

Timing of Definitive Fixation for Comminuted Talar Fracture in Patient with Multiple Injuries

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Comminuted talus fractures are commonly the result of high-energy trauma. The timing for treatment of these talar fractures remains controversial, especially in the polytrauma patient. We present the case of a multiply injured patient with many orthopedic injuries including a comminuted talus fracture. Patient management and outcome are discussed and the relevant current literature is reviewed.

Key Words: Comminuted talar fractures, high-energy trauma, early definitive care, damage control orthopedics.

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Comminuted talar fractures are commonly the result of high-energy trauma and frequently associated with multiple injuries. These injuries are treated in descending order from most life threatening, and the definitive treatment of talar fracture may be staged.¹⁶ However, the risk of developing osteonecrosis has been suggested with delayed fixation in displaced fracture variants⁴. Early reduction may help preserve any remaining blood supply to the talar body.

In poly-traumatized patients, there are frequently more vital injuries to be addressed first. However, care to the foot and ankle injury cannot be overlooked.¹⁴ For all cases of talar fracture, treatment goals include anatomic reduction, preservation of motion, joint stability, and minimization of complications.³

We present the case of a stable patient with multiple musculoskeletal injuries and a comminuted talar fracture, the subsequent management and outcome, and review the current literature for management of comminuted talar fractures.

Case Report

A 43 year-old male was involved in an unrestrained motor vehicle accident while being chased by police. Multiple injuries were sustained including a left open intra-articular comminuted supracondylar femur fracture, right femoral shaft fracture, right intertrochanteric hip fracture, right tibial plateau fracture, and a left closed talar body and neck fracture. (Fig. 1) He was immediately evaluated by the trauma service per ATLS protocol. Utilizing a multidisciplinary approach, the patient was deemed a candidate for early total care. However, due to the complex nature of the talus fracture and the surgical burden associated with his other musculoskeletal injuries definitive surgery was delayed for three days post-injury. (Fig. 2 and Fig. 3)

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Figure 1 Three days after initial presentation, the patient's foot and ankle was assessed pre-operatively.

At the time of injury, his vitals were within normal range, but laboratory values were significant for pH of 7.46, pCO₂ of 25, bicarbonate of 17, anion gap of 17, CPK of 295, WBC of 10.6, neutrophils at 89%, and an INR of 1.0. Three days following initial treatment, the patient was afebrile with vital signs stable. Laboratory findings included Anion gap 8.0, WBC 6.0, platelets 124, hemoglobin 8.2, hematocrit 22.9, neutrophils 79, lymphocytes 8(L), Monocytes 11, eosinophils 2, basophils 0. His abnormally high value for neutrophils was determined to be an inflammatory reaction to the initial injury.

Open reduction internal fixation techniques were used for definitive fixation of the comminuted talar fractures through both a medial and lateral exposure. A transfixation pins was placed into the calcaneus to allow distraction of the hindfoot for adequate visualization of the talar body/neck fractures. Minifragment plates were utilized to stabilize the fractured anatomy.⁶ Status post internal fixation, the talonavicular, subtalar and tibiotalar joints were unstable per intra-operative examination. An external fixation device was placed to address the instability of the injured hindfoot and to act as a rigid splint. The patient received prophylactic antibiotics prior to and post surgery.



Figure 2 During his secondary surgery, radiographs were taken that revealed a closed talar comminuted fracture among his other injuries.

After discharge from the hospital, the patient's multiple injuries were followed uneventfully. In regard to his comminuted talar fracture, he remained non-weightbearing to his injured side for a total of three months.

The external fixator addressing his foot instability was removed at six weeks, and the patient was allowed to begin passive range of motion exercises (Fig. 4). Normal post-operative pain and tenderness was apparent but insignificant. Following removal of external fixator, he was placed into a fracture boot.

Radiographs were taken at all follow-up appointments, and at six months status post definitive treatment, the radiographs showed healing of talar body fracture without hardware complications (Fig. 5). Notably, there was no evidence of talar avascular necrosis.



