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Fourth and fifth carpometacarpal fracture dislocations

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Objective: The aim of this study was to evaluate the mid-term results of patients with surgically treated 4th and 5th carpometacarpal (CMC) fracture dislocation.

Methods: The study included 9 CMC dislocation patients (9 males; mean age: 31.2 years, range: 20 to 40 years) treated with open reduction and internal fixation between 2008 and 2012. Mean follow-up period was 19.4 months. Mean interval between trauma and operation was 10.7 (range: 3 to 35) days. Radiological evaluation was performed at the final follow-up. Hand grip power was measured using a hand dynamometer and the injured and uninjured sides were compared.

Methods: There was a statistically significant difference compared to the injured side in hand dynamometer measurements ($p<0.05$). Three patients experienced pain during heavy labor. Among these cases, 2 had delayed diagnosis and 1 a comminuted CMC dislocation and was unable to return to his previous job. There were no recurrent dislocations or revision surgery due to complications.

Conclusion: Early diagnosis and treatment of 4th and 5th CMC dislocation results in good anatomical and functional results. Delayed or incorrect diagnosis of this region causes severe radiological and functional problems. Detailed physical and radiological examination can prevent CMC dislocation from being overlooked.

Key words: Carpometacarpal joint; dislocation; fracture; surgical treatment.

Carpometacarpal (CMC) dislocations are rare injuries. The 4th or 5th CMC joints are the most affected CMC joints and the dislocation may be accompanied by other hand injuries. The 4th and 5th CMC joints are extremely mobile because of their saddle shape anatomy and loose ligamentous attachments.[1] Mobile CMC joints increase the mobility of the midcarpal, radiocarpal and ulnocarpal joints. In addition, the extensor and flexor tendons provide dynamic stabilization and resistance to injuries. Structural configuration of the metacarpal base also plays an important role in the dislocation process.[2] Contrary to the first three metacarpals, the 4th and 5th CMC joints are very mobile due to their loose ligamentous and joint properties and are subject to injury.[3]

Injuries of this type are caused by longitudinal trauma occurring in a palmarly flexed wrist as in motorbike accidents.[4]

Carpometacarpal dislocation of the ulnar side con-

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stitute less than 1% of all hand injuries and are often overlooked.[5] Radiological evaluation of this side of the hand is also very difficult due to the overriding of bony structures in the lateral view. Detailed physical examination and high-quality images are the cornerstones of diagnosis.[4]

The purpose of this study was to evaluate the diagnosis and treatment of 4th and 5th CMC dislocation.

Patients and Methods

The study included 9 patients (mean age: 31.2 years, range: 20 to 40 years) with CMC dislocations operated by open reduction and K-wires between 2008 and 2012. All patients were male and the dominant extremity was affected in all patients (Table 1). Mean follow-up time was 19.4 (range: 14 to 36) months and mean time to surgery was 10.7 (range: 3 to 35) days. All cases were closed fractures.

Fractures occurred after punching a hard object or person. Four of the patients were diagnosed as simple metacarpal basis fracture at their first admission and were treated with short-arm splint. Among these, 2 cases were diagnosed with unstable CMC dislocations at follow-up on the 10th day and 1 on the 15th day following hand-wrist radiographs in the AP, true lateral and oblique views. The final patient was diagnosed following splint removal at the 32nd day follow-up. All 4 cases were admitted for surgery (Fig. 1). Unstable CMC dislocation was diagnosed in the remaining 5 patients at the initial evaluation and surgery was planned. Radiological examination was carried out by repeated different-angled X-ray images in all 5 patients and computed tomography (CT) was used to provide a better view for joint surfaces in two.

All patients were operated by the same surgeon (CK). A dorsoulnar longitudinal incision was used. Sensory branches of the ulnar nerve were protected and soft tissue interposition was retracted from the fracture side. After reduction of the fracture and dislocation, the metacarpocarpal joint was fixed using K-wires and the capsuloligamentous structures were repaired.

Short-arm splint was applied in all patients for 5 to 6 weeks. After radiological evaluation, a physical therapy program was initiated for the hand and wrist (Fig. 2a-d). Percutaneous K-wire fixation and revision surgery were not performed in any of the patients. Open surgery was performed instead of percutaneous fixation due to the intense sensory innervation of the region and the probability of soft tissue interposition.

