), 9.6% of men and 18.0% of women aged over 60 years have symptomatic osteoarthritis worldwide^[1] and is also the most frequent joint disease with a prevalence

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of 22% to 39% in India.^[1] A study conducted in India among adults had shown a significant difference in the prevalence of OA between rural (56.6%) and urban areas (32.6%).^[2] Due to lifestyle habits, Asians have a higher risk for knee joint arthritis compared to Americans and Europeans.^[3]

Although there are various modalities of treatment like physiotherapy^[4,5] along with NSAIDs, high tibial osteotomy (HTO),^[6,7] unicompartmental knee replacement,^[8-10] or total knee replacement (TKR)^[11] are available in the armamentarium of an orthopedic surgeon to relieve the patient from pain, most of the patient in our set up choose to take conservative approach using painkillers as their mainstay of treatment.^[12] Although we do not have any Indian data regarding NSAID-induced

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nephropathy, American data suggest that approximately 2.5 million people experience NSAID-induced renal injury every year.^[13] NSAID users have a three-fold greater risk of developing clinical AKI compared with non-NSAID users in the general population.^[14] Patients with normal renal function are unlikely to develop AKI secondary to taking NSAIDs, but those with a history of hypertension, heart failure, or diabetes have a higher chance of developing these complications.^[14] With increasing age, osteoarthritis patients usually have one or more of these above co-morbidities.

TKRs are now the gold standard of managing OA knee, however, it is not free from complications^[15] and has a high financial repercussion on the patients. As per an article by Molloy IB *et al.*^[16] average cost of TKR in America was \$22,837 in 2013. In India, the average cost of single knee replacement varies from approximately Rs 1,60,000 to Rs 2,16,000 in different cities.^[17] Even in our center average cost of TKR of single knee costs around Rs 1.5 to 1.8 lakhs, whereas the average income of Indian household is approximately Rs 1.2 lakhs per year,^[18] which means for one knee surgery, they have to spend the entire income of 1 year.

Most of the patients who come to our outpatient department (OPD) are scared of major surgeries like HTO, unicompartmental knee, or TKR because of their perceived risk of failure of surgery, poor financial status, some wants to delay TKR to arrange money and some felt that TKR is a big and painful surgery.^[12]

The current treatment modalities are costly and not affordable by the masses considering the economic implication to the dependent patients and their families in the Indian scenario.^[18]

Considering these problems, we searched PUBMED and other literatures and found few articles on proximal fibular osteotomy (PFO)^[19,20] as an alternative approach to medial compartmental osteoarthritis of the knee and we wanted to see the result of PFO in patients who are unwilling to undergo total knee replacement surgery for various reason.

PFO is a simple and low-cost technique. It provides quick relief to patients with reduced hospital stay leading to reduced hospital charges. The average length of stay in hospital following TKR is 5.4 days in the UK,^[21] whereas patients with PFO can be discharged the next day of surgery.^[12]

In all these cases, identified from among a random selection of patients, in the time frame of the study, within August 2017 to August 2019 (24 months of study period “in- patient’s” of the Department of Joint replacement and Orthopaedic surgery, Tata Main Hospital, special consent was taken after taking clearance from the ethical committee.

PFO works in the principle of diverting the mechanical axis to the lateral compartment, which is not affected by the arthritic process, leading to relief of symptoms.^[19,20,22]

There are also articles from Dr. L. Prakash, where he has shown very good results from PFO.^[23]

Subjects and Methods

Study site: The study was a prospective, interventional, and cohort study conducted in the department of Joint replacement and Orthopaedic surgery at our center, which is a 940-bedded multidisciplinary teaching hospital. Approval by the ethics committee of Hospital, Jamshedpur was taken and written informed consent of patients was obtained to conduct the study.

The study was conducted from August 2017 to August 2019 (24 months of the study period) in the “in- patient’s” of department of Joint replacement and Orthopaedic surgery, among consecutive samples fulfilling study criteria during our study period. 30 patients were identified to be taken for the study as per the defined inclusion criteria.

Defined inclusion criteria

1. Patients with knee pain and difficulty in walking due to medial compartment osteoarthritis.
2. Weight-bearing X-ray showing medial compartment OA knee.

Exclusion criteria

1. Genu valgus
2. Lateral compartment OA knee
3. More than one compartment involved
4. Bone to bone contact on weight-bearing X-ray
5. Acute major trauma
6. Inflammatory joint disease
7. Malignant tumors
8. Patient not fit for surgery (abnormal liver or renal functions)
9. Patient not willing for surgery.

