

Original Article

Outcome of Primary Ankle Fusion with Modified Blair Technique in Hawkins Type III Fracture of the Talus

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ABSTRACT

Introduction: The rates of post-traumatic osteoarthritis after Talar neck and body fractures vary between 16% and 100%, and as the Talar body gets most of its blood supply in a retrograde manner from the anastomosis, this predisposes it to develop avascular necrosis. The need for secondary arthrodesis to address pain, discomfort, malunion, and non-union increases to 40%. Due to such high rates of secondary arthrodesis, the concept of primary arthrodesis for high-grade complex fractures is emerging.

Methods: This retrospective study was conducted in a tertiary-level hospital among patients with talus fractures who had undergone Modified Blair fusion in the institution. Data from January 1, 2017, to December 30, 2022, was accessed for patient selection. A median with an interquartile range was used for continuous variables. Data analysis was performed in SPSS 20.

Results: Nine patients were included in this study, with a male-to-female ratio of 8:1, an age of 37 (29–51), and an average follow-up of 18 (14–26) months. All fusions were united without the need for secondary operations in 19 (16–20.5) weeks. The AOFAS at 12 months was 74 (63–81). There were two excellent results (tibiopedal motion of 15°–20°), five good results (tibiopedal motion of 10°–15°), and two poor results (tibiopedal motion of less than 10°).

Conclusion: Modified Blair Fusion is an effective modality with a minimal complication rate and can be performed as primary surgery for Hawkins type III Talar neck body fractures.

Keywords: Arthrodesis; Fracture; Primary fusion; Talus

INTRODUCTION

The Talus has 70%–80% of its surface covered with articulating cartilage and is devoid of muscle attachments, which puts the Talus at risk of developing osteoarthritis at the tibiotalar and/or talocalcaneal joints over slight malreduction. The rates of post-traumatic osteoarthritis after Talar neck and body fractures vary between 16% and 100%.^{1–3} Also, the Talar body gets only 15–20% of its blood supply directly, and the majority of its parts get blood supply in a retrograde manner from the anastomosis, which predisposes it to develop avascular necrosis (AVN).⁴

The need for secondary arthrodesis to address pain, discomfort, malunion, and non-union ranges from 15.3% to 40% in cases of Talus fracture.^{3,5–7} With such high rates of secondary arthrodesis usually performed in the cases of

higher grades of fractures of the Talar neck and/or body, a different school of thought has been emerging that advocates primary arthrodesis for the higher Grade and more complex fractures.

In our study, we have assessed the outcomes among patients undergoing primary modified Blair fusion for Hawkins Type III Talar neck fractures with or without a comminuted Talar body fracture.

METHODS

This retrospective study was conducted in a tertiary care center among patients with a talus fracture who had undergone Modified Blair fusion in the institution. Ethical clearance for this study was obtained from the Institutional Review Committee of the Nobel Medical College Teaching Hospital (IRC-NMCTH) (Reference No. 806/2023). The total population sampling method, a non-probability sampling technique, was applied in this study. All the cases meeting the predefined inclusion criteria that were operated from January 1, 2017, to December 30, 2022, were included in

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this study. Inclusion criteria for this study were patients with Hawkins Type III Talar neck fractures with or without comminuted Talar body fractures, operated in the study institution, aged more than 18, and completed follow-up.

A structured questionnaire was formulated to extract data from the hospital records. The study tool had sections for demographic details (age and sex), details of injury (mode of injury and type of fracture), details of surgery (procedure performed and complications), and outcomes (time taken for union, AOFAS, VAS, Tibio-pedal motion, and Grade). The categorical variables of this study were sex, mode of injury, type of fracture, procedure performed, complications of the surgery, and Grade of outcome. All the remaining variables were continuous.

The American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Score (AOFAS Ankle-Hindfoot Score) is a rating system developed by the American Orthopaedic Foot and Ankle Society to report the clinical status of the ankle and foot.⁸ The tibiopedal motion range was assessed and measures with the help of goniometer between the axis of the tibia and the foot, in maximum dorsiflexion and plantarflexion positions. If the tibiopedal motion (range of maximum planter flexion to maximum dorsiflexion) was 15° – 20° , then it was considered an excellent result; if it was 10° – 15° , it was good; and if it was $<10^{\circ}$, it was considered a poor result.⁹ A measure of central tendency (Median) with an interquartile range (IQR) was used to present continuous variables. The data was analyzed using SPSS 20 software.