Radiological evaluation was performed at the final follow-up. Hand grip power was measured using a hand dynamometer and the injured and uninjured sides were compared.

All statistical assessments were performed using IBM SPSS Statistics Version 20.0. Statistical data were evaluated by descriptive statistical methods (mean, standard deviation). Independent samples t-test was used for

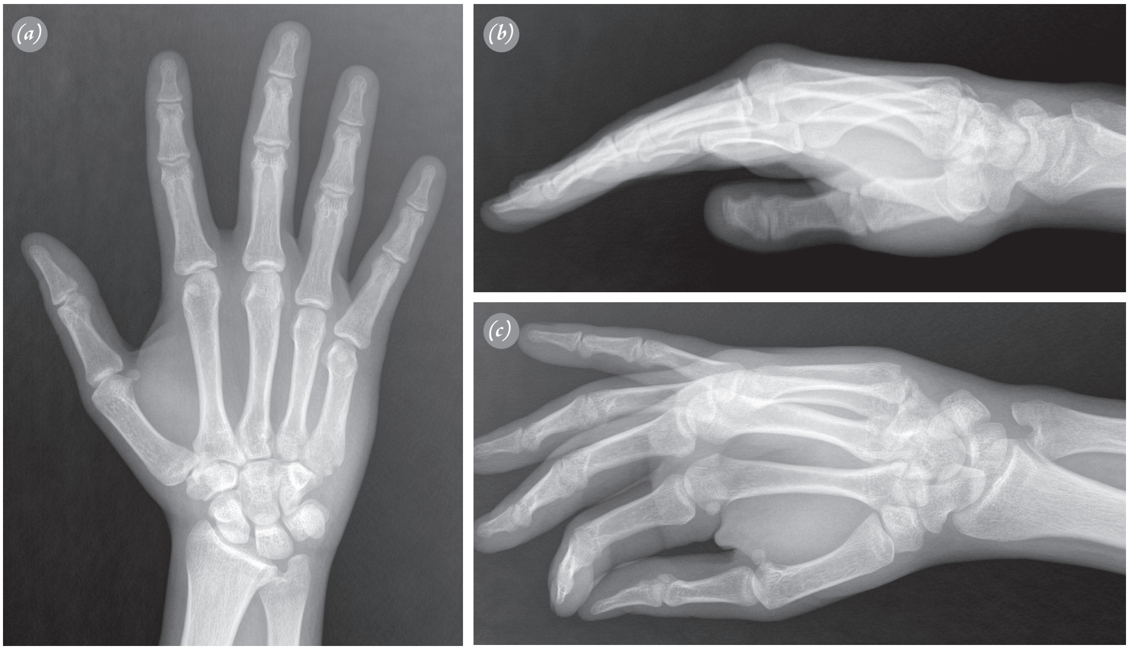

Fig. 1. **(a)** Anteroposterior, **(b)** lateral, and **(c)** 45° oblique view radiographs of a 20-year-old male injured after punching a wall.

Table 1. Demographics and postoperative evaluation of the patients.

Patient no.	Age	Sex	Type of trauma	Time to surgery (days)	Type of surgery	Dynamometric measurement (kg)		Pain			Return to previous job	
						Fractured side	Normal side	None	Light work	Heavy work	Yes	No
1	36	M	Punch	35	Open reduction and K-wire fixation	70	85					
						65	65			+	+	
						65	80					
2	25	M	Punch	3	Open reduction and K-wire fixation	73	90					
						80	105	+			+	
						80	105					
3	20	M	Punch	3	Open reduction and K-wire fixation	50	90					
						50	90			+		+
						50	90					
4	38	M	Punch	17	Open reduction and K-wire fixation	60	70					
						50	65			+	+	
						55	65					
5	34	M	Punch	4	Open reduction and K-wire fixation	60	70					
						50	65	+			+	
						55	65					
6	28	M	Punch	7	Open reduction and K-wire fixation	100	90					
						95	95	+			+	
						100	105					
7	40	M	Punch	12	Open reduction and K-wire fixation	60	95					
						65	95	+			+	
						75	75					
8	28	M	Punch	12	Open reduction and K-wire fixation	70	90					
						75	80	+			+	
						70	90					
9	32	M	Punch	4	Open reduction and K-wire fixation	80	90					
						85	90	+			+	
						80	100					

