

# Intra-articular Opening Osteotomy Combined with Lateral Ligament Reconstruction for Varus Ankle Arthritis

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## ABSTRACT

**Background:** Ankle arthritis is often reported to either secondary to traumatic incidence or in cases of chronic instability of the ligamentous. Other reasons may include primary osteoarthritis or systemic arthropathies including those of rheumatoid or of the gout. Early treatment plan is highly recommended for better quality of life.

**Objective:** To determine the effectiveness of intra-articular opening osteotomy combined with lateral ligament reconstruction for varus ankle arthritis.

**Study Design:** Cross-sectional analytical study.

**Place and Duration of Study:** Department of Orthopaedic, Shaikh Zayed Hospital, Lahore from 1<sup>st</sup> April 2023 to 30<sup>th</sup> September 2023.

**Methodology:** Twenty patients (8 left and 12 right ankles) undergoing intra-articular opening osteotomy combined with lateral ligament reconstruction for varus ankle arthritis was enrolled. The age of the patients was between 30-55 years and both genders. At the anteroposterior ankle views (AP) radiological imaging through X-ray machine was performed pre or post-operation of each patient's ankle as weight bearing. The scan was reviewed through MRI and evaluated on various scoring methods including the American Orthopedic Foot & Ankle Society Ankle-Hindfoot Score (AOFAS-AH), Ankle Osteoarthritis scale (AOS), the visual analogue scale (VAS), the Short Form-36 scale (SF-36). The varus type of ankles was surgically corrected through osteotomy by medial longitudinal incision.

**Results:** The majority of the ankle arthritis was presented in the right ankle than the left with a ratio of 12:8 and the majority of the patients were females (75%). After the scan was reviewed through MRI and evaluated on various scoring methods it was recorded that osteotomy combined with lateral ligament reconstruction for varus ankle arthritis resulted in the betterment of the score from 47.8±15.9 to 75.8±12 as pre and post-operative respectively. Similarly, there was a significant improvement noticed in the VAS score from 5.6±1.7 to 2.4±1.8 as well as improvement in the SF-36 and AOS up to a post-operative value of 67.8±14.7 and 28.1±17.8 respectively.

**Conclusion:** Intra-articular opening osteotomy combined with lateral ligament reconstruction to treat varus ankle arthritis is an effective method for medial distal tibial platform erosion.

**Keywords:** Osteotomy; Ankle arthritis; Ligament; Osteophytes.

## INTRODUCTION

Research has classified the ankle arthritis into four types. The first stage consists of early sclerosis as well as development of osteophytes without the involvement of the space of ankle joint. The second stage comprises of medial joint narrowing without any contact of sub chondral bone. The third stage consisted of ankle space obliteration keeping a sub chondral contact with bone. In the fourth stage, there is a complete joining of the varus-ankle joint with the bone. There is an add on classification of the third stage wherein 3A and 3B are sub-stages. In stage 3B the ankle space obliteration is extended to the roof having a contact with sub chondral bone.<sup>1,2</sup>

Science has advanced in technological measures and promotes the application of minimal risk and damage procedures. Similar is the cases of the ankle arthritis surgical measures where Intra-articular opening osteotomy combined with lateral ligament reconstruction has shown promising results than any other surgical procedure. In young patients as well as adults where sacrificing the ankle joint is not the option other techniques as joint sparing procedure becomes highly important. The osteotomy is an effective and reliable procedure for the varus ankle arthritis specifically in the patients with small TAS angle presence.<sup>1-8</sup>

Cases where no positive outcomes were observed with the 3B ankle arthritis undergoing osteotomy, although in few patients the talus abrades in the medial-distal platform post long time walking and there is an erosion of the tibial platform while the lateral tibial surface has been observed to be normal.<sup>9</sup>

For facilitation of osteotomy an advanced new technique has been introduced which is termed as intra-articular opening medial tibial wedge osteotomy. It has good efficient results interpretation by various researchers.<sup>9,10</sup> There is yet a relevant amount of data which supports not to recommend the 3B ankle arthritis for osteotomy.<sup>10</sup>

The present study was designed to assess the functional outcome of the Intra-articular opening osteotomy combined with lateral ligament reconstruction for varus ankle arthritis. The results of the study provided sufficient effective data for analyzing the follow up outcomes of the ankle arthritis cases undergoing subject surgery. The results assisted in identifying and using the best available procedure for the ankle arthritis treatment.

