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Arthroscopic triple fusion joint preparation using two lateral portals: A cadaveric study to evaluate efficacy and safety

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ABSTRACT

Background: Arthroscopic triple fusion has several advantages over open techniques, but its use has yet to become widespread. Preliminary published techniques use five portals with neurovascular risk. Our aim was to assess the safety and efficacy of an alternative lateral two portal technique.
Methods: Four cadaveric hindfeet were arthroscopically prepared for a triple fusion using two lateral portals. The distance to relevant subcutaneous nerves was measured as well as the prepared joint surface percentage.
Results: Mean distance from mid-lateral portal to the nearest sural nerve branch was 22.3 mm (range 20–24 mm) and from the dorsolateral portal to the intermediate branch of the superficial peroneal nerve was 7.8 mm (range 4–11 mm). Mean percentages of joint preparation were 63% (talar head), 62% (navicular), 75% (calcaneum) and 74% (cuboid).
Conclusions: Two lateral arthroscopic portals allow adequate joint preparation for triple fusion procedures. The proximity of subcutaneous nerves is important to appreciate when using these portals.

1. Introduction

Triple arthrodesis involves fusion of several joints within the hindfoot with the aims of pain relief from osteoarthritis or for the correction of deformity. These joints are the subtalar joint, the talonavicular joint and calcaneocuboid joint [1]. Fusion procedures involve the removal of remaining joint cartilage, intra-articular ligaments and capsule and in post-traumatic cases, fibrous scar tissue. The ideal prepared surface for fusion is vascular subchondral bone. The deformity is corrected, the joints immobilized and compressed with screws, plates, staples or a combination of these, until union is achieved.

Access to the hindfoot joints has traditionally been achieved using large open incisions, which involves extensive soft tissue dissection. This has led to a higher than desirable incidence of wound problems, one series reporting 25% wound dehiscence resulting in a 16% infection rate [1]. As a consequence, alternative options have been considered to avoid these complications. A recent change in practice has involved the use of arthroscopic techniques [2–4].

Proponents of arthroscopic techniques report fewer soft tissue complications such as wound dehiscence and infection, neurovascular damage, scar tethering as well as higher or equivalent fusion rates [2,5]. These authors also propose improved intra-articular visualization, minimal bone resection and improved fusion surface preparation by arthroscopic techniques with likely improvements in fusion rates as a consequence. Other proponents also suggest that preservation of osseous blood supply with arthroscopic techniques when compared to open techniques as a major advantage [4], these authors reported no infections and rapid union in their series of arthroscopic subtalar fusions. It is also thought that patient satisfaction is improved with arthroscopic techniques due to faster postoperative recovery, decreased postoperative pain and fewer complications [6,7].

This interest regarding arthroscopic techniques in hindfoot fusion procedures has progressed to triple fusion. A five, potentially six, portal technique for arthroscopic triple fusion has been described [2,8]. Concerns have been raised with regard to the safety of several of these portals, including the dorsomedial portal due to demonstrated proximity and the potential for damage to the deep peroneal nerve [9,10]. If this nerve is damaged

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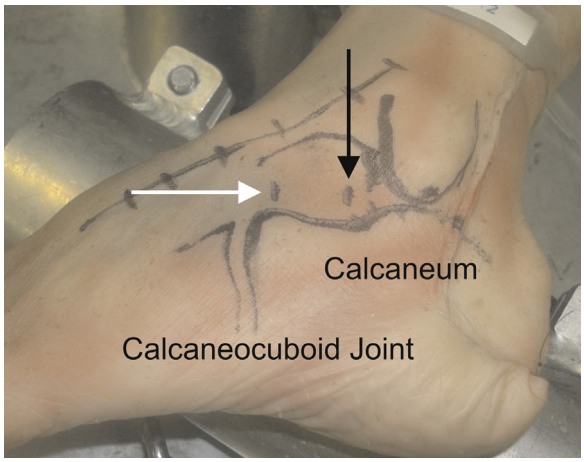

Fig. 1. Lateral aspect of the cadaveric hindfoot indicating mid lateral portal placement (black arrow) and dorso lateral portal placement (white arrow).

it carries significant morbidity for the patient. The dorsomedial portal allows access to the part of the talonavicular joint reported to be the most technically demanding to reach arthroscopically. The talonavicular joint also has high reported symptomatic nonunion rates as part of a triple arthrodesis [10].

