Evaluating the Safety of Percutaneous Dorsolateral Talonavicular Joint Fixation in Modified Double Arthrodesis: An Anatomic Study

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Introduction/Purpose: Hindfoot arthrodesis has demonstrated reliable long-term outcomes for treatment of symptomatic hindfoot arthritis, but the incidence of nonunion of the talonavicular joint has been reported as high as 29%. Retrograde percutaneous insertion of a dorsolateral screw in addition to the standard medial distal to proximal screw has been shown to add significant construct stiffness across the talonavicular joint in biomechanical testing. However, placement of this dorsolateral screw may result in increased neurovascular injury. The purpose of this cadaveric study was to investigate the proximity of important anatomic structures to dorsal, percutaneous, screw fixation across the talonavicular joint for hindfoot arthrodesis.

Methods: 17 fresh frozen cadaveric limbs without deformity were transected across the supracondylar femur. A single fellowship-trained orthopedic surgeon performed all procedures. Percutaneous dorsolateral fixation across the talonavicular joint was performed with a cannulated screw. A 1.5-cm incision was created over the lateral third of the navicular after localization under fluoroscopy, and a 4.5 mm cannulated screw was inserted using standard AO technique. The guide wire was left within the screw. The incision was extended 2 cm proximal and distal and a separate orthopaedic surgeon used a caliper to measure the distance from the guide wire to the superficial peroneal nerve, extensor hallucis longus, extensor digitorum longus, deep peroneal nerve, and deep peroneal artery. Injuries to neurovascular structures were noted. Finally, solder wire was laid atop the deep neurovascular bundle to allow radiographic imaging of the screw and the bundle.

Results: Injury to the deep neurovascular bundle occurred in 6 of 17 specimens (35.3%). There were 5 injuries (29.4%) to the deep peroneal nerve, 3 to the deep peroneal artery, and 2 to branches of the superficial peroneal nerve. The average distances from the guide wire to anatomic structures were superficial peroneal nerve: 1.8 mm (0.5-4.10 mm), extensor hallucis longus: 6.10 mm (0.6-15.0), extensor digitorum longus: 6.8 mm (0.5-14.0 mm), deep peroneal artery: 2.27 mm (0.0-5.1), and deep peroneal nerve: 2.4 mm (0.0-7.10 mm).
Conclusion: A high rate of neurovascular injury was observed after percutaneous dorsolateral fixation across the talonavicular joint. These data suggest that this approach should be avoided in favor of an open approach, which allows identification and protection of the superficial peroneal nerve, extensor tendons, and the neurovascular bundle.