The functional outcome will be measured by pre-and postoperative visual analogue scale (VAS), Tegner Lysholm Knee score; X rays to be taken both pre-and postoperative period to measure “Medial joint space” as well as the “Femoro-tibial angle (FTA)”, “whereas VAS and Tegner Lysholm knee scores will be taken on immediate post-op, at 14th postop at 6 weeks, at 3 months, 6 months, and 2 years’ time.

Surgical technique

Under spinal anesthesia and tourniquet control, patients were placed supine on the operating table with a pillow below knee and sandbag under ipsilateral hip.

Through fluoroscope, the fibular head was identified and point 7 cm distal to head of fibula was marked over the skin with the help of a radio-opaque scale [Figure 1].

A skin incision of approximately 4 cm given over the lateral aspect of the leg and the bone was exposed [Figure 2].

Care was taken to identify the superficial and deep peroneal nerve. Multiple drill holes were made over fibula in an interval of 2 cm and osteotomy was done [Figure 3].

The radiographically stress view was taken both before and after osteotomy to note the changes in lateral joint space. [Figure 4 and 5].

Wound was closed and sterile dressing done.

Results

In our study, 27 patients had undergone PFO, out of which 3 patients had bilateral medial compartmental osteoarthritis of the knee. It may be noted that these 3 bilateral osteoarthritis knee were so influenced with the result of the first PFO that they insisted us go for the same procedure on the other side.

These patients were followed for a maximum of 2 years and some patients were followed up for a minimum period of 6 months due to the constraint of our limitation of study time.

In this study, a maximum number of patients was found to be in the 6th decade of life with a mean (standard deviation (SD)) age of 55.80 (± 4.41) years. There were 10 male and 20 female patients. Sixteen PFOs were done on the right knee with 14 on the left side.

In our study, pain was assessed by VAS. The mean (SD) preoperative VAS score of the study population was 8.1 (± 0.66), which decreased to 2.7 (± 0.60) at 3 months postoperation and 2.37 (± 0.49) at 6 months postoperation. Preoperatively there was a VAS score of 9 in 8 (26.66%), 8 in 17 (56.67%), and 7 in 5 (16.67%). Postoperatively mean (SD) VAS at 3 months postoperatively was 2.7 (± 0.60) with a VAS of 4 in 2 (6.67%), 3 in 17 (56.67%), and 2 in 11 (45.83%). Mean (SD) VAS at 6 months postoperation is 2.37 (± 0.49) with a VAS of 3 in 11 (36.67%) and 2 in 19 (63.33%). The differences in VAS

pre- and postoperatively has a 'P value' of < 0.0001 , which is statistically highly significant. [Figure 6].

Out of the 30 patients on preoperative evaluation, the Tegner Lysholm knee score of 26 patients were in poor (86.67%) grade while 4 patients had fair (13.33%) grade.

On postoperative day 14, all 30 patients had fair grade (100%). After 6 weeks of operation, all 30 patients had fair grade (100%).

After 3 months of operation, 19 patients had fair grade (63.33%) and 11 patients had good (36.67%) grade.

After 6 months of operation, 16 patients had fair (53.33%) grade while 14 patients had good (46.67%) grade.

Using Chi-square test to find the significance 'P value' is < 0.0001 , which is statistically highly significant. [Figure 7].

Six patients were followed for 2 years. The mean VAS at the end of 6 years of these 6 patients is 2.33 and the mean Tegner Lysholm knee score for these 6 patients is 85.33 (grade = good). We are expecting similar results in the rest of the patients in due course of time. [Figure 8].



Figure 2: Superficial surgical dissection

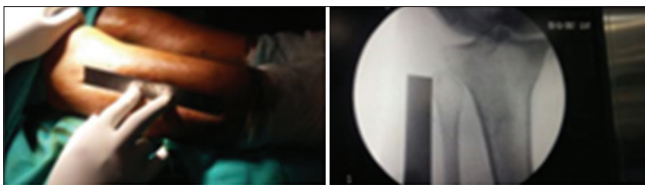


Figure 1: Intra-operative marking with radiopaque scale and confirmation on C arm



Figure 3: Osteotomy being performed, pre- and postosteotomy clinical picture



Figure 4: Medial joint narrowing on a stress view

Medial joint space was measured on plain AP X-ray of the knee after adjusting the magnification factor. The preoperative mean (SD) value of 30 patients was 5.63 mm (\pm 0.21) and the mean (SD) at 6 months postoperatively was 6.05 (\pm 0.27).