## MATERIALS AND METHODS

The study was conducted at Department of Orthopaedic, Shaikh Zayed Hospital Lahore from 1<sup>st</sup> April 2023 to 30<sup>th</sup> September 2023. The study was cross sectional analytical involving 20 patients (8 left and 12 right ankles) undergoing intra-articular opening osteotomy combined with lateral ligament reconstruction for varus ankle arthritis. The study was ethically approved through the institutional review board. An informed consent or participation in this study was taken from each patient. The age of the patients was between 30-55 years and both genders and followed for up to 88 months. The sample size was calculated using WHO sample size calculator with 80% power of test, 95% CI and 5% margin of error. The inclusion criteria consisted of all patients suffering from Takakura-stage 3B ankle arthritis as well as two medial-distal tibial platform erosions and having normal lateral-tibial surface. Those

Received on 05-06-2023

Accepted on 09-11-2023

ankles arthritis which painful and under conservative treatment for a year were included. Those patients wherein end stage ankle arthritis, neuropathic arthropathy, rheumatoid arthritis, regional infection around the ankle joint, already operated or suffering from severe osteoporosis/ bone loss were excluded from the study. At the anteroposterior ankle views (AP) the radiological imaging through X ray machine was performed pre or post operation of each patient ankle as weight bearing. The operational definitions for lateral tibial articular surface angles, general tibial articular angle as well as talar tilt angle were adapted from previously stated definitions.<sup>11</sup> The hind foot alignment was evaluated and anteroposterior and lateral radiographs of tibial axis was drawn through a midpoint connection between 13cm of the cortex and 8cm of the proximal joint line. The scan was reviewed through MRI and evaluated on various scoring methods including American Orthopedic Foot & Ankle Society Ankle-Hind Foot Score (AOFAS-AH), Ankle Osteoarthritis Scale (AOS) the visual analogue scale (VAS), the Short From-36 scale (SF-36). The varus type of ankles was surgically corrected through osteotomy by medial longitudinal incision. A guide wire (K wire) was placed. In addition to this 2-3 K wires were placed parallel to ankle joint surface of tibial stage within subchondral bone at plafond angulation. The intraarticular osteotomy was conducted with fluoroscopic estimation for tibial-articular surface was conducted. In case where varus talus was not returned to normal a release process of medial-ankle ligament with superficial as well as deep deltoid ligament was conducted. Osteophytes-debridement was proceeded in cases where ankle joint impingement was performed for improving ankle movement. This was done through incision at medial and lateral position. Furthermore, a wedged shaped allograft was inserted in osteotomy site and made fixed through locking plate. The ankle joint was fixed in a neutral position with assistance of the 1-2 K-wires. The K wires were removed post 3-4 weeks after surgery and medial ligaments were sutured in same position with reconstruction of lateral ligaments through minimal invasive method.<sup>12</sup> The functional outcomes observed at follow up of the procedure were entered in proforma and analyzed using Data analysis SPSS tool version 26.0 via using chi square test with a p value <0.001 as significant.

**RESULTS**

The mean age of the patients was 51.2±3.6 years wherein 75% of the patients were females while only 25% of the patients were males. Majority of the ankle arthritis was presented in the right ankle than left with a ratio of 12:8 (Table 1).

The clinical history of the patients elaborate the fact that within the ankle arthritis patients about 80% reported ankle sprain while only 5% reported ankle fracture and 15% had no reason documented behind the ankle pain (Fig. 1).

Table 1: Demographic distribution of the cases (n=20)

Parameter	No. (%)
Age (years)	51.2±3.6
Gender	
Male	5 (25%)
Female	15 (75%)
Ankle	
Left	8 (40%)
Right	12 (60%)

Table 2: Functional Outcomes of the procedure

Outcome	Preoperative	Postoperative	P value
VAS	5.6±1.7	2.4±1.8	< 0.001
AOFAS	47.8±15.9	75.8±12.1	< 0.001
SF-36	41.8±14.2	67.8±14.7	< 0.001
AOS	60.8±14.0	28.1±17.8	< 0.001
TT (°)	14.2±5.1	5.3±4.1	< 0.001
TAS (°)	83.5±2.7	90.7±2.3	< 0.001
TLS (°)	77.4±2.3	78.7±2.2	0.0149
LTAS (°)	91.3±2.9	91.4±3.1	0.553

After the scan was reviewed through MRI and evaluated on various scoring methods it was recorded osteotomy combined with lateral ligament reconstruction for varus ankle arthritis resulted in the betterment if the score from 47.8±15.9 to 75.8±12 as pre and post operative respectively. Similarly, there was a significant improvement noticed in the VAS score from 5.6±1.7 to 2.4±1.8 as well as improvement in the SF-36 and AOS up to a post operative value of 67.8±14.7 and 28.1±17.8 respectively. There was not a major significant improvement in the LTAS scoring (Table 2).

