ALTERNATIVE TECHNIQUE FOR FIXATION OF TONGUE TYPE CALCANEAL FRACTURES

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Statement of Purpose:

Traditionally, tongue type fractures have been reduced using two screws placed percutaneously from posterior-superior to anterior-inferior through the calcaneal body. Tension band fixation and suture-endobutton fixation have also been described [5,6]. In this work we aim to present a technique guide for a novel approach to fixation of these fractures, as well offer patient populations where this method is indicated and, in some cases, perhaps superior to the current paradigm of fixation for these injuries.

Conceptual Overview:

Fractures of the calcaneus comprise approximately 2% of all fractures and 60% of tarsal injuries [1]. These fractures can be broadly classified as intra-articular and extra-articular, with respect to involvement of the Subtalar and calcaneocuboid joints. While those violating the Subtalar articular surface often demand timely operative intervention due to the potential propensity for future biomechanical alterations and functional limitations, these tend to not have the immediate concerns of the tongue type fracture pattern. Tongue type fractures have been found to have a 21% incidence of compromise to the posterior skin [2].

When a person falls from a height and the calcaneus impacts the ground, a force is transmitted through the talus, impacting it into the posterior Subtalar facet, and ultimately, the cancellous substrate that lies below [3].

In tongue type fractures (Fig 1A), the primary fracture line courses from superior to inferior, originating at the critical angle of Gissane. As the talus initiates the primary fracture line, the anterior aspect of the posterior facet is levered downward while the eccentric contraction of the Achilles causes the superior tuber to be levered upward, thus creating a wedge or tongue fragment [3,4]. This fragment ultimately puts the overlying integument at risk.

Throughout this work we will refer to the fixation method as a “Hurricane Strap” as it mimics the principles of the common construction technique of the same name. In areas where tropical storms are common, hurricane straps serve to create continuous load paths from the roof to the foundation. This is done using tie-downs and anchors that connect the roof to the walls and the wall to the foundation (Fig 1B).

Methods:

A series of four patients with tongue type calcaneal fractures were treated using a Hurricane Strap technique. A modified lateral extensile incision is made (Fig 2A) and a midfoot fusion plate is pre-bent and fit to the calcaneus with two holes covering the superior surface of the calcaneus so that two interfragmentary screws can be incorporated into the plate construct (Fig 2C). The fracture is reduced using peri-articular clamps, placed directly onto the calcaneus through the incision (Fig 2B). The two interfragmentary screws are placed first, coursing from dorsal posterior to plantar anterior. Four screws are then placed orthogonally into the calcaneus through the plate. A combination of locking and non-locking screws are used with the non-locking screws primarily serving to contour the plate to the calcaneus as needed. Typically this construct allows for two screws to be placed in the superior fragment and two screws to be placed in the inferior fragment (Fig 2D).

All of the screws used in our cases have been 3.5mm in core diameter. The incision is then closed in a two-layer fashion using Vicryl for deep closure and Allgower-Donati sutures to close skin. The patient is placed into a posterior splint post-operatively in which they remain until sutures are removed at approximately two weeks. The patient is kept non weight bearing and then transitioned to protected weight bearing in a fracture boot with heel lifts. At time of initial protected weight bearing, physical therapy is initiated. The patient removes heel lifts weekly and progresses to weight bearing in supportive shoes at approximately 10 weeks from the date of surgery.

Discussion:

The Hurricane Strap technique provides a more stable construct for fixation of tongue-type calcaneal fractures when compared to percutaneous screws alone. The technique was initially used after the authors experienced multiple fixation failures using two percutaneous screws in patients who were non-compliant with weight bearing instructions. In these instances it was hypothesized that the force applied across the fracture by the Achilles tendon when ambulating was greater than screw fixation alone could withstand. While further studies are needed, we currently see this fixation technique as a viable alternative for treatment of tongue-type fractures in patients with poor bone quality or anticipated non-compliance with weight bearing instructions, due to neuropathy for example. Risk factors that may increase a patient’s risk of wound healing complications need to be taken into consideration when deciding on open versus percutaneous fixation.

Results:

Average follow-up time was 16 months. All four patients were noted to have osseous union at 10 weeks post-op and were weight bearing in regular shoe gear at last appointment. None of the patients experienced delayed-union or malunion secondary to hardware failure or diastasis across the fracture site due to failure applied by the Achilles tendon. One patient was noted to have wound healing complications and had hardware removed after osseous union had occurred. The same patient’s surgical incision and subsequent dehiscence went on to heal without further complication. Three of the four patients treated with this particular construct were noted to be daily smokers, including the patient who experienced wound healing complications. No other pertinent risk factors to soft tissue or osseous healing were noted within the group.

References: