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FACTORS MODIFYING THE OUTCOME IN MANAGEMENT OF TALUS FRACTURE

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ABSTRACT Fractures of the talus are known to be relatively uncommon. Talus fractures comprise approximately 0.1 to 0.85 percent of all fractures. Most occur as a result of high-energy trauma, such as motor vehicle accidents. As a result, talus fractures are often accompanied by other injuries, including dislocation of adjacent joints and fracture of neighboring bones. However due to the relatively better diagnostic methods introduced more talar fractures have been recognized and it remains the second most common tarsal bone to get fractured after calcaneum. This paper deals with the factors modifying the outcome of management of talus fracture. The fracture was managed with open reduction and internal fixation with 4 mm partially threaded cancellous screws and followed for outcome clinically and radiologically.

KEYWORDS : Talus Fracture, Cancellous screw fixation

I.INTRODUCTION

Fractures of the talus are known to be relatively uncommon. Talus fractures comprise approximately 0.1 to 0.85 percent of all fractures. Most occur as a result of high-energy trauma, such as motor vehicle accidents. As a result, talus fractures are often accompanied by other injuries, including dislocation of adjacent joints and fracture of neighboring bones. However due to the relatively better diagnostic methods introduced more talar fractures have been recognized and it remains the second most common tarsal bone to get fractured after calcaneum.

Displaced fractures of the talar neck and body are best treated urgently, although the exact timing is controversial. Reduction of dislocated joints is critical to maintain vascularity to the talar body where possible and to reduce tension on the soft tissues and neurovascular structures around the foot and ankle.

Early reduction is theorized to assist the restoration of blood flow and potentially decrease the rate of osteonecrosis. However, clinical studies have, to date, not demonstrated a significant effect of surgical timing on rates of osteonecrosis. When delayed treatment is an unfortunate necessity due to the condition of the patient, a prolonged delay in transfer, or other reasons, immediate management should still include an attempt at reduction of dislocations. Preferred surgical timing for talar neck fractures is controversial.

A recent survey of orthopaedic trauma experts regarding the timing of surgical treatment for displaced talar neck fractures revealed that 40% of respondents felt treatment should occur within 8 hours, and 76% felt treatment should occur within 24 hours; the remaining 24% felt treatment after 24 hours was acceptable.[153]

The principles of surgery are to obtain an anatomic reduction of the talar neck fracture and the associated joints and to achieve sufficient stabilization to facilitate early motion. A variety of surgical techniques have been described to accomplish these principles. Emergent reduction of dislocated joints, precise fracture reduction and stabilization, and protection of the remaining vascular supply and soft tissue envelope provide the best probability of regaining an excellent functional result. Each talar body injury is different and requires individual preoperative planning in order to achieve an open reduction and then stable fixation. Screws alone, or plates and screws, can each be used. Occasionally, lag screws alone, if the fragments are large, will suffice in securing stable fixation of fractures of the body.

Fractures of talus comprises of three basic types- Talar head, Talar neck, Talar dome and body and transchondral fractures. Fractures of the lateral and medial processes of the talus occurs in trivial injuries like eversion and inversion injuries. Early descriptions by Anderson[3] and others of the "aviator's astragalus", fractures of the talus have earned a reputation as a problematic fracture.

Coltart[5] reviewed 228 talus fractures and noted that chip and avulsion injuries were most common, followed by fractures of the talar neck. In 1959 Peterson[6] described that the typical pattern of talar neck fracture was achieved by the application of an axial load to the plantar surface of the foot when the body of the talus was fixed as a cantilever between the tibia and the calcaneus.

The mechanism by which progressive hyper dorsiflexion force causes a talus fracture was described in 1980 by Penny and Davis. Understanding of the talar circulation is ascribed to Wildenauer[8], who described the critical anastomotic sling of vessels in the tarsal sinus and tarsal canal, lying inferior to the neck of the talus.

Peterson and Goldie demonstrated that undisplaced fractures of the talar neck are associated with intraosseus disruption of the branches of the arteries of the tarsal sinus and tarsal canal. These findings confirm the clinical observation that the rate of osteonecrosis depends upon the degree of fracture displacement. Daniels et al. performed a biomechanical study using cadaver specimens and demonstrated that Varus malalignment of the talar neck is associated with forefoot adduction, calcaneal internal rotation, and loss of subtalar motion.

Hawkins[22] described that the time to recognize the presence of avascular necrosis is between the sixth and the eighth week after the fracture dislocation. Subchondral atrophy excludes the diagnosis of avascular necrosis.

Most common cause of injury results from excessive dorsiflexion of the foot, causing rupture of the posterior capsular ligament of the subtalar joint followed by impact of neck of talus against the anterior edge of distal tibia, causing a fracture along the non-articular portion of subtalar joint between the middle and posterior facet.