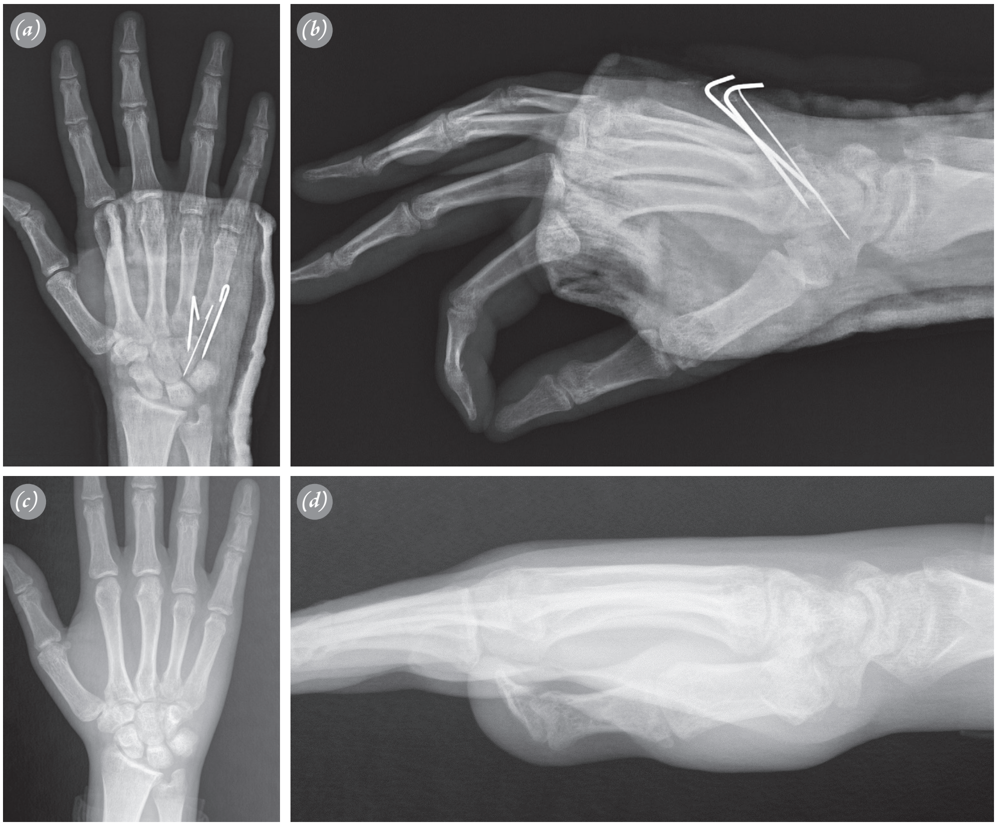

Fig. 2. **(a)** Anteroposterior and **(b)** oblique view radiographs of the patient from Fig. 1 in the early postoperative period. **(c)** Anteroposterior and **(d)** oblique view radiographs of the patient from Fig. 1 at the 15th month follow-up.

normally distributed parameters to compare the groups. A p value of less than 0.05 was considered significant with a 95% confidence interval.

Results

There was a considerable time delay between trauma and surgery in 4 patients. All dislocations were dorsally placed. Metacarpal base avulsion fractures were detected during surgery in 2 cases.

In the dynamometric measurement, comparison of each of three measurement and mean values between the two sides was statistically significant ($p<0.05$) (Table 2). Mean grip power was 81.3% of the mean value of the healthy side. There were no superficial or deep infections, implant failure, delayed union, nonunion or neurovascular complications.

Only 1 patient had to work in lighter duties compared with his previous job. This case had a comminuted CMC dislocation and the highest difference between the healthy and fractured side.

