



Original Research Article

Functional outcome of modified Blair's arthrodesis for injuries of Talus

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ABSTRACT

Introduction: Fracture neck of the talus associated with or without subtalar, tibiotalar joint and talo-navicular joint dislocation can be considered a devastating injuries to the ankle joint. Most of these cases will complicate as osteonecrosis of body of talus, which takes very long time (years) for revascularization even after prolonged non weight bearing. The present study reports the functional outcome of talus injuries, which are treated with modified blair's arthrodesis through anterior approach.

Materials and Methods: This is a prospective study conducted in katuri medical college & hospital, Guntur, from July 2018 to January 2020. Total nine number of patients who were treated with modified blair's arthrodesis for talar neck fracture in nonunion and osteonecrosis were selected in this study. The median interval between injury and index surgery was 6 weeks to 20 weeks. All the patients were followed with serial radiographs and assessment of tibio pedal movement was done. Ankle joint functional outcome after the surgery was assessed by rating systems such as visual analog scale and American orthopaedic foot and ankle society score preoperatively and at follow up of 1 year.

Results: Tibio talar bony union was achieved in all cases at an average of 20 Weeks. Five cases (55.5%) had excellent results with 15-20 deg tibio pedal movements and four cases (44.4%) had good results with 10-15 deg of tibio pedal movements. In this study, postoperative American orthopaedic foot and ankle society score was 85.44 ± 5.20 , $P < 0.01$, showing significant difference when compared with preoperative score 51.3 ± 16.19 , $P < 0.01$. Visual analog scale was significantly decreased from 2.89 ± 1.05 to 0.44 ± 0.88 at follow up of 1 year (P value= 0.0001).

Conclusion: Good longterm results were achieved with modified blair's arthrodesis. This technique has high reliability in pain relief and with remaining tibio pedal motion patient can walk more physiologically without any difficulty.

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1. Introduction

Fracture neck of talus associated with or without subtalar, tibio talar and talo-navicular joint dislocation can be considered as serious injuries around ankle and poses challenging problem for an orthopaedician when these fractures are neglected and resulting in non-union and osteonecrosis of the talus. Talar neck fracture and body dislocation occurs due to forced ankle dorsiflexion combined with axial loading, results in talar neck impacting against the anterior edge of tibia. These fractures sometimes

can be treated with manipulation and casting. Detenbeck and Kelly recommended excision of talus and tibio calcaneal arthrodesis by compression as main stay of treatment for fracture dislocation around talus but this technique resulted in widening of hind foot and shortening of foot which lead to difficulties in shoe fitting.¹ To avoid this complication Blair performed a tibiotalar fusion, in this procedure body of talus was removed and sliding cortical tibial bone graft was placed anteriorly between anterior aspect of tibia and head of talus.² After that Morris et al. modified the procedure by introducing a trans-calcaneal Steinmann pin through calcaneum in to tibia and fixing tibial sliding graft with a cortical screw proximally to prevent

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proximal migration of sliding graft.³ With this procedure the foot maintained its normal appearance, alignment and shortening was minimized and remaining subtalar range of movements were increased.

The present study evaluates the functional outcome of patients treated by modified blair's arthrodesis using American orthopaedic foot and ankle society score and visual analog scale preoperatively and postoperatively and tibio pedal movement postoperatively.

2. Materials and Methods

This is a prospective study conducted in katuri medical college and hospital, Guntur, from July 2018 to January 2020. Total nine cases who were treated with modified blair's arthrodesis for non-union and osteonecrosis were included in this study. The median interval between injury and index surgery was 6 weeks to 20 weeks. Among nine patients, 6 (66.6%) were males and 3(33.3%) were females. Preoperatively roentgenogram was performed to all patients for conformation of fracture and were managed with modified blair's arthrodesis using sliding graft from anterior tibia. All the patients were followed up for 1 year with serial radiographs and tibio pedal movements were assessed postoperatively American orthopaedic foot and ankle society score and visual analog scale were assessed preoperatively and at postoperative 1 year follow up.

2.1. Statistical analysis

Statistical analysis was performed using Statistical package for social sciences 23.0 medical software package. Data were analyzed with t- test. $P < 0.05$ was considered statistically significant.