The senior author of this study has increasingly used arthroscopic techniques for joint preparation when performing triple fusions largely utilizing a two portal technique. These portals are both laterally based. There remains very little published literature on this subject. There are cadaveric studies documenting the "safe" position of incisions for portals. To our knowledge, there is no published literature on the extent of the talonavicular surface that can be reached by a two lateral portal technique or on the feasibility of achieving access to all the areas required during a triple fusion.

The aim of this study was to assess the safety and efficacy of a two incision technique for the preparation of the hindfoot for triple arthrodesis. Using cadaveric specimens the proximity to subcutaneous nerves and the extent of joint preparation was assessed.

2. Methods

Four fresh frozen cadaveric hindfeet from two individuals were assessed. The individuals died at age 79 years (female) and 72 years (male). Both had mobile hindfeet without history of trauma or previous surgery and with no evidence of arthritis evident during dissection. The specimens were prepared in a semilateral position without traction being used. The specimens were arthroscopically prepared for a triple fusion using two lateral based portals. This work was approved by the appropriate ethical committees.

The portals were a mid lateral, placed at the angle of Gissaine and a dorsolateral placed at the level of the calcanealcuboid joint halfway between the cuboid and navicular (Fig. 1). The first portal established was the mid lateral portal, the site of insertion ascertained using a white needle slightly dorsal to the angle of Gissaine, insufflating the joint with normal saline. A longitudinal incision was placed in the skin and an artery clip used to spread the soft tissues and enter the subtalar joint.

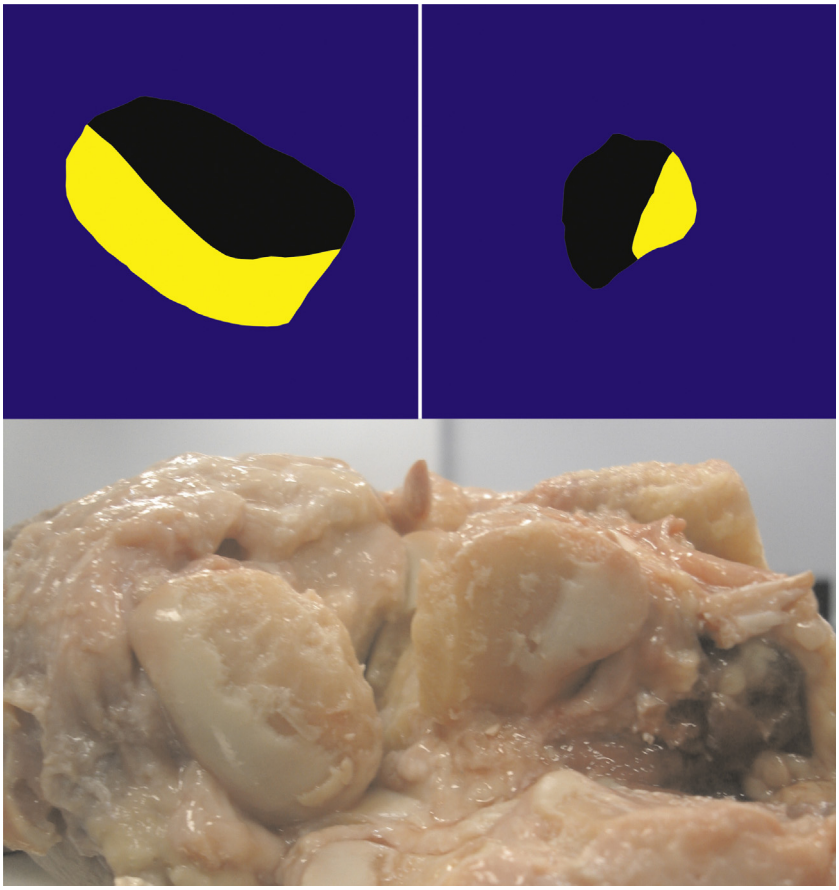

Fig. 2. Digitized two dimensional representation of prepared talus (above left) and calcaneum (above right) with photograph of cadaveric specimen (below). Black represents prepared surface, yellow intact cartilage. Orientation: viewed from distal aspect, anterior (up page), lateral (right of page). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of the article.)