

## A PROSPECTIVE STUDY OF THE OUTCOME OF HIGH TIBIAL OSTEOTOMY IN OSTEOARTHRITIS OF KNEE WITH VARUS DEFORMITY AT DARBHANGA MEDICAL COLLEGE, BIHAR

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### ABSTRACT

**Background:** High tibial osteotomy (HTO) is a widely performed procedure to treat medial knee arthrosis. Many techniques have been developed (i.e. closing wedge, opening wedge, dome and “en chevron” osteotomies), but opening (medial) and closing (lateral) wedge osteotomies are the most commonly used. These include the choice between opening or closing wedge tibial osteotomy, the graft selection in opening wedge osteotomies, the type of fixation, the comparison with unicompartmental knee arthroplasty (UKA) and whether HTO affects a subsequent total joint replacement (TKR). **Materials and Methods:** It is a prospective interventional single centre study that was conducted during period between January 2024 to December 2024 after permission from Institutional Ethical committee. About 25 patients were selected and assessed preoperatively and postoperatively with knee society score and knee society functional score. The Knee society score is a special score which has been widely accepted as an objective measure of knee status in patient undergoing high tibial osteotomy. All the data were entered into the protocol proforma. The postoperative X-ray was done immediate postoperative and after 1 month, 6 month and yearly thereafter. The analysis was carried out using SPSS software v.24 with appropriate statistical tests to determine significance level. **Results:** In the current study, the age of the patients had ranged from 42 – 51 years with a mean age of 47.7 years. Among the 25 patients, majority were female with a male: female ratio of 0.54:1. For majority of the patient, right side of the knee was involved and 3 patients had bilateral knee involvement. More than two-third of the patients had grade III type of Osteoarthritis and while rest had grade IV type of Osteoarthritis. **Conclusion:** It is indisputable that appropriate patient selection, precise surgical planning and various operative techniques provide a favorable outcome of High Tibial Osteotomy in medial knee arthritis in young or middle-aged active patients.

## INTRODUCTION

Medial opening wedge high tibial osteotomy (HTO) is surgical treatment option for the management of medial compartment knee osteoarthritis.<sup>[1]</sup> High tibial osteotomy (HTO) is a widely performed procedure to treat medial knee arthrosis. Many techniques have been developed (i.e. closing wedge, opening wedge, dome and “en chevron” osteotomies), but opening (medial) and closing (lateral) wedge osteotomies are the most commonly used. The goal of the treatment is to relieve medial compartment knee pain and slow down the arthritic progression. The surgery is described as a

biomechanical intervention designed to alter dynamic knee joint loading, with the aim of improving patient function and decreasing pain This is achieved by a partial unloading of the medial compartment with a slight overcorrection 3-5 degree of the mechanical axis. Some studies showed that regenerative process began after realignment. HTO was considered as an option to treat an isolated medial compartment Osteoarthritis (OA) in Varus knees, which was reported by Jackson in 1958. This surgery was not popular until Coventry reported good results in 1973,<sup>[2]</sup> HTO became more popular in young active patients after improvement in surgical technique, fixation devices, and patient

selection with fewer complications. Although overall HTO results show the effectiveness of the procedure there are still some debated issues about osteotomies. These include the choice between opening or closing wedge tibial osteotomy, the graft selection in opening wedge osteotomies, the type of fixation, the comparison with unicompartmental knee arthroplasty (UKA) and whether HTO affects a subsequent total joint replacement (TKR).

#### **Aims and Objectives**

**Aim:** To evaluate the clinical, functional and radiological outcome achieved by high tibial osteotomy performed in osteoarthritis of knee patient with varus deformity.

**Objectives:** To assess clinical, functional and radiological outcome from the high tibial osteotomy done in osteoarthritis patients with varus deformity.

## **MATERIALS AND METHODS**

The current study was conducted by the Department of Orthopedics, Darbhanga medical college and hospital, Darbhanga among younger and active patients who fulfilled the following inclusion Criteria 1. Medial compartment arthrosis only 2. Kellgren-Lawrence of grade 1–4 3. Varus limb alignment 4. Knee flexion more than 90 degree 5. Good muscle strength to carry out rehabilitation 6. Good vascular status without arterial insufficiency. Patients with ligamentous instability, lateral tibial subluxation of more than 1 cm, Medial compartment tibial bone loss of more than 2 cm, flexion contraction of more than 15 deg, knee flexion of less than 90 deg, more than 20 deg correction needed or those with rheumatoid arthritis were excluded from the study. It is a prospective interventional single centre study that was conducted during period between January 2024 to December 2024 after permission from Institutional Ethical committee. About 25 patients were selected and assessed preoperatively and postoperatively with knee society score and knee society functional score. Assessment and evaluation were done using a regularized custom-made protocol which included the symptom of patients, associated medical condition, knee society score and knee society functional score. The Knee society score is a special score which has been widely accepted as an objective measure of knee status in patient undergoing high tibial osteotomy. All the data were entered into the protocol proforma. The postoperative X-ray was done immediate postoperative and after 1 month, 6 month and yearly thereafter.