It is pertinent to mention that the outcomes of 4 patients were self-reported as “excellent” while of 9 patients was as “good” while 3 interpreted as “fair.” There were 4 such patients who reported “poor” outcome with consistent discomfort. No cases of joint arthroplasty or arthrodesis were found because of the cost involved or other reasons (Fig. 2).

Fig. 1: Clinical History of patients Pain

Fig. 2: Ankle arthritis radiological outcomes before and after osteotomy (A→B)

**DISCUSSION**

There is still no known aetiology of varus-type ankle arthritis. Various studies have reported that trauma is typically the primary cause of ankle arthritis.<sup>4,7,13</sup> In this study, the majority of the patients had a history of ankle sprains. The main reason behind this is that ankle arthritis of varus type might have been caused by a weak lateral ligament.

Takakura and Tanaka classified varus ankle arthritis into stages and sub-stages 1, 2, 3 (3A, 3B), and 4.<sup>1,2</sup> There is a contentious issue on whether 3A of ankle arthritis is the direct

cause of stage 3B or not. It seems unlikely that all cases of stage 3B ankle arthritis originated from stage 3A cases. Long periods of walking cause the varus talus to touch and eventually abrade the surface of the tibia when the talus inverts into the ankle mortise. It is possible that stage 2 led directly to the development of stage 3B ankle arthritis. The TAS angle is typically narrow in these patients, but the LTAS is typically normal. The results support our hypothesis that intra-articular opening osteotomy was beneficial for 3B ankle arthritis with medial distal tibial platform erosion.

A majority of the patients in our research had a history of recurrent ankle sprains. This led to a persistently unstable varus ankle caused by the weak lateral ligament. The medial malleolus experiences persistent pressure from the medially driven talus, which causes it to become non-vertical.<sup>9</sup> Following the loosening of ligaments surrounding the ankle joint and the debridement of osteophytes, ankle instabilities persisted in several of the study's subjects, despite their lack of history of ankle sprains. We believe that lateral ligament restoration was crucial in maintaining the talus in this position when it was able to return to normal after the procedure.

Favourable results of ankle replacement or ankle arthrodesis for varus ankle arthritis, particularly Takakura stage 3 or 4 ankle arthritis reported in various studies.<sup>16-20</sup> On the other hand, ankle arthritis is treated by ankle arthrodesis, a joint sacrifice procedure that limits ankle mobility. The patients may not be candidates for ankle arthroplasty due to their relative youth. These individuals were still quite enthusiastic and desired to preserve their original ankle joint.

According to earlier research, it was not recommended to have surgery if the varus ankle was inflexible and could not be adjusted to normal under fluoroscopic inspection.<sup>9,21</sup> In our research, however, we are more interested in determining whether or not the varus ankle can recover to normal after surgery. If the correction of the varus deformity following osteotomy was not possible, we executed a comprehensive release of the ligaments and capsule surrounding the ankle joint. The ankle joint was flexible following the release and debridement procedures, therefore, one or two K-wires were used to keep it in a neutral position. These wires were removed three to four weeks after surgery. The lateral ligaments were rebuilt and the medial ligaments were sutured in this location. In our opinion, whether the varus ankle might return to normal throughout the procedure is important.

## CONCLUSION

Intra-articular opening osteotomy combined with lateral ligament reconstruction to treat varus ankle arthritis is an effective method with medial distal tibial platform erosion.

## REFERENCES

1. Takakura Y, Tanaka Y, Kumai T, Tamai S. Low tibial osteotomy for osteoarthritis of the ankle. Results of a new operation in 18 patients. *J Bone Joint Surg (Br)* 1995;77(1):50-54.

