Imaging of Hallux Valgus

How to Approach the Deformity

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KEYWORDS

• Imaging • Radiology • Hallux valgus • Weight-bearing computed tomography

KEY POINTS

- Hallux valgus is a multiplanar deformity with transverse, sagittal, and rotational aspects.
- Conventional imaging techniques help with quantifying and analyzing the deformity; however, they suffer from some reproducibility and accuracy issues.
- Newer techniques are allowing further research into the deformity, and may afford a better understanding and improve surgical planning and assessment of surgical outcomes.

INTRODUCTION

Hallux valgus was originally thought to be caused by an enlargement of the metatarsophalangeal joint of the great toe. The deformity was later described by Carl Hueter (1838–1882), a German surgeon, as a lateral deviation of the great toe at the metatarsophalangeal joint; the term hallux abducto-valgus was developed.[1]

ETIOLOGY AND PATHOANATOMY

Despite its frequency,[2,3] the etiology of HV remains somewhat disputed. The etiology is often usefully subdivided into intrinsic and extrinsic causes[4–8] as discussed in previous articles.

HV is a slowly progressive condition resulting from a series of biomechanical changes. There are several steps in the pathophysiology; however, they do not always occur sequentially.[1]

The medial supporting structures of the first metatarsophalangeal joint are the capsule, the medial metatarso-sesamoid ligaments, and medial collateral ligament. These stretch and fail, and this is felt to be an early and fundamental step. This then allows the metatarsal head to drift medially. As the metatarsal moves medially, the

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sesamoids remain tethered in position by the adductor hallucis tendon and the intermetatarsal ligaments. The proximal phalanx is in turn tethered to the sesamoids; therefore this moves into a valgus position. Furthermore, as the metatarsal slides over the sesamoids, the metatarsal crista erodes, and the lateral sesamoid can appear to sit in the intermetatarsal space. As the metatarsal head drops off the sesamoid apparatus, it pronates because of the muscle forces acting across it. This defunctions the abductor hallucis, which usually strongly resists valgus of the proximal phalanx. The extensor and flexor hallucis longus tendons now bowstring laterally, further increasing the valgus displacement and occasionally acting as dorsiflexors of the proximal phalanx. The bursa overlying the medial eminence thickens due to the pressure effect of footwear on a prominent medial eminence (**Figs. 1** and **2**).

An oblique or an unstable first tarsometatarsal joint may support this process.

TRADITIONAL IMAGING TECHNIQUES

Traditionally AP, lateral, and oblique view plain radiographs form the mainstay of imaging in HV deformity. From these, various radiographic angles have been utilized to assess and quantify the radiographic deformity of HV (**Fig. 3**).[9]

Hallux Valgus Angle

Reference points are placed on the proximal and distal midmetaphyseal regions of the first metatarsal and proximal phalanx.[9] Axes are drawn through these reference points on the first metatarsal and proximal phalanx. The angle created by the intersection of these axes is the hallux valgus angle (HVA). A normal angle is less than 15°, mild deformity less than 20°, moderate deformity 20 to 40°, and severe deformity greater than 40°. There are many discrepancies over these boundaries in the literature.

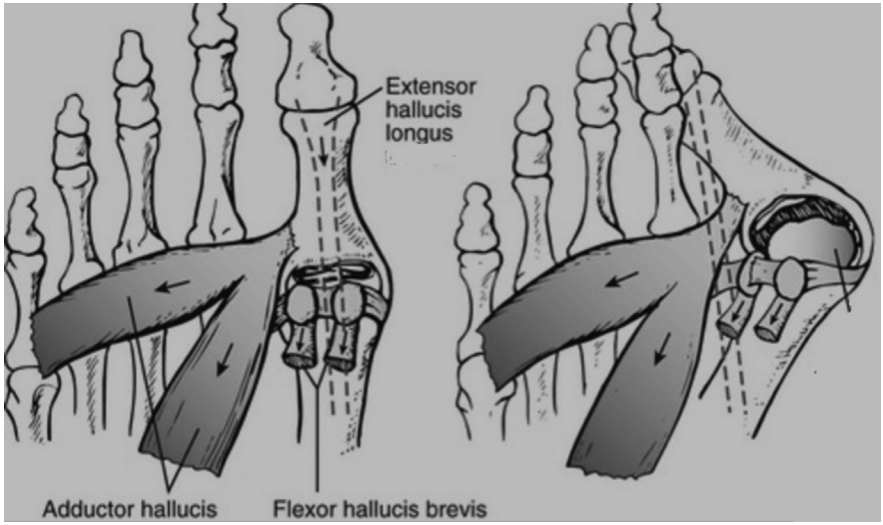

Fig. 1. This shows the metatarsal head moving into varus, and the sesamoids being tethered in place by the adductor hallucis tendon and the intermetatarsal ligament. It also demonstrates how the extensor hallucis tendon acts as a bowstring to perpetuate the deformity. (*From* Welck MJ, Singh D, Cullen N, et al. Evaluation of the 1st metatarso-sesamoid joint using standing CT - the Stanmore classification. Foot Ankle Surg 2017;[pii:S1268-7731(17)30059-0]; with permission.)