

ORIGINAL RESEARCH

Management of the osteoarthritis of the medial compartment of the knee with proximal fibular osteotomy: Assessment of the efficacy and clinical outcomes

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ABSTRACT

Osteoarthritis (OA), which will affect 86 million people worldwide by 2020, is the most prevalent type of arthritis in the Indian population. Treatment options include unicompartmental arthroplasty, high tibial osteotomy, total knee arthroplasty and high tibial osteotomy with a proximal fibular osteotomy (PFO). PFO helps in decreasing the pain and satisfactory functional recovery. The purpose of this study was to evaluate the radiological and clinical outcomes of medial compartment OA knee treatment with minimally invasive PFO as a novel and alternative modality of care. A total of 44 patients, aged 48 to 69, who underwent PFO for medial compartment OA knee between January 2022 and March 2023, were selected (12 men and 32 women). A weight-bearing whole lower extremity scanogram was taken both before and after surgery to evaluate the lower limb alignment (femorotibial angle) and joint space ratio (medial/lateral joint space). Functional outcome was assessed with American Knee Society Score (KSS), and knee pain was assessed with visual analog scale (VAS). In our study, 44 patients received PFO treatment and underwent at least three months of observation. Following surgery, the VAS significantly decreased from 6.93 before surgery to 3.78 afterward, and all patients reported feeling significantly less pain. Weight-bearing lower extremity radiographs showed a significant expansion of the medial knee joint space in 42% of patients. Additionally, we observed an increase in the medial joint space, which went from 1.84 ± 0.22 mm preoperatively to 3.95 ± 0.56 mm after surgery. Similar improvement were also observed in Oxford knee score and knee society score. PFO is an innovative, secure, and efficient treatment for medial compartment arthritis of the knee that is minimally invasive, reduces pain, and improves joint function. It aids in the adjustment of a varus knee.

Key Words: Osteoarthritis, Medial compartment of the knee, Proximal fibular osteotomy, Clinical efficacy

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INTRODUCTION

Knee osteoarthritis (OA) is a degenerative condition that affects the articular cartilage and causes pain, deformity, disability, and a reduction in the range of motion in the affected joint [1]. For people aged 20 and older, the combined global incidence of knee OA was 203 per 10,000 person-years. In line with this, approximately 86 million people (20 years of age or older) will develop incident knee OA worldwide in 2020 [2]. Primary osteoarthritis of the knee is more prevalent than in other joints in the body [3]. The majority of women and people over the age of 60 are affected by osteoarthritis (OA) of the knee joint, which is primarily caused by osteoporosis and reduced bone

mineral density [4]. The main factors that contribute to the onset of OA are biomechanical as a result of collagen fiber fatigue fracture or microfracture of the subchondral bone. No one has accurately explained the cause of this uneven load distribution since the medial knee compartment is the weight-bearing component and bears 60% to 80% of the load [5].

Both conservative and surgical options are available for managing knee joint OA. Analgesics, physical therapy, intra-articular injections of steroids or platelet-rich plasma, and viscosupplementation agents are all considered conservative treatments for osteoarthritis of the knee [6–8]. The primary surgical treatments for OA of the knee are total knee

arthroplasty and high tibial osteotomy, both of which are surgical options [9]. The majority of surgical treatments for knee osteoarthritis (KOA) to date have involved arthroscopic techniques, total knee and unicompartmental knee replacements (TKA and UKA), or high tibial osteotomies (HTO). Although total knee replacement is a great procedure for pain relief, deformity correction, and improved function, it is not a good choice for young patients with mild to moderate OA [10]. In healthy individuals, the medial compartment carries nearly 60% to 80% of the load because the mechanical axis tends to lie more frequently medial to the center of the knee joint [11]. As a result, the medial compartment is most frequently affected by knee joint OA.