Discussion

The 4th and 5th metacarpals are the most frequently injured regions of the hand. Dorsal dislocations are more common due to the anatomy of the region.[6]

De Beer et al. reported 10 multiple CMC dislocation cases with dorsal dislocation.[7] We also found dorsal dislocation in our cases.

Table 2. Statistical analysis of consecutive dynamometric measurements performed at the last follow-up.

	Fractured side (kg)	Normal Side (kg)	Difference	p*
1st measurement	69.2±14.6	85.5±9.2	16.3±14.7	0.01
2nd measurement	68.3±16.6	83.3±15.2	15±14.1	0.013
3rd measurement	70±15.8	86.1±15.8	16.1±11.9	0.004
Mean of measurements	69.2±15.3	85±12.3	15.8±11.5	0.003

*Independent samples t-test.

Cain et al.[8] reported that 4th CMC joint fracture dislocation could occur together with 5th CMC joint dislocation. The authors stated that axial loading transmitted to the carpus through the 4th finger axes. Overloading of this force causes fracture and shortening of the metacarpal. Continuation of this load transfer can lead to CMC dislocation through the 5th metacarpal axes. Depending on the amount of load increase, avulsion fractures may occur in the affected bones. Despite the lack of radiological evidence of fracture, avulsion fracture was detected during surgery in 2 of our patients.

Missed and incorrect diagnoses are very frequent in metacarpal base injuries of the hand. Henderson and Arafa[9] reported 15 overlooked CMC dislocation cases in their series of 21 patients. Ten of their patients were diagnosed between the 2nd and 10th days, 3 between the 3rd and 8th weeks, and 2 at the 16th week. Our series had similar findings. Five patients were diagnosed at first admission, 3 between 10 and 15 days, and 1 at the 32nd day. These delayed diagnoses were due to inappropriate radiological evaluation, low-quality radiographs and inexperienced resident evaluation. Patients with pain and swelling on the ulnar side of the hand should be evaluated with a 45° oblique view. Cain et al. reported oblique hand and wrist radiographs to be the best evaluation method in 4th and 5th CMC injuries.[8] True lateral view is necessary to evaluate dorsal dislocation. Computed tomography can be used to evaluate CMC joint surface congruity and surgical planning.[10] In 2 of our cases, we used CT to evaluate the comminution and joint relations. In these 2 cases, CT showed highly comminuted fractures that were undetected in routine radiographs.

Closed reduction and K-wire fixation are sufficient for the treatment of early-diagnosed CMC dislocations. Open reduction is necessary in fracture-dislocation cases.[6] The first 7 to 10 days are more appropriate for closed reduction.[9]

Diffuse edema, overlapping of metacarpal bases and interposition of ligamentous structures may cause insufficient treatment during closed reduction. In closed reduction cases, dorsal metacarpal base subluxation and dorsal bumping of the hand might occur. These complications are extremely rare in open reduction.[2]

Lawlis and Gunther reported a possible decrease in grasping force and increase in CMC arthritis rate after delayed diagnosis of CMC dislocation.[11] In our series, all cases were treated by open reduction and fixation using 2 to 4 K-wires. Two important complications may be observed after closed reduction and percutaneous K-wire fixation; insufficient reduction in an edematous hand and iatrogenic injury to the dorsal sensory branch of the ulnar nerve.[2] Two of our cases had a comminuted 4th metacarpal base fracture, and seven had an avulsion fracture. One comminuted fracture case had functional impairment. This case also healed with shortening with an inevitable bad functional result.

In the 4 cases with delayed diagnosis, there was a decrease in grasping force similar to that reported by Lawlis and Gunther.[11] One patient with comminuted joint surface fracture had posttraumatic arthritis. This patient could not return to his previous job.

In conclusion, good quality anteroposterior, true lateral and 45° oblique radiographs should be evaluated in patients presenting with ulnar-sided pain and tenderness of the hand. In the event of any minor suspicion, a more experienced orthopedic surgeon should view the radiographs. Computed tomography can also be used to interpret joint harmony and surfaces in uncertain cases. Proper examination provides early diagnosis of fracture-dislocation cases and will decrease joint surface and social complications.

Conflics of Interest: No conflicts declared.

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