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# Open irreducible fracture/dislocation of the four ulnar metacarpals at the metacarpophalangeal joints: case report

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**Abstract** Open irreducible fracture/dislocation of multiple metacarpophalangeal joints is an exceedingly rare injury and, to our knowledge, not yet described in the literature. An earlier belief that metacarpophalangeal dislocations were high-energy injuries is questioned by this case report due to an unusual case of open irreducible fracture/dislocation of the four ulnar metacarpals that occurred in a hand trauma. A 24-year-old man presented in the emergency department with an open irreducible fracture/dislocation of the four ulnar metacarpals and impaired flexion of the metacarpophalangeal joint of his left hand. The injury was described as an open injury of his third metacarpal head with an associated fracture of the fourth metacarpal head and dorsal dislocation of the four ulnar metacarpals after a fall onto the outstretched hand. Early recognition and anatomical reduction are essential to achieve good long-term outcomes. Massive edema, interposed volar ligaments, and overlapping metacarpal bases are the usual obstacles to a successful closed reduction. Use of a palmar approach was the key to reduce the displacement. Joint stability and osteosynthesis with K-wires were achieved, and the patient has been asymptomatic for more than 24 months.

**Keywords** Irreducible metacarpophalangeal joint dislocation · Dorsal metacarpophalangeal joint dislocation · Hand trauma · Open metacarpophalangeal joint dislocation

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## Introduction

Traumatic dislocation of the metacarpophalangeal (MCP) joint is considered a very rare injury, although some reports indicate that it might be an infrequently reported or often overseen injury rather than one that rarely occurs [1]. A dislocation is considered to be simple when it is easily reducible without open surgical procedures and complex when open reduction is necessary.

Complex dislocation of the MCP joint was originally described by Farabeuf [2] in 1876. However, not until 1957, we did begin to develop a better understanding of the difference between simple and complex fracture/dislocations. In that year, Kaplan [3] published his now classic article describing the pathologic anatomy of the metacarpal head buttonholing into the palm and the factors preventing closed reduction.

A great deal of force is usually necessary to disrupt the joints, and most dislocations are accompanied by avulsion fractures of the involved bones. Dislocation without fracture is rare, and it most often involves the carpometacarpal joint of the little finger [4].

We report an unusual case of isolated dorsal open irreducible dislocation of all four ulnar MCP joints that occurred after hand trauma. The mechanism of injury and the management of this unusual injury are discussed.

## Case report

We report the case of a 24-year-old male that sustained a fall from approximately 2 m landing on his left outstretched hand. He presented to the emergency department with pain,

swelling, and dysfunction of his left hand, without any complaints of neurovascular deficits (Fig. 1). On inspection, we noted superficial dorsal abrasions and an open injury of the palmar side with an exposed third metacarpal head (Fig. 2).

He was able to do some degree of extension without any ability to flex the four ulnar MCP joints. There were no neurovascular deficits, and he presented with dorsal dislocation of all ulnar MCP joints with a fracture of the fourth metacarpal head as an associated injury (Fig. 3).

Immediate reduction was attempted under sedation in the emergency room without success. Open reduction was performed 4 h after injury through a limited volar approach (Fig. 4) since in complex volar MCP dislocations, the structure most likely to hinder reduction of the joint is the interposed volar plate, and the metacarpal head is thus strangulated between volar plate, flexor tendon, and the lumbrical muscle in the commonly "buttonhole trap" (Fig. 5) [5].

Interposed volar ligaments and massive edema were found to be obstructing the reduction. The reduction was achieved by pulling the fingers distally and applying a direct push over the heads of the metacarpals. The reduction was stable, and a K-wire construction was used for the fourth metacarpal head osteosynthesis (Fig. 6).

A splint was applied postoperatively for 4 weeks. Postoperative radiographs showed accurate reduction of the MCP joints.

The Kirschner wires and splint were removed at 4 weeks, and a splint was used for another 4 weeks during physical therapy. At his last follow-up, 24 months after surgery, the patient had no complaints, full range of motion, normal grip strength, and no degenerative changes.



