

Open Reduction of Complex Metacarpo-phalangeal Joint Dislocations

Ruban Raj Joshi^a

ABSTRACT:

The metacarpophalangeal (MP) joint is resistant to injury due to its strong capsuloligamentous structures, which include the volar plate, deep transverse metacarpal and collateral ligaments. Complex MP joint dislocations are, by definition, irreducible by closed means and require open reduction, as the volar plate becomes entrapped between the metacarpal head and proximal phalanx. Two cases of isolated closed & one case of open complex dislocation of the metacarpophalangeal joint of the three different fingers are presented. Such dislocations require open reduction, and the dorsal approach is simple and effective.

Keywords: complex dislocation • metacarpophalangeal joint • open reduction • volar plate

BACKGROUND:

Traumatic dislocation of the metacarpophalangeal (MCP) joint is considered a rare injury, although the experience of Hunt et al. indicates that it might be an infrequently reported injury rather than one that rarely occurs. They can be classified directionally as either being volar or dorsal, and are further categorized as simple or complex complete. A dislocation is considered to be simple when it is easily reducible with closed manipulation and complex when open reduction is necessary (Fig 1). Dorsal MP joint dislocations tend to occur most frequently among the exposed border digits, with the index finger most commonly affected, followed by the small finger.^{9,10} The long and ring fingers are protected by the deep transverse metacarpal ligaments and the border digits such that they rarely suffer an isolated dislocation.¹¹ Complex MP joint dislocations, by definition, require open

reduction.

This may be accomplished via either a volar or dorsal approach. This article reviews the operative technique for open reduction of complex MP joint dislocations using a dorsal approach.

HISTORICAL REVIEW AND PATHOANATOMY:

Complex dislocation of the MCP joint was originally described by Fara-beuf in 1876.² However, not until 1957 did we begin to develop a better understanding of the difference between simple and complex forms. In that year, Kaplan published his now classic article describing the pathologic anatomy of the metacarpal head buttonholing into the palm and the factors preventing closed reduction.³

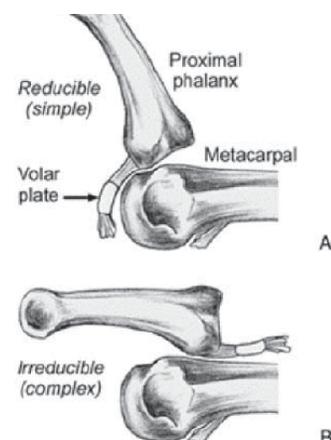


Fig 1: Simple and complex MCP dislocation

a - Lecturer

Department of Orthopedics and Traumatology
Lumbini Medical College Teaching Hospital, Palpa, Nepal

Corresponding Author:

Dr. Ruban Raj Joshi
e-mail: dr_rubanjoshi@yahoo.com

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The volar plate becomes entrapped between the metacarpal head and base of the proximal phalanx by its attachment to the deep transverse metacarpal ligament, thus becoming the primary impediment to reduction.^{4,5} The flexor tendons, pretendinous band of the palmar fascia slips ulnarward, and lumbrical muscles shift radially forming a noose around the dislocated MP joint, further inhibiting closed reduction (Fig 2). Initial attempts at reduction using traction will further tighten this noose, possibly interposing additional structures. This underscores the need for clinical and radiographic recognition of this injury pattern. The radial digital nerve of the finger is under tension and often assumes a precarious position between the metacarpal head and the skin, making it susceptible to injury during the volar approach.

CLINICAL FINDINGS AND RADIOLOGY:

On examination, the patient with a complex MP joint dislocation will have a relatively benign clinical appearance consisting of mild extension and ulnar deviation at the MP joint, as well as flexion of the interphalangeal (IP) joints (Fig 3,7A,8B). A pathognomonic sign of palmar skin puckering over the head of the metacarpal may be observed.³ The posteroanterior (PA) plain radiograph demonstrates increase in MCP joint space (Figure 4B), while the oblique radiograph shows a dorsal dislocation with the MP joint in slight hyperextension (Fig 4A). The presence of sesamoid interposition within the MP joint, best visualized on the oblique radiograph, is pathognomonic.⁶

MATERIALS AND METHODS:

Case 1:

A 11 year old boy, reported to department of Orthopaedics, Lumbini Medical College Teaching Hospital , Palpa, with pain, swelling and deformity of MCP joint of index finger of left hand for one day.