Proximal fibular osteotomy (PFO), another minimally invasive surgical procedure, has recently been suggested for the management of KOA. Comparing PFO to high tibial osteotomy, PFO is a superior form of treatment for medial compartment OA [12]. Additionally, it is associated with fewer or no complications than those that are frequently experienced after a high tibial osteotomy [13]. Compared to other procedures like HTO, UKA, and TKA, this one is easier to perform, costs less money, and requires less recovery time. A varus deformity in the KOA can be corrected with the PFO, which shifts the loading force from the medial compartment more laterally [14]. It, therefore, contributes to a less painful and satisfactory functional recovery. This method is more popular in the Eastern world (China and India) than elsewhere.

Medial compartment knee joint OA is the surgical indication for PFO [12]. The goal of the current study was to assess the effectiveness of PFO in terms of pain relief and functional improvement.

MATERIALS AND METHODS

STUDY DESIGN, INCLUSION, AND EXCLUSION CRITERIA

This prospective study was conducted between January 2022 and March 2023. All patients, regardless of gender, who meet the inclusion and exclusion requirements will be included in the study after receiving ethical approval. The study included people with knee pain, people with medial compartment OA (Kellgren and Lawrence Grade 2 and 3) [15] who have difficulty walking, and people whose weight-bearing X-rays revealed medial compartment OA in the knee. Patients who have genu valgus, bicompartamental compartment OA, early OA (Kellgren and Lawrence grades 0 and 1), bone-to-bone contact on weight-bearing X-ray, acute major trauma morbid obesity, or any infectious pathology involving the knee joint, malignant tumors, patient not fit for surgery (abnormal liver or renal functions), patient not willing for surgery were excluded from the study.

SURGICAL TECHNIQUE

The procedure was carried out with the patient supine, under spinal anesthesia, with antibiotic coverage, and without the usual tourniquet. The osteotomy site was found to be 7.5–10 cm from the head of the fibula after the fibular head was felt and measured. A lateral incision of five centimeters was made over the intended site of the osteotomy, and the periosteum of the fibula was exposed by dissecting through the skin and subcutaneous tissues and then being incised. After drilling a few holes at the osteotomy site, a 1.5–2 cm section of the fibula was removed using an oscillating saw. Curved Hohmann retractors were placed behind the fibula before osteotomy, and care was taken not to stretch the soft tissues too much to protect the nerve from potential damage. After ensuring hemostasis and giving wound wash, closure was done in layers, and a sterile dressing and compression bandage were applied. All patients were encouraged to stand and walk on the same evening of the surgery or on the first day of surgery and were discharged on the third postoperative day after the first wound inspection. Intravenous antibiotics were given for 3 days followed by oral antibiotics for a period of 5 days.

FOLLOW-UP AND FUNCTIONAL AND CLINICAL EVALUATION

Patients were contacted for a follow-up visit for sutural removal on postoperative days 10–12 after being released. After the operation, weight-bearing X-rays were evaluated and documented. Values of VAS [16] and the Oxford knee scores [17] were evaluated and documented for all patients at preoperative and postoperative (3 months post-surgery) time points. The knee society score (KSS) was used to evaluate the functional outcomes. The knee surgery score is broken down into a function score and a knee score. The knee score evaluates pain, range of motion, and stability. There is a 100 point maximum.

RESULTS

A total of 44 patients, 12 (27.3%) male and 32 (72.7%) female, were enrolled in the study. The mean age of patients was 55.3 ± 6.4 years. The total duration of surgery from incision to closure of the wound was 35.20 ± 4.4 minutes. The mean preoperative lateral joint space was 9.57 ± 1.79 mm, which was significantly reduced to 5.51 ± 0.62 mm 3 months post-surgery ($P < 0.001$). Preoperative mean medial joint space measurement on standard anteroposterior radiograph was 1.84 ± 0.22 mm, which then increased significantly to 3.95 ± 0.56 mm 3 months post-surgery. The recorded mean preoperative Oxford knee score was 22.56 ± 2.52 . The postoperative Oxford knee score was significantly higher than the preoperative score (38.29 vs 4.9 , $P = 0.001$). The average preoperative VAS for measuring pain was 6.93 ± 0.58 . All patients experienced significant pain relief after surgery, as evidenced by a decreased VAS score (3.78

0.39, P0.01). An average of 89.23 points was achieved following PFO, compared to an average of 65.7 points preoperatively.

