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A Nobel procedure for symptomatic pain relief in medial compartment knee osteoarthritis in countries of low socioeconomic status

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Abstract

Background: The author found simpler, safe, effective, affordable, easy to perform, surgical procedure called partial fibular osteotomy (PFO) as compared to high tibial osteotomy and total knee replacement which could effectively relieve knee pain and also correct the varus deformity for patient with medial compartment knee osteoarthritis kellgren and Lawrence grade I to III.

Methods: 40 patients with medial compartment knee osteoarthritis who presented between January 2018 to July 2019 were treated by proximal fibular osteotomy in author's hospital all were followed for 1.5 yrs.

Anteroposterior and lateral weight bearing radiographs, the femorotibial angle (FTA) and lateral joint space and America knee society score (KSS) and visual analog scale (VAS) of knee joint were evaluated preoperatively and at 3month, 6 month and at final follow up respectively.

Results: At final follow mean FTA and lateral knee joint space were (172 ± 1.8) and (2.18 ± 0.8) , which were significantly smaller than those measured preoperatively (184.27 ± 2.4) and (5.22 ± 1.2) respectively; both $p < 0.05$

Mean KSS at final follow up was (74.66 ± 12.54) , significantly higher than preoperative score of (55.6 ± 11.54) $p < 0.05$, mean VAS score at final follow up (2.33 ± 0.98) significantly lower than preoperative VAS (6.66 ± 1.24) .

Conclusion: The author found that proximal fibular osteotomy is a simple, safe, effective, affordable, easy to perform, cost effective, gives excellent pain relief and can significantly improve both the radiographic appearance and function of affected knee joint.

This procedure can be alternative treatment option for medial compartment knee osteoarthritis kellgren and Lawrence grade I to III especially in countries with limited health care delivery.

Keywords: A Nobel procedure symptomatic pain surgical procedure, affordable

Introduction

Osteoarthritis (OA) of knee joint is a common disease that causes significant disability, the global prevalence of radiographically confirmed symptomatic knee OA was estimated to be 3.8%, it was higher in female (4.8%) than in males (2.8%) 1. Knee osteoarthritis (OA) is an enduring, progressive degenerative disease with accompanying joint pain, stiffness, and deformity 2. The risk of developing OA substantially increases with each decade after age of 45 years 3.

Among reported upper and lower extremity sites the most common region for OA to manifest is the medial compartment of knee. The initiation and progression of knee OA involves structural, mechanical, genetic and environmental factor.

The tibiofemoral mechanics and loading patterns during walking have a significant influence on the regional development of articular cartilage. Disruption of normal gait mechanics with trauma, acute injury, ligamentous laxity, weight gain and improper footwear can shift the loading patterns during weight bearing to cartilage regions not well adapted to accept those loads. Although normal healthy cartilage respond positively to loading and increase regional thickness, diseased or injured cartilage degenerates and decreases regional thickness ^[4]

Ageing or injury to the knee joint increase joint laxity and permits excess or aberrant motion about the knee, a process that exacerbate progression of OA ^[5]

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Knee varus deformities, characterised by mechanical femoral axis of less than 180 degree on full leg standing anteroposterior radiograph and narrowed medial joint space are common in patient with knee OA [6].

Treatment for knee osteoarthritis can be broken down into non surgical and surgical management. Initial treatment begins with non surgical modalities and moves to surgical treatment once the non surgical methods are no longer effective [7]

Non surgical treatment option include patient education activity modification, physical therapy, weight loss, knee bracing etc.

Surgical treatment options includes osteotomies (High tibial osteotomy, Proximal fibular osteotomy), unicompartmental knee arthroplasty (UKA), and total knee arthroplasty (TKR).

High tibial osteotomy can be technically demanding procedure and may result in complications including neuromuscular injury, iatrogenic fractures and non union [8, 9]. Total knee arthroplasty can correct lower extremity alignment, relieve pain, and improve function significantly. However for younger active patients or patients with moderate OA it may not be the treatment of choice [10].

The author believe that lateral support to osteoporotic tibia by fibula soft tissue complex may lead to non uniform settlement and degeneration of plateau bilaterally [11, 12]. This result in shifting load from normal distribution medially to medial plateau and consequently leads to knee varus, aggravating the progression of medial compartment knee OA of knee joint.

