

Case Report

Irreducible Dislocation of the Hallucal Interphalangeal Joint: A Rare Case Report and Literature Review

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ABSTRACT

A 47-year-old male presented to emergency department with dislocation of hallucal interphalangeal joint of the left great toe. A trial of closed reduction under local anesthesia was attempted but failed. An emergency open reduction

of the irreducible dislocation of hallucal interphalangeal joint was done with stabilization by K-wire. We report this unusual case of rare injury and review the relevant literature.

KEYWORDS: dislocation, hallux, sesamoid

INTRODUCTION

Toe dislocation is an uncommon disorder. Most reported cases are of dislocation of the metatarsophalangeal joint of the great toe owing to its greater mobility and longer lever arm^[1].

Irreducible dislocation of the hallucal interphalangeal joint is a rare disorder. In the past six decades, only 41 cases have been reported in the literature^[2].

The interphalangeal sesamoid of the phalanx is only present in approximately 13% of the population^[3]. According to Miki *et al*, dislocation of the hallucal interphalangeal joint can be classified into two types based on radiographic and clinical findings. In the first type, the plantar plate is ruptured from one or both of its phalangeal attachment and is trapped within the joint. In the second type the distal phalanx lies dorsal to proximal phalanx, locking the joint in hyperextension^[4].

We report a case of irreducible dislocation of hallucal interphalangeal joint after a fall down the stairs.

CASE REPORT

A 47-year-old male presented to the emergency department with painful swelling of left great toe following a fall down the stairs. The mechanism of injury described was one of hyperextension, with axial loading. Examination revealed a tender and swollen left hallux with distal phalanx in slight

extension. Passive movements of the interphalangeal joint were painful. There was no wound on the hallux. Radiographs revealed a dorsal dislocation of hallucal interphalangeal joint and an interposed small sesamoid bone. The distal phalanx was subluxated dorsally and medially (Fig. 1). No fracture had been identified. After local anesthesia an attempt at closed reduction was undertaken, but was unsuccessful. An emergency open reduction was performed for irreducible dislocation of the interphalangeal joint. A dorsal inverted L-shaped incision was given with the transverse limb at the joint and the longitudinal limb placed dorsolaterally. Arthrotomy revealed the volar plate with its sesamoid bone over the proximal phalangeal head. The interposed structure was moved in the plantar direction while the distal phalanx was under traction. After relocation of the volar plate, the joint was stable, with full range of motion. Neither reconstruction of volar plate nor excision of the sesamoid was needed. An axial Kirschner wire (K-wire) was then fashioned to provide stability for the volar plate during healing (Fig. 2). The postoperative radiographs revealed satisfactory reduction of the joint and sesamoid bone. The joint was immobilized with a splint with strict elevation of the limb for five days and then partial weight bearing with crutches was allowed. The wire was removed after four weeks. The patient returned to normal activity without any kind of functional disability.

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Fig. 1: (a) Anterior-posterior radiograph showing a widened hallucal interphalangeal joint space. The hallucal interphalangeal sesamoid is evident; and (b) lateral radiograph showing a dorsally dislocated interphalangeal joint with hyperextension deformity. The sesamoid is seen to override the proximal phalanx head.



Fig. 2: (a) Anterior-posterior radiograph showing the reduced interphalangeal joint fixed with K-wire; and (b) oblique radiograph showing the reduced sesamoid bone

DISCUSSION

The interposition of the sesamoid bone with dislocation of the interphalangeal joint of the great toe is a rare disorder and may even remain neglected^[5]. Sorene and Regev reported a case of traumatic complex dislocation of the interphalangeal joint of the hallux with intra-articular entrapment of two sesamoid bones. Intra-articular entrapment of the sesamoid may result in irreducible dislocation of the interphalangeal joint of great toe^[6].

The sesamoid bone

Few osseous structures have received as little attention from anatomists and surgeons as the hallucal interphalangeal sesamoid bone (os sesamoidium interphalange hallux). The name 'sesamum' was first

used for this bone by Galen in approximately AD 180 due to its resemblance to a sesame seed (*Sesamum indicum*)^[7].

Since then, the limited attention probably reflects difficulty in recognition of the sesamoid and uncertainty of its nature. There is still controversy regarding whether it is a rudimentary structure, an accessory ossicle, or a pressure-induced reactive bone formation. Its size varies from 0.05 cm to 1 cm^[7].

The sesamoid bone is known, however, to be associated with several clinical pathologies, ranging from relatively minor painful hyperkeratotic plantar lesion to irreducible interphalangeal dislocation^[4].

Miki *et al* described anatomical details of the irreducible dislocations of hallucal interphalangeal joint. There are two types of irreducible dislocations