2. Tanaka Y, Takakura Y, Hayashi K, Taniguchi A, Kumai T, Sugimoto K. Low tibial osteotomy for varus-type osteoarthritis of the ankle. *J Bone Joint Surg (Br)* 2006;88(7):909-13.
3. Krahenbuhl N, Zwicky L, Bolliger L, Schadelin S, Hintermann B, Knupp M. Mid- to long-term results of supramalleolar osteotomy. *Foot Ankle Int* 2017;38(2):124-32.
4. Hintermann B, Knupp M, Barg A. Supramalleolar osteotomies for the treatment of ankle arthritis. *J Am Acad Orthop Surg* 2016;24(7):424-32.
5. Ahn TK, Yi Y, Cho JH, Lee WC. A cohort study of patients undergoing distal tibial osteotomy without fibular osteotomy for medial ankle arthritis with mortise widening. *J Bone Joint Surg Am* 2015;97(5):381-8.
6. Lee WC, Moon JS, Lee K, Byun WJ, Lee SH. Indications for supramalleolar osteotomy in patients with ankle osteoarthritis and varus deformity. *J Bone Joint Surg Am* 2011;93(13):1243-8.
7. Takakura Y, Takaoka T, Tanaka Y, Yajima H, Tamai S. Results of opening-wedge osteotomy for the treatment of a post-traumatic varus deformity of the ankle. *J Bone Joint Surg Am* 1998;80(2):213-8.
8. Xu Y, Xu XY. Medial open-wedge supramalleolar osteotomy for patients with Takakura 3B ankle osteoarthritis: a mid- to long-term study. *Biomed Res Int* 2019;2019:7630868.
9. Mann HA, Filippi J, Myerson MS. Intra-articular opening medial tibial wedge osteotomy (plafond-plasty) for the treatment of intra-articular varus ankle arthritis and instability. *Foot Ankle Int* 2012;33(4):255-61.
10. Becker AS, Myerson MS. The indications and technique of supramalleolar osteotomy. *Foot Ankle Clin* 2009;14(3):549-61.
11. Xu Y, Li XC, Guo CJ, Xu XY. Intra-articular opening osteotomy combined with lateral ligament reconstruction for varus ankle arthritis. *J Orthop Surg Res* 2021;16(1):7.
12. Xu X, Hu M, Liu J, Zhu Y, Wang B. Minimally invasive reconstruction of the lateral ankle ligaments using semitendinosus autograft or tendon allograft. *Foot Ankle Int* 2014;35(10):1015-21.
13. Knupp M, Bolliger L, Hintermann B. Treatment of posttraumatic varus ankle deformity with supramalleolar osteotomy. *Foot Ankle Clin* 2012;17(1):95-102.
14. Harrington KD. Degenerative arthritis of the ankle secondary to long-standing lateral ligament instability. *J Bone Joint Surg Am* 1979;61(3):354-61.
15. Noguchi K. Biomechanical analysis for osteoarthritis of the ankle. *Nihon Seikeigeka Gakkai Zasshi* 1985;59(2):215-22.
16. Joo SD, Lee KB. Comparison of the outcome of total ankle arthroplasty for osteoarthritis with moderate and severe varus malalignment and that with neutral alignment. *Bone Joint J* 2017;99-B(10):1335-42.
17. Lee GW, Wang SH, Lee KB. Comparison of intermediate to long-term outcomes of total ankle arthroplasty in ankles with preoperative varus, valgus, and neutral alignment. *J Bone Joint Surg Am* 2018;100(10):835-42.
18. Trajkovski T, Pinsker E, Cadden A, Daniels T. Outcomes of ankle arthroplasty with preoperative coronal-plane varus deformity of 10 degrees or greater. *J Bone Joint Surg Am* 2013;95(15):1382-8.
19. Maenohara Y, Taniguchi A, Tomiwa K, Tsuboyama D, Kurokawa H, Kumai T, et al. Outcomes of bilateral vs unilateral ankle arthrodesis. *Foot Ankle Int* 2018;39(5):530-34.
20. Grass R, Rammelt S, Biewener A, Zwipp H. Arthrodesis of the ankle joint. *Clin Pediatr Med Surg* 2004;21(2):161-78.
21. Hintermann B, Ruiz R, Barg A. Novel double osteotomy technique of distal tibia for correction of asymmetric varus osteoarthritic ankle. *Foot Ankle Int* 2017;38(9):970-81.

**This article may be cited as:** Shah SWA, Malik IS, Noor F, Tunio MZ, Naseer MK, Abideen ZU: Intra-articular Opening Osteotomy Combined with Lateral Ligament Reconstruction for Varus Ankle Arthritis. *Pak J Med Health Sci*, 2023; 17(12): 97-99.