Case Report

# Open reduction for irreducible dislocation of hallux interphalangeal joint: case report and literature review

Martinus V. Tjandra,[1] Margaretta S. Yolanda,[2] Jafri Hasan[3]

[1] General Practitioner, Tarakan Hospital, Jakarta
[2] Orthopedic Surgeon, Bintaro Hospital, Jakarta
[3]Sport Consultant of Orthopedic Surgeon, Tarakan Hospital, Jakarta, Indonesia

## ABSTRACT

**Introduction:** Irreducible dorsal dislocation of the interphalangeal (IP) joint of the great toe is an uncommon entity. Most reported cases reviewed metatarsophalangeal joint injury as the most common location for trauma of forefoot. Closed reduction of hallux IP joint is difficult when accompanied by sesamoid bone and plantar plate interposition.

**Case Presentation:** A twenty two year-old man complaining of painful swelling of the left big toe for five days after falling from skateboarding. The big toe was suffered from axial loading and hyperdorsoflexion. Local examination showed bruised, hyperextended deformity, and swelling of the left hallux. X-ray revealed interposed hallucal sesamoid between the IP joint from anteroposterior view and the dorsal dislocation from oblique view. Attempt for closed reduction was unsuccessful. The patient underwent dorsal-approach open reduction, resection of the interposed sesamoid, and K-wire fixation.

**Discussion:** Intra-articular entrapment of the sesamoid may result in irreducible dislocation of the hallux IP joint. The challenge is likely to be the result of the interposed plantar capsule with the sesamoid. Open reduction of the left great toe IP joint was approached with midline dorsal incision and split the extensor expansion. Dorsal-approach has been performed in some cases, it's easy to perform and can be used to confirm and reposition the interposed tissue. The K-wire removed at the third week after surgery. Postoperative radiograph revealed satisfactory reduction of the joint.

**Conclusion:** Dorsal-approach open reduction and fixing with K-wire shows good result for dislocation of hallux IP joint. The patient could walk without discomfort and returned to daily activities after four weeks postoperative.

## ABSTRAK

***Pendahuluan:*** *Dislokasi sendi interphalanx (IP) ke bagian dorsal pada ibu jari kaki yang sulit direduksi merupakan kasus yang jarang. Mayoritas laporan membahas cedera sendi* metatarsophalangeal *yang merukapakan kasus tersering trauma kaki bagian depan. Reduksi tertutup untuk IP ibu jari kaki menjadi sulit jika disertai tulang sesamoid yang terjepit pada* plantar plate.

***Presentasi Kasus:*** *Pria usia 22 tahun datang dengan keluhan bengkak dan nyeri pada ibu jari kaki kiri yang sudah dirasakan lima hari karena terjatuh saat bermain* skateboard. *Ibu jari tersebut mengalami beban axial dan hiperdorsofleksi. Pemeriksaan lokal didapatkan memar, hiperekstensi, dan bengkak pada ibu jari kaki. X-ray menunjukkan hallux sesamoid terjepit diantara sendi IP pada foto anteroposterior dan dislokasi dorsal pada foto* oblique. *Reduksi secara tertutup tidak berhasil. Dilakukan reduksi terbuka melalui bagian dorsal, reseksi sesamoid yang terjepit, dan fiksasi dengan K-wire.*

***Diskusi:*** *Sesamoid yang terjepit di dalam sendi menyebabkan reduksi sendi IP ibu jari menjadi sulit. Hal ini disebabkan sesamoid terjepit pada kapsul sendi bagian plantar. Reduksi terbuka pada ibu jari kaki dilakukan dengan insisi garis tengah bagian dorsal dan memisahkan bagian ekstensor. Operasi dari bagian dorsal telah dilakukan pada beberapa kasus karena mudah dilakukan dan dapat memastikan reposisi jaringan yang terjepit. K-wire dilepas tiga minggu setelah operasi. Radiologi setelah operasi menunjukkan reduksi yang memuaskan.*

***Kesimpulan:*** *Reduksi terbuka dari bagian dorsal dan fiksasi dengan K-wire menunjukkan hasil yang baik untuk dislokasi sendi IP ibu jari kaki. Pasien dapat berjalan tanpa gangguan dan kembali pada aktifitas sehari-hari empat minggu setelah operasi.*

**Keywords:** Dislocation of hallux, interposed hallucal sesamoid, K-wire

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**Corresponding author :** Martinus V. Tjandra, MD. tjandramartinus@gmail.com

