
Hallux Interphalangeus

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Abstract

Hallux Valgus Interphalangeus describes the symptomatic lateral deviation of the Hallux that is derived from deformity distal to the metatarsophalangeal joint. Symptoms include overcrowding of the lesser toes and painful callosities. Surgical correction is based on the site of deformity and can involve joint sparing or sacrificing procedures.

Keywords

Clinical features • Diagnosis • Hallux • Interphalangeus • Non-operative treatment • Surgical precautions • Surgical techniques • Surgical treatment

Introduction

In a typically shoe-wearing population the normal weight-bearing attitude of the Hallux is recognised to have a valgus deviation originating beyond the metatarsophalangeal joint of 13° [2, 6] (Fig. 1). This is based on radiographic studies of the divergent longitudinal axes of the proximal and distal phalanges. It is a feature seemingly unique to *homo sapiens* of the primates studied by Barnett in 1962 [2].

Though previously recognised and treated [1], the term Hallux Interphalangeus was first used in 1935 by Daw to describe the symptomatic excessive lateral deviation of the great toe that has its contributing abnormalities derived from the base of the proximal phalanx

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Fig. 1 Normal frontal plane alignment of hallux distal to metatarsophalangeal joint is 13° valgus

distally [3] (Fig. 2). Despite the name, it is not typically a deformity of the interphalangeal joint (IPJ) but rather of the phalanges themselves. Superimposed on the frontal plane abnormality can be rotational and sagittal deformities that exaggerate the clinical appearance and must be considered.

Clinical Presentation

Hallux interphalangeus can present as an isolated problem, though a more common clinical encounter is as part of the multifactorial elements contributing to hallux valgus.

The insidious onset of symptoms develop from the lateral deviation crowding the second toe with subsequent pressure related pain and corns. Painful skin callosities can

also form at various points on the medial border of the hallux due to a shift of weight-bearing from the normal pulp during toe-off. This is seen particularly in conjunction with hallux valgus as the toe adopts a pronated attitude. A familial history may be elucidated and bilateral presentation is not uncommon. Exaggeration of the deformity and worsening symptoms can be related to the use of more constrained fashion footwear as is popular with European women.

With hallux valgus the interphalangeal deviation is often less pronounced and more a cosmetic contribution.

A thorough examination of the foot is necessary beginning proximally with limb and hindfoot alignment. Assessment of the longitudinal arches and local muscle power, especially tibialis posterior is important. The flexor hallucis tendon excursion and power should be tested in isolation with the foot both neutral and plantar flexed. This will assess any flexoral contribution to the hallux interphalangeus and whether it is fixed or not. Both the metatarsophalangeal joint and the interphalangeal joint should be examined for signs of arthritis or laxity. An appreciation of any neurovascular deficit of the toe or foot must guide surgical decision-making.

Weight-bearing radiographic studies, both anteroposterior and lateral of the foot are the mainstay of supporting clinical assessment. The resting position and bony anatomy of the proximal and distal phalanges can be assessed in the frontal and sagittal planes.

The anteroposterior radiograph will demonstrate most of the components of hallux interphalangeus that contribute to the frontal plane deformity. From this an assessment can be made of the site of maximal deviation to guide subsequent management. As has been recognised by Elliot and Saxby [4] hallux interphalangeus is better evaluated when the distal phalanx longitudinal axis is measured as a tangent from a perpendicular of the proximal basal articular surface (Fig. 3). The Centre of Rotation of Angulation (CORA) of the valgus can be identified at



Fig. 2 Radiograph and clinical photograph demonstrating hallux interphalangeus with a congruent and aligned 1st metatarsophalangeal joint

