



International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2019; 5(3): 322-325
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www.orthopaper.com
Received: 09-05-2019
Accepted: 12-06-2019

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Proximal tibial inverted 'V' osteotomy and cast application for medial compartment knee osteoarthritis

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DOI: <https://doi.org/10.22271/ortho.2019.v5.i3f.1549>

Abstract

Background: Knee osteoarthritis (OA) may cripple an individual due to pain and/or deformity, resulting in disability and diminished quality of life. The goal in these patients is to relieve pain, provide motion, maintain stability and correct deformity.

Surgical treatment options are required in arthritic knees with radiographic evidence of joint damage and not responding to conservative treatment. Total knee Arthroplasty (TKA) is usually preferred for severe arthritic knees in this modern era of joint replacement. However, it is expensive and has its own set of complications and survival rates depending on surgical technique, implant design and comorbid conditions. Hence, in developing countries like India where majority patients are from poor socioeconomic status, other treatment options deserve consideration especially for early mild to moderate Unicompartamental OA. Proximal tibial osteotomy (PTO) has been a good alternative surgical treatment in such patients.

Aim: To evaluate the results of PTO followed by above knee plaster of Paris (POP) cast application for medial compartment knee OA.

Material and Methods: A prospective study was done on 11 knees in 11 patients (4 males, 7 females) who underwent proximal tibial inverted 'V' osteotomy followed by above knee POP cast application for the treatment of medial compartment knee OA. Grading of OA was done according to Ahlback's classification. All patients were followed up for 1 year and assessed for progress of union, pain relief, range of motion (ROM) and deformity correction. Evaluation was done as per criteria by Japanese Orthopaedics Association Score for knee arthritis (1992).

Observations and Results: The mean age of patients was 61.02 years. The preoperative flexion and varus deformities improved in majority after the PTO. Preoperatively all patients had poor score. Postoperatively at the end of 1 year, 90.91% patients had fair or good results. Superficial infection occurred in one patient which healed with dressings and antibiotics. One patient developed compartment syndrome for which fasciotomy had to be done.

Conclusion: PTO followed by above knee POP cast application is a satisfactory and cost-effective alternative to knee replacement surgery for isolated medial compartment knee OA in developing countries like India.

Keywords: Knee osteoarthritis, proximal tibial osteotomy, cast application

Introduction

Primary Osteoarthritis (OA) is inevitable due to aging and is characterized by degenerative changes in the articular cartilage of diarthrodial joints and subsequent new bone formation at the articular margin. Primary defect as result of excessive aging is an alteration in the ratio of total glycosaminoglycans and fiber content in the matrix ^[1, 2].

Although multifactorial, the biomechanical stresses produced at the knee are supposed to be the primary etiology for knee OA ^[3, 4]. The medial compartment of knee is more involved leading to loss of articular cartilage and subchondral bone giving rise to varus deformity, which enhances due to overloading activities with time ^[5, 6].

Knee OA may cripple an individual due to pain and/or deformity, resulting in disability and diminished quality of life. The goal in these patients is to relieve pain, provide motion, maintain stability and correct deformity.

Total knee arthroplasty (TKA) is indicated in severe arthritic knees with radiographic evidence of joint damage and not responding to conservative treatment.

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However, it is expensive and has its own set of complications and survival rates depending on surgical technique, implant design and comorbid conditions. In a developing country like India most of knee OA patients do not undergo arthroplasty due to financial constraints and are reluctantly forced to suffer with pain and/or deformity of the disease. Hence other surgical treatment options for early, mild to moderate Unicompartamental knee OA Specially in young and mid-age patients deserve consideration in developing countries like India. Proximal tibial osteotomy (PTO) has been a good alternative surgical treatment option in such patients. It has been a proven concept in literature for the management of OA knees [7-9]. Various recent studies on PTO for knee OA have shown that correction in the alignment of weight bearing axis brings about regeneration of articular cartilage and pain relief in patients [10-14]. PTO is usually followed by plate fixation that increases the risk of complications like infection, wound dehiscence, impingement and implant failure. These complications usually require revision surgeries and/or implant removal that adds to the financial burden on the patient and his/her family besides the cost of the implant itself.

This study was done to evaluate the results of PTO followed by above knee POP cast application for medial compartment

knee OA in terms of pain relief, ROM, deformity correction and functional outcome.

Material and Methods

A prospective study was conducted from April 2017 to June 2019 at Integral Institute of Medical Sciences and Research, Lucknow (Uttar Pradesh, India) on 11 knees in 11 patients (4 males and 7 females) who underwent PTO for medial compartment knee OA followed by above knee POP cast application and followed up for at least 1 year.

All patients with medial compartment knee OA had pain with/without deformity (varus < 15 degrees and/or flexion contracture < 20 degrees).

Xrays included short film standing antero-posterior (AP), lateral and skyline views of the knee. Grading of OA was done according to Ahlback's classification [15]. Radiological evaluation was done preoperatively [Figure 1a] and postoperatively [Figure 1b] by measuring the tibiofemoral angle formed between femoral axis (line between midpoint of medullary canal in the diaphysis and apex of femur intercondylar notch) and tibial axis (line between centre of tibial inter-spinous notch and midpoint of tibial diaphyseal medullary canal).

