

Carpometacarpal Joint Fracture Dislocation of Second to Fifth Finger

Gopal Tukaram Pundkare, DNB, Aniket Machindra Patil, MS

Department of Orthopaedic, Bharati Vidyapeeth Deemed University Medical College and Hospital, Pune, India

Background: Carpometacarpal joint fracture dislocation of the second to fifth finger is a rare hand injury associated with high energy trauma. Due to severe swelling and overlapping of bones on the radiograph of wrist-hand, dislocations are missed. We reported a series of six patients with rare carpometacarpal joint fracture dislocation treated with open reduction.

Methods: We retrospectively studied six cases of carpometacarpal joint fracture dislocation. All patients were treated with open reduction and internal fixation with Kirschner wire. Functional assessment was done with Quick Disabilities of the Arm, Shoulder and Hand score (Quick DASH score) at regular intervals.

Results: Average Quick DASH score was improved from 75.76 to 1.9 from 6 weeks to 18 months of duration. Of the six patients, three patients had a Quick DASH score of 0 at the end of 18 months.

Conclusions: Careful hand examination and radiographic assessment is necessary to avoid missed diagnosis of carpometacarpal joint fracture dislocation. Early open reduction and internal fixation lead to excellent recovery of hand function.

Keywords: *Carpometacarpal joints, Volar dislocation, Dorsal dislocation, Fracture*

Traumatic fracture dislocations of carpometacarpal (CMC) joints is a rare injury that presents in less than 1% of hand and wrist injuries.¹⁾ CMC joint dislocation occurs with other associated fractures. Most CMC joint dislocations are missed on X-ray of wrist joint and hand due to overlapping of bones.²⁾ Severity of displacement depends on position of hand, wrist and intensity of force applied. Dorsal CMC joint dislocations are more common than volar CMC joint dislocations. In addition, divergent variety of CMC dislocations is very rare.^{3,4)} Most of the case reports in literature have presented single CMC joint dislocation management, but little literature is available on multiple CMC joint fracture dislocation.⁵⁾ Delayed treatment of CMC dislocations results in poor functional outcome and chronic residual pain.

We reported a retrospective case series on six pa-

tients of CMC joint dislocation with volar, dorsal and divergent variants.

METHODS

We treated six patients with CMC joint fracture dislocation. The average age of the patients was 31 years. Four patients had volar fracture dislocation of CMC joint (Figs. 1 and 2), one had dorsal fracture dislocation of CMC joint and one had divergent variant. Road traffic accident was the mode of injury in all patients. Diagnoses on X-ray of wrist joint and hand was made on arrival in the Emergency Department of Bharati Vidyapeeth Deemed University Medical College and Hospital. One patient had compound fracture and five patients had closed fracture. Three patients had associated fractures of first metacarpal shaft fracture, comminuted fracture of neck of fourth metacarpal and long oblique fracture of second metacarpal base extending to shaft, respectively (Table 1). Patients were admitted with cock-up slab and operated within 24 to 48 hours after injury.

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Correspondence to: Aniket Machindra Patil, MS

Department of Orthopaedic, Bharati Vidyapeeth Deemed University Medical College and Hospital, Katraj, Pune, Maharashtra 411043, India

Tel: +91-94-0304-4345, Fax: +91-20-24379432

E-mail: draniketpatil12@gmail.com

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Fig. 1. Anteroposterior, lateral, and oblique radiographic views of left volar fracture dislocation of the second to fifth carpometacarpal joint.

