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Joy Stick Maneuvre for Closed Reduction and Internal Fixation of Hawkins Type III Talar Neck Fracture

KEYWORDS: Hawkins sign, Minimally invasive surgery, joystick manouvre, talar neck fractures

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ABSTRACT *Talar fractures are rarely encountered and accounts to less than 3% of all foot fractures and 50% of these are fractures of the talar neck. Urgent fracture reduction and fixation is mandatory so is absolute anatomical reduction of the fracture and the dislocation is a must and most often open reduction through a medial malleolar osteotomy will be needed and internal fixation with screw will be performed. These fractures often associated with other major injuries and outcome is often fraught with complication. In this article a simple technique of closed reduction and percutaneous fixation of a type III Hawkins talar neck fracture dislocation is being described, where the swollen skin condition of the ankle and foot did risked wound complications if open reduction was attempted and the dislocation and fracture displacement would not allow any delay in intervention. In this technique Steinmann pins are inserted into the calcaneum and the body of the talus and the dislocation is reduced and the fracture fragments of talus are aligned and percutaneously fixed with a 6.5 mm screw. Talar fracture healing is associated with numerous unfavorable outcomes and achieving a stable and accurate fixation without jeopardizing the skin and vascular structures is paramount in achieving good results, Hence this procedure may be helpful in wriggling out of unpleasant situations.*

INTRODUCTION:
Fractures of the talar neck often present a challenge in its management[1]. Axial compression force along with forceful dorsiflexion at the ankle is often noted mechanism of injury. [2-9] The axial force is directed through the plantar surface of the mid foot just distal to the talus. Hawkins and Canale and Kelly observed occasionally a rotational component associated with talar neck fractures[2,3,9]. These injuries are sustained due to fall from a height and landing on the foot, and in high speed road traffic accidents. It was initially described in pilots who land hard in their planes with rudders under the feet referring it to as "Aviator's Astragalus.

The Hawkins classification system is used to describe talar neck fractures. Hawkins type I talar neck fractures, which are non-displaced, Hawkins type II talar neck fractures are displaced fractures with dislocation of the subtalar joint. Hawkins type III injuries involve fracture with dislocation from the ankle and subtalar joints. Type IV injuries, are displaced fractures associated with an ankle, subtalar, and talonavicular dislocation.[10]

The talar body is vulnerable to avascular necrosis (AVN) because of its tenuous blood supply. The artery of the tarsal canal, which is a branch off the posterior tibial artery is the most consistent blood supply to the talar body and is susceptible to injury in a talar neck fracture dislocation. There is a correlation between severity of injury to the talar neck and likelihood of progression to AVN.[11]

Type I Hawkins injuries carry a small risk for AVN. In Type II injuries, AVN may be noted in up to 40% and in type III injuries it is 84% and in type IV injuries, 100% of patients develop AVN. The development of AVN can be assessed during the follow up radiographic investigations. At 6-8 weeks after injury a subchondral lucency in the talar dome, referred to as the Hawkins sign[5] is a good indicator of absence of AVN. Subchondral lucency is indicative of hyperemia and disuse osteopenia and that it correlates well with the improbable progression of AVN in the talus but be advised that a negative, Hawkins sign does not necessarily mean AVN will develop. Recent studies indicate that posttraumatic subtalar arthritis is the most common complication after operative treatment,[12] the most debilitating complication is AVN. The treatment for talar neck fractures entails accurate fracture reduction and stable internal fixation. The development of swelling following trauma and the stretching of the soft tissue structures due to the dislocation, places a lot of ischemic stress on the tissue.

Surgical dissection acts a second hit and leads to difficulty in achieving wound closure, or delayed wound healing and necrosis of the skin which makes attempt of open reduction quite demanding. Hence, a closed reduction technique attempts at limiting these complications.

Materials and Methods:
A 45 year old gentleman with alleged history of fall from a tree and landing heavily on his feet with a forced dorsiflexion injury of the right foot noticed pain and swelling of the foot and ankle with deformity and inability at attempted movements of the foot. He was attended to at a hospital where x-rays were done and the limb splinted in a plaster slab and was referred to our institute for further management. On arrival at our institute 12 hours after the incident

Volume : 5 | Issue : 1 | Jan 2015 | ISSN - 2249-555X

the ankle and foot had swollen with skin stretched over the medial malleolar area and had blanched with valgus deformity of the ankle. No other injuries were recorded and his vitals were stable. The posterior tibial and dorsalis pedis artery pulsations were not palpable but the capillary refill time of the limb was normal. The radiography of the ankle revealed a Hawkins type III fracture of the talar neck (Fig-1).

