

Chronic Complex Volar Dislocation of the Middle and Ring Finger Metacarpophalangeal Joint: A Case Report

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ABSTRACT

Metacarpophalangeal (MCP) joint dislocations are uncommon injuries. Most dislocations occur dorsally, with volar dislocations being rarer owing to the architecture of the joint. Because of the rarity of the condition, there is no accepted standard treatment for these injuries. The most commonly affected digit is the ring finger, followed by the middle finger and then the small finger. Management depends on the complexity of the injury, with complex dislocations requiring open reduction owing to interposed soft tissue and repair of damaged ligaments and tendons. We describe a 52-year-old man with chronic MCP dislocation who underwent unsuccessful open reduction and subsequently required joint arthroplasty.

Keywords: Dislocation, Metacarpophalangeal Joint, Arthroplasty, Chronic, Irreducible

INTRODUCTION

Finger dislocations can occur at three different locations, including the distal interphalangeal (DIP), proximal interphalangeal (PIP), or metacarpophalangeal (MCP) joints. PIP joint dislocations are the most common, while MCP joint dislocations are relatively rare injuries owing to the increased protection from the volar plate and collateral ligaments.^{1,2,3} Most finger dislocations occur dorsally.² Volar dislocations are rare, with most of our knowledge obtained from case reports and small case series (Table 1). Given the limited number of reported cases, there is no consensus regarding the treatment of these injuries. Multiple surgical approaches have been described.^{2,4,5,6} In this case report, we describe a chronic irreducible, volar MCP joint dislocation of the middle and ring finger.

CASE REPORT

A 52-year-old man presented to an outside emergency department 2 hours after a 170-lb object fell from approximately 2 m onto his closed right hand. He had concerns of pain, swelling, and the inability to extend the fingers of his right hand. He was diagnosed with a hand contusion and placed in a volar resting splint for 3 weeks. The patient did not follow up, and he underwent 2 months of immobilization before initiating occupational therapy for range of motion (ROM) training.

After experiencing persistent limited motion, the patient was referred to our institution 6 months after the initial injury. He noted mild pain with terminal flexion. Physical examination showed 45° of extensor blockade of the right middle and ring fingers about the MCP joints. He had full flexion at the MCP joints and full active ROM of the interphalangeal joints. He denied any pain at the involved MCP joints. Plain films and computed tomography scans showed complete volar dislocation of the middle and ring proximal phalanges (Figure 1). The patient was diagnosed with a chronic volar dislocation of the MCP joints at the middle and ring fingers.

Closed reduction was not attempted in the clinic owing to the chronic nature of the dislocations. The patient was indicated and consented for open reduction. During the initial operation, the middle finger was explored first. A dorsal approach was used to expose the middle finger MCP joint. The dorsal capsule was interposed in the joint space and was subsequently removed. Erosive changes to the articular surfaces of the proximal phalangeal base and the metacarpal head were identified. Following reduction attempts, the joint remained dislocated volarly owing to pathologic contracture of the collateral ligaments. However, a collateral ligament release failed to allow adequate

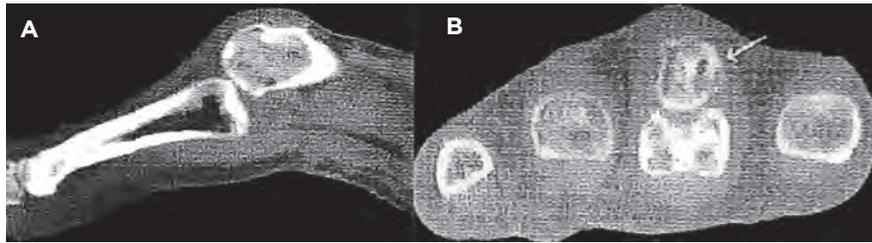


Figure 1. Computed tomography slices of the third metacarpal joint showing volar dislocation in the A) sagittal and B) axial planes.

reduction. The joint was then exposed through a volar approach. By sacrificing the A1 pulley and accessory collateral ligaments, the volar plate was found to be interposed in the joint with a rupture of the distal insertion. Following relocation of the volar plate, the joint was reducible but unstable due to articular surface erosion and incongruity as sequelae from chronic dislocation. Pinning was not attempted due to the absence of cartilage to provide a viable articular surface. The ring finger was subsequently explored in a similar manner, and the volar plate was found to be interposed into the joint as in the middle finger. Multiple attempts at reduction were made; however, the joint remained unstable due to disruption of the volar plate and collateral ligaments. Pinning was not attempted. The volar and dorsal joint capsules and skin of both digits were closed, and the hand was then placed in a bulky dressing. Following surgery, there was a persistent 45° extensor blockade with preserved interphalangeal joint flexion and extension. The patient was informed of the inability to restore joint congruity owing to the significant cartilage destruction. He elected to proceed with pyrolytic carbon joint reconstruction of the middle and ring finger MCP joints. The procedure was uncomplicated.

