

Minimally invasive Akin osteotomy and lateral release: Anatomical structures at risk—A cadaveric study



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HIGHLIGHTS

- This study analyzed the anatomical relationships and the risks for soft tissue lesions when performing the dorsomedial MIS portal for the Akin osteotomy of the proximal phalanx of the hallux, and the MIS dorsolateral portal for soft tissue release.
- The possibility of tendon lesion was seen in 12.5% and 18% of cases, the first figure corresponds to EDB detachment. No lesions involving nerves and vessels were reported.
- The dorso-medial portal must be performed as close as possible to the extensor tendon to reduce the risk of nervous lesion.
- This type of percutaneous procedures should be conducted by surgeons with experience in foot surgery, and extensive knowledge of the anatomy of the region.

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ABSTRACT

Background: Among the many surgical techniques used for hallux valgus correction, different osteotomies may be performed in the proximal phalanx as well as lateral release as associated procedures. The aim of this study is to analyze the anatomical relationships and the risks for the soft tissue lesions when performing the dorsomedial minimally invasive surgery (MIS) portal for the Akin osteotomy, and the MIS dorsolateral portal for lateral release, in order to define a safety zone when conducting the procedure in order to avoid complications.

Materials and methods: The procedures were carried out on 16 fresh-frozen cadaveric feet. A MIS dorso-medial and dorsolateral portals were performed. The anatomical dissection of the cadaveric pieces was carried out and the different anatomic and surgical relationships were analyzed and measured.

Results: No nerve injury was found. Injury of the extensor hallucis longus (EHL) paratendon were seen in 9 cases (56%). There was no injury of the flexor hallucis longus (FHL) tendon and or collateral plantar nerves. A partial injury of the FHL sheath was observed in 44% of the samples.

Conclusions: Although percutaneous Akin osteotomy is clinically effective, the possibility of injury of anatomic structures is high (9–55%), however injuries upon vascular or nerve structures were not seen.

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1. Introduction

Among the many surgical techniques used for hallux valgus correction, different osteotomies may be performed in the proximal phalanx. The most widely used type of proximal phalanx osteotomy is still that described as early as 1925 by Akin [1], who depicted the treatment of hallux valgus as a resection of the medial exostosis of the first metatarsal, a medial wedge osteotomy of the proximal

phalanx of the hallux, associated with the lateral release of the abductor tendon. Indicated in the past as the only procedure for the treatment of hallux valgus, it is at present, indicated unusually as the only surgical procedure [2]. However, it is often performed in association with other osteotomies of the first metatarsal (Chevron, Scarf, etc.) [3] and with surgical procedures involving soft tissues.

Some minimally invasive surgery (MIS) techniques [4] have been developed in recent years in order to perform osteotomies of the metatarsals and phalanges. These techniques are conducted by means of small incisions or “portals”, using power instruments together with specific burrs for both cutting and trimming. The surgical planes are not directly exposed, and radiological guidance is

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required during the procedure. The pioneers [5] of the MIS perform the Akin osteotomy which represents a regular surgical procedure.

Dhukaram et al. [6], recently assessed the risk of iatrogenic injury while performing MIS techniques. They included the lateral release, a minimally invasive Chevron and Akin (MICA) and a minimally invasive distal metatarsal extra-articular osteotomy (DMO) on his cadaveric study.

The aim of this study is to analyze the anatomical relationships and the risks for soft tissue lesions when performing the dorsomedial MIS portal for the Akin osteotomy of the proximal phalanx of the hallux, and the MIS dorsolateral portal for soft tissue release, in order to define the safety zone when conducting the procedure in order to avoid complications.

2. Materials and methods

The procedures were carried out in a cadaveric laboratory on 16 fresh-frozen cadaveric feet. The cadaveric specimens were ethically approved for surgical validation and research purpose by the Research Committee of the Austral University Hospital. An Akin MIS osteotomy was conducted using a dorsomedial portal in combination with the release of the lateral joint tendon through a second lateral percutaneous portal. The surgical procedure was conducted by two foot and ankle surgeons with experience in forefoot MIS. The phalangeal osteotomy was conducted through a paratendinous dorso-medial portal medial to the extensor hallucis longus tendon, using specific instruments for percutaneous surgery; a short Shannon cutting burr for the bony section was used. No fluoroscopy was used during the surgical procedures.

