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ORIGINAL RESEARCH

Clinical outcome of open reduction and internal fixation in closed fractures of the talus

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ABSTRACT

Introduction: Fractures of the talus neck are rare and serious injuries with a high complication rate. The talus is affected in approximately 2% of all lower extremity injuries and 5-7% of foot injuries. Fixation of the talus neck can lead to significant complications, including ankle and subtalar joint stiffness, avascular necrosis (AVN) of the talus body, ankle arthritis, and subsequent subtalar arthritis. This study aimed to evaluate the operative treatment for talus neck fractures.**Methods:** All adult patients with talus neck fractures admitted to NMCH&RC in Raichur, Karnataka, India, from March 2022 to May 2024 were included in this study. The cohort consisted of 15 patients, comprising 10 males and 5 females. The fractures were classified according to the Hawkins classification and were treated with open reduction and internal fixation using cannulated compression (CC) screws.**Results:** All patients were prospectively followed postoperatively, undergoing both clinical and radiological evaluations. The results were analyzed, revealing skin complications in 2 patients and a consolidation rate of 60-70%. The final follow-up examination included the determination of the AHS score (ankle-hind foot scale) from the American Orthopaedic Foot and Ankle Society (AOFAS), as well as assessments of range of motion and radiological analysis.**Conclusions:** Displaced talar neck fractures present a significant therapeutic challenge due to their substantial early and late complications. Even with optimal management, the non-union rate for type III and type IV Hawkins fractures is 85%, and the incidence of avascular necrosis (AVN) of the talus body is 90-95%, primarily due to compromised blood supply from the talar neck. Types II, III, and IV fractures are often associated with talar body dislocation, which exerts excessive pressure on the soft tissues, leading to significant complications. Achieving early anatomical reduction and stable fixation is crucial for a successful outcome.

Key words: Talar neck fracture, Hawkins classification, Hawkins sign

INTRODUCTION

Fractures of the talus account for only 2% of all lower extremity injuries and 5-7% of foot injuries[1].The talus is the second most commonly fractured tarsal bone, following the calcaneus. Although fractures and dislocations of the talus are relatively rare, they present significant challenges in treatment. Additionally,there is limited evidence available in the literature regarding these fractures and their management. Talus neck fractures make up 50% of these injuries, and their treatment is surrounded by many controversies, highlighting the difficulties in assessment, surgical approach, fixation methods, and the frequency of postoperative complications.

The management of talus fractures hinges on whether the fracture is displaced, necessitating a thorough assessment for appropriate treatment. The talus is unique in that it has no muscular attachments, with 60% of its surface covered by articular cartilage, making it a critical component of the ankle joint. It is also known for its precarious blood supply. Poor outcomes can result in disability due to non-union, the development of avascular necrosis, and osteoarthritis[5].Talar neck fractures typically result from hyper-dorsiflexion injuries and are often

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secondary to high-energy trauma. These fractures are commonly associated with other injuries and usually present with foot and ankle swelling and deformity[6].

The appropriate diagnosis and treatment of these fractures play an important role in the patient's outcome. Treatment has evolved slowly throughout the years, from closed treatment to open reduction and internal fixation (ORIF)[2].The treatment approaches for type I and type II talar neck fractures vary within the orthopedic community.

The option of closed reduction versus ORIF is dependent upon the degree of injury, surgeon experience, and preference[3, 4].

The frequent incidence of serious complications of skin dehiscence, non-union, osteonecrosis, neurovascular injuries, pain, stiffness and post traumatic arthritis of the subtalar and the ankle joint, leads to high risk of unsatisfactory results. Still, the talus fracture remains among the most interesting and difficult injuries in orthopaedic trauma[1].

This article presents a prospective study on talus neck fractures, their management, and rehabilitation at a tertiary care institute.

MATERIALS AND METHODS

During the time frame from March 2022 to May 2024, the patients coming to the Department of Orthopedics at NMCH and RC were selected for the study

INCLUSION CRITERIA

1. Closed fracture of talus with or without dislocation.
2. Road traffic accidents and fall injury Age-15- 60 years.

EXCLUSION CRITERIA

1. Compound fractures with Talus bone exposed.
2. Neglected fractures with > 3 months duration.
3. Prior native treatment done.

SAMPLE SIZE: 15.

CLASSIFICATION

Hawkins's classification is mostly used to classify talar fractures, it is simple and provides guidelines for the treatment and predicts the prognosis. Hawkins's classified talar fractures into: Type I, II, III and IV.

