Fracture Healing in Tibia Fractures with an Associated Vascular Injury

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Background: **Tibial fractures with an associated vascular injury are a challenging management problem for the orthopedic and vascular surgeon. The effect of a concomitant vascular injury on fracture healing has not been specifically delineated previously.**

Methods: **We performed a retrospective review of 29 fractures of the tibial shaft with an associated vascular injury in 28 patients.**

Results: **Overall there were 44 vessels injured (38 arterial and six venous). A total of six patients had an amputation performed; patients requiring amputation were significantly older than those without amputation. Fractures with an associated injury to the posterior tibial artery had a significantly higher nonunion rate and a greater number of weeks to union than fractures without this vascular injury.**

Conclusion: **Outcomes of tibial fractures with an associated vascular injury are poorest in older patients (who are at increased risk of amputation) and those with an injury to the posterior tibial artery (who are at increased risk of delayed union and nonunion).**

Tibial fractures with an associated vascular injury are a challenging management problem for the orthopedic and vascular surgeon. As is the case with all open fractures, successful treatment of these injuries requires skeletal stabilization of the bony injury and careful management of the associated soft tissue injuries. The effect of a concomitant vascular injury on fracture healing has not been specifically delineated previously.

The purpose of the current investigation was to evaluate the effect of a vascular injury on tibial shaft fracture healing. It was not the intent of this study to analyze outcomes based on pain or functional status. Our specific aims were to analyze the clinical course of these patients using objective criteria to determine which clinically relevant factors (i.e., age, gender, bone injury, soft tissue injury, vascular injury) were predictive of outcome in terms of complications and fracture healing.

MATERIALS AND METHODS

We performed a retrospective review of 46 patients with 47 tibial fractures treated at Hermann Hospital, Houston, Texas (between October 1987 and July 1993), which were suspected of having an associated vascular injury. Of these 47 fractures, a thorough diagnostic work-up, including arteriography, revealed that 13 of these patients had a fracture of the tibia with no associated vascular injury. A vascular injury was documented based on arteriography, or operative exploration, or both in 33 patients with 34 tibial shaft fractures. At the most recent follow-up, five patients with five fractures could not be located and 28 patients with 29 tibial fractures who had had an associated vascular injury were available for detailed analysis. The average age of all patients at the time of injury was 34.6 years (range, 4 to 70 years). There were 22 men and six women.

Tables 1 and 2 summarize the clinical data of our patient population. In 14 patients, the injury was isolated to the tibia and neighboring soft tissue and neurovascular structures; 14 patients had concomitant injuries to other bones and organ systems (Table 3). One patient (patient 24; Table 1) had a significant history of peripheral vascular disease related to hypertension and diabetes mellitus.

Analysis of outcomes in this retrospective review was based on data obtained through a review of the medical records, follow-up examinations, and telephone conversations with the patients. A number of clinically relevant factors were analyzed including the location and type of fracture, the extent (classification) of soft tissue injury, the specific vessel injured and the type of vascular injury, and the type of treatment for the bone, soft tissue, and vascular injuries.

Tibial fractures were classified according to the location of the major fracture fragments as described by Veliskakis.[1] Fractures were further described by the direction of their fracture line(s) and configuration of the fracture (Table 2). A record was made of the specific treatment of the fracture including method of stabilization. Additionally, we recorded whether the bone or vascular injury was repaired first.

Soft tissue injuries were classified in a manner similar to the method of Gustilo[2] (types I–III). We intentionally did not subclassify our type III injuries. This strategy made it possible to analyze outcomes based on the soft tissue wound independent of the vascular injury (to be included in the study, all patients, by definition, had had a vascular injury; the indications for vessel repair were based on the individual surgeon's clinical judgement and therefore were not uniform). The treatment of soft tissue injuries associated with open fractures was performed in a routine manner using intravenous antibiotics, serial debridements, and soft tissue

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