Figure 3 CT scan further demonstrates the comminuted nature of the talar fracture, and allowed for better surgical planning pre-operatively.

Discussion

High energy talus fractures especially in the polytrauma patient can be fraught with both short and long term complications. The blood supply of the talus is clearly vulnerable after traumatic injury.² Comminuted fractures involving the neck and body carry a risk of osteonecrosis due to the retrograde blood supply⁵ Irreversible osteochondral injury to the tibiotalar, subtalar, and talonavicular joints can lead to early post-traumatic arthrosis. Further, the compromised soft tissue envelope surrounding the fractured talus predispose surgical efforts to complication including skin necrosis, frank wound dehiscence, and infection.^{7,10}

Traditional treatment of these fractures evolved from reduction and immobilization, to limited fixation, and currently, open reduction internal fixation is performed on most talar fractures.¹⁶ Although there are recommendations for primary arthrodesis or talectomy for severe talar fractures⁹, the consensus has been to maintain anatomic alignment and preserve motion of the adjacent joints.¹⁷ In polytraumatized patients, these goals remain valid although the timing of talar fracture fixation in this patient population remains controversial.¹ Vallier, et al.,¹⁶ found no correlation between surgical delay and development of osteonecrosis, but did find a



Figure 4 Along with appropriate internal fixation, an external fixation device was placed to address instability of the hindfoot and act as a rigid splint.

significant association of osteonecrosis with comminuted fractures. Pape, et al.,¹¹ recommended that careful considerations be made when determining initial fixation or a staged surgical approach in polytraumatized patients. Although the authors were not specifically referring to talar fractures, the degree of initial surgery may represent additional burden to patients at high risk for complications. Primary fracture stabilization with secondary surgery may be implemented if clinical conditions warrant a staged treatment course.

In our case, the soft tissue edema was well controlled around the ankle, and the talar fracture was definitively fixated three days after initial injury. An external fixator was used for two reasons: to provide a rigid splint and to stabilize the hindfoot. By definition, the soft tissue envelope around the foot



Figure 5 Ankle x-rays were taken status-post six months definitive talar fracture surgery. No evidence of AVN

and ankle is considered tenuous and severely traumatized in most cases of talar fractures.¹⁴

Delicate care of the soft tissue is vital to the traumatized limb. As with our patient, the multi-injured patient typically does not require an initial lengthy foot and ankle procedure¹¹, but reduction of fractures and dislocations must be addressed adequately. Because of his multiple injuries, provision of basic skeletal stabilization proceeded after the patient was determined to be stable. This is regarded as early care, however early care does not mean total care.¹⁴ Early care for fractures has been recommended if the patient is determined to be stable, but damage control orthopaedic (DCO) techniques have been recommended for patient that are considered borderline, unstable or in extremis.¹²

DCO techniques recommend that definitive fixation surgery for unstable patients with long bone fractures are delayed until they are hemo-dynamically stable.⁷ External fixation is commonly implemented for compromised soft tissue structures and gross instability.¹³

By allowing for inflammatory mediators including interleukins, tumor necrosis factors, interferons and colony stimulating factors to decrease, the hope is to prevent a “second hit phenomenon”.^{8,11,12}

The application of this concept to foot and ankle trauma has the potential to help prevent post-operative complications. However, the role of inflammation control still needs to be investigated in foot and ankle trauma when confronted with multiple injuries.¹⁴ In our case, the patient was admitted post-operatively and discharged after four days without complications. His subsequent follow-up appointments were uneventful and absent of radiographic evidence for osteonecrosis.

Because comminuted talar fractures are generally associated with multiple injuries, it is important to prioritize trauma based on clinical condition.¹¹ However, talar fractures should not be undervalued when planning treatment protocols. Tran and Thordarson¹⁵ determined that patient functional outcomes were significantly worse off in poly-traumatized patients with foot and ankle injuries than those without. It is therefore critical to implement aggressive care for poly-traumatized patients with comminuted talar fractures.

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