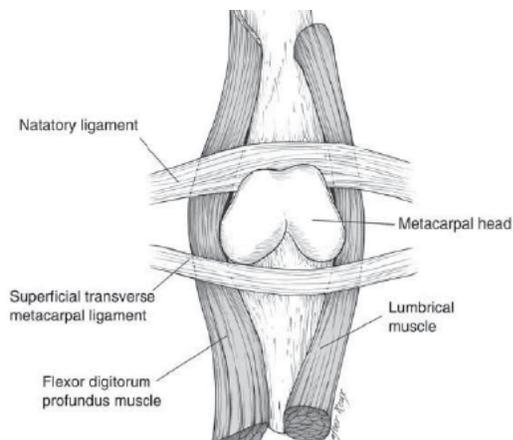


Fig 2: Structures that prevent dislocation reduction of a metacarpophalangeal joint dislocation



Fig 3 : (Case 1) 11 years boy with dorsal MCP dislocation of left index finger



Fig 4: Right hand PA view showing increase in MCP joint space of index finger and Right hand oblique view showing dorsal dislocation of second MCP joint.



Fig 5: Repair of extensor mechanism



Fig 6: Intraoperative fluoroscopic image of MCP reduction of index finger



Fig 7 (A) : (Case 2) 40 years male with MCP dislocation right ring finger. (B) Radiograph showing volar dislocation of MCP ring finger



Fig 8 (A and B): (Case 3) 24 years female with open complex dislocation of left thumb MCP joint

There was an alleged history of fall on out-stretched hand while playing. On clinical examination, there was mild extension and ulnar deviation at the MP joint, as well as flexion of the interphalangeal (IP) joints of right index finger (Fig: 3). A pathognomonic sign of palmar skin puckering over the head of the metacarpal was noted. A volar prominence was palpated at the MP joint corresponding to the metacarpal head with a void dorsally. Radiographs demonstrated dorsal dislocation of the proximal phalanx of the index finger without fracture (Fig: 4 A & B). Attempted reduction under anesthesia were unsuccessful. Given the clinical and radiographic picture of a complex MP joint dislocation, we proceeded with operative reduction via a dorsal approach

Case 2:

A 39-year old man was examined at a local hospital ten hours after sustaining a hyperextension injury to his right ring finger. He complained of pain, swelling and limitation of active motion at the metacarpophalangeal joint of ring finger (Fig 7A). Radiographs showed volar dislocation of that joint (Fig 7B).

Case 3:

A 24 years old female injured her left thumb following a fall on her outstretched left hand from a moving tractor. Soon after injury, she was brought to our hospital where a diagnosis of made (Fig 8 A and B). Radiographs showed volar proximal phalanx (Fig 9) open, volar dislocation of the MP joint of the thumb was dislocation metacarpophalangeal joint of the thumb with a osteochondral fracture of base of proximaphalanx.

SURGICAL TECHNIQUE:

An arm tourniquet is applied, and under regional anesthesia the upper extremity is prepped and draped in the usual sterile fashion. A curvilinear incision is made overlying the MP joint. The sagittal band of the extensor mechanism is incised and later repaired. The capsule is incised longitudinally and inspection of the joint is undertaken (Figure 5). The collateral and accessory collateral ligaments may be imbricated into the joint. The volar plate is the most common impediment to reduction and must be carefully assessed. Often, the volar plate remains attached to the proximal phalanx and may become completely dorsally translocated over the metacarpal head. Initially the volar plate may be confused with the articular surface of the metacarpal head as it is



Fig 9: Oblique radiograph (right thumb) at presentation demonstrating a complex complete volarly dislocated metacarpophalangeal joint. Note possible sesamoid bone within the joint space.



Fig10: Metacarpophalangeal joint was reduced after releasing the entrapped volar plate, splitting it longitudinally and allowing it to slip back to its anatomical position volar to the metacarpal head

taut, shiny, and white, with an appearance similar to articular cartilage. Close inspection and proper identification of anatomic structures is critical for proper reduction of the MCP joint. Manipulation of the volar plate with a Freer Elevator may be attempted in an effort to reduce the joint maintaining the continuity of the volar plate. More commonly, a longitudinal incision in the volar plate (with articular protection afforded by a Freer Elevator passed over the metacarpal head) will allow it to be reduced over the metacarpal head. The leaflets of the volar plate are allowed to subluxate radial and ulnar to the metacarpal head. As the metacarpal head is being reduced, care must be taken to identify any osteochondral fracture. This allows for a concentric, stable reduction without injury to the articular surfaces. Direct visualization and intraoperative fluoroscopic evaluation confirms a stable reduction through a full arc of motion (Figure 8). A transarticular K-wire fixation was needed for the open complex MCP dislocation (Fig 10 and 11) The capsule and the extensor mechanism is reapproximated with 4-0 Vicryl (Ethicon) to prevent iatrogenic subluxation (Fig 5B). Skin is closed with nonabsorbable horizontal mattress sutures after tourniquet deflation and hemostasis is confirmed. The patient is then placed into a gutter splint with the wrist in gentle extension, the MP joint in 70° to 90° of flexion, and the IP joints in extension. Early protected mobilization with a gutter-type splint is initiated after a few days to allow early wound healing. Strengthening begins at six weeks to allow for ligamentous healing.

