

# Percutaneous Surgery of the Forefoot



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## KEYWORDS

• MIS • Percutaneous • Forefoot • Hallux valgus • Hammer • Rigidus

## KEY POINTS

- In overview, minimally invasive chevron Akin (MICA) is a chevron-shaped first metatarsal osteotomy and an Akin-type osteotomy of the proximal phalanx (P1) of the hallux.
- These osteotomies are performed percutaneously with a burr under image intensifier guidance and then rigidly internally fixed with screws.
- A percutaneous soft-tissue release may be performed involving division of the lateral sesamoid:phalangeal ligament (lateral head of flexor hallucis brevis distal to the fibular sesamoid).

In foot and ankle surgery, percutaneous techniques were first explored by Morton Polokoff in 1945 and later by Leonard Britton.<sup>1</sup> Wilson<sup>2</sup> and Bosch and colleagues<sup>3</sup> have subsequently also promoted minimally invasive techniques. However, it was probably Stephen Isham<sup>4</sup> who attracted a wider interest from the orthopedic community when he published a modification of the Reverdin osteotomy<sup>5</sup> in 1991. Interest has subsequently grown across Europe. Since the turn of the new millennia further publications have appeared.<sup>6–9</sup> De Prado and colleagues<sup>10</sup> from Spain have also been influential in this field.

## MINIMALLY INVASIVE CHEVRON AKIN FOR CORRECTION OF HALLUX VALGUS

There have been more than 130 different operations described for the surgical correction of hallux valgus.<sup>11</sup> The MICA procedure is the first percutaneous technique for correction of hallux valgus to combine percutaneous osteotomies with the benefits of modern rigid internal fixation. This technique was first described by Vernois and Redfern<sup>12–16</sup> in 2011, and other surgeons are also beginning to publish their results with this and similar percutaneous techniques.

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In overview, the MICA procedure is a chevron-shaped first metatarsal osteotomy and an Akin-type osteotomy of the P1 of the hallux. These osteotomies are performed percutaneously with a burr under image intensifier guidance and then rigidly internally fixed with screws. In addition, a percutaneous soft-tissue release may be performed involving division of the lateral sesamoid:phalangeal ligament (lateral head of flexor hallucis brevis distal to the fibular sesamoid).

### ***Indications/Contraindications***

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In terms of radiologic severity, the MICA procedure is indicated for mild to moderate hallux valgus deformities, but with experience, the surgeon can quite reasonably extend the indications to treat more severe deformities as long as 100% lateral displacement of the metatarsal head is sufficient to correct the intermetatarsal angle.

In addition to the aforementioned indications, patients with hallux valgus with poor soft tissues or a history of keloid scarring can also be a good indication for the MICA technique.

Furthermore, this technique can be useful in the revision situation, as the percutaneous extracapsular technique minimizes further vascular insult (and stiffness). The MICA procedure also involves a plane of screw fixation different from most open osteotomies, and hence, this can also be useful in the revision situation.

The main contraindications are active infection and critical arterial occlusive disease.

### ***Surgical Technique***

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#### **1. Equipment**

Burrs: 2 × 20-mm Shannon burr, 2 × 12-mm Shannon burr

Driver: System with ability to control speed and torque (saline irrigation for cooling also preferable). The ability to control both speed and torque is important as the authors recommend use of very low burr speeds (<500 rpm) and high torque (eg, 80 Ncm) to avoid the risk of skin or soft-tissue burns (and also minimize thermal injury to bone)

Instruments: Beaver blade, percutaneous elevators

Mini C-arm (rather than large C-arm), as this is both more maneuverable in obtaining anteroposterior (AP) and lateral views and delivers a very low dose of radiation to both patient and surgeon

Tourniquet: Not required but depends on surgeon preference. If using a tourniquet, then saline cooling of the burr must be used, as the cooling effect of bleeding at the point of burr entry is lost

2. Anesthesia (either general or regional is administered) and intravenous antibiotics as per local guidelines

3. Positioning: The patient is positioned supine with the feet overhanging the end of the operating table (**Fig. 1**). The mini C-arm is positioned to the right of the patient regardless of which foot is being operated on (left side for left-handed surgeon)

#### ***Chevron osteotomy***

4. The surgeon creates a chevron osteotomy of the distal first metatarsal at the distal diaphyseal metaphyseal junction using a 20-mm Shannon burr.

A Beaver blade is used to create a skin portal on the dorsomedial aspect of the first metatarsal at the level of the intended osteotomy (**Fig. 2**). A curved elevator is used to create a working space over the dorsal aspect of the metatarsal and free the lateral periosteum, but this should never be used on the plantar aspect

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