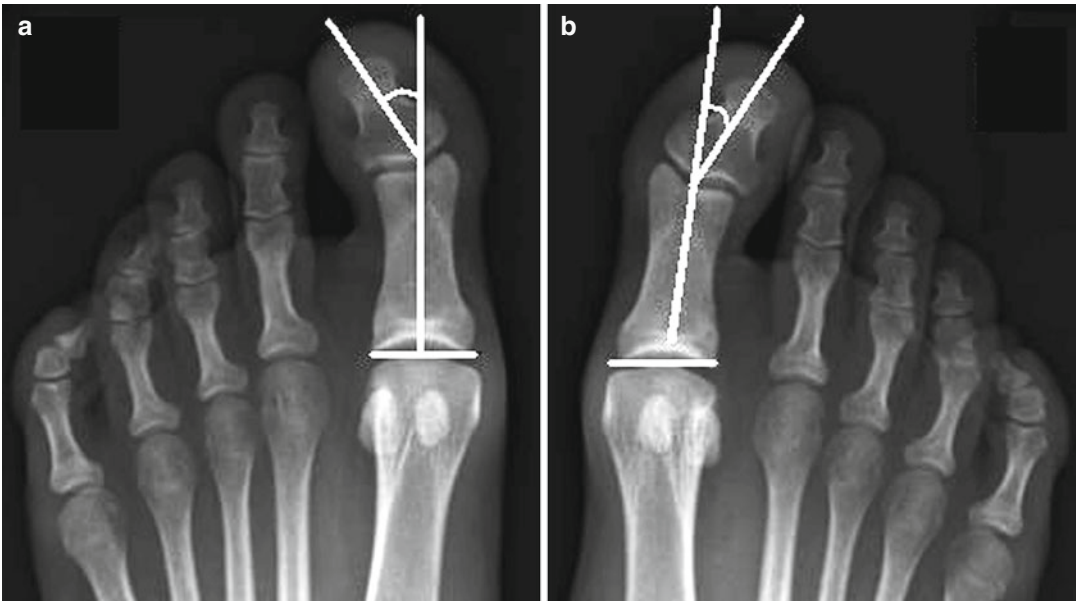


Fig. 3 Radiographs demonstrating the Saxby & Elliott [4] measurement, fully appreciating the contributing abnormalities of hallux interphalangeus (a) versus the more traditional technique as described by Daw [3] (b)

the site of maximal acute angle change which may guide subsequent surgical planning.

The lateral radiograph enables the clinician to evaluate sagittal interphalangeal joint

congruity or phalangeal elevation that should be addressed.

Any pronation of the hallux will alter radiological assessment and must be appreciated.

Treatment

Non-Operative

Hallux interphalangeus in isolation is a fixed deformity due to its bony pathology. Pressure related symptom relief can be achieved using custom made or a proprietary spacer in the first web space. Varus-producing alignment splints are available or can be fashioned by the clinician using adhesive tape. Their effect is produced by abduction at the metatarsophalangeal joint rather than correcting the underlying deformity. Protection of the second toe from any resultant abrasion and soft corns can be achieved with a protective toe sleeve. Wide toebox shoes may be sufficient to provide symptomatic relief.

When present with hallux valgus the same measures are employed along with insole orthoses as required.

Operative

Mobile Interphalangeal Joint - No Arthritis

The mainstay of surgical correction of hallux interphalangeus is the Akin osteotomy as originally described in 1925 [1] (Fig. 4). Though modifications of both site and obliquity are described (Fig. 5) the principle has remained unchanged. Alternatives to the Akin osteotomy can be found in the literature including a proximal phalanx-rotating Scarf osteotomy but are much less common [5].

When managing hallux interphalangeus in isolation, appreciation of the apex of the deformity can guide the site of the closing wedge Akin osteotomy.

When managed surgically in conjunction with hallux valgus, initial alignment correction is of the metatarsal and sesamoid complex. This should result in a congruent metatarsophalangeal joint (See chapter ► [“Osteoarthritis of the Great Toe Metatarsophalangeal Joint”](#)). Only once this is achieved should attention be paid to any



Fig. 4 Post-operative radiograph demonstrating the authors' preferred technique of Akin osteotomy

hallux interphalangeus seen radiographically or clinically on the operating table, with a simulated weight-bearing test on a flat surface. A Modified Akin osteotomy can provide a clinically and radiologically satisfactory result (Fig. 6).

Authors' Preferred Technique – Modified Akin Osteotomy

A direct medial approach to the proximal phalanx is made followed by subperiosteal dissection over the dorsal and plantar aspects. The flexor hallucis longus tendon must be freed from the plantar aspect and protected with a retractor. The flexor hallucis brevis insertion should not be damaged.

A tri-cortical saw cut is made in the proximal phalanx at a site guided by the apex of the deformity leaving most of the lateral cortex intact. A medially-based closing-wedge osteotomy is fashioned sufficient to correct the alignment. This is opposed and secured in compression. Many fixation techniques are