- **Type I:** Fracture without associated joint dislocation i.e. un-displaced fracture of talar neck.
- **Type II:** Talar neck fracture with associated subluxation or dislocation of the subtalar joint.
- **Type III:** Fracture neck talus with dislocation of the ankle as well as of subtalar joint.
- **Type IV:** Type III with associatedsubluxation/dislocation of the talo-navicular joint.

According to the classification system, fractures were categorized, and appropriate treatment options were selected and implemented.

For Hawkins type II fractures with subluxation and dislocation of the talus, an attempt at closed reduction was made using distraction and plantar-flexion.

In this study, surgeries were performed using an anterolateral approach, with additional exposure through an anteromedial incision and a posterior lateral approach when necessary. For cases involving an associated medial malleolus fracture, an anteromedial incision was made, which included the medial malleolus.

The anteromedial approach extends from the anterior aspect of the medial malleolus to the dorsal aspect of the navicular tuberosity. Care was taken to avoid disrupting the deltoid ligament, as this could further compromise the remaining blood supply to the body of the talus.

If necessary, the anterolateral hindfoot approach was used to confirm the accuracy of the reduction and to facilitate the removal of fracture debris or osteochondral fragments from the subtalar joint. Fracture comminution frequently occurs on the medial aspect of the talus neck, and visualizing the lateral aspect can provide a more accurate gauge of reduction adequacy, as comminution on the lateral aspect is rare.

In the study, efforts were made to avoid varus mal-reduction of the talus neck in cases of comminution by direct visualization. It was observed that if the fracture was malpositioned in varus, the fracture site exhibited diastasis or a gap.

After provisional reduction, the fracture was stabilized with two K-wires from the posterior body to the anterior head of the talus, engaging the subchondral bone. The alignment of the neck was inspected using intra-operative anteroposterior foot, lateral foot, and Canale views (15 degrees internal rotation and tilting of the C-arm 75 degrees cephalically for a modified anteroposterior view).

Once the quality of the reduction was confirmed, the fracture was definitively fixed with 4.0 mm cannulated screws. Either one K-wire and one screw or two screws were used across the fracture site. Care was taken to ensure that the screw heads were buried deep into the cartilage to avoid impingement.

In Hawkins type III and type IV fracture dislocations, a Denham's pin was inserted into the calcaneus to achieve distraction at the ankle and subtalar joints. When a posteromedial dislocation occurred with an intact medial malleolus obstructing the reduction of the rotated talar body, an osteotomy of the medial malleolus was performed. A Steinmann pin was inserted into the non-articular surface of the talus to gain better control over the talar body fragment, using it as a joystick to aid in reduction. These types of fracture dislocations were typically associated with spiral fractures of the fibula, which were fixed to stabilize the ankle mortise.

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28yr old male with RTAType 3 talar neck fracture.

CASE 1

Figure1: Pre op Type 3 Talar neck fracture

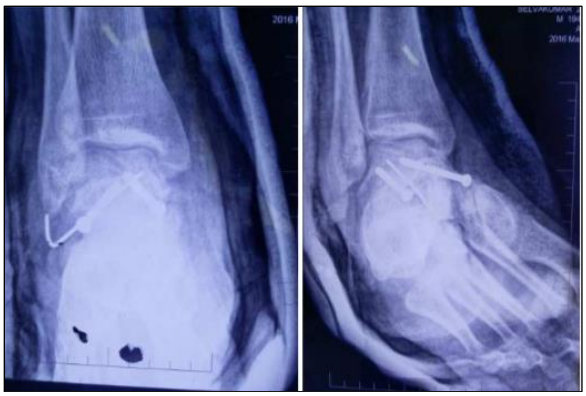

Figure 2: Immediate Post op

Figure 3: 3 months follow-up

Figure 4: 6 months post-op Xray

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Figure 5:One year follow-up, Good ROM

CASE 2

34yr old male with RTA having Hawkins type 2 Talar neck fracture with medial process fracture.

Figure 6:pre op communited Talar neck fracture with medial process of talus fracture

Figure 7: 6 months follow up good ROM

The incision was closed in layers using Vicryl 2-0 for the deeper layers and Ethilon 2-0 sutures for the skin. A sterile dressing was applied, and intravenous third-generation cephalosporins or broad-spectrum antibiotics were administered for seven days. Anti-edema measures included strict limb elevation and administration of serratiopeptidase or trypsin/chymotrypsin for ten days. Postoperative dressing checks were performed on the second and seventh days. Sutures were removed on the 10th or 12thpostoperative day. Patients were followed up at 4 weeks, 10 weeks, 14 weeks, and at 6, 12, and 24 months.