Proximal fibular osteotomy weakens the lateral fibular support and leads to a correction of varus deformity which can subsequently shifts the loading force from medial compartment more laterally leading to decreased pain and satisfactory functional recovery. Although proximal fibular osteotomy is a simple procedure care should be taken to avoid damaging the common peroneal nerve [2]

The goal of this prospective study was to evaluate the radiographic and clinical outcomes of patient with medial compartment OA treated with partial fibular osteotomy with mean follow up of 12 months

Material and methods

This study was approved by ethical committee of Gandhi medical college and Hamidia group of hospitals Bhopal (MP) India. All patients agreed to participate in the study and gave informed consent.

Study populations

Inclusion criteria

- 1) Patients with symptomatic medial compartment knee OA kellgren and Lawrence grade I to III who gave consent for surgery after being briefed about the complete procedure including video and clinical data display to them.
- 2) Patients in whom conservative management failed (i.e patients educations, activity modifications, physical therapy, weight loss, knee bracing, analgesics etc.).
- 3) Patients aged between 45- 70 yrs.

Exclusion criteria

- 1) Patients in whom post traumatic OA or inflammatory joint disease and history of previous operation or fracture of knee.
- 2) Patients less than 45 years, and not more than 70 years.
- 3) Osteoarthritis knee kellgren and Lawrence grade IV.
- 4) Between January 2018 and July 2019, a total of 40

patients with medial compartment knee OA kellgren and Lawrence grade I to III were operated (proximal fibular osteotomy)

Criteria for evaluations of results

- **(AKSS) Americal knee society score [13] preoperatively and postoperatively.**

KSS major is calculated by measuring factors such as pain, stability, and range of motion, Further functional KSS include measuring activities of patients.

- **Visual analog scale (VAS) [14]**

Preoperatively and postoperatively. Higher score correspond to more serious pain.

- **Femoral tibial angle (FTA) [15]**

On anteroposterior radiograph of knee preoperatively and postoperatively. FTA was the lateral angle of femoral lower axis and tibial upper axis formed in knee joint.

- **Lateral knee joint space [15]**

On anteroposterior radiograph of knee - preoperatively and postoperatively. (mark a point on outer 1/6th of a line running through top of medial and lateral condyl of tibia and then draw another line perpendicular to previous line from this point upto lateral femoral condyl, this second line stands for distance of lateral knee joint space).

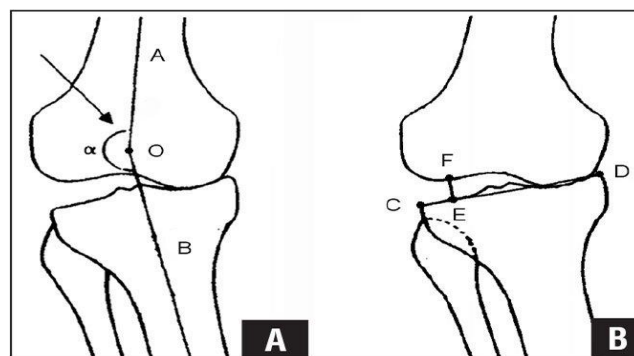


Figure showing FTA (A) and Lateral knee joint Space (B).

Patients were followed up at 1 months, 6 months, 12 months postoperatively

Surgical technique

Proximal fibular osteotomy was done by same team of surgeons, the patient were placed in supine position after administration of spinal anaesthesia, under adequate antibiotics coverage (inj ceftriaxone 1gm iv in 100ml normal saline over 10-15 min) with tourniquet inflated for haemostats and fibular exposed by posteriolateral approach, first the fibular head was marked to avoid injury to common perineal nerve. A 5 cm longitudinal incision were made over the lateral skin of proximal fibula. The fascia was then incised in line and fibula was exposed between peroneus and soleus muscle by posteriolateral approach. Two broad osteotomes were used to protect the soft tissue along fibular medial surface. PFO was performed by removing 2-3 cm length of fibula at a site 6-10 cm away from caput fibulae by using oscillating saw. Then 0.9% sodium chloride was used to wash it off thoroughly. Bone wax used to seal broken ends. The muscle, fascia and skin were sutured separately