Surgical Procedure

In all the patients, the approach to surgery was anteriorly, with an interval between the extensor hallucis longus and the extensor digitorum longus. The neurovascular bundle was retracted, and the capsule was incised in line with the skin incision. The tibial articular surface was denuded, and the remaining Talar body was left in place. Then an anterior sliding arthrodesis was performed. For sliding the graft, a 2 cm by 5 cm cut was made in the distal anterior portion of the tibia. This graft is snugly fitted into a slot deeply gouged about 2 cm into the neck of the Talus. The foot was kept in about 5° – 10° of plantar flexion while the graft was slid into place (Figure 1). The placement of the graft into the Talus and alignment of the foot with the ankle and leg were carefully assessed by intraoperative radiographs. Cancellous bone from the tibial graft site was then harvested and packed around the sliding graft; finally, the proximal portion of the graft was secured with one or two screws. A transcalcaneal pin through the Talar body to the tibia was applied to provide more stability and varus/valgus alignment. The posterior slab was applied for 2 weeks until the suture was removed, and then the ankle was immobilized with a cast for the next 4 to 6 weeks. The cast and transcalcaneal pin were removed after 6–8 weeks, and weight bearing was allowed after evidence of radiographic union (Figure 2). Examinations were done on all these occasions of visits and after weight bearing, patients were called for follow-up every six months for the next two years or as per the needs of the patients.

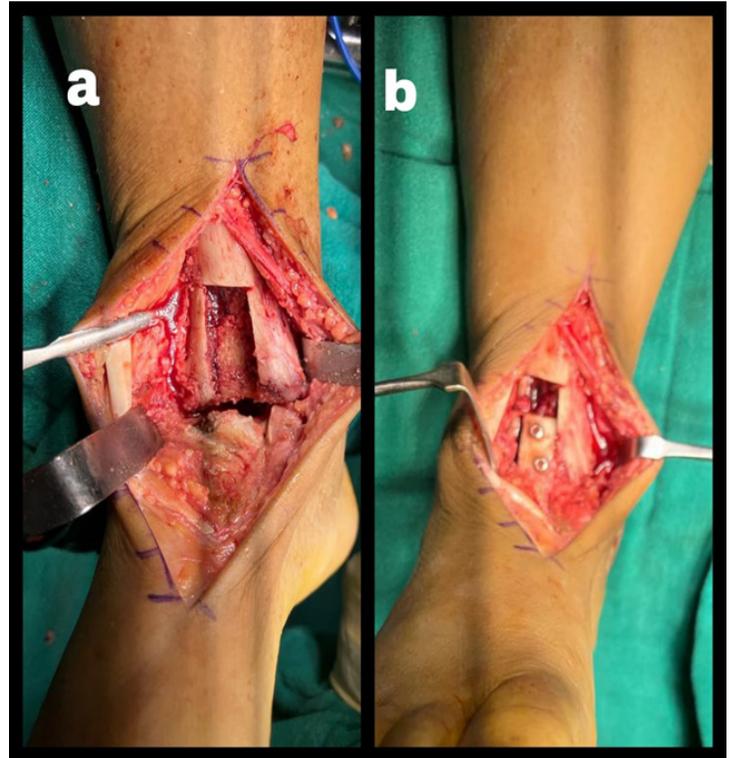


Figure 1. a) Slot in the distal tibia after obtaining bone graft b) sliding graft fit into the slot of Talar neck and secured with two screws into the distal tibia