## INTRODUCTION

Irreducible dorsal dislocation of the interphalangeal (IP) joint of the great toe is an uncommon entity.[1] Most reported cases in the literature reviewed metatarsophalangeal (MTP) joint injury as the most common location for trauma of forefoot.[2] Closed reduction is the usual treatment for hallux IP joint dislocation. However, closed reduction of hallux IP joint dislocation is difficult when accompanied by sesamoid bone and plantar plate interposition in the joint, which needs open reduction.[3] The patient should be informed for open reduction if full IP joint reduction is not achieved. Plain radiograph is usually sufficient to diagnose IP joint dislocation. According to Miki et al. dislocation of the hallucal IP joint can be classified into two types based on the radiographic and the clinical findings.[4] In the first type, plantar plate is ruptured from one or both of its phalangeal attachments and is trapped within the joint. In the second type, distal phalanx lies dorsal to proximal phalanx, locking the joint in hyperextension. In our case, attempt at closed reduction was unsuccessful and the patient underwent dorsal-approach open reduction, resection of the interposed sesamoid bone, and fixed with Kirschner wire (K wire).

### Case Presentation

A twenty-two year-old man brought to outpatient clinic complaining of painful swelling of the left big toe for five days after falling from skateboarding. The patient was not brought to the hospital immediately because he was seeking a non-medical advice priorly. His toe was massaged and they attempted to reduce the dislocation by the help of five people without anesthesia, but it didn't succeed. Eventually, he decided to go to orthopedic outpatient clinic because the pain had not subsided. Other than the pain and the swollen left big toe, the patient had no other significant complain. From his description of the injury, the big toe suffered from axial loading and hyperdorsoflexion of the left hallux (See Figure 1).

On general examination, the vital signs were within normal limits. Local examination showed bruised, hyperextended deformity, and swelling of the left hallux. Pain aggravated when the IP joint was palpated. There was also lack of both active and passive movements of the affected IP joint. The radiograph examination revealed interposed hallucal sesamoid between the IP joint from the anteroposterior (AP) view and the dorsal dislocation with hallucal sesamoid trapped in the IP joint from the oblique view (See Figure 2). Close reduction under local anesthesia was attempted but unsuccessful.

The patient underwent surgical intervention with dorsal-approach open reduction, resection of the interposed sesamoid, and K wire fixation of the left great toe IP joint (See Figure 3&4). The postoperative radiograph revealed satisfactory reduction of the joint. The patient was then discharged from the hospital and informed to follow up.

The patient was followed up at Orthopedic outpatient clinic at the first and the third week postoperative. The K-wire was removed at the third week after surgery. The patient could walk without discomfort and returned to daily activities without disability after four weeks after surgery.

(a) (b)

**Figure 1.** Local Examination shows bruised, swelling (a), and hyperextended deformity (b).

(a) (b)

**Figure 2.** Radiology examination from anteroposterior (a) and oblique (b) views.

## DISCUSSION

Dorsal dislocation of the IP joint of the great toe is a rare

injury.[1] The anatomy of the joint makes closed reduction difficult to achieve. The instability of this joint, due to short lever arm of the distal phalanx, the condylar shape of the joint, the extensor and flexor tendons insertion, and the short, thick, strong collateral ligaments, explains the consequent rarity of this injury.[5] Intra-articular entrapment of the sesamoid may result in irreducible dislocation of the hallux IP joint.[6] The challenge is likely to be the result of the interposed plantar capsule with the sesamoid.[1] Injury to the sesamoid can be difficult to diagnose as in up to 44% of the interphalangeal sesamoid is invisible radiographically.[7,8]

There are two types of irreducible dislocations depending upon the position of the displaced volar plate including the sesamoid. The sesamoid is entrapped in the joint in type I dislocation and radiograph reveals wider joint space, good alignment of phalanges, and intra-articular displacement of the sesamoid.[5] In type II dislocation, the sesamoid bone is located over the proximal phalangeal head and radiograph reveals narrower joint space or overlapping of phalanges and hyperextension of the distal phalanx.[6,9] Clinical presentation and radiograph can be utilized to differentiate the two groups. In type I dislocation, the distal phalanx is in neutral position and displays resistance to dorsoflexion and plantar flexion.[1]

There is still controversy regarding whether it is a rudimentary structure, an accessory ossicle, or a procure induced reactive bone formation.[4] The dorsal surface, with two facets, is predominantly cartilaginous and articulates largely with the head of the proximal phalanx. The hallucal IP sesamoid can be identified radiographically with a frequency varying from 4.3 to 93% according to the penetration and focus of the film.[4]

From the patient's history described, the big toe suffered from axial loading and hyper-dorsoflexion. The mechanism of dislocation of the hallucal IP joint is known to be a combination of axial loading with hyper-extensive force acting on the plantar skin at the time of injury.[4] Closed reduction under local anesthesia was attempted for this patient but was unsuccessful. The stability of the hallucal IP joint seemed to depend on the volar plate, joint capsule, collateral ligaments, and the tendons of the extensor and flexor hallucis longus acting together to prevent the joint from hyperextended more than 20°. However, the volar plate is still not able to be invaginated into this joint, except the attachment to both phalanges is disrupted, as seen in this presented case. As the interposed sesamoid effectively "tightens" the intact collateral ligaments, close reduction becomes very difficult, if not impossible.[4,8] However, this should not preclude a trial of close reduction prior to operative treatment.

