Comparative Study of Functional Outcome of Different Methods of Treatment of Fracture Talus and their Complications: A Prospective Study

Dinesh Chandra Srivastava¹, Sachin Yadav¹, Manish Shukla¹, Alok Gupta¹, Ankur Singh¹, Rajeev Yadav¹

Abstract

Introduction: Ankle injuries gain importance because body weight is transmitted through it and locomotion depends upon the stability of this joint. The Talus fractures are relatively uncommon injuries but they can be associated with significant complications. Talus is involved in about 2% of all lower extremity injury and 5-7% foot injury. There are several methods of treatment. The purpose of this study was to assess the functional outcomes and results of a comparative study of different method of treatment of Talus fractures by conservative modalities and by surgical methods.

Material and Methods: This was a prospective cohort study of the patients with Talus fractures who attended SRN Hospital, Allahabad from August 2014 to July 2016. Cases were taken up according to inclusion and exclusion criteria. A total of 37 patients of fracture of the Talus were admitted, out of which 7 patients were excluded as per exclusion criteria as they didn’t turn up at least at 6 month follow up. Each patient was followed up for interval of 3 weeks, 6 weeks, 12 weeks and 6 months duration but only thirty patients were included in this study who turned up for at least 6 months of follow up.

Results: All the patients were followed up at least for 6 months with the mean follow up time is 8.5 months. Total 30 patients were treated in our study out of which 12 patients were managed conservatively in which maximum number of patients 5(41.67%) had fair results, 3(25%) had good and poor results whereas only 1(8.33%) patient had excellent result. In operative group maximum number 7(38.89%) of cases had good results followed by excellent and fair results with 4(22.22%) of each whereas only 3(16.67%) had poor results

Conclusion: Anatomical reconstruction of articular surface, restoration of overall geometry of ankle and hind foot and stable fixation of the fracture fragments allow early rehabilitation. Non-invasive or conservative treatment should be reserved for stable and undisplaced fractures. Results of our study showed that the rate of complications associated with conservative managements of displaced fractures was much more as compare to open reduction and internal fixation. Minimally invasive surgical intervention gives better result than aggressive open reduction and internal fixation.

Keywords: Anatomical reconstruction, fracture Talus.
vehicle accidents and fall from height with component of dorsiflexion of ankle. Talus fractures are second in frequency among all tarsal bone fracture. Anatomical Classification of Talus Fracture: Talar neck fracture, Talar body fracture Talar head fracture, Lateral process fracture, Posterior process fracture. The most commonly used classification for talar neck fractures is that described by Hawkins with the modifications suggested by Canale and Kelly[1,3]. Type I- fracture refers to a fracture without associated dislocation, that is, an undisplaced fracture of the talar neck. The Hawkins II fracture refers to a talar neck fracture with associated dislocation of the subtalar joint. This is perhaps the most common type of talar neck fracture dislocation. Hawkins Type III fracture involves a dislocation at the ankle as well as at the subtalar joint. The Hawkins Type IV fracture was described by Canale and Kelly and implies associated subluxation or dislocation of the talonavicular joint. There are several methods of treatment, in conservative slab followed by cast or closed reduction percutaneous screw fixation and surgically using standard open reduction technique followed by K-wire fixation, lag screw fixation or plating. Every method of management has their own merits and demerits like osteonecrosis, arthritis (post-traumatic), non-union, malunion, infection. The purpose of this study is to assess the functional outcomes and results of a comparative study of different method of treatment of Talus fractures by conservative modalities and by surgical methods in the form of screws fixation, K-wire fixation, plating, arthrodesis to attain a proper anatomical alignment and stability of the ankle and hind foot joint, and appropriate definitive treatment based on the fracture pattern and soft tissue condition.