The analysis was carried out using SPSS software v.24 with appropriate statistical tests to determine significance level. All the results were considered statistically significant at  $p < 0.05$ . Baseline variables were compared between groups to determine baseline equivalence using independent t tests for continuous data and chisquare tests for nominal

variables. Differences on KSS and Lysholm scores were examined using repeated-measure analysis of variance (ANOVA) with time (6 months) as the within-subject factors and groups as the between-subjects factor. Pair wise comparisons using only 2 time points was conducted to assess differences between the groups at each time period.

## **RESULTS**

In the current study, the age of the patients had ranged from 42 – 51 years with a mean age of 47.7 years. Among the 25 patients, majority were female with a male: female ratio of 0.54:1. For majority of the patient, right side of the knee was involved and 3 patients had bilateral knee involvement. More than two-third of the patients had grade III type of Osteoarthritis and while rest had grade IV type of Osteoarthritis. The mean knee score was 54.5 with a standard deviation of 2.2 and the mean functional score was 51.8 with a standard deviation of 3.2. Both the mean scores were considered as poor based on the categorization of the scores.

The immediate postoperative infection was the wound infection which had developed in 5 – 7 days post-operative. Out of 25 patients, 3 patients had developed the infection and for the remaining patients the wound was clear without any infections. Patients with infection presented with serous discharge. The patients who had infection were treated with high level antibiotics for 5 days and at the end of 1 week the discharge was cleared and wound were healthy. Out of all, only one patient had developed the foot drop due to the common peroneal nerve injury. For that patient proper braces were given to improve the condition.

[Table 1] shows that all the patients were followed for a period of 1 year at the interval of 1, 6 and 12 months. Each visits the patients knee score and functional score was assessed using the standard orthopaedics knee society protocol. The grading of the knee society was done as score below 60 was considered as poor, score 60 – 69 was considered as fair, score 70 – 79 was good and score 80 – 100 is excellent. It has inferred from the table that the patients total knee score has gradually improved over the period of 1 year. The score was initially in the range of fair to good and at the end of 1 year it was excellent ( $>80$ ). The improvement in the score over the period of 1 year was proven to be statistically significant ( $p < 0.05$ ). The knee society score at the end of 1 month was 60.2 and at end 12 months were 85.1. The patient's functional score had gradually improved over the period of 1 year. The initial score at the end of 1 month was 61.2 and at the end of 12 months it was 87.8 and this improvement in the functional knee score over the period of 12 months was found to be statistically significant ( $p < 0.05$ ). It shows that the patients who were in the grade of poor based on the total knee score and functional score before the high tibial

osteotomy had improved to excellent after the surgery.

**Table 1: Mean and Standard Deviation of the Knee Society Score and Functional Score among the Study Population after High Tibial Osteotomy**

Score	Post-operative period (Mean ± SD)			P-value
	1 month	6 months	12 months	
Knee Society Score	60.2	77.3	85.1	<0.05
Functional score	61.2	75.2	87.8	<0.05

## DISCUSSION

The present study had shown a favorable outcome for high tibial osteotomy. The patients who had undergone lateral closing wedge high tibial osteotomy for osteoarthritis with Varus deformity had shown a statistically significant improvement in both the knee score and the functional score at the end of 1 year follow-up following the surgery. Out of all patients only one patient had developed a foot drop due to common peroneal nerve injury, as a post-operative complication.