To test the statistical significance, paired t-test was used and *P* value of $<$ 0.0001 was considered statistically highly significant. [Figure 9].

Mean (SD) FTA preoperatively was 178.80 (\pm 32.69) and 179.45 (\pm 0.94) postoperatively at 6 months. The calculation of *P* value revealed it to statistically insignificant. [Figure 10].

We encountered a few complications where we had 3 cases of extensor hallucis longus (EHL) weakness and 1 surgical site infection. The EHL weakness recovered completely after

4 months. Surgical site infection was treated by exploring the wound and a large hematoma was noted for which a thorough lavage was done. The infection subsided within 2 weeks.

We noted a significant drop in VAS and a significant increase in Tegner Lysholm knee score.

Discussion

Osteoarthritis of the knee is the most common degenerative condition of the knee after the fifth decade.^[24] Most of the time it affects the medial compartment of the knee causing significant pain. There is a 4-fold increase in odds of medial progression of the knee with varus alignment.^[25]

Although initially medial compartmental osteoarthritis of the knee can be managed with physiotherapy, NSAIDs, and local analgesic applications.^[4,5] However, in long term, these patients require surgical procedures like HTO, unicompartmental knee replacement, or TKR at some point in time.^[26]

HTO tends to relieve pain by diverting the weight-bearing axis to the lateral compartment and effectively relieves pain.^[7] However, this needs surgical expertise and is costly. Infection, non-union,