**Material and Methods**

Patients with Talus fractures who attended SRN Hospital, Allahabad from August 2014 to July 2016 were included in the study. A total of 37 patients of fracture of the Talus were admitted, out of which 7 patients were excluded as per exclusion criteria as they didn’t turn up at least at 6 month follow up.
Patient included in the study are based on the following inclusion criteria: All patients in age group above 18 years presenting with fracture Talus which is confirmed radiologically, patients willing to complete a rigorous rehabilitation program, patients completing at least 6 month follow up. Exclusion criteria were: Patients with the Talus fracture with an active infection at the site of injury, with associated neurovascular disorder, compound fractures and patients who do not turn up at least at 6 month follow up.

On admission of the patient, the general condition of the patient and the vital signs were recorded. Methodical clinical examinations including both local and systemic were carried out. Fracture anatomy was assessed with X-rays and fractures were classified according to anatomical classification. Talar neck fractures are further classified by Hawkins Classification with the modifications suggested by Canale and Kelly. Of the 30 patients, 15 patients (50%) had talar neck fracture, 8 patients (26.67%) had talar body fracture, 4 patients (13.33%) had talar head fracture, 3 patients (10%) had posterior process fracture. Of the 15 patients with talar neck fracture, 6 patients (40%) had type I fracture (4 patients were treated conservatively and 2 were treated operatively), 6 patients (40%) had type II fracture (1 patient was treated conservatively and 5 were treated operatively), 2 patients (13.33%) had type III fracture (all 2 treated operatively), 1 patient (6.67%) had type IV fracture (treated operatively). Thus of the 15 patients (50%) with talar neck fracture, 5 patients were treated conservatively and 10 were treated operatively. Of the 8 patients (26.67%) with talar body fracture, 3 patients were treated conservatively and 5 were treated operatively. Of the 4 patients (13.33%) with talar head fracture, 2 patients were treated conservatively and 2 were treated operatively. Of the 3 patients (10%) with posterior process fracture, 2 patients were treated conservatively and 1 was treated operatively. The following surgical procedures are used: Fixation with percutaneous screws, Open reduction with internal fixation by screws, Open reduction with internal fixation by plating, Blair fusion. Of the 10 patients with talar neck fracture treated operatively, 4 patients (2 patients with Hawkins’s Type I and 2 patients with Hawkins’s Type II) were treated with fixation with percutaneous screws, 5 patients (3 patients with Hawkins’s Type II and 2 patients with Hawkins’s Type III) were treated with open reduction with internal fixation by screws and 1 patient (with Hawkins’s Type IV) treated with open reduction with internal fixation by plating. Of the 5 patients with talar body fracture treated operatively, 1 patient was treated operatively.

### Table 2: Overall mean, S.D., p values of ankle and hind foot score at each follow up.

<table>
<thead>
<tr>
<th>Group</th>
<th>3 Weeks</th>
<th>6 Weeks</th>
<th>12 Weeks</th>
<th>6 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conservative</td>
<td>Operative</td>
<td>Conservative</td>
<td>Operative</td>
</tr>
<tr>
<td>Mean</td>
<td>48.83</td>
<td>60.89</td>
<td>55.58</td>
<td>67.89</td>
</tr>
<tr>
<td>SD</td>
<td>15.05</td>
<td>17.03</td>
<td>15.74</td>
<td>16.51</td>
</tr>
<tr>
<td>P value</td>
<td>0.0567</td>
<td>0.0513</td>
<td>0.0439</td>
<td>0.0445</td>
</tr>
</tbody>
</table>

Overall mean and S.D. of ankle and hind foot score at each follow up.
treated with fixation with percutaneous screws, 2 patients were treated with open reduction with internal fixation by screws and 2 patient treated with Blair fusion. Of the 2 patients with talar head fracture treated operatively, 1 patient was treated with fixation with percutaneous screws, 1 patient was treated with open reduction with internal fixation by screws. 1 patient with posterior process fracture, treated operatively with percutaneous screws. From all the patients treated operatively informed written consent was taken for respective surgical procedure. Surgical procedures were carried out. Postoperative treatment included routine antibiotics, analgesic, regular cleaning and dressing of the wound. Post-operative evaluation is done by X-rays - AP and lat Views. Clinical and radiological assessment is done at 3 weeks, at 6 weeks, at 12 weeks and at 6 months. The functional assessment of the patient was done according to AOFAS - Ankle and Hind foot score.