(a) (b)

**Figure 3.** Dorsal-approach open reduction was made, showing the interposed sesamoid bone (arrow) (a) and fixation with K-wire (b).

**Figure 4.** Foot X-ray post-surgery shows good anatomical alignment

**Figure 5.** Foot X-ray post-K-wire removal at the fourth week

## Surgical Intervention

Open reduction can be performed using different approaches: plantar, plantar medial, lateral, medial, and

dorsal.[3] In this presented case, the patient underwent dorsal-approach open reduction. The left great toe IP joint was approached with midline dorsal incision and split the extensor expansion. Dorsal-approach has been performed in some cases, it is easy to perform and can be used to confirm and reposition the interposed tissue.[3] The plantar approach has been performed in five cases, it is used to repair the volar plate. Hartog et al. performed dorsal S-type incision over the IPJ, incised the extensor tendon longitudinally and opened the joint capsule.[10]

Sesamoidectomy has been shown to be safe and effective of symptomatic relief in athletes as reviewed by many authors. A systematic review by Shimozono et al. showed pain reduction with sesamoidectomy.[11] Another studies reported that sesamoidectomy provides good clinical outcomes and a quick return to sporting activities.[12-14]

In this case, the left great toe IP joint was approached with a midline dorsal incision and split of the extensor expansion through the skin and blunt dissection through the subcutaneous tissue while keeping neurovasculature protected. Dissection proceeded to the joint capsule, and the interposed sesamoid was found in the IP joint space. The IP joint was checked to be free, but the sesamoid bone tended to cause mechanical block. Scalpel was used to tease the sesamoid away from the flexor hallucis longus tendon, beginning at one edge of the sesamoid. The bone was carefully elevated off the tendon while dissection proceeded around the perimeter. A 2.5 mm Kirschner-wire was driven percutaneously to hold the IP joint in its native reduction.

Although removal might have a negative effect on the biomechanics of the hallux, in most cases a complete recovery is made.[10] Bichara et al. in their study also demonstrated good results after sesamoidectomy for sesamoid non-unions with reliable pain relief and return to activities.[11] There is 10-20% risk including the development of hallux valgus with medial sesamoidectomy or hallux varus with lateral sesamoidectomy following the procedure, and it is mitigated with proper soft tissue dissection and tensioning.[11-14]

Increased laxity after open reduction of the IP joint arises from overstretching of the capsule and the collateral ligaments at the time of injury.[1] As recommended by Woon et al., temporary K-wire immobilization was performed. There have been other methods of stabilization described in the literature, such as bulky dressing, buddy splinting, and immobilization in a short leg cast up to four weeks.[1]

Percutaneous reduction of an incarcerated IP joint sesamoid is an alternative to open surgery.[4] It is only possible in patients with radiographically apparent sesamoids, as intraoperative fluoroscopy is necessary to visualize engagement of the sesamoid by the reduction after the maneuver. In Hamdy et al. study, K-wire is used as a joystick to lever the sesamoid away from the head of proximal phalanx and into the joint and then to push it plantarward.[4,16] Post-reduction radiograph is essential, and in this case may have helped to prevent long term complication for the patient.

After surgery, the patient's left toe was immobilized in splint with elevation for five days. At the fourth week, the Kirschner wire was removed. On examination, interphalangeal range of motion slightly reduced (about 5°) whereas metatarsophalangeal joint range of motion was normal. Radiographs revealed normal anatomy alignment. He was then able to return to active sports, including light skateboarding.

## CONCLUSION

Closed reduction of hallux IP joint dislocation is difficult when accompanied by sesamoid bone and plantar plate interposition in the joint, which needs open reduction. The anatomy of the joint makes closed reduction difficult to achieve. The challenge is likely to be the result of the interposed the plantar capsule with the sesamoid. In this case, the patient underwent dorsal-approach open reduction, resection of the interposed sesamoid bone, and fixed with Kirschner wire (K-wire). The K-wire was removed at the fourth week after surgery. The patient could walk without discomfort and returned to daily activities without disability after four weeks postoperative.

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