2.2. Surgical procedure

Through anterior approach, interval is developed between extensor hallucis longus & extensor digitorum longus. After exposure of joint, tibial articular surface is denuded, foot placed in 0 degrees of dorsiflexion, 5 degrees valgus and 10 degrees of external rotation and tibial, talar surfaces are placed in contact with each other and sliding bone graft of size 5 cm × 2.5 cm from anterior aspect of tibia is inserted in to talar neck and fix the proximal part of graft with a 4.5mm cortical screw. To increase stability at arthrodesis site and to prevent varus and valgus deformity of foot a trans calcaneal Steinmann pin is passed through calcaneum in to tibia.

2.2.1. Post-operative management

Postoperatively, long leg cast with knee in 30 degrees flexion was applied for 6 weeks. After 6 weeks, Steinmann pin removal was done and short leg walking cast was substituted. Non weight bearing walking up to 12 weeks after surgery and weight bearing is allowed after healing of graft which is confirmed by radiography. Tibio pedal



Fig. 1: Intraoperative surgical photograph showing sliding graft.

movement was assessed clinically. Tibio pedal movement is defined as arc of movement from maximum dorsiflexion to maximum plantar flexion, and angles subtended by long axis of tibia and foot in lateral projection.

3. Results

Practically, results were assessed based on degree of tibio pedal movement and ability of patient to do full activities without any symptoms. We have considered the patient have had an EXCELLENT result if degree of tibio pedal movement is of 15-20° and is able to do his daily activities without any symptoms and outcome of patient is considered to be GOOD if the patient is having tibio pedal movement of 10-15° and have occasional discomfort but no restriction of daily activities. Outcome is considered to be poor if tibio pedal movement is less than 10° and daily activities of patient are restricted because of severe pain. Final outcome was shown in (Table 1).

Table 1: Final outcome assessment

Final out come	No of patients	Percentage
Excellent	5	55.5%
Good	4	44.4%
Poor	0	0

The position of arthrodesis of ankle was assessed clinically and is fused in 0 degree dorsiflexion in all cases and fusion was assessed radiologically by formation of trabeculations across tibia, talus and sliding graft. All the patients were with satisfied ankle function postoperatively. American orthopaedic foot and ankle society score (AOFAS), visual analog scale scores (VAS) were significantly different 1 year after surgery compared to preoperative period ($p < 0.05$), indicating significant improvement in ankle joint function (Table 2).

Table 2: AOFAS and VAS before and after operation ($\bar{x}\pm s$, *n=9)

Item	* AOFAS	* VAS
Preoperative	51.3±16.19	2.89±1.05
Postoperative	85.44±5.20	0.44±0.88
T	6.13	5.5
P-Value	0.0003 statistically significant	0.0001 statistically significant

*AOFAS - American Orthopaedic foot and ankle society score,

*VAS - Visual analog scale

*n= total number.

On measuring limb length no shortening was noted. Normal heel height and shape were maintained in all the cases. Gait was assessed which is physiologically normal. No limp was noticed and patient is able to walk more physiologically.

**Fig. 2:** Pre operative radiograph**Fig. 3:** Immediate post operative radiograph showing fixation with 4.5 mm cortical screw and steinmann pin

4. Discussion

The best suggested treatment of fracture in non-union and Osteonecrosis of talus is blair's arthrodesis. In 1943 blair described tibiotalar arthrodesis as main stay of treatment for fracture of the talus in non-union and osteonecrosis.² This technique involves removal of fragments of talar body and insertion of sliding tibial graft in to neck of

**Fig. 4:** Post operative radiograph at 1 year follow up**Fig. 5:** Post-operative clinical photograph at 1 year**Fig. 6:** Post-operative clinical photograph at 1 year

talus. In 1971 morris et al. modified this technique by fixing the graft to tibia with a screw proximally and tibia on to calcaneum is fixed with transcalcaneal Steinmann pin.³ These modifications stabilized the ankle. Linsy et al. and Patterson et al. performed modified blair's fusion, but none of them tried to salvage talus body.⁴ Kitaoka et al. explained about talar body removal for first time.⁵ These studies stated that when blair's arthrodesis is performed with excision of talar body, loads of three to four times body weight occurs in ankle joint during normal walking.



