The Intraosseous and Extraosseous Arterial Anatomy of the Adult Navicular

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Summary
The vascularity of the navicular has previously been implicated as a causative factor in navicular stress fractures. This study uses chemical debridement and a modified Spälteholz technique to describe the intraosseous and extraosseous vascular supply of the navicular. The dorsalis pedis and posterior tibial arteries provide predictable extraosseous branches to the navicular. The majority of specimens had a dense intraosseous vascular pattern.

Introduction
The etiology of navicular stress fractures is a topic of interest due to the implications in high-level athletes. The classic location of a navicular stress fracture is a sagittally oriented fracture in the central one-third of the bone. Previous studies suggest that an avascular zone in the central one-third of the bone is a potential causative factor making the area more susceptible to fracture. However, previous descriptions of vascular supply to the adult navicular are limited. This study investigates the extraosseous and intraosseous arterial anatomy of the navicular in adult specimens.

Methods
Sixty legs from thirty adult cadavers were amputated below the knee. India ink followed by Wards Blue Latex was injected into the anterior tibial, peroneal, and posterior tibial arteries under constant manual pressure. The specimens were frozen for 48 hours, thawed to room temperature, and the skin was sharply dissected away. The remaining soft tissues were chemically débrided with sodium hypochlorite, leaving the bones, interosseous ligaments, and casts of the extraosseous blood vessels exposed. The vascular supply to the navicular was successfully elucidated in 57 specimens. The navicular was then cleared using a modified Spälteholz technique; the intraosseous vascularity was successfully exposed and reviewed in 54 specimens.

Results
The dorsal navicular was supplied consistently by a large medial tarsal branch of the dorsalis pedis. The lateral aspect of the dorsal navicular also received supply from lateral tarsal branches of varying size and distribution patterns. On the plantar surface, there is a consistent branch from the superficial branch of the medial plantar artery that supplies the medial plantar surface of the navicular. In approximately half of the specimens, there is a well defined anastomotic ring formed by the medial tarsal branch of the dorsalis pedis and the branch from the superficial medial plantar artery that surrounds the navicular tuberosity. The majority of specimens (30 of 51) had a dense intraosseous vascular supply diffusely throughout the bone. Only six specimens had an avascular zone in the central third of the navicular extending to the dorsal cortex.

Conclusions
The dorsalis pedis and posterior tibial arteries branch in predictable patterns to supply blood flow to the navicular. In some specimens, there is a zone of avascularity in the central dorsal region of the bone, but in most adult cadaver specimens, the navicular has a dense intraosseous vascular supply throughout.