Surgical Technique

All patients were operated in the operation room under regional block in supine position. Open reduction was done with dorsal approach under aseptic precautions. Two longitudinal incisions were made in the second and fourth web space addressing adjacent respective joints. CMC joint and fractures were exposed and reduction was visually achieved; subsequently, internal fixation was done with Kirschner wire (K-wire) (Fig. 3). Antegrade K-wires were used in undisplaced fractures, and retrograde K-wiring in displaced fractures. K-wire of 1 to 2.5 mm in size was used depending on the meta-carpal canal size. Reduction and stabilisation of third metacarpal CMC joint is the key for reduction of remaining CMC joints.⁶⁾ Attempts to exit the longitudinal K-wires from metacarpal head recess were unsuccessful in a few cases. In two cases, intermetacarpal wire was used for stability; in the other case, lag screws (2.5 mm) were used for long oblique shaft fracture of metacarpal; and intercarpal wire was used in one case. Alignment of fracture and joint reduction was evaluated under image intensifier in anteroposterior, lateral and oblique views. The incision was closed in layers. One case showed good alignment intraoperatively under image intensifier; but immediate postoperative X-ray showed loss of fracture reduction of second metacarpal and CMC joint subluxation. In that case, revision surgery was conducted with additional screws for metacarpal shaft fracture and intermetacarpal K-wires for additional joint stability. Cock-up splint was applied and immobilisation was continued for 6 weeks. K-wires were removed after 6 weeks. Physiotherapy was started 6 weeks postoperatively with metacarpal brace. Metacarpal brace was continued for 3 to 6 weeks. Active



Fig. 2. Preoperative clinical photograph of volar carpometacarpal fracture dislocation of the left hand.

and passive mobilisation of wrist joint, metacarpophalangeal joints, proximal and distal interphalangeal joints of fingers were started along with metacarpal brace, in order to achieve good functional recovery.

Follow-up was done at 6 weeks (Fig. 4), 3 months, 9 months, 12 months (Figs. 5 and 6), and 18 months postoperatively with anteroposterior, lateral, and oblique X-ray of the wrist joint and hand. In addition, functional assessment was conducted with Quick Disabilities of the Arm, Shoulder and Hand score (Quick DASH score) at 6 weeks, 3 months, 9 months, and 18 months postoperatively.⁷⁾

Table 1. Demographics and Clinical Parameters of Six Patients

No.	Age (yr)	Sex	Type of fracture dislocation	Closed/open fracture dislocation	Associated fracture	Quick DASH score				Complication	Follow-up (mo)
						6 wk	3 mo	9 mo	18 mo		
1	22	Male	Volar	Closed	-	70.5	29.5	0	0	First palmar interosseous muscle weakness (adduction of index finger not possible)	24
2	56	Male	Volar	Open	First metacarpal shaft fracture	72.7	30	2.3	2.3	Digital nerve injury (loss of sensation on radial aspect of index finger)	24
3	19	Male	Dorsal	Closed	-	68.2	25	0	0	Third palmar interosseous muscle weakness (adduction of fifth finger not possible)	24
4	25	Male	Volar	Closed	Long oblique fracture of second metacarpal base extending to shaft	77.3	29.5	9.1	2.3	Loss of reduction was revised	18
5	24	Male	Divergent	Closed	Comminuted fracture of neck of fourth metacarpal	84.1	45.5	20.5	6.8	Nonunion of neck of fourth metacarpal	18
6	38	Male	Volar	Closed	-	81.8	43.2	2.3	0	Carpal boss deformity	18
Average						75.76	33.78	5.7	1.9		21

Quick DASH score: Quick Disabilities of the Arm, Shoulder and Hand score.

RESULTS

Average follow-up was 21 months (range, 18 to 24 months). In our series, four of six cases were volar CMC joint fracture dislocation. Average Quick DASH score was 75.76 at 6 weeks, 33.78 at 3 months, 5.7 at 9 months, and 1.9 at 18 months. Average Quick DASH score was improved from 75.76 to 1.9 from 6 weeks to 18 months. Three of six patients had a Quick DASH score of 0 at the end of 18 months.

Radiological fracture healing was observed at 10 to 12 weeks. At the end of final follow-up, no signs of osteoarthritis of CMC joints were observed clinically and radiologically in any of the patients.

In our series, we encountered the following complications. Inability to adduct fifth and second finger, carpal boss deformity, loss of sensation over radial aspect of index finger, nonunion of neck of fourth metacarpal, and revision of surgery due to loss of fracture reduction.