Further dorsiflexion causes more tear of the posterior capsular

ligament and deltoid ligament causing wedging of the body medially and posteriorly out of the mortise. However typical pattern of a talar neck fracture occurred or was achieved by application of an axial load to the plantar surface of the foot when the body of talus was fixed as a cantilever between tibia and calcaneum. In this study we evaluate the role of mode of injury in the management of talar fractures.

II.METHODS

A prospective study was done in Talus fracture patients operated from November 2014 to August 2016.

Inclusion criteria- Closed fracture of talus with or without dislocation Traumatic injury (RTA/Self fall) Age -15- 60 years

Exclusion criteria- Compound fractures with Talus bone exposed Neglected fractures with > 3 months' duration Prior native treatment done Detailed clinical examination was done with complete haemogram and radiographs of the ankle and foot- anteroposterior and lateral views and CT ankle with 3 D reconstruction was done.

In open reduction and internal fixation of talus, 4 mm partially threaded cancellous screws were used after preliminary reduction with K wires. Anterolateral approach was most commonly employed followed by anteromedial approach and in cases where subtalar involvement was appreciated, a combined anteromedial and anterolateral approach was done. Post operatively intravenous antibiotics was administered for 5 days and oral antibiotics for 7 days. Suture removal was done on 12th post-operative day.

Mobilization of ankle was started on day 1 post-operative day was divided into three phases as follows:

Phase I week 1-6

- Surgical scar protection
- Mobilization of ankle/foot to increase joint mobility
- Active ROM exercises (i.e. ankle pumps) to increase circulation to the foot and promote cartilage healing
- Instruction in non-weight bearing crutch ambulation

Phase II week 6-12

- Initiate instruction in partial weight bearing restriction with crutch ambulation.
- Pain free open chain exercises with band.

Phase III week 12-24

- Progressive resistive strengthening of ankle musculature with band balance
- Gait training on treadmill with progression to incline surface
- Single leg support activities
- Fast walking with progression to jogging for patient specific activities

Patients were followed up at first month (4weeks), third month (12 weeks) and 6 months. During follow up, x ray radiograph of ankle joint was taken in both anteroposterior view and lateral view and mortise view to assess the reduction as well as to analyses and check for any signs of avascular necrosisand also to see joint congruity. Clinical evaluation included range of motion of ankle, complaints of pain and tenderness or swelling in ankle joint. Gait examination was done. Implant assessment- Screw position was assessed radiologically.

III.OUTCOME ANALYSIS

Results were analysed both clinically and radiologically. Time of clinical union was defined as the period between operation and full weight bearing without external support along with radiographically healed fracture. Radiologically fracture inion was assessed in X rays. Functional outcome was assessed using The American Orthopaedic Foot and Ankle Society Score (AOFAS), Olerud & Molander scoring. The results were tabulated and analysed.

V.RESULTS

Follow up period ranged from 12 months to 28 months. All the patients were followed at 1, 3, 6, 12, 18, and 24 months postoperatively and either yearly or 2 years thereafter. 2 patients have been lost to follow-up. The mean follows up was 15 months.

Totally 15 patients were analysed and out of which 8 patients were between 15-30yrs and 4 of them were between 30-45 yrs and 3 between 45-60 yrs. There was a male predominance with 13 of them were male and only 2 females in our study population.

The major mode of injury which accounted for the talar fracture is fall injury which accounted for 2/3rd of the patients and only 1/3rd of them were due to road traffic accidents which satisfied our criteria. There were associated fractures of malleoli in 3 of them with one bimalleolar and one medial malleoli alone, calacaneum in one patient and forearm fracture in one of them. 10 patients were operated within 10 days of injury and 2 of them were operated within 20 days and 3 of them took more than 20 days.

Management of open reduction was done via anteromedial in 6 patients; anterolateral in 7 patients, anterior in 1 patient, dual approach- anteromedial and anterolateral in 1 patient. Distribution of the talar neck fracture accounted mostly to Hawkins type II in 6 of the patients and type III in 4 patients, type III in 3 of them and type IV in 2 of them.

In our study, 5 of the 15 cases had signs of avascular necrosis in follow up x-rays taken and there was clinical complaints of pain and inability to walk and undergo daily activities along with gait abnormalities. 4 out of these 5 cases had joint incongruity and ankle joint pain and restriction of movement signifying arthritic changes. One case had nonunion seen at 3rd month post op x-ray and was advised and put on Below knee cast and immobilization for 8 weeks. In all cases cancellous screws were used as implant of choice and no implant related complications were found in any of the patients. There was no post-operative skin infection or skin necrosis seen in any patients. Clinical outcome based on AOFAS came out to be Excellent in 2 cases, Good in 3 cases, Fair in 6 cases and Poor in 4 cases. In Olerud Molander scoring Good results were obtained in 4 cases; Fair results in 9 cases; Poor results in 2 cases.