The lateral release of the joint tendon was performed through a dorso-lateral portal, using a no. 64 Beaver blade, paratendinous lateral to the extensor hallucis longus tendon.

After a careful anatomical dissection of the cadaver, the technique was conducted, and then the following landmarks/data were assessed and measured; the data collected was included in a study spreadsheet:

- (1) Distance between (DB) the lateral release portal and the lateral edge of the extensor hallucis longus tendon.
- (2) DB the lateral release portal and the dorsolateral cutaneous nerve (Fig. 1).
- (3) DB the portal for the Akin osteotomy (“PA”) and the extensor hallucis longus tendon (Fig. 2 - red circle and red line).
- (4) Distance between the PA and the dorsomedial cutaneous nerve (Fig. 3 - red line).
- (5) Presence of hallux metatarsophalangeal instability after the procedure.



Fig. 1. Lateral release portal-dorsolateral cutaneous nerve.

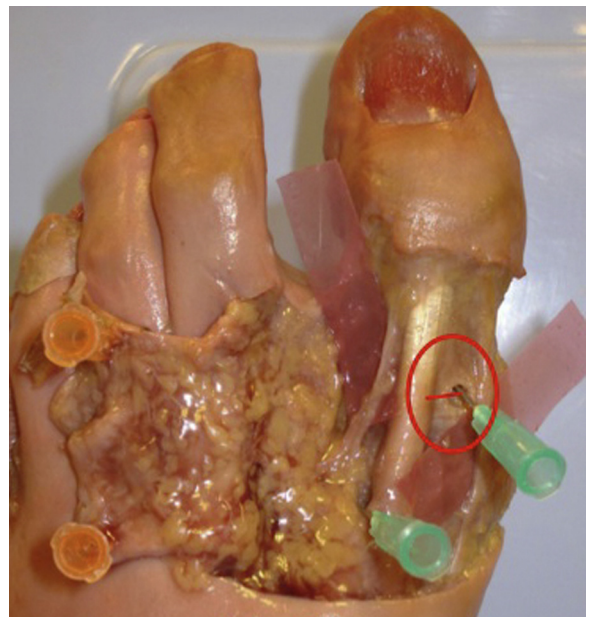


Fig. 2. Akin portal-EHL (red circle, red line) (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article).

- (6) DB the “PA” and the metatarsophalangeal joint.
- (7) Presence of an overt macroscopic lesion in the dorsomedial cutaneous nerve.
- (8) Lesion of the dorsolateral capsular periosteal tissue.
- (9) Lesion of the extensor hallucis longus tendon.
- (10) Appearance of the plantar aspect of the paratendon of the extensor hallucis longus.

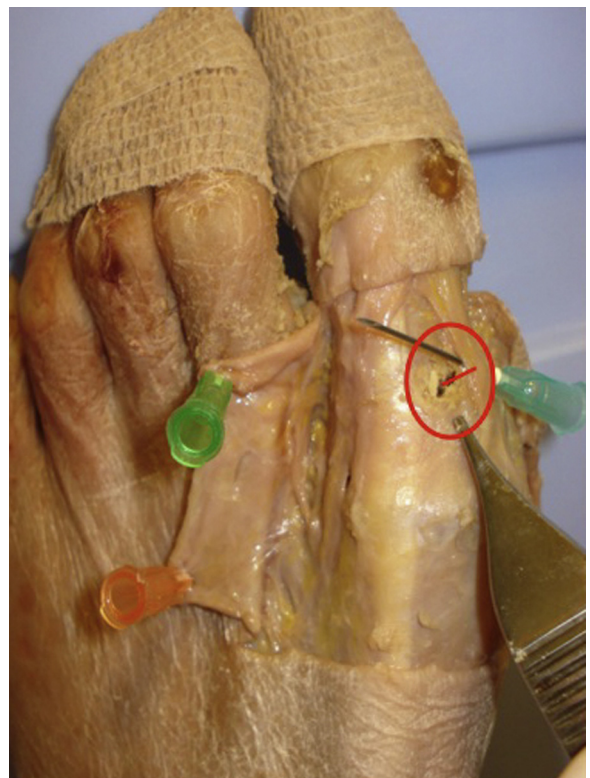


Fig. 3. DB Akin portal-dorsomedial cutaneous nerve (red line) (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article).

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