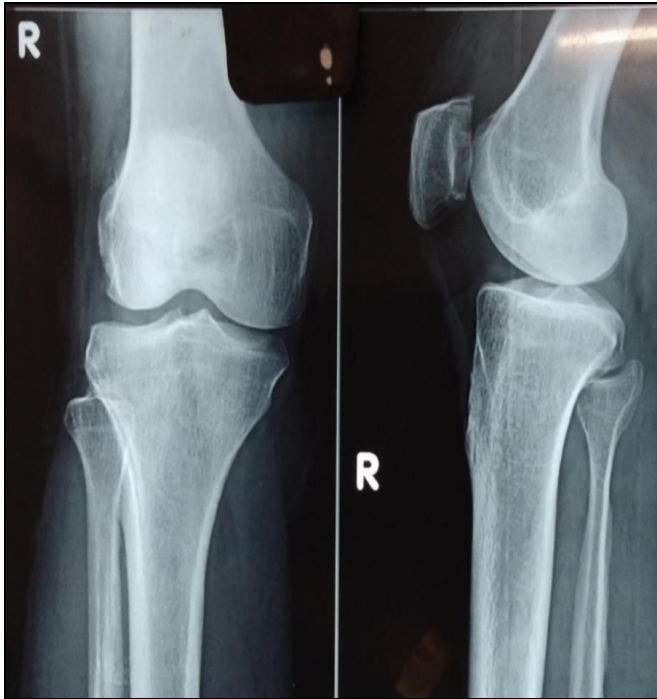


Fig 1: Pre operative X-ray of Right knee



Fig 2: PFO was performed by removing a 2- to 3-cm length of fibula at a site 6 to 10 cm below the caput fibulae



Fig 3: Approximately 5-cm longitudinal incision was made over the lateral skin of the proximal fibula



Fig 4: PFO was performed by removing a 2- to 3-cm length of fibula at a site 6 to 10 cm below the caput fibulae by using the oscillating saw

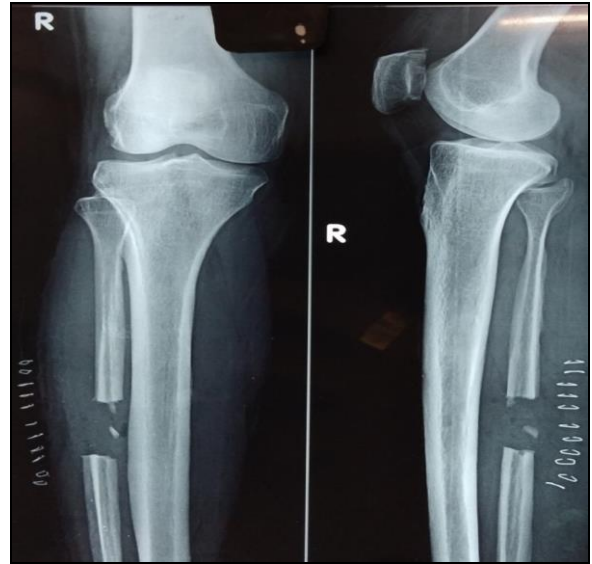


Fig 5: Post operative X-RAY of RT knee after 15 days



Fig 6: Patient showing pain free flexion of right knee at 1 year follow up



Fig 7: Patient showing pain free extension at 1 year follow up



Fig 8: Post operative X-RAYS after 1 year of Right knee

Postoperative care

Patients were started on antibiotics and analgesics in immediate postoperative periods as follows

- Inj Ceftriaxone 1gm iv 12 hourly for 7 days.
- Inj Amikacin 500 mg iv 12 hourly for 5 days.
- Inj Diclofenac 1 ampule im 8 hourly for 5 days.
- Inj Ranitidine 1 ampule iv 8 hourly for 5 days.

Dressing was done on 3rd, 5th and 8th post operative day and suture removal done on 12th post operative day.

Statistical analysis

Mobilisation started on next postoperative day.

Follow up done at TSR, 3 months, 6 months. and 12 months.

Statistical analysis were performed using SPSS version 19.0 statistical software for window. Continuous variable were expressed as mean+_{SD} and dichotomous variable expressed as percentages. Two tailed t test was applied to analyse the FTA and Lateral joint space data. The non parametric test

(Wilcoxon's signed rank test) was applied to analyse the VAS and KSS data. A *P* value less than .05 was considered to be significant.