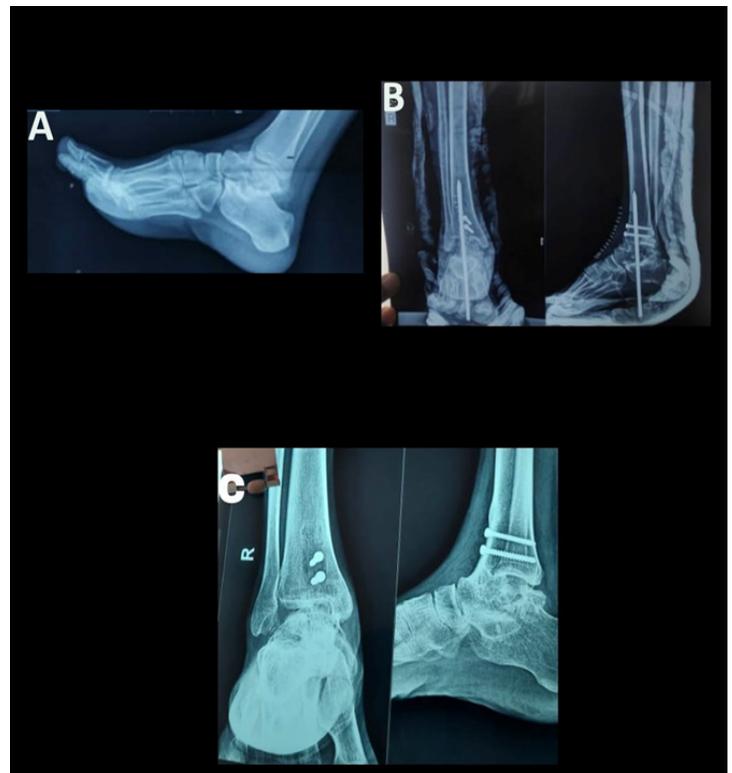


Figure 2. a) X-ray at the time of injury showing Hawkins type III fracture b) immediate post-op X-ray c) X-ray after 1 year of surgery

RESULTS

A total of nine patients met the inclusion criteria and were selected for this study, out of whom eight were male and one female. The median (IQR) age of the patients was 37 (29–51). Seven patients sustained injuries due to road traffic accidents, while two of the patients fell from heights. Out of nine patients, four had open fractures. All the open fractures were initially managed with debridement and ankle-spanning external fixators. Among the open fractures, one was a Gustillo-Anderson grade 3C fracture. It had posterior tibial artery and tibial nerve injuries at the level of the ankle, which were both repaired and then partial thickness skin grafting was done. In that case, fusion was delayed for two months. Except for this patient and the patients who presented after one month of injury, the fusion procedure was initiated within one month of injury.

The average follow-up was median (IQR) 18 (14–26) months. All fusions were united without the need for secondary operations. The median (IQR) union time was 19 (16–20.5) weeks. The median (IQR) AOFAS at 12 months was 74 (63–81). Similarly, VAS for pain had a median (IQR) of 8 (7–9). There was one incident of superficial infection in an open fracture, which was controlled after debridement and the use of antibiotics. In all cases, some motion in the sagittal plane, including eversion and inversion, was preserved. All ankles were either at neutral or a few degrees of planter flexion (range of 0°–10°). If the tibiopedal motion (range of maximum planter flexion to maximum dorsiflexion) was 15°–20°, then it was considered an excellent result; if it was 10°–15°, it was good; and if it was <10°, it was considered a poor result. As such, there were two excellent results (with tibiopedal motion of 15°–20°), five good results (with tibiopedal motion of 10°–15°), and two poor results (with tibiopedal motion of less than 10°). The details of the patient outcome are given in Table 1.

Table 1. Demographics and Outcomes

SN	Sex	Age (years)	Type	Complication	Union (weeks)	Follow-up (Months)	AOFAS	Tibiopedal motion	Grade
1	M	51	Hawkins Type III	-	16	17	81	15° – 20°	Excellent
2	F	55	Hawkins Type III	-	16	12	65	10° – 15°	Good
3	M	28	Hawkins Type III Neck/ Body, Open	-	20	20	75	10° – 15°	Good
4	M	34	Hawkins Type III	-	18	13	54	<10°	Poor
5	M	41	Hawkins Type III Neck/ Body	-	17	15	81	10° – 15°	Good
6	M	30	Hawkins Type III, Open	Infection	19	28	69	10° – 15°	Good
7	M	27	Hawkins Type III	-	21	18	88	15° – 20°	Excellent
8	M	52	Hawkins Type III Neck/ Body, Open GA IIIC	-	20	25	61	<10°	Poor
9	M	37	Hawkins Type III, Open	-	25	30	74	10° – 15°	Good