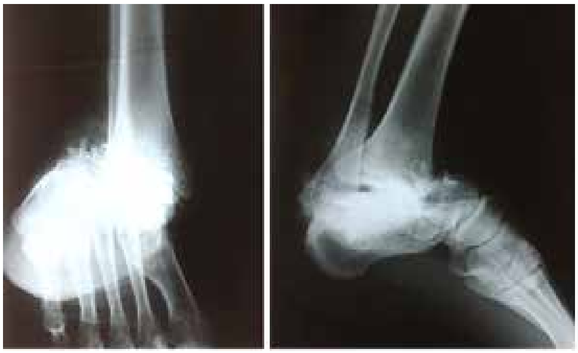

Fig-1: Pre-op radiograph AP and lateral view

Patient required immediate reduction of the fracture dislocation with minimum soft tissue dissection; hence option of closed reduction and internal fixation was first choice and in case anatomical dissection was not achieved open reduction through a transmalleolar osteotomy and internal fixation was planned. The risk associated with of a medial surgical approach and a malleolar osteotomy was the difficulty in achieving a wound closure or the problem with wound healing or the risk of damaging the vascular pedicle to the talar fragments due to soft tissue dissection. The patient was immediately shifted to the operating room for the operative procedure under spinal anaesthesia for closed reduction and internal fixation. Patient was put under a tourniquet and left lateral position. Under image intensifier guidance two 2.5 mm Steinmann pin were inserted. The first pin placed in the calcaneum through a stab incision medial to tendoachilles posteromedial to anterolateral direction.

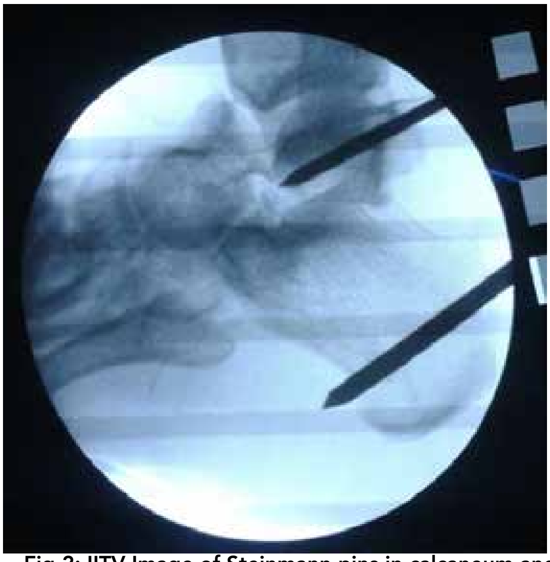

Fig-2: IITV Image of Steinmann pins in calcaneum and talus pre-reduction

2nd pin was inserted into the talar body fragment from posterior to anterior direction through another stab incision lateral to tendoachilles (Fig-2). Once both the fragment were held with pins they were used as joysticks and were manipulated with medial rotation of the talar fragment and lateral rotation of the calcaneus with inferior thrust so as displace it inferolaterally, distracting the space between the tibia and calcaneus to relocate the body of the talus in the mortise and fine adjustments are done to achieve anatomical alignment between the talar body fragment and the head fragment.(Fig-3)

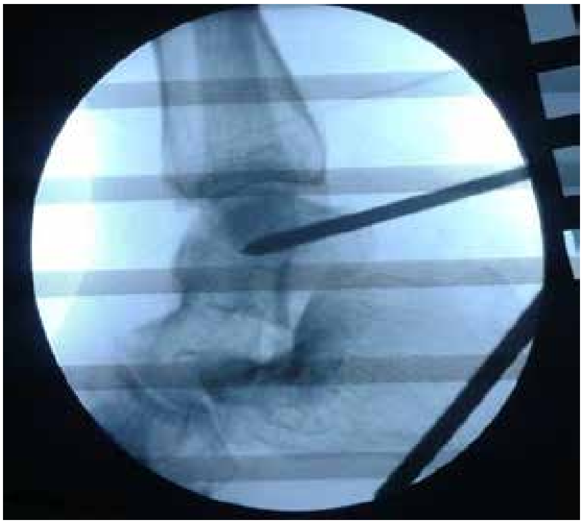

Fig-3: IITV Image of Steinmann pins in calcaneum and talus –post-reduction

Stab incisions made and three guide wires passed under image intensifier guidance across the fracture site and the Steinmann pins removed, the guide wire with central purchase in the head of talus perpendicular to the direction of fracture was drilled and 6.5 mm cannulated cancellous screw was placed. (Fig-4) Three guide wires were removed and stab wounds were sutured and bulky dressing with a plaster splint was applied.