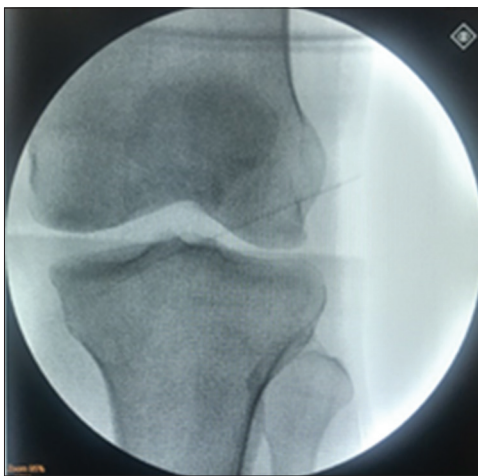


Figure 5: Rectification of joint after osteotomy

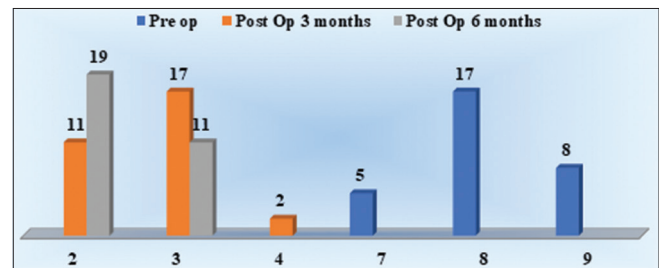


Figure 6: VAS score

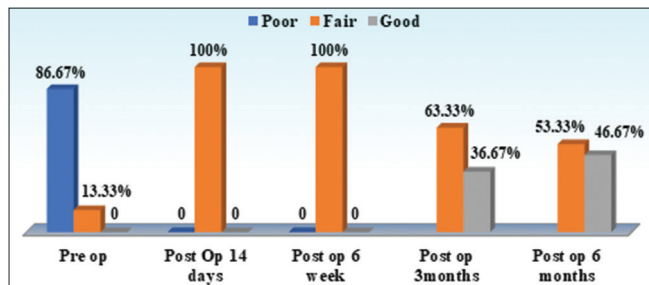


Figure 7: Tegner Lysholm knee score

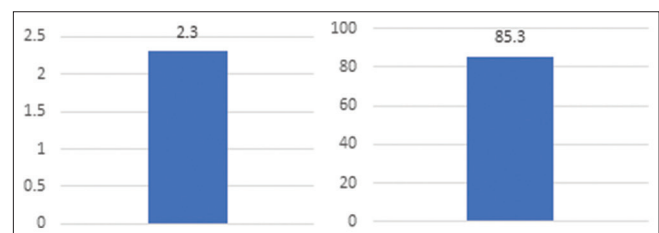


Figure 8: VAS and Tegner Lysholm knee score

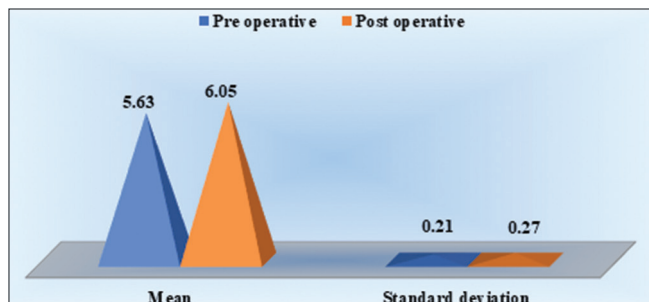


Figure 9: Mean medial joint space at different times

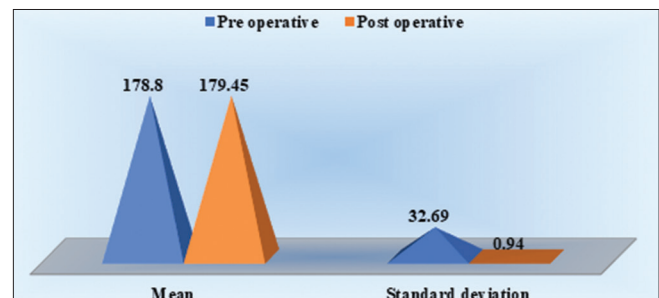


Figure 10: Femoro-Tibial Angle

common peroneal nerve injury are some of its disadvantages.^[27] Another problem with HTO is while converting these patients to TKRs one needs to remove the plate and then go for TKR. Technically, converting HTO to TKR is more difficult because of the distortion of the proximal tibial metaphysis and due to ligamentous imbalance.^[26]

Unicondylar knee replacement surgery is effective but requires highly specialized surgical expertise and specialized instrumentation.^[8] The high cost of surgery and revision cost is a prohibitive factor for most of the Indian population because of low per capita income.^[28]

TKR is too radical surgery for a single compartment involvement and is cost-prohibitive. Also, this requires expertise and can only be done in higher centers. After TKR patients cannot squat as they cannot fully flex the knee,^[29] which is required for many of the day to day activities of common Indian population.

One of the recent study done by Harshwardhan *et al.* suggest good functional outcome in varus deformity of the knee, reducing joint pain.^[30]

Cost is also a prohibitive factor for TKR surgeries. Even in developing countries, 70% of patients were willing to pay something while 14% of patients did not wish to pay for their TKR surgeries.^[31] The average Indian population has an income of INR 10,534/month.^[28] Google search showed an average cost of single knee replacement to vary from Rs 1,60,000 to Rs 2,16,000 in different cities in India.^[17] Those patients who are economically sound have a perceived fear of surgery,^[12] which discourages them from undergoing either HTO, UKR, or TKR. PFO is an alternative approach suitable for these types of patients. Family physicians are the first contact for arthritic knee patients. If they are aware of this procedure, then they can disseminate this alternative mode of surgery to the masses who are either unwilling to go for HTO, TKR, or UKR for any reason.

PFO hypothetically works on the principle of redistribution of forces towards the lateral compartment as described by Wang *et al.*, Yang *et al.*, and Shanmugasundaram *et al.*^[19,20,22]

In our study, we found significant pain relief as evidenced by VAS [Figure 6] and Tegner Lysholm knee score. Biomechanically the distribution of force seems to be shifted towards the lateral compartment as evidenced by an increase in Tegner Lysholm knee score Figure 7, medial joint space [Figure 8], and decrease in FTA [Figure 9]. Patients can perform all the activities including squatting, which is essential for daily activities of most of the Indian population. Moreover, this is in an implant-less and low-cost surgery, which can be done in any setup.

We encountered three cases of EHL weakness, which was probably due to excessive stretch over the nerve due to the placement of spikes that later on we avoided and instead we used Langenback retractors and did not encounter this problem further.

Conclusions

In our view, PFO is a good surgical alternative to HTO, unicondylar knee arthroplasty, or TKR in patients with medial compartment osteoarthritis knee especially for the rural population at large who do not have access to advanced facilities and resources or willingness to undergo such radical surgeries.

However, long-term follow-up and a large sample size are needed for future studies.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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