DISCUSSION

The most frequent complications of talar neck and/or body fractures are avascular necrosis of the talar body

and osteoarthritis of the tibiotalar and subtalar joints. Joint damage is caused by the injury at the time of trauma and progressive damage is secondary to reduction defects that alter the biomechanics of the foot and ankle.¹⁰ Usually, talar fractures occur due to high-energy trauma. And most of the time, high-energy trauma has associated injuries along with talar fractures. In a study, 55% of the patients had suffered an associated injury.¹⁰ In our study, one patient (11.11%) had posterior tibial artery and tibial nerve injuries at the level of the ankle joint. He was treated by anastomosis for artery and nerve repair.

With a higher rate of secondary ankle arthrodesis after primary fixation of high-grade talar fractures, primary fusion has been considered a superior option. With consideration of cost and outcomes, modified Blair fusion is a better operation than most of the fusion methods. The modified Blair fusion is a simple method that is easier to learn, has a low cost, preserves some subtalar joint motion, maintains hindfoot height, and has comparable complication rates compared with the alternative procedure.^{1,11–13}

In our study, all patients achieved union within a median of 19 weeks of surgery. Overall, the median AOFAS score was 74, and the median VAS score for pain was 8. There was at least 15° of tibiopedal motion in 77.8% of patients. 22.2% of the patients had excellent results, 55.5% had good results, and 22.2% had poor results. This result is comparable to the findings of the study done by Van Bergeyk in which seven patients underwent modified Blair fusion for osteonecrosis of the Talus, of whom 71% healed within 16 weeks of surgery while the remaining patients needed a secondary procedure to achieve union. All the patients achieved union, the median AOFAS Score was 67 and the median VAS pain score was 7.1. All the patients were satisfied with the surgery. About 85% walked with a minimal limp, and 71% of patients had at least 25% of their subtalar joint motion preserved.¹⁴

In a series of 5 patients studied by Bhattacharya with at least 24 months of follow-up, 60% of patients had excellent

results with a range of Tibiopedal movement of 15°–20°, 20% had good results, and 20% had poor results.¹⁵ In a similar study in 2005 by Shribastava et al., with an average follow-up of 2 years, the results were good in six patients, fair in one, and poor in one of the eight patients that had

been studied.⁹ Similarly, Singh studied 11 patients who underwent modified Blair fusion, where there were nine cases of excellent results and two cases of good results.¹⁶ The blood supply network of the Talus predisposes it to develop avascular necrosis, and up to 40% of the patients have to undergo secondary arthrodesis to address pain, discomfort, malunion, and non-union. This means that the readmission rate goes up, the total cost of care increases, the length of hospital stay increases, and productivity decreases. In a country like Nepal, where patients have to wait for months for surgery and where patients have to bear the whole cost of hospital care, undergoing secondary arthrodesis seems to be an irrational decision in terms of patient-centered care. In gist, primary modified Blair fusion may be opted for in patients with Hawkins type III fracture-dislocation. It has the advantage over tibio-calcaneal arthrodesis of giving a normal-appearing foot, producing no shortening and allowing the motion to remain at the talonavicular and anterior subtalar joints, thus helping the patients to walk with comfort, without having to bear the risk of secondary arthrodesis.

Despite the current study being limited in patient numbers and the lack of prospective data collection, it can be helpful in choosing an appropriate form of treatment when needed. Due to the relative rarity of this problem in many practices, a prospective, comparative trial with enough power to detect a true difference would be extremely difficult to perform. However, further studies with a better level of evidence are needed in this matter.

CONCLUSION

Modified Blair Fusion is an effective modality with having minimal complication rate. It can be performed as primary surgery for Hawkins type III Talar neck body fractures to avoid reintervention rate.

CONFLICT OF INTEREST

No conflict of interest.

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