Conservative Management:
After closed reduction, below knee POP slab was applied for 1 week, followed by below knee POP cast for 8 to 10 weeks with ankle in slight equinus position. Cast is removed after 8 to 10 weeks and short leg walking cast applied for 2 more months until clinical and X-rays sign of healing appears.

Surgical technique:
Fixation with closed reduction and fixation with percutaneous screws:
After closed reduction in anatomical position, first hold the reduction with two 2mm K-wire under C-Arm. After that fracture was fixed with two 4.5 mm partially threaded cannulated screws that weAre passed perpendicular to the fracture line. Reduction and placement of screws were checked under the C-Arm. Patients were given a non-weight bearing B/K POP slab with planter flexion for 8 -10 weeks and after 10 weeks below knee walking cast was given and partially weight bearing was allowed.

Open reduction with internal fixation by screws:
Approach used for the complete visualization of fracture Talus are Anteromedial, Anterolateral, Combined Anterolateral and Anteromedial, Posterolateral, Direct medial and direct lateral approach.
Anteromedial Approach: Expose the head and neck of Talus through incision 7.5 to 10cm long, beginning proximal and just anterior to the medial malleolus, curving distal ward and plantar ward toward the sole of the foot, and ending on the medial side of the body of the navicular, using the interval between the anterior and posterior tibial tendons. Avoid incising the posterior tibial tendon and neurovascular structures inferior to the medial malleolus. If the body of the Talus is extruded from the ankle mortise, osteotomy of the medial malleolus may make exposure and reduction easier. Expose the fracture and the anteromedial aspect of the neck and body of the Talus. Preserve as much soft tissue as possible around the head and neck of the Talus. Reduce the fracture, and irrigate the joint to remove bone fragments and debris. If the medical malleolus was osteotomized to improve exposure, reduce it and fix it with a malleolar screw or TBW.
Anterolateral approach: Expose the lateral neck through a 5-cm incision over the sinus tarsi, extending toward the base of the fourth metatarsal. Protect the dorsal intermediate cutaneous nerve in this region. After incising

<table>
<thead>
<tr>
<th>Complications</th>
<th>Conservative (12 patients)</th>
<th>Operative (18 patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>5 (41.67%)</td>
<td>10 (55.56%)</td>
</tr>
<tr>
<td>AVN</td>
<td>2 (16.67%)</td>
<td>4 (22.22%)</td>
</tr>
<tr>
<td>OA</td>
<td>5 (41.67%)</td>
<td>5 (27.78%)</td>
</tr>
<tr>
<td>Malunion</td>
<td>2 (16.67%)</td>
<td>-</td>
</tr>
<tr>
<td>Non-union</td>
<td>1 (8.33%)</td>
<td>1 (5.55%)</td>
</tr>
<tr>
<td>Infection</td>
<td>-</td>
<td>4 (22.22%)</td>
</tr>
</tbody>
</table>

Table 3: Distribution of cases according to post-op complications in different treatment groups

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schulze et al.</td>
<td>12 (26.08%)</td>
<td>14 (30.43%)</td>
<td>11 (23.95%)</td>
<td>9 (19.56%)</td>
</tr>
<tr>
<td>Comfort et al.</td>
<td>6 (16.67%)</td>
<td>8 (22.22%)</td>
<td>17 (47.23%)</td>
<td>5 (13.89%)</td>
</tr>
<tr>
<td>Hawkins et al.</td>
<td>14 (25.92%)</td>
<td>13 (24.0%)</td>
<td>19 (35.18%)</td>
<td>8 (14.82%)</td>
</tr>
<tr>
<td>Our Study</td>
<td>5 (16.67%)</td>
<td>10 (33.33%)</td>
<td>9 (30.0%)</td>
<td>6 (20.0%)</td>
</tr>
</tbody>
</table>