Fig. 7: Post-operative clinical photograph at 1 year



Fig. 8: Pre operative radiograph



Fig. 9: Immediate post operative radiograph showing fixation with 4.5 mm cortical screw and Steinmann pin



Fig. 10: Postoperative radiograph at 1 year follow up



Fig. 11: Post-operative clinical photograph at 1 year



Fig. 12: Post-operative clinical photograph at 1 year



Fig. 13: Post-operative clinical photograph at 1 year

With removal of posterior facet, forces act on subtalar joint and contact characteristics of anterior and middle facet changes substantially leading to degenerative arthritis of sub talar joint. In this study, bone is not excised instead tibial articular surface is denuded which increases not only the intraoperative stability but chances of varus and valgus are reduced. With this technique, cortical bone with added cancellous bone from lower end of tibia produces sound fusion in all cases and also maintains normal height of heel.

Most of the patients had a successful clinical result, almost the normal alignment of the foot with relative to ankle and leg was observed. Radiologically the talus, the graft and tibia got incorporated and sound fusion was achieved in all the cases. Dunn et al. was first to observe the revascularization of the talar body after fracture and it took many years to for revascularization.⁶

For normal physiological gait 10-20° of tibiopedal movement is necessary.⁷ With limitation of arthrodesis at tibiotalar level and preservation of talus, hind foot function

Table 3: Shows the comparative functional outcomes of pre-Op and post-Op AOFAS and VAS scores of various studies performed over the years

Study	Preop AOFAS	Postop AOFAS	Preop VAS	Postop VAS
Wang Shuangli et al.	45.38±3.21	83.13±3.76	8.01±0.63	2.31±1.05
Shay Tenenbaum et al.	32.7 ± 8.7	72.1±10.1	6.9 ±1.5	1.7± 2.2
Our study	51.3±16.19	85.44±5.20	2.89±1.05	0.44±0.88

remains unaltered by sharing load to anterior and middle facet of subtalar joint. In the present study four patients (44.4%) showed tibio pedal motion of 10°- 15° and five patients (55.5%) showed tibio pedal motion of 15°-20°, resulting in good to excellent gait. There was no certainty in position of arthrodesis as varied opinions among different authors regarding best position for arthrodesis was noted. Barr and record recommended 5° equinus,⁸ Watson-jones as 10° equinus for arthrodesis.⁹ Anthony A. Mascioli preferred neutral dorsiflexion as best position for arthrodesis.¹⁰ In this study the ankles were fused in 0 degree dorsiflexion with which patient is able to walk more physiologically without any difficulty. With this technique, AOFAS was significantly increased and VAS was reduced.

The comparative functional outcomes of pre-Op and post-Op AOFAS and scores of various studies performed over the years shown in (Table 3).

5. Conclusion

We achieved good longterm results with modified Blair's arthrodesis. Arthrodesis with preservation of talus provided greater intraoperative stability and almost normal looking foot with no limb length discrepancy. This technique has high reliability in pain relief and remained tibio pedal movement helps the patient to walk more physiologically without any difficulty.

6. Sources of Funding

None.

7. Conflict of Interest

None.

References

1. Detenbeck LC, Kelly PJ. Total Dislocation of the Talus. *J Bone Jt Surg.* 1969;51(2):283–8.
2. Blair HC. Comminuted fractures and fracture dislocations of the body of the astragalus: operative treatment. *Am J Surg.* 1943;59:37–43.
3. Morris HD, Hand WL, Dunn AW. The Modified Blair Fusion for Fractures of the Talus. *J Bone Jt Surg.* 1971;53(7):1289–97.
4. Patterson BM, Inglis AE, Moeckel BH. Anterior Sliding Graft for Tibiotalar Arthrodesis. *Foot Ankle Int.* 1997;18(6):330–4.
5. Kitaoka HB, Patzer GL. Arthrodesis for the Treatment of Arthrosis of the Ankle and Osteonecrosis of the Talus*. *J Bone Jt Surg.* 1998;80(3):370–9.
6. Dunn AR, Jacobs B, Campbell RD. Fractures of the talus. *J Trauma: Inj, Infecti Crit Care.* 1966;6(4):443–68.
7. Waugh T. Joe King Visiting Lectureship. Baylor College of Medicine. Houston, Texas; 1977.
8. Barr JS, Record EE. Arthrodesis of the ankle joint: indications, operative technic and clinical experience. *New England Journal of Medicine.* 1953;248(2):53–59.
9. Watson-Jones R. Fractures and joint injuries. Livingstone ES, editor; 1962.
10. Azar FM, Canale ST, Beaty JH. Campbell's operative orthopaedics e-book. Elsevier Health Sciences. Elsevier Health Sciences; 2016.

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