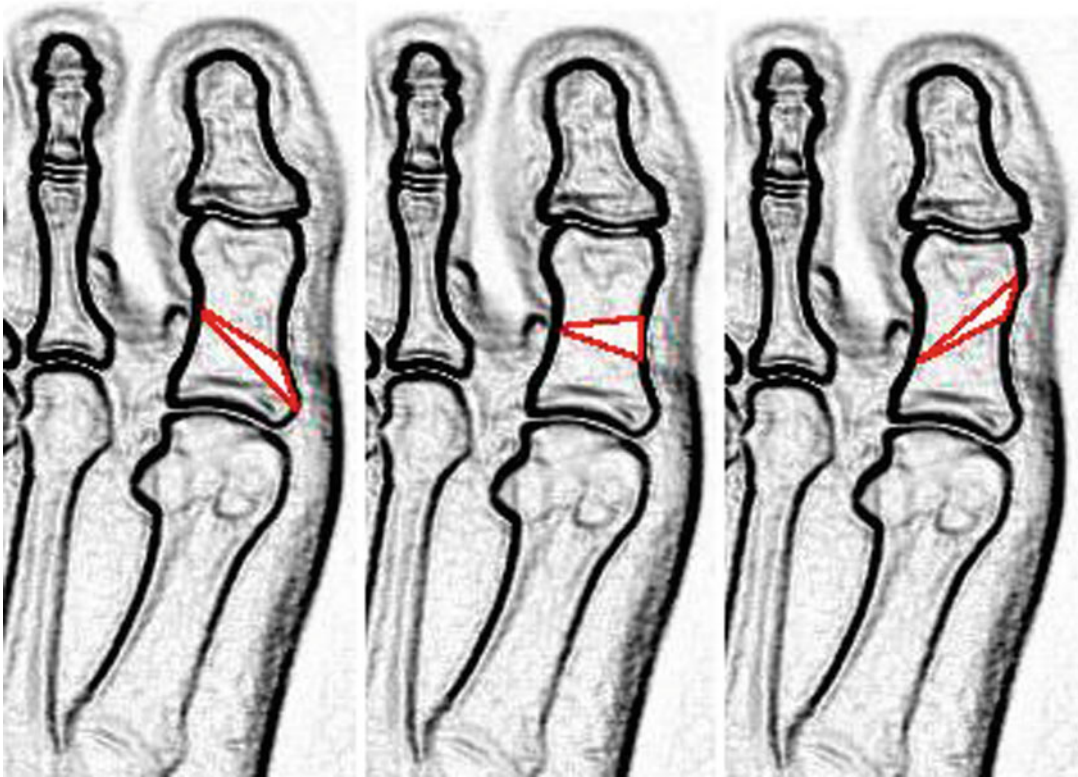


Fig. 5 Potential sites of Akin closing wedge osteotomy



Fig. 6 Bilateral hallux valgus correction with metatarsal osteotomies. Right foot – No phalangeal osteotomy. Left foot – Including Akin osteotomy. *Note the improved cosmetic correction



Fig. 7 Pre- and post-operative radiographs of interphalangeal joint fusion for hallux interphalangeus in the presence of a fixed flexion deformity

available to hold the wedge closed including, staples, screws and wires. The apex of the wedge can be focussed dorsally or plantarly as necessary to correct any subtle sagittal plane deformity. Correction of any pronation deformity is achieved by completing the osteotomy through the lateral cortex. This allows the distal fragment to be freely rotated appropriately before fixation. Inherently then more unstable, augmented fixation is advised in the form of bi-planar fixation or a more substantial implant.

A number of points of reference of acceptable alignment are available to the surgeon from local surface anatomy:

- The plane of motion of the IPJ should be $< 10^\circ$ of valgus, avoiding any varus.
- The Extensor Hallucis Longus tendon should lie in straight line through the foot and centrally along the great toe to its insertion on the dorsum of the distal phalanx.
- A guide to rotational correction is the nail plate which should be parallel with the sole of the foot when simulating weightbearing. The eponychium of the nail should lie approximately perpendicular to its longitudinal axis in the frontal plane.

On-table fluoroscopy should be performed to ensure good correction and an extraarticular position of the fixation device.

Once satisfactorily aligned the wound is closed and a sterile wool and crepe type bandage is used to gently hold the position whilst applying modest compression.

Post-operatively the foot is elevated, though essential weight-bearing is permitted in an off-loading heel wedge type shoe for 6 weeks before weaning into normal footwear.

Interphalangeal Joint Fixed Flexion or Arthritis

In the presence of painful interphalangeal joint arthrosis in association with hallux interphalangeus, corrective osteotomy will not suffice. Interphalangeal joint fusion should be performed with wedge correction made at the time of subchondral joint surface preparation (Fig. 7).

Authors' Preferred

Technique – Interphalangeal Joint Fusion

A Horizontal 'L' skin incision is made over the interphalangeal joint with a short proximal limb from the lateral end. This can be extended as

necessary and a second distal 'Z' limb incised from the medial end if needed. The skin flaps are elevated. Extensor Hallucis Longus is divided over the joint followed by a horizontal capsulotomy. The collateral ligaments are carefully divided protecting the neurovascular bundle. A condylectomy is performed with two parallel saw cuts perpendicular to the longitudinal axes of the phalanges. The cut surfaces are petalised to improve contact area when in compression. The fusion is held with a retrograde cancellous lag screw introduced through the tip of the toe (See Fig. 7). Alignment checks are the same as for the Akin osteotomy. Care must be taken to bury the head of the screw as any prominence here is poorly tolerated. The extensor tendon and capsule remnants are repaired followed by a skin closure.



Fig. 8 Right foot demonstrating malrotation with pronation of hallux following Akin osteotomy

Surgical Precautions

Neurovascular damage must be prevented by careful subperiosteal dissection and soft tissue retraction at the time of osteotomy or condylectomy. The flexor hallucis longus tendon is at risk of laceration from the saw unless carefully protected. Metatarsophalangeal Joint perforation with the staple or screw should be checked for. Excessive wedge resection will produce over correction of the hallux interphalangeus. This must be avoided as any hallux varus is poorly tolerated and can be a cause for revision surgery. As important as the valgus correction is the rotational alignment and any pronation or even supination should be corrected (Fig. 8).

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