Table 4: Comparison of outcome of our study with different past studies.
the inferior extensor retinaculum, reflect the extensor digitorum brevis plantarly to expose the fracture. Careful reduction is important because slight varus at the fracture still can produce mal-union that is quite disabling. Try to locate interdigitating fracture lines medially or laterally for a guide to reduction, even if a gap remains in the opposite cortex. Beginning just posterior to the articular surface of the head, on the medial or lateral aspect of the neck, drill two or three small Kirschner wires through the neck and into the body to hold the reduction. Depending on the available space for fixation, a 4.0 mm, 4.5 mm or 6.5 mm partially threaded cannulated screw can be used. In each case, care must be taken to countersink the screw head to provide a flat area for seating of the screw head. Alternatively, mini-fragment plates and screws can be placed, especially if there is excessive comminution or limited space for fixation in the head fragment. Check the final position with radiographs.

Posterolateral Approach: For placement of posterior-to-anterior screws, use the Henry approach from the lateral side of the Achilles tendon, and develop the interval between the flexor hallucis longus and the peroneal tendons. Place the guidewire above the lateral projection of the posterior process, and direct it toward the lateral talar head. Fluoroscopic guidance is essential to avoid the subtalar joint.

Open reduction with internal fixation by Plating:
With the K-wires placed appropriately and with image intensification verifying accurate reduction, a plate is contoured both medially and laterally through the anteromedial and anterolateral combined approaches. The medial plate will fit along the medial neck with screws into the head and the body, leaving the mid-portion overlying the comminution free of screws. With this fixation, medial talar neck shortening or collapse will not occur. Talus neck bone defect was filled with bone graft.

The lateral plate will fit along the lateral neck and process of talus. The fixation of the plate was done with mini-fragment 2.4 mm and 2.7 mm screws. The medial plate prevents loss of medial length, and the lateral plate acts as a tension band to resist fracture gapping.

Blair Fusion
Expose the ankle through an anterolateral incision, removed the fragments of the fractured body of the talus, and leave the talar head and neck undisturbed, sliding graft 2.5 cm wide and 5 cm long from anterior aspect of distal tibia, cartilaginous tip is removed and introduced the graft into a previously prepared hole about 1.8 cm deep in neck of the Talus. Pack the cancellous chips around the distal end of graft. Postoperative care; a cast is applied from the groin to the toes with the knee in extension for 4 to 6 weeks, after that short leg cast is applied, cast immobilization should be continued till the appearance of healing on X-rays.

Fixation of fracture talar head:
Displaced talar head fracture should always fixed. Anteromedial approach with medial malleolus osteotomy is used for better exposure of head. A 7.5 to 10 cm long incision beginning proximal and just anterior to medial malleolus curving downward and plantarward towards the sole of foot and ending on medial side of the body of navicular bone. Retract the soft tissues and tendon away from surgical view, reduced the fragments and hold with k-wire and fix with headless compression screws. And then medial malleoli fix with malleolar screws. Closed the incision after cleaning with normal saline, B/K POP slab given with strictly non weight bearing for 8 to 10 weeks after 12 days of postoperative stitches was removed and limb is kept in B/K POP slab.

Statistical analysis: Statistical analysis was performed using the software SPSS 21.0 for windows. Test used was the student t test for the comparison of the means which was considered significant at \( p < 0.05 \).

Results
All the patients were followed up at least for 6 months with the mean follow up time is 8.5 months. Total 30 patients were treated in our study out of which 12 patients were managed conservatively in which maximum number of patients 5(41.67%) had fair results, 3(25%) had good and poor results whereas only 1(8.33%) patient had excellent result. In operative group maximum number 7(38.89%) of cases had good results followed by excellent and fair results with 4(22.22%) of each whereas only 3(16.67%) had poor results.