**Fig. 1** Palmar view of the MCP dislocation just after admission in the emergency department



**Fig. 2** Dorsal view of the open III metacarpal dislocation just after admission in the emergency department



**Fig. 3** X-ray views showing associated fracture of the IV metacarpal head



**Fig. 4** Volar approach showing the damaged volar structures during surgical reduction of the complex open dislocation and IV metacarpal head fracture pinning

**Discussion**

The usual mechanism of injury to an MCP joint is a fall on the outstretched hand causing forcible hyperextension of the joint. Dorsal dislocations are more frequent than volar dislocations, and MCP joint dislocations are less common than interphalangeal dislocations [6].

Irreducible dorsal dislocations occur through the mechanism of forceful hyperextension of the MCP joint. However, the volar plate becomes interposed in the joint. The metacarpal head lies prominently displaced in the palm and is easily palpated.

Kaplan [3] described the pathogenesis and anatomy of irreducible dislocations. The most important structure preventing reduction is the displaced volar plate. However, the surrounding tendons and ligamentous structures form a tight noose around the metacarpal neck preventing closed reduction as it was the case in this patient. In MCP dislocations, anteroposterior, lateral, and oblique radiographic views confirm the diagnosis, and in complex, irreducible dislocations, a widened joint space is normally indicative of interposed volar plate within the joint as it was the case with this reported injury [7].

Associated fractures of the proximal phalanx and metacarpal head can occur in up to 50 % of MCP joint dislocations



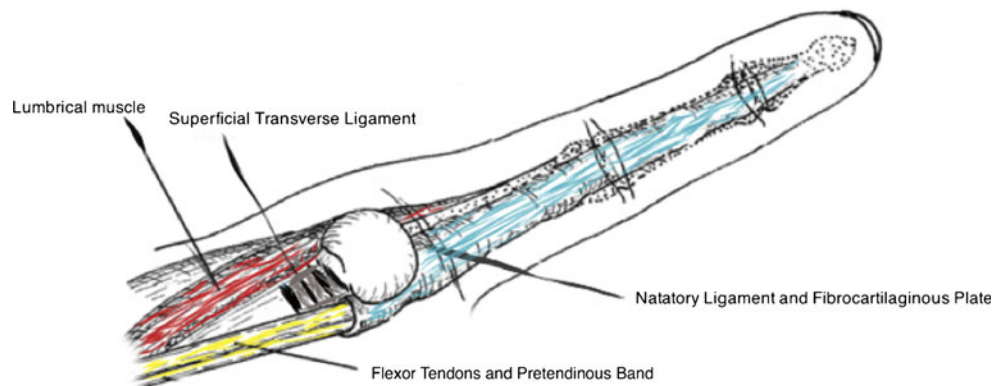
**Fig. 6** Immediate postoperative X-ray showing adequate reduction of the dislocated metacarpal heads and K-wire osteosynthesis of the IV metacarpal fracture

[8]. In this case, there was an associated fracture of the fourth metacarpal head.

Simple distraction as a reduction maneuver for MCP dislocations is usually unsuccessful. The original surgical approach for irreducible dorsal dislocations was first described by Kaplan [3], who believed that volar approach allowed access not only to the interposed volar plate but also to the surrounding ligaments and tendons that trap the metacarpal head and cannot be addressed through a dorsal approach. In this case, we combined an approach described by Eaton and Dray [9] that releases the A1 pulley, consequently releasing tension from the flexor tendons and allowing for the proximal phalanx and attached volar plate to go back to their anatomical position.

The vulnerability of the neurovascular bundle during the volar approach is of prime importance due to its displacement by the dislocated metacarpal head rendering the bundle more superficial and sometimes just beneath the skin [10]. An excellent visualization is possible by a volar

**Fig. 5** Illustrative sketch showing a view of the commonly buttonhole trap



approach, and release of the A1 pulley helps reduction by diminishing the tension on the flexor tendons.

The vast majority of complications described in patients with MCP dislocations are related to delay and failure of establishing a proper diagnosis and appropriate treatment. Repeated attempts at closed reduction, traumatic open reduction, or prolonged dislocation may result in early degenerative changes or osteonecrosis of the metacarpal heads. Worst results are associated with delays in treatment and are often the result of soft tissue trauma, like joint stiffness, and decreased range of motion [11].

Joint contracture release or tenolysis may be necessary to improve final ROM. Damage to the neurovascular bundle can occur during open reduction due to the already described superficial position of the bundle over the metacarpal head.

**Conflict of interest** The authors declare that they have no conflict of interest.

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