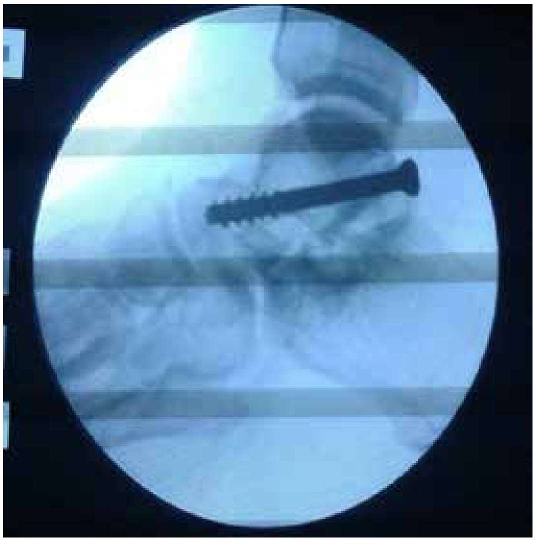

Fig-4: IITV Image reduced fracture dislocation with screw in talus

Volume : 5 | Issue : 1 | Jan 2015 | ISSN - 2249-555X

The post-operative x-rays revealed good alignment of the fracture fragments.(Fig-5)

Fig-5: Post op radiograph

Post-operatively, the patient was maintained on a below knee slab for 4 weeks and aggressive ankle rehabilitation was begun with active assisted and passive mobilisation of the ankle and sub-talar joints and weight bearing on the affected limb was instituted after 3 months.

RESULTS:

The patient was on regular review so as to follow up with the fracture healing and ankle range of motion. At eight weeks post-op, "Hawkins sign was noted.(Fig-6) At six months, the x-rays showed good union with no signs of AVN.(Fig-6) The patient had full range of motion of ankle and on Hawkins scoring system a total of 12 points which is good outcome.(Fig-7).

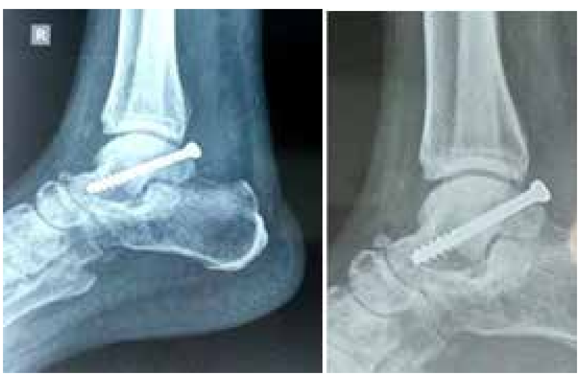

Fig-6: 4 months post op radiograph with 'Hawkins sign'(left) and fracture union at 6 months(right)

figure 7: Ankle function at 6 months, full range of dorsiflexion and plantar flexion with healed surgical scar

DISCUSSION:

The understanding of the vascular anatomy of the talus is vital in planning a surgical procedure as the vascularity is vulnerable to injury in talar neck fractures. The vascular flow being retrograde from the head to the body is compromised in fracture dislocations which risks AVN of the talar dome and body which is proportional to injury severity as in type III and type IV Hawkins fractures, and the vital link in such injuries is the vascular pedicle through the deltoid ligament which escapes injury in trauma. The intent for a closed reduction and percutaneous fixation of talar neck fracture is to avoid damage to the deltoid ligament vascular pedicle during dissection and hence reduce the risk of AVN and better the overall outcome.

In 2002, Fayazi and colleagues[13] performed closed reduction and percutaneous fixation to minimize damage to soft-tissue structures, maintain and/ or minimize disruption of the blood supply to the talus. Poor outcomes in such injuries are attributed to: First, the insult to the talus articular cartilage at time of injury that may result in posttraumatic arthritis.[14] Secondly when dissection for ORIF leads to soft tissue injury and further disruption of blood supply,[13]and risks AVN . Third, a delay in treatment may increase the risk for subsequent AVN[9,15,16].

CONCLUSION:

Despite type III and type IV talar neck fractures have higher risk of AVN without a stable internal fixation. The soft tissue cover and the skin conditions are also a major criteria to be taken under consideration. The technique described here is simple maneuver of closed reduction done with very simple instruments and is easily reproducible and hence warrants a try in situations when closed reduction and fixation may be definite option.

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