Mean (AOFAS) Ankle and Hind foot Score improved in both the conservative and operative groups at 3, 6, 12
weeks and at 6 month follow up, p value at 12 weeks and 6 months were statistically significant, it means surgical fixation of the fracture Talus is better than conservative.

In our study 15 patients developed no complications (50%) after follow up of 3 weeks, 6 weeks, 12 weeks and 6 months. 6 patients developed AVN (20%) at 12 weeks and 6 months of follow up (2 in conservative and 4 in operated), 10 patients developed osteoarthritis (5 out of 12 in conservative, 5 out of 18 in surgical managed patients) at 12 weeks and 6 months. 2 patients developed malunion, all of those managed conservatively. 2 developed non-union and 4 patients developed infection at 3 weeks of follow up.

Discussion
Comparison of outcome of our study with different past studies. In Schulze series he studied 46 patients and found 26.08%(12 patients) had Excellent, 30.43%(14 patients) had Good, 23.91%(11 patients) had Fair result and 19.56%(9 patients) had poor result[5]. Comfort et al studied 36 patients and found 16.67%(6 patients) had Excellent result, 22.22%(8 patients) had Good result, 47.23%(17 patients) had Fair result and 13.89%(5 patients) had Poor result[6]. Hawkins et al studied 54 patients in his series and 25.92%(14 patients) had Excellent result, 24%(13 patients) had Good result, 35.18%(19 patients) had Fair result and 14.82%(8 patients) had poor result[1].

Increased knowledge about the normal and post traumatic anatomy and function of the ankle and hindfoot has led to demands for exact reduction and rigid fixation of the Talus fractures. Prompt operative treatment of displaced Talus fracture decrease morbidity and improves functional outcome. The treatment of the Talus fracture with accurate closed reduction of fracture fragments and joints, percutaneous fixation or open reduction stable internal fixation using AO method and principles protection of remaining vascular supply and soft tissue was found to give a high percentage of excellent and good results.

Conclusion
Preoperative assessment of fracture anatomy, skin condition and regional vascularity should be assessed properly for good results. The aim of treatment for the fractures Talus is to make the ankle and hind foot stable and painless with near normal range of motion as well as gait. This required anatomical reconstruction of articular surface, restoration of overall geometry of ankle and hind foot and stable fixation of the fracture fragments to allow early rehabilitation. Although these goals are difficult to achieve in presence of substantial comminution and the loss of vascularity by trauma. The Talus fractures are not so common, but they lead to serious complications and invalidating disability. Early and accurate diagnosis of the Talus fractures is mandatory in order to provide adequate treatment and avoid major complications such as avascular necrosis and osteoarthritis. Before deciding the mode of treatment, it is necessary to evaluate the fracture anatomy, soft tissue condition and regional vascularity. CT and MRI are required for detailed fracture analysis and for the determination of fracture anatomy and mode of treatment. Non-invasive or conservative treatment is reserved for stable and undisplaced fractures. First Displaced and unstable fracture were tried by closed reduction, if reduction not achieved, open surgical reduction and fixation was done, with precaution to avoid damage to vascularity leads to good result and minimizes the complications. Despite the prompt and early reduction and fixation of the Talus fracture the long term complications are high specially in type3 and type4 neck fracture, comminuted head fracture and comminuted body fracture. Results of our study showed that the rate of complications associated with conservative managements of displaced fractures was much more as compare to open reduction and internal fixation. Conservative treatment in stable fracture leads to good result. Unstable fracture those managed by closed reduction, rigid fixation and early rehabilitation lead to good result. In cases of unstable fracture with open reduction and internal fixation, the probable results are govern by vascular damage of tissue, the degree of displacement and fracture comminution. Minimally invasive surgical intervention gives better result than aggressive open reduction and internal fixation.
References


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How to Cite this Article