At his 1-year follow-up appointment, the patient reported no pain and improved stability of the joint. The active ROM of the middle finger MCP joint was 7° flexion to 53° flexion, with a total ROM of 46°. The active ROM of the ring finger was 13° flexion to 58° flexion, with a total ROM of 45°. The grip strength of the affected right hand was 35 lbs versus 75 lbs on the unaffected left hand. There were no radiographic signs of subsidence on the proximal or distal component of either finger.

DISCUSSION

Finger dislocations have a reported incidence of 166,000 cases per year in emergency departments in the United States.⁷ MCP joint dislocations are uncommon, with incidence rates as low as 3.2%.^{7,8} Owing to the rarity of the condition, there have been no epidemiological studies regarding the incidence of isolated volar MCP dislocations.^{2,6} Here, we describe a case of a chronic volar MCP dislocation of the middle and ring fingers that was ultimately treated with joint arthroplasty of both digits due to erosive joint cartilage destruction.

The rarity of volar dislocations is due to the architecture of the MCP joint. Dislocations commonly occur dorsally because the volar side is reinforced with the volar plate, flexor tendons, collateral ligaments, and the A1 pulley.⁶ The disruption of these structures during a traumatic volar dislocation, such as volar plate interposition into the joint, results in significant joint instability.^{4-6,9} A biomechanical analysis of volar MCP dislocations by Afifi et al¹⁰ suggests the volar plate is the primary restraint to volar dislocation; however surgical repair did not increase the stability of the joint. Chronic MCP dislocations can cause pathologic joint alignment through scarring, adhesion formation, and erosive articular surface changes, as observed in this case. These degenerative changes could further weaken the volar plate, thus making the joint even more unstable and necessitating more complex reconstructive procedures. Despite multiple attempts at open reduction, the proximal phalanx remained dislocated volarly. Prior reports of chronic injuries range from 5 weeks to 24 months, and all required multiple attempts at open reduction before achieving an acceptable joint alignment.^{6,9,11}

Our patient's injury was classified as a chronic, complex volar MCP dislocation. To our knowledge, this is the only case report involving a chronic dislocation of both the middle and ring fingers and only the second describing chronic dislocation of multiple digits (Table 1). Delayed diagnosis is a problem in MCP dislocations because depression between the metacarpal head and the proximal phalanx base may be masked by significant dorsal swelling.¹² In several previously reported cases, the diagnosis was initially missed.^{11,13} In our patient, dorsal swelling from the blunt trauma to his hand was likely why his injury was initially missed. When the patient presented to our clinic 6 months after the initial injury, we were able to palpate a depression on the dorsal surface of the proximal phalanx. Retained ability to actively flex the digits may also underestimate the severity of the injury.¹⁴ On the physical examination of our patient's hand, he had retained full flexion of the MCP joint but had a significant extensor blockade of 45°.

Indications for open reduction include irreducible, unstable, or open joints.^{2,7,11,14} Approaches include the dorsal, volar, or combined approach. The dorsal approach is known to have a lower risk of neurovascular injury and easier access to the entrapped volar plate

or dorsal capsule.^{6,9,11,14} However, the volar approach improves visibility of the volar plate and surrounding ligaments and tendons.^{6,14} We used a combination of the dorsal and volar approach to explore the joint, which revealed interposition of the dorsal capsule and volar plate into the joint space. In prior reports, the combined approach was the most commonly used while the isolated volar approach was the least.^{5,6,9,13}

If reduction of the joint cannot be achieved through open reduction, joint arthroplasty can provide structural stability and re-establish joint congruity.¹⁵ Joint replacement was used in our patient because of the significant cartilaginous and ligamentous damage incurred over the 6 months before presentation. Arthroplasty remains a viable option for unsalvageable joints due to chondrolysis and stiffness. Traditionally, silicone implants were used; however, due to high rates of complications, pyrolytic carbon is currently the material of choice.^{6,15,16} Wall et al¹⁴ reported significant improvement in ROM, subjective improvement in pain, and high patient satisfaction (90.0%) at an average of 4 years after surgery. This study found similar results.

