

# The Treatment of Complex Traumatic Problems of the Forearm Using Ilizarov External Fixation

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Ilizarov methods have expanded our ability to effectively manage complex traumatic injuries and their sequelae. Because most traumatic conditions of the forearm can be adequately treated with conventional surgical methods, the literature contains relatively few reports of forearm applications of thin wire circular external fixation. We believe the indications for Ilizarov external fixation of the forearm are limited, yet certain cases of complex traumatic injuries are best treated with this method.

A thorough understanding of the cross-sectional anatomy of the forearm is essential for safe and accurate wire placement (Fig. 1). Transosseous implants must be positioned to avoid neurovascular structures. Implants also should be positioned to minimize tethering of muscles and tendons to maximize upper limb function while in the frame.

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*Journal of Orthopaedic Trauma*  
Vol. 14, No. 3, pp. 194-198  
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## Tibial Shaft Fractures With an Associated Infrapopliteal Arterial Injury: A Survey of Vascular Surgeons' Opinions on the Need for Vascular Repair

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**Objective:** To determine current practice for tibial arterial revascularization in trauma patients with tibial shaft fractures associated with infrapopliteal arterial injuries.

**Design:** Nationwide survey of board-certified vascular surgeons, proportionally stratified by geographic region.

**Methods:** We surveyed a random sample (probability sample stratified by geographic region) of 200 members of the 729 active members of the Society for Clinical Vascular Surgery. We designed a twenty-one-item questionnaire to elicit opinions on the need for vascular repair for a variety of clinical scenarios.

**Results:** Completed questionnaires were returned by fifty-one vascular surgeons. For the eight isolated and combined infrapopliteal arterial injuries we studied, agreement between vascular surgeons as to the need for arterial repair was better for scenarios with clinical evidence of limb ischemia than for those without clinical evidence of limb ischemia. For injuries with clinical evidence of limb ischemia, excellent agreement (90 percent or more of respondents agreeing) was seen for five of the eight injuries, good agreement (80 to 89 percent of respondents

agreeing) was seen for two injuries, and poor agreement (less than 70 percent of respondents agreeing) was seen for one injury. For injuries without clinical evidence of limb ischemia, excellent agreement was seen for one injury, good agreement was seen for two injuries, fair agreement (70 to 79 percent of respondents agreeing) was seen for three injuries, and poor agreement was seen for two injuries.

**Conclusions:** A review of the literature and results of our study suggest that no standardized protocol exists in the current practice of revascularization of infrapopliteal arterial injuries with concomitant tibial shaft fractures; disagreement among vascular surgeons was particularly common for cases where a vessel was known to be injured but there was no clinical evidence of limb ischemia. Our study highlights the need for randomized prospective studies so that standardized protocols can be developed for these serious injuries. Because of the relatively small numbers of this type of injury and the wide variety of injury patterns seen, a study such as this would best be designed as a multi-center study.  
**Key Words:** Tibial shaft fracture, Vascular injury, Survey.

The literature addressing tibial shaft fractures associated with a vascular injury is difficult to interpret. As we have previously discussed (1), comparisons among published series from various centers are made difficult because of differences in definitions and treatment protocols. In their original series, Gustilo et al. (4) defined a Type III C injury as one in which a fracture is associated with an arterial injury "requiring repair." As we have previously suggested (1), because the indications for vascular repair of the infrapopliteal vessels have been poorly delineated in the literature (and are typically at the discretion of the

attending vascular surgeon), the term "requiring repair" is subject to interpretation. To the best of our knowledge, no published articles have presented a clear, evidence-based treatment algorithm regarding the indications for operative repair of infrapopliteal arterial injuries associated with a tibial shaft fracture.

The purpose of the current study was to determine whether or not there is general agreement among vascular surgeons as to the indications for operative repair of infrapopliteal arterial injuries associated with a tibial shaft fracture. For this investigation, we surveyed active members of the Society for Clinical Vascular Surgery to elicit their opinions on the need for vascular repair in a variety of clinical scenarios.

### MATERIALS AND METHODS

To assess current practice for revascularization of infrapopliteal arterial injuries associated with tibial shaft

Accepted June 23, 1999.

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No financial support of this project has occurred. The authors have received nothing of value.

This manuscript does not contain information about medical devices.