DISCUSSION

CMC joints are saddle joints that are stabilised by volar and dorsal ligaments, transverse metacarpal ligaments, long flexor and extensor tendons, and intrinsic muscles of hand. Dorsal ligaments are stronger than volar ligaments. Furthermore, ulnar sided CMC joints are more mobile than radial CMC joints.⁸⁾ The third metacarpal articulation with the capitate is a “key-stone” due to its more proximal location than the carpal articulations of the other metacarpals.⁶⁾ Kumar and Malhotra³⁾ and Kumar et al.⁵⁾ described a “divergent variant” of multiple CMC dislocations in which divergence is defined as volar dislocation of ≥ 1 joint with concomitant dorsal dislocation of ≥ 1 joint.

High velocity injury is the most common mechanism of injury for CMC dislocation.^{9,10)} Type of CMC joint fracture dislocation depends on direction of force.¹¹⁾ Previous reports suggest that dorsal CMC joint fracture dislocation is more common, but volar fracture dislocation was most common in our series.^{9,12)} This injury may be associated with other injuries, such as fractured first metacarpal shaft in one case, long oblique fracture of second metacarpal base extending to shaft in one case, and fractured neck of metacarpal which resulted in nonunion in one case in our series.

On the anteroposterior radiograph, evaluation of CMC joint is done by parallel “M lines” as described by Gilula.¹³⁾ In lateral radiograph, it is important to assess the direction of displaced CMC joint fracture dislocation.²⁾ Computed tomography is used to diagnose occult or missed carpal bone fractures.



Fig. 3. Postoperative anteroposterior, oblique, and lateral radiographic views of the left hand.



Fig. 4. Six weeks postoperative anteroposterior and oblique views of radiograph of the left hand.



Fig. 5. One-year postoperative anteroposterior radiograph of the left hand.



Fig. 6. One-year postoperative lateral radiograph of the left hand.

CMC joint fracture dislocation can be treated by close reduction immobilisation, close reduction internal fixation or open reduction internal fixation with K-wires. However, in case of close reduction, there is a higher risk of redislocation of CMC joint, as compared to open reduction.¹⁾ Open reduction and internal fixation is the recommended treatment for CMC joint dislocation.^{1,14)} In this study, all cases were treated by dorsal approach open reduction and internal fixation. Advantages of open reduction are as follows: (1) under vision reduction; (2) drainage of local hematoma; and (3) avoidance of transfixation of tendons. In every case, the base of third metacarpal was fixed initially, as it is key in cases of multiple CMC joint fracture dislocations. Excellent results can be expected with normal anatomic reduction of the joint, as any loss of movement is compensated by the adjacent joint.¹⁵⁾

Physiotherapy of hand and wrist joint is required after 6 weeks of immobilisation to avoid postoperative stiffness.^{14,16)} In our case series, the average Quick DASH score was improved from 75.76 to 1.9. Three patients of our series achieved a Quick DASH score of 0 at the end of 18 months follow-up.

We encountered some rare postoperative complications (Table 1). The inability to adduct second and fifth finger was seen in two different cases probably due to pal-

mar interosseous muscle weakness. Interosseous muscle weakness may occur due to damage to the deep branch of ulnar nerve, but isolated interosseous weakness cannot be explained on this basis, as remaining interossei and adductor pollicis had grade V power. Carpal deformity at fourth CMC joint was observed in one patient due to partial loss of reduction. There was loss of sensation over the radial aspect of index finger due to digital nerve injury in compound fracture. Nonunion of neck of fourth metacarpal resulted from the patients' unwillingness for further revision surgery due to loss of fracture reduction.

In conclusion, CMC joint fracture dislocation from second to fifth finger is an extremely rare injury that needs thorough clinical examination and radiological assessment. Missed diagnoses are frequently reported. Hence, CMC joint fracture dislocation should be considered on careful examination of the hand injury, in addition to true lateral X-ray of wrist and hand. Early open reduction and internal fixation is required for excellent functional results of the hand injury.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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