During follow-up visits, clinical evaluations were conducted to assess soft tissue healing, skin necrosis, and superficial infections (Table 1). Radiological evaluations were performed at each follow-up to detect any signs of avascular necrosis (AVN), osteoarthritis of the subtalar and ankle joints, nonunion, and malunion, presence of osteonecrosis was examined using Hawkins' sign in both anteroposterior and lateral radiographs.

RESULTS

Most fractures resulted from road traffic accidents, accounting for 8 cases (53.34%), followed by falls

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from height in 4 cases (26.67%), and sports injuries in 3 cases (20.00%). Among the 15 fractures, 12 patients presented to the hospital within 24 hours of injury, while 3 presented after 24 hours. Of the 15 talar neck fractures, 14 were treated surgically with screw fixation and K-wires, while 1 patient with a type I Hawkins fracture was treated conservatively with a POP cast due to being unfit for surgery.

Skin necrosis and wound dehiscence was commonly seen in type 3 and type 4 Hawkins fracture (Table 1).

TABLE 1:EARLY COMPLICATIONS

Hawkins type/complication	Number of cases	Skin necrosis	Wound dehiscence
I	3	00	01
2	5	01	00
3	5	01	02
4	2	01	01
Total	15	03	04

Secondary ankle arthritis and subtalar arthritis developed approximately 7-9 months post-fracture. Ankle arthritis was observed in 2 cases of type II Hawkins fractures, 4 cases of type III Hawkins fractures, and 2 cases of type IV Hawkins fractures (Table 2). Avascular necrosis was seen in 3 cases of type II Hawkins fractures, 4 cases of type III Hawkins fractures, and 2 cases of type IV Hawkins fractures (Table 2). Nonunion occurred in 6 cases, 10 months post-fracture, and was observed in both conservatively managed and surgically treated cases (Table 2).

Table 2: Outcome of Operative Treatment

Hawkins type	No of cases	AVN	Non union	Ankle arthritis	Subtalar arthritis
1	3	00	00	00	00
2	5	03	01	02	00
3	5	04	03	04	03
4	2	02	02	02	02
Total	15	09	06	08	05

Secondary subtalar arthritis was observed in 5 patients (33.34%), with 3 cases in type III Hawkins fractures and 2 cases in type IV Hawkins fractures. The study had a two year follow-up in 70% of patients. By the end of the first year, 60% of patients had a good prognosis, while 30% had a fair prognosis.

DISCUSSION

The management of talar neck fractures should prioritize the prevention of impending complications. The primary treatment approach is early anatomical reduction and stable internal fixation within 6-8 hours to minimize complications.

A common reason for delaying surgery is significant soft tissue edema or delayed presentation after injury. Lindevall *et al.*, in a study of 26 fractures, found that minimizing the time to surgical fixation is crucial and that the development of avascular necrosis (AVN) does not depend on the delay of surgery[2].

This study's limitations include a small sample size. However, the results are consistent with other studies, such as those by Hawkins *et al.* and Low *et al.*, which indicate that AVN is challenging to identify on plain X-rays, and osteophytes and subchondral cysts are late signs of post-traumatic arthritis or AVN.

For open reduction and internal fixation (ORIF), the anteromedial approach was found to be more versatile. Patients with significant soft tissue injury had less satisfactory outcomes. Types I and II fractures had better union rates and lower percentages of AVN compared to types III and IV.

Early anatomical reduction (within 6-8 hours of injury) and stable internal fixation are vital for achieving a successful outcome.

CONCLUSION

Displaced talar neck fractures present a significant therapeutic challenge due to their substantial early and late complications. Despite excellent management, the non-union rate for Type III and Type IV Hawkins fractures is 85%, and avascular necrosis (AVN) of the talus body occurs in 90-95% of cases due to the inherent complications related to disrupted blood supply from the talar neck. Types II, III, and IV fractures were associated with talar body dislocation, causing excessive pressure on the soft tissues and leading to significant skin complications. Achieving early anatomical reduction (within 6-8 hours of injury) and stable internal fixation is crucial for a successful outcome.

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