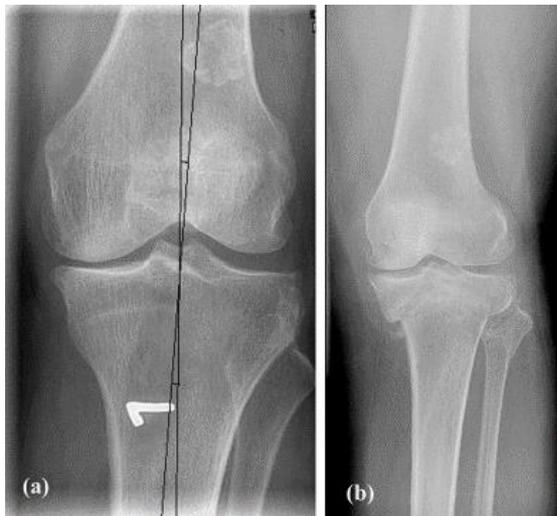


Fig 1: X-ray Image: (a) Preoperative and (b) Postoperative



Fig 2: Perioperative Image

The base of wedge was calculated in millimeters approximately equal to the degree of angle to be corrected. We aimed a little overcorrection of 5 degrees with an anticipation of OA progression. Further 5 degrees of correction were added for normal valgus of knee. It was in accordance with the recommendations of Coventry [16].

Surgical Technique: Inverted 'V' shaped osteotomy as described in 1973 by Levy *et al.* [17] was performed under spinal/epidural Anaesthesia and tourniquet. An 'S' shaped incision was used running obliquely and crossing ligamentum patellae from lateral to medial side. The fibula was osteotomized 1.5 – 2 cm distal to its proximal end using a small oscillating saw. Two Kirchner wires were inserted into the proximal tibia from lateral to medial at a distance equal to the wedge to be resected. The proximal wire was passed parallel to the joint line while distal wire was passed at an angle to converge to meet the first pin at medial cortex [Figure 2]. An inverted 'V' osteotomy was done using a broad osteotome or a power saw under direct vision. The apex of 'V' was proximal to the tibial tuberosity under the patellar

tendon. A wedge of cancellous bone was resected from the tibia beneath the lateral plateau. Varus deformity correction was achieved by valgus force till the Kirchner wires became parallel to each other. The resected bone block was placed into the triangular space that was created beneath the medial plateau. Internal fixation was not done by any implant. The wound was closed with a vacuum suction drain and a long leg cast was applied at 10-20° knee flexion. Stiches were removed on 14th postoperative day through a window in the cast. The cast was applied for 6-8 weeks and gradual weight bearing was allowed as per the progress of osteotomy site healing. The patients were assessed at follow up for progress of union, pain relief, ROM and deformity correction. The patients were evaluated as per criteria by Japanese Orthopaedics Association Score for knee arthritis (1992).

Results

The mean age of patients was 61.02 years (range 55 to 72 years). Right knee was involved in 6 patients while left knee in 5. Grading of OA was followed according to Ahlback's classification [Table 1].

Table 1: Ahlback's Classification

Grade	Number of knees
I – Narrowing of joint space	0
II – Obliteration of joint space	04
III – Minor attrition of bone	05
IV – Moderate attrition of bone	02
V – Major attrition of bone	0
Total	11

The preoperative and postoperative values for flexion and varus deformity are shown in Table 2 and 3 respectively.

Table 2: Preoperative and postoperative flexion deformity

Flexion deformity	Preoperative	Postoperative
0-10 degree	06	09
11-30 degree	05	02
<30 degree	0	0
Total	11	11

Table 3: Preoperative and postoperative varus deformity

Varus Deformity	Preoperative	Postoperative
< 5 degree	8	04
6-15 degree varus	3	07
>15 degree varus	0	0
Total	11	11

Superficial infection occurred in one patient which healed with dressings and antibiotics. One patient developed compartment syndrome for which fasciotomy had to be done. The overall postoperative results have been summarized in Table 4.

Table 4: Postoperative results (in %)

Results	Preoperative	Postoperative		
		At 3 months	At 6 months	At 1 Year
Good	0	09.09	72.73	54.55
Fair	0	63.63	18.18	36.36
Poor	100	27.27	09.09	9.09
Total	100	100	100	100

Discussion

The reversal of degenerative process of knee by changing the alignment and transfer of weight bearing axis to the relatively better portion of knee has been advocated in the literature [14, 17-20]. PTO as described by Coventry and Levy [17, 18] has been followed in this study.

The exact mechanism by which the patients are relieved of pain by osteotomy is not clear and various theories have been proposed for it like reduction in the intraosseous venous engorgement as seen on Osteomedullography [21] and redistribution of the weight bearing stresses produced due to varus or valgus deformity [5].

Closed wedge PTO has proved to be a satisfactory operative technique for varus deformity correction of knee and our results are quite comparable to those obtained by other workers [22-25]. Superficial infection occurred in one patient which healed with dressings and antibiotics within 2 weeks. An Undisplaced fracture of lateral tibial plateau occurred in one patient that healed without any joint deformity. Similar complication has also been mentioned by Hernigow [26]. In one patient, the varus deformity persisted even after surgery which could possibly be due to inadequate correction or error in removing the wedge at the time of osteotomy.

The comparison of mean deformity correction one year after surgery is shown in Table 4. The recurrence of varus deformity with the progression of OA as has been reported in the literature [18] which is yet to be followed up in our study.

Conclusion

PTO followed by above knee POP cast for the management of medial compartment knee OA is a satisfactory and cost-effective alternative to joint replacement surgery in developing countries like India. It needs to be mentioned that this technique may not provide absolutely painless knee but brings patients in comfortable zone by correction of deformity which ultimately prolongs the functional ability and quality of life of patients.

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