Among the patients, 39 (n=39; 88.6%) had no complications. No patients experienced peroneal nerve

damage. Two patients experienced a loss of the great toe's dorsiflexion, which resolved on its own. One patient had a deep wound infection, and two patients had superficial wound infections that were treated with antibiotics and daily dressings.

Table 1: Clinical and Functional assessment after proximal fibular osteotomy

Parameters (n = 44)	Mean \pm SD or Frequency	p-value
Age (years)	55.3 \pm 6.4	
Gender		
Male	12 (27.3%)	
Female	32 (72.7%)	
Duration of surgery (min)	35.20 \pm 4.4	
Lateral joint space (mm)		
Preoperative	9.57 \pm 1.79	
Postoperative	5.51 \pm 0.62	< 0.001
Medial joint space (mm)		
Preoperative	1.84 \pm 0.22	
Postoperative	3.95 \pm 0.56	< 0.001
Oxford knee score		
Preoperative	22.56 \pm 2.52	
Postoperative	38.29 \pm 4.9	< 0.001
VAS		
Preoperative	6.93 \pm 0.58	
Postoperative	3.78 \pm 0.39	< 0.01
Knee society score		
Preoperative	65.7	
Postoperative	3.78 \pm 0.39	< 0.01
Complication		
No complications	39 (88.6%)	
Peroneal nerve palsy	0	
Loss of dorsiflexion of the great toe	2 (4.5%)	
Sensory loss over the dorsum of the foot	0 (00.0%)	
Superficial wound infection	2 (4.5%)	
Deep wound infection	1 (2.3%)	

DISCUSSION

Previous treatments for medial compartmental arthritis included high tibial osteotomy and unicompartmental arthroplasty, both of which had advantages and drawbacks as well as significant complications [18]. An emerging type of compartment knee joint osteoarthritis is proximal fibular osteotomy. The literature continues to provide insufficient data on PFO in medial compartment OA of the knee. The common peroneal nerve would most likely be injured by an osteotomy performed at a level higher than this, whereas the osteotomy's intended effect on medial compartment arthritis would be lost if it were performed at a level much lower than this.

For the clinical and functional evaluation following surgery, pain is the primary criterion. The mean VAS score before surgery was 6.93; it significantly dropped to 3.78 during the recovery period, showing a significant improvement in knee function and pain relief. In a study on PFO for medial compartment conducted by Wang et al., all patients experienced OA pain relief following PFO as measured by mean VAS [19]. The average preoperative Oxford score also

demonstrated a notable improvement in function, going from 22.56 preoperatively to 38.29 in the postoperative period. From the preoperative time point to three months after surgery, there was a decrease in the medial and lateral joint space. In terms of pain relief and function, the aforementioned findings—changes in medial joint space, lateral joint space, VAS, and Oxford knee score—were all positive indicators of the benefits of PFO. The findings of our study were comparable to those of studies by other authors, including Subash and Naidu [20], Wang et al. [19], and Yang et al. [12]. PFO is not a novel procedure, but doctors are still hesitant to use it for medial compartment OA. PFO is a safe procedure that is inexpensive and simple to carry out. It gives dramatic pain relief postoperatively and is associated with a shorter recovery time. On the day after surgery, all patients can be mobilized and weight-bearing. Investigations with a longer follow-up period are still required to fully evaluate the procedure's efficacy.

CONCLUSION

Our findings showed that the PFO procedure is reasonably effective for treating medial compartment OA of the knee joint, both clinically and radiologically. It has minimal recovery time and few to no complications.

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