This case represents a rare pathology with no described standard of care. Chronic MCP dislocations are challenging to treat owing to frequently missed diagnoses and the architecture of the MCP joint itself. Despite failed open reduction, this case had a satisfactory outcome with pyrolytic MCP reconstruction, suggesting this could be a viable treatment option for complicated cases.

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APPENDIX I. Summary of previous case reports of volar metacarpophalangeal dislocations

Author (Year)	Age / Sex	Mechanism of Injury	Finger Involved	Acute / Chronic	Missed initial diagnosis	Treatment	Associated feature(s) (eg, interposed tissue, anatomic pathology)	Follow-up
Mclaughlin et al (1965) ¹	--	Hyperextension injury	Middle	Acute	No	ORIF (dorsal approach)	Interposed dorsal capsule	--
Renshaw et al (1971) ²	48/M	Hyperextension injury	Small	Acute	No	ORIF (volar approach)	Interposed volar plate	15 months; ROM: -10 to 70°; no disability
Wood et al (1981) ³	17/F	MVA	Index	Chronic (9 months)	No	Closed reduction attempt Transarticular fixation with K-Wire failure Arthrodesis (dorsal approach)	Volar displacement of collateral ligaments, ulnar lateral band, and interosseous tendon displacement Articular damage of metacarpal head Interposed dorsal capsule	12 months; pain-free; complete ROM
	20/M	MVA	Middle	Acute	No	Closed reduction attempt; ORIF (dorsal approach); Transarticular fixation with K-wire	Interposed dorsal capsule Ruptured ulnar collateral ligament	Lost to follow-up
	61/F	Hyperflexion injury	Middle	Chronic (5 months)	Yes	Silastic implant arthroplasty	Interposed dorsal capsule Articular surface erosion	12 months; painless; 60° ROM
Betz et al (1982) ⁴	70/F	Hyperextension injury	Ring	Acute	No	Closed reduction attempt; ORIF (volar and dorsal approach)	Interposed volar plate Interposed ulnar collateral ligament	7 months; full ROM regained; no disability
Moneim et al (1983) ⁵	59/M	Hyperflexion with blunt trauma to dorsum of the hand	Small	Chronic (5 weeks)	No	Closed reduction attempt; Closed reduction attempt with percutaneous pinning ORIF (dorsal and volar approach); Trans-articular fixation with K-wire	Scarring and attenuation of dorsal capsule; Scarring and attenuation of collateral ligaments; Articular surface erosion; Scarring and interposed volar plate	7 months; ROM 0 to 70° (vs 0° to 90°); grip strength
Boland et al (1984) ⁶	65/F	--	Ring	Acute	--	Closed Reduction	--	Decreased ROM by 20°
Khuri et al (1986) ⁷	31/M	Hyperflexion injury	Ring	Acute	No	Closed Reduction	Rotatory deformity Ruptured unilateral collateral ligament	5 weeks; minor pain; full ROM regained
Qiu et al (1992) ⁸	20/M	Hyperflexion injury	Index	Chronic (3 months)	Yes	ORIF (dorsal and volar approach)	Interposed volar plate	21 months; painless; ROM limited to 20°; osteoarthritis
Hargarten et al (1992) ⁹	66/M	Hyperflexion injury; blunt trauma to dorsum of the hand	Small	Chronic (4 months)	Yes	ORIF (unspecified approach)	Fixed flexion contracture of 45°	12 months; mild joint discomfort
Hughes et al (1993) ¹⁰	63/M	MVA, Blunt trauma to dorsum of the hand	Small	Acute	No	Closed reduction attempt; ORIF (volar approach) failure; ORIF (volar approach) with trans-articular fixation with K-wire failure; ORIF (dorsal approach) with trans-articular fixation with K-wire	Avulsed volar plate	Follow-up time not specified; limited ROM (unspecified); degenerative changes on plain film
Paul et al (1995) ¹¹	22/M	Blunt trauma (unspecified; fell while riding bike)	Ring	Acute	No	ORIF (unspecified approach)	Ruptured volar plate Interposed volar plate	12 months; painless; full ROM regained