VI.DISCUSSION

The management of these fractures is complex and there is a high complication rate. Undisplaced talar neck or body fractures are treated conservatively in most cases with very good results. However, for displaced fractures, open reduction and internal fixation is the rule. In this prospective study of displaced talar fractures, we preferred a fast and slightly aggressive operative treatment to avoid wound complications and avascular necrosis.

However, we noted a high rate of surgical failure and only 30% anatomical reduction. For a better initial reduction, some authors recommend a dual anteromedial and anterolateral approach. This dual approach is sometimes associated with a medial malleolar osteotomy. This technique permits good visualization of the talus but increases the risk of skin necrosis or infection (10–20% depending on authors) and increases the duration of surgery.

Avascular necrosis is a common complication after talar fractures, initial degree of fracture displacement is an important risk factor for osteonecrosis. The surgical delay also seems important and most authors recommend urgent reduction and stabilization of displaced talar fractures. The majority of the talar surface is articular cartilage. This explains the high risk of osteoarthritis after a talar fracture.

Many authors have demonstrated a relation between hind foot misalignment or osteonecrosis and osteoarthritis. However, arthritis of the ankle and subtalar joint can occur in the absence of

osteonecrosis or joint incongruity. Chondral damage can result only from the initial injury or from prolonged immobilization. At long-term follow-up, we observed a very high rate of post-traumatic osteoarthritis. This arthritis mainly affected the tibiotalar joint and the subtalar joint.

Post-operative MRI scan, though gives a better picture about the joint congruency and Avascular Necrosis, it couldn't be done owing to the stainless steel screw implant involved. Though posterior to anterior screw fixation has shown to yield good results according to studies, it was not done in our study due to the technical difficulty involved. In our case, a single case was done using both anteromedial and anterolateral approach (Dual) approach. Even though delay in that case was there for around 3 weeks, the outcome was excellent probably due to better visualization of the fracture and thus better reduction. The risk factor associated with dual approach is skin infection and necrosis, however in young active patient's occurrence of infection carries a lesser probability.

The anterior approach is an alternative to the more commonly described and utilized anterolateral and anteromedial approaches. Most commonly anterior approach is performed for talar dome fractures but there are literature evidences stating that visualization of talar neck was also excellent in anterior approach (Cadaveric study)

In our study a single case was done using anterior approach. The case was followed up after 2 years and the outcome was found to be excellent in AOFAS and was good in Olered Mollander scoring. In the cadaveric study performed earlier it was inferred that the talar surface area visible using the anterior approach is significantly greater than that visible using the anterolateral approach or anteromedial, without and with medial malleolar osteotomy, as well as combination approaches.

VII.CONCLUSION

The aim of the study is to analyse the factors modifying the outcome of closed talar fractures treated by open reduction and internal fixation.

Open reduction and internal fixation is recommended for the treatment of displaced talar neck and/or body fractures. A delay in surgical fixation does not appear to affect the outcome, union, or prevalence of osteonecrosis, rather the type of fractures which might be indirectly influenced by the mechanism of injury provides a statistical significance.

Road traffic accidents rather than fall from height causes a more displaced fractures and these type IV fractures though fixed with screws carries a high risk of Avascular necrosis and post traumatic stiffness and osteoarthritis overall resulting in a poor outcome consequently.

Partially threaded cancellous screws were found to be an ideal implant of choice and both anterolateral and anteromedial approaches provided better results with Dual approach and anterior approach providing good results. However, the case with good results were too small (1 in each) to provide a significant value.

Serial X-rays need to be taken during follow up and X-ray plays a major role in deciding the weight bearing status. In patients where no signs of union were present the patient was found to be partial weight bearing which was not advised and further immobilization was administered.

Displaced talar fractures remain a therapeutic challenge for orthopaedic surgeons. According to the literature, these fractures are often associated with a high complication rate, including malunion, osteonecrosis or osteoarthritis. The operative treatment of such fractures seems to require a balance between an aggressive treatment with a strictly anatomical reduction and essential respect of soft tissues to limit skin complications or osteonecrosis.

Fig-1: A shows the pre-op x rays; B-E shows the follow up x rays at immediate post op, 6 weks, 6 months & 1 year respectively; F shows the clinical outcome at 1 year follow-up

Fig-2: A shows the pre-op x rays & CT with talar neck fracture; B-D shows the follow up x rays at immediate postop, 3 month & 6 month respectively; E shows the clinical outcome at 6 months

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