RESULTS:

At three months follow-up, case 1 and case 2 active range of motion consisted of MP joint hyperextension to 5° and 60° of flexion, and 75° of flexion respectively. Case 3 with open dislocation had dorsal skin necrosis which healed by second intention. Two-point discrimination was

within normal limits. Radiographs demonstrated maintenance of reduction.

DISCUSSION:

Complex MP joint dislocations are classically described as complete. Irreducible dislocations, and require a surgical approach for reduction and proper alignment. They occur most commonly in the index and little fingers. They are relatively rare in the thumb, and exceedingly uncommon in the long or ring fingers.¹² The most common structure that inhibits a closed reduction of a complex MP joint dislocation is the volar plate.¹³ It usually ruptures from its weakest proximal attachments to metacarpal bone, remains attached to the base of the proximal phalanx, and flips over the metacarpal head, becoming trapped between the base of the proximal phalanx dorsally and the head of the metacarpal volarly. Any attempts at reducing the proximal phalanx over the metacarpal head are then impossible because the volar plate remains wedged within the joint space. Other culprits sesamoid bones, collateral ligaments, bony fragments and the flexor pollicis longus tendon. If closed reduction is unsuccessful, an operative reduction is required. There is some controversy in the literature regarding the preferred approach to open reduction. Farabeuf first described the dorsal approach, claiming it offers good visualization to release the entrapped volar plate without any risk of injury to neurovascular structures.² Kaplan later described the volar approach, concluding that this approach could better address under more direct visualization the anatomical pathology most commonly involved in these irreducible dislocations, namely the volar plate or flexor pollicis longus tendon.³ In the volar approach, a Bruner type incision is made on the volar aspect of the MP joint. Care is taken not to damage the displaced and more superficially located neurovascular bundles.³ The A1 pulley is released, the flexor tendon is moved radially or ulnarly, the

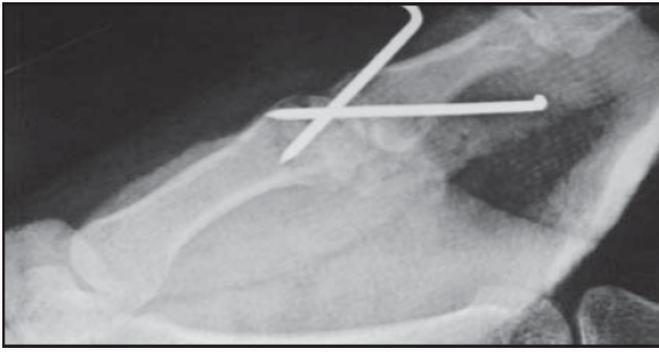


Fig 11: Postoperative radiographs with transarticular K- wires

joint is inspected and the off ending anatomical structure(s) removed from the joint space under direct visualization.

In the dorsal approach, the extensor apparatus is split longitudinally and the joint approached from a dorsal direction. A trapped interposed volar plate is usually easily identified, split longitudinally and anatomically reduced. Proponents of the dorsal approach cite several advantages. These include lower risk of injury to the digital neurovascular bundles, full visualization of a dorsally entrapped volar plate and, if present, a better management of associated osteochondral fractures.^{2,5} Unfortunately, the dorsal open reduction is also associated with its own drawbacks. It requires vertical splitting of volar plate to reduce it and the metacarpal head. It has been hypothesized that splitting of the volar plate could reduce long-term stability of the MP joint. We found as others that in a dorsal dislocation of the MPJ, the volar plate, which is detached from its weakest attachment to the neck of the metacarpal, is always interposed into the joint and represents the most important element preventing reduction.^{14,15} The deep transverse ligament lies in direct continuity with the volar plate ; this anatomic relationship is also, in part, responsible for the irreducibility.^{13,14} We also found the dorsal approach to be simple and effective in our cases. It avoids the risk to damage the digital nerve and it allows better access to the frequently associated osteochondral fracture of the metacarpal head. Postoperatively, there is some debate over the period of immobilization. Some authors recommend an early mobilization protocol, while others prefer immobilization for three to four weeks postoperatively.^{13,14,16} As a guide, it is important to stress the MP joint postreduction to assess the degree of joint stability. If it feels stable, an earlier mobilization protocol is reasonable. If it is unstable, splinting and/or K-wires are required to stabilize the joint, preferably in approximately 25 degrees of flexion. In this instance, most recommend three to four weeks of immobilization followed by range-of-motion exercises guided by a trained hand therapist and gradual weaning of the splint.

CONCLUSION:

Three cases of complex dislocations of the MP joint of three different digits approached from a dorsal incision was presented. The volar and dorsal approaches are viable options in the treatment of complex MP joint dislocations of the fingers. The dorsal approach may offer the critical advantage of decreased risk of neurovascular injury, as well as the ability to manage associated osteochondral fractures. Awareness and knowledge regarding necessity of open reduction and operative approaches to the dislocated complex MP joint are imperative.

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