(Continued on next page)

Appendix 1. Summary of previous case reports of volar metacarpophalangeal dislocations (Continued)

Author (Year)	Age / Sex	Mechanism of Injury	Finger Involved	Acute / Chronic	Missed initial diagnosis	Treatment	Associated feature(s) (eg, interposed tissue, anatomic pathology)	Follow-up
Vandeweyer et al (1998) ¹²	48/F	MVA; hyperflexion injury	Middle	Chronic (4 months)	Yes	Closed reduction attempt; ORIF (dorsal approach), trans-articular fixation with K-wire; ORIF (volar approach), trans-articular fixation with K-wire	Interposed dorsal capsule Articular surface erosion Interposed volar plate	12 months; ROM 0 to 80° (vs -30 to 90°)
Takami et al (1999) ¹³	20/M	Blunt trauma (unspecified; fell while running)	Ring	Acute	No	Closed reduction	--	4 months; painless; full ROM regained
	60/F	MVA (unspecified)	Ring	Acute	No	Closed reduction	Laxity felt in the radial collateral ligament	7 months; painless; ROM full extension, 75° flexion
Lam et al (2000) ¹⁴	44/M	Hyperflexion injury	Ring	Acute	No	Closed reduction attempt; ORIF (dorsal and volar approach) with intraarticular K-wire fixation	Scarred dorsal capsule Scarred collateral ligaments Interposed volar plate	2 months; ROM 10 to 90° flexion
Patel et al (2000) ¹⁵	71/M	MVA; Hyperflexion injury	Small	Acute	No	Closed reduction attempt ORIF (dorsal approach)	Ruptured collateral ligaments Interposed Junctionae tendinum Avulsed dorsal capsule	3 months; painless; ROM 20° extension lag and 75° flexion; partial volar subluxation
Murase et al (2004) ¹⁶	52/F	Hyperextension injury	Ring	Acute	No	Closed reduction attempt ORIF (dorsal and volar approach)	Ruptured collateral ligaments; Avulsed dorsal capsule Chondral defect at dorsoulnar aspect of metacarpal head Ruptured flexor tendon sheath; Avulsed volar plate	8 months; painless; ROM 70° of flexion, extension only limited by 10°
Panchal et al (2010) ¹⁷	45/M	Blunt trauma (unspecified; fell while riding bike)	Middle	Acute	No	Closed reduction	--	12 weeks; painless; ROM 0 to 85°; grip strength 48 kg
Başar et al (2014) ¹⁸	22/M	MVA	Ring; Small	Chronic (24 months)	Yes	Closed reduction attempt ORIF (dorsal approach) with intraarticular K-wire fixation Volar closing wedge osteotomy	Ruptured dorsal capsule	12 months; painless; ROM 4th digit - full flexion, no extension limitation; ROM 5th digit - 10° flexion limitation, no extension limitation
	34/M	Blunt trauma (punched wall)	Ring	Chronic (10 months)	Yes	ORIF (dorsal approach) with intraarticular K-wire fixation Volar closing wedge osteotomy	Ruptured dorsal capsule	8 months; painless; ROM 30° limitation of flexion, no extension limitation
Keung et al (2016) ¹⁹	49 / M	Blunt trauma (unspecified; fell on outstretched hand)	Ring	Acute	No	Closed reduction attempt ORIF (volar approach) with trans-articular K-wire fixation	Interposed volar plate Ruptured collateral ligaments Cartilage defect on proximal phalangeal base	12 months; painless; ROM limited to 5 to 10°; Significant chondrolysis
Ramzi et al (2018) ²⁰	30 / M	MVA; Forced Hyperextension	Ring	Acute	No	Closed Reduction	--	No Pain, full ROM9
Current study (2020)	52 / M	Blunt trauma (unspecified; heavy object fell on hand)	Middle, Ring	Chronic (6 months)	Yes	Closed Reduction attempt ORIF (dorsal and volar approach) Pyrocarbon MCP joint arthroplasty	Interposed dorsal capsule Scarred collateral ligaments Interposed volar plate	Significant chondrolysis

Appendix 1. References

- M, male; F, female; MVA, motor-vehicle accident; ORIF, open reduction internal fixation; ROM, range of motion; MCP, metacarpophalangeal
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