Results

A total of 40 patients, including 24 females and 16 males were followed up for 12 months, majority of the patients were in the age group of 56-60 years (33.33%) followed by 45-50 years (26.7%). The right knee operated in 12 patients and left knee in 18 patients.

Knee pain relief was seen in all patients after surgery,

At final follow up mean VAS score decreased significantly from 6.66+_{1.24} preoperative to 2.33+_{0.98} postoperatively, the comparison was significant with *P* value<0.05.

At final follow up mean AKSS score increased significantly from 55.6+_{11.54} preoperatively to

74.66+_{12.54} postoperatively, the comparison was significant with *P* value<0.05

Table 1: Clinical parameters

Clinical score	Pre-op values	Post-op values	P values
Visual analog scale	6.66+ _{1.24}	2.33+ _{0.98}	<0.05
American knee society Score	55.6+ _{11.54}	74.66+ _{12.54}	<0.05

Radiological parameter also changed significantly after surgery

At final follow up mean FTA decreased significantly from 182.27+_{2.4} preoperative to 172+_{1.8} postoperatively, the comparison was significant with *P* value<0.05.

Mean lateral joint space decreased significantly from 5.22+_{1.2} preoperative to 2.18+_{0.8}

postoperatively, the comparison was significant with *P* value<0.05.

Table 2: Radiological parameters

Radiological parameter	Pre-op values	Post-op values	P values
Femoral tibial angle	182.27+ _{2.4}	172+ _{1.8}	<0.05
Lateral joint space	5.22+ _{1.2}	2.18+ _{0.8}	<0.05

No cases were reported to have any complications like infections and common perineal nerve injury immediately after operations or at final follow.

Discussion

Knee osteoarthritis causes pain and impaired mobility of joint leading to difficulties in activities of daily living

For medial joint osteoarthritis surgical option include knee arthroplasty or high tibial osteotomy (HTO), both are very effective procedures astray relieves pain and improves knee varus deformity but they have their own limitation like component loosening, complex procedures, use of implant for stabilization in open wedge osteotomy, iatrogenic fractures, delayed weight bearing until union of osteotomy site, prolonged recovery

period, recurrence of varus deformity, revision of surgery due to persistent pain, and lastly the high cost of implant and surgery.

In this scenario there is a need for a procedure which is simple, safe, effective, affordable, easily reproducible, gives good functional result and improves quality of life of the affected patients.

These above mentioned demands are met by a newly devised surgical procedure called proximal fibular osteotomy (PFO).

Yang *et al* [2], proposed that lateral support provided to the tibia by fibula soft tissue complex may lead to non uniform settlement and degeneration of plateau, this causes the load from normal distribution to shift medially to medial plateau

leading to knee varus leading to aggravation of medial compartment osteoarthritis of knee.

Proximal fibular osteotomy weakens the lateral fibular support leading to correction of varus deformity by improving axial alignment. Hence subsequently shifting the loading force from medial compartment more laterally leading to decreased pain and slowing the degenerative process so delaying arthroplasty if needed.

As it is performed on fibula there is no patellar tendon issue and it also does not affect future replacement surgery.

Although proximal fibular osteotomy is a simple procedure, care should be taken to avoid potential common peroneal nerve injury.

Limitation of our study include its lack of control group for comparison, Smaller number and short term follow up were areas where further studies are required.

Conclusion

Based on the finding of present study it was concluded that proximal fibular osteotomy is a simple, safe, effective, affordable, easy to perform, cost effective and gives excellent pain relief postoperatively.

PFO also result in improvement in medial compartment space, FTA angle, VAS score and KSS score which are important outcome parameter

It is associated with lesser complications like fracture, non union, compartment syndrome, deep vein thrombosis, delayed time to full weight bearing, common perineal nerve palsy,

wound infection, prosthesis infection and prosthesis loosening which are commonly seen in other modalities like HTO and TKA. PFO also has shorter recovery period as compared to HTO and TKA.

All patients had pain relief, they were able to walk without taking aids, squats, climb stairs up and down and able to sit cross legged which they had difficulty to perform.

Hence PFO is a Nobel promising alternative procedure in most developing countries because of there financial and health care delivery limitation. Also, it a promising alternative surgery for osteoarthritis of medial compartment of knee especially for patient who cannot undergo TKA because of certain medical comorbidities.

Further long term studies are required to substantiate these results.

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