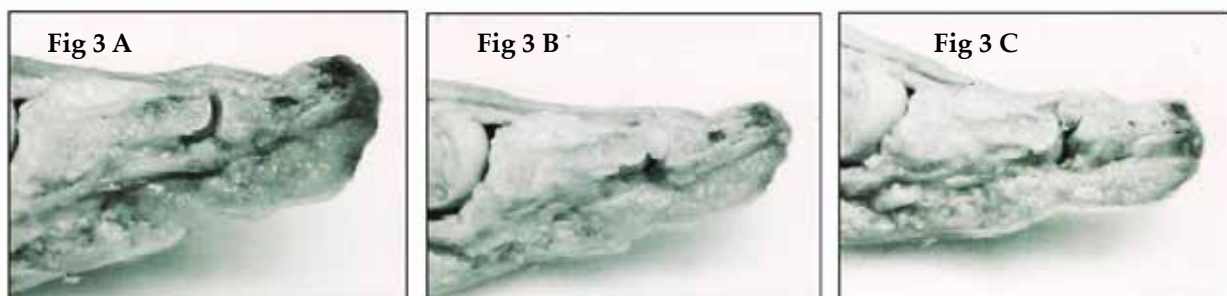


Fig. 3: Anatomical specimens of the hallux (a) Normal anatomy of the hallux is demonstrated: the sesamoid is partly embedded within the volar plate. The major facet is articulating with the condyles of the proximal phalanx. The minor articulating facet is in contact with the base of the distal phalanx. Loose connective tissue intervenes between the volar plate and the flexor hallucis longus tendon; (b) Miki type 1 dislocation: the toe is slightly elongated with a widened joint space. There is gross alignment and the sesamoid is within the joint; and (c) Miki type 2 dislocation: the sesamoid is located over the proximal phalangeal head. The joint is hyperextended and a skin depression is noted^[14].

depending on the position of the displaced volar plate including the sesamoid. In type I dislocations, sesamoid is entrapped in the joint. In type II dislocations, sesamoid is located over the proximal phalangeal head (Fig. 3)^[4].

The dorsal surface, with two facets, is predominantly cartilaginous and articulates largely with the head of the proximal phalanx. The non-articulating part is osseous and firmly embedded within the plantar capsule of the interphalangeal joint, commonly termed the volar plate. Loose connective tissue spans the space between the volar plate and the flexor hallucis longus tendon proper. The bone is found in 57% of embryological specimens as a well-defined osseous structure, allowing it to be classified as an accessory ossicle within an otherwise normal foot^[4]. The hallucal interphalangeal sesamoid can be identified radiographically with a frequency varying from 4.3 to 93% according to the penetration and focus of the film. Bilateral occurrence has been reported in 94% of cases, and in up to 95.5% in a study based on macroscopic examination of over 144 cadaveric feet^[8].

Dislocation: Biomechanical considerations

The mechanism of dislocation of the hallucal interphalangeal joint is known to be a combination of axial loading with hypertensive force^[9]. This is supported both by patient recall and by occasional lacerations seen over the plantar surface, suggesting a significant hyperextension force acting on the plantar skin at the time of injury^[4,10].

The stability of the hallucal interphalangeal joint appears dependent on the volar plate, joint capsule, collateral ligaments, and the tendons of extensor and flexor hallucis longus acting together to prevent the joint from hyperextension of more than 20°. The collateral ligaments not only confer side-to-side stability but also limit the amount of hyperextension. When these ligaments and the joint capsule are cut, further extension is possible up to the end-point limited by the volar plate. A cadaveric study performed by Miki *et al*^[4] demonstrated that when the volar plate is detached from either the proximal or distal phalanx, dislocation of the interphalangeal joint becomes possible. However, the volar plate still cannot be invaginated into the joint. It is only when the attachment to both phalanges is disrupted that this can occur, as seen in reported case. As the interposed sesamoid effectively 'tightens' the intact collateral ligaments, close reduction becomes very difficult, if not impossible^[11, 12]. Difficulty can be encountered during close reduction due to the 'tightened' collateral ligaments and problems handling the short and swollen distal phalanx. Only a handful of successful cases have been reported^[11].

This should not preclude a trial of close reduction prior to operative treatment. Percutaneous reduction of an incarcerated interphalangeal joint sesamoid is an alternative to open surgery. The procedure is based on the anatomical understanding that the sesamoid-plantar plate complex displaces and reduces together as a unit. Percutaneous reduction is only possible in patients with radiographically apparent sesamoids, as intraoperative fluoroscopy is necessary to visualize engagement of the sesamoid by the reduction implement and confirm a satisfactory reduction after the maneuver. The K-wire is used as a joystick to lever the sesamoid away from the head of the proximal phalanx and into the joint and then to push it plantarward. This technique can be complicated by laceration of the extensor hallucis longus tendon and sesamoid fracture. Also, this technique cannot be done, if the sesamoid is not visible radiographically (in up to 44% of ambulatory patients) in chronic dislocations, when it is no longer possible to distract the joint space enough to allow passage of the sesamoid through it and in open dislocations^[13].

Surgical approaches including plantar, medial, dorsal, and dorsal or dorsal-lateral with extensor tendon division approaches have been described. Although the medial approach is favoured by Japanese surgeons, none of the surgical options is clearly superior. Extensor tendon division offers better exposure than required and may result in greater surgical trauma. After reduction, it is not an uncommon practice to remove the offending volar plate. In general, the literature discourages repair of the dislocated volar plate in view of its inherent stability after reduction. Repair of both the origin and insertion of the minute volar plate is technically demanding. Moreover, repair of the volar plate necessitates use of a plantar approach, which is frequently complicated by a hyperkeratotic scar over the weight-bearing area^[14].

CONCLUSION

Dislocation of interphalangeal joint of big toe is a rare disorder. Trial of closed reduction should be attempted first but if it fails, an emergency open reduction is advised. Most cases of dislocation of the hallucal interphalangeal joint require open reduction, with dorsal approach. The consensus view is that after reduction, the volar plate need not be repaired. The mode of immobilization to be followed is a matter of discussion. Regardless of the method of treatment adopted, the prognosis appears excellent in most, if not all, cases.

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