Aglietti et al,<sup>[3]</sup> performed 139 osteotomies with three different techniques: (1) lateral closed wedge osteotomy, without internal fixation followed by long leg cast; (2) lateral closed wedge or “en chevron” osteotomy, fixed with two screws and immobilized with a long leg cast; and (3) Lateral closed wedge osteotomy according to Insall et al,<sup>[4]</sup> without internal fixation and with cylinder cast immobilization. The outcomes were satisfactory in 87% (from 2 to 5 years of follow-up), in 70% (from 6 to 10 years of follow-up) and in 64% (more than 10 years of follow-up). The authors concluded that the third group of patients had better results and correction, that severe articular destruction had poorer outcomes and that under corrected knees tended to relapse. Matthews et al,<sup>[5]</sup> treated 40 patients with Coventry or Coventry-Bowman techniques followed by cast immobilization. Internal fixation with staples was used in 25 cases and external fixation in three cases. They reported 86% of satisfactorily results at one year from surgery, 64% at three years, 50% at five years and 28% at nine years. They also concluded that obesity, advanced age, overcorrection or under correction had the worst outcomes.

Ivarsson et al,<sup>[6]</sup> performed 99 lateral closing wedge High Tibial Osteotomy, fixed with staples and immobilized in a cast. They reported 75% of good and acceptable outcomes at 5.7 years and 60% at 11.9 years. They obtained better results in patients with Ahlbäck grade I or II osteoarthritis and when a slight overcorrection was achieved (from 3° to 7° of valgus). Naudie et al,<sup>[7]</sup> performed 94 closing wedge osteotomies and 12 dome osteotomies, fixed with staples and followed by cast immobilization in 75 cases. The Kaplan-Meier analysis showed survivorship of 75% at five years, 51% at ten years, 39% at 15 years and 30% at 20 years. However, in patients younger than 50 years old and with range of motion >120°, the longevity increased to 80% at ten years. They thus underlined the importance of correct patient selection. In their series, earlier

failure was associated with age >50 years, previous arthroscopic debridements, lateral tibial thrust, preoperative knee flexion < 120°, under correction and delayed union.

Sprenger and Doerzbacher,<sup>[8]</sup> treated 76 knees with closing wedge High Tibial Osteotomy and internal fixation. Survival rates were 65–74% at ten years from surgery. However, tenyear survivorship was 90%, when the femurotibial angle was between 8 and 16° valgus at one year from surgery.

Tang and Henderson,<sup>[9]</sup> treated 67 knees with lateral closing High Tibial Osteotomy, fixed with staples or plate or immobilized in a long leg cast. Survival rates reported were: 89.5% at five years, 74.7% at ten years and 66.9% for 15 and 20 years.

Asik et al,<sup>[10]</sup> performed 65 open wedge osteotomies fixed with the Puudu plate. They reported significant improvement of pain and knee function at an average follow-up of 34 months.

Chiang et al,<sup>[11]</sup> used dome-shaped High Tibial Osteotomy and external fixation to treat 25 knees with medial compartment arthrosis. In their series, the Hospital for Special Surgery (HSS) score was excellent or good in 18 knees at five years and in 13 knees at an average of 15 years.

Papachristou et al,<sup>[12]</sup> followed up 44 closing wedge High Tibial Osteotomy, fixed with one or two staples. Survivorship analysis showed a success rate of 80% at ten years, 66% at 15 years and 53% at 17 years from surgery.

Flecher et al,<sup>[13]</sup> followed up 301 patients treated with closing wedge High Tibial Osteotomy and internal fixation. Survivorship was 85% at 20 years. They also concluded that the most important risk factors predicting revision (the chosen endpoint) were: age >50 years and preoperative Ahlbäck grade III or more arthrosis.

Gstöttner et al,<sup>[14]</sup> treated 134 arthritic knees with lateral closing High Tibial Osteotomy, fixed with staples. The survival rates were 94% at five years, 79.9% at ten years, 65.5% at 15 years and 54.1% at 18 years.

Akizuki et al,<sup>[15]</sup> followed up 118 closing wedge High Tibial Osteotomy, fixed with a plate. Survivorship was 97.6% at ten years and 90.4% at 15 years from surgery.

High Tibial Osteotomy in social settings, where floor sitting (rather than chair sitting) and use of toilets without seat are common, and also where economy, in terms of health insurance coverage, are important issues, is one of the useful armamentarium in the hand of an orthopedic surgeon. An improvement in functional scoring, particularly in items such as pain, surface walking,

use of Persian-style toilets, floor sitting, shopping, participation in social activities and self-esteem are to be expected in over the year's period.

## CONCLUSION

The main improvements seen in this study were related to pain reduction and an increase in the knee score and functional score after high tibial osteotomy and also delay the need for total knee replacement. Hence it is indisputable that appropriate patient selection, precise surgical planning and various operative techniques provide a favorable outcome of High Tibial Osteotomy in medial knee arthritis in young or middle-aged active patients.

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