

A Case of Palmar Dislocation of the Second to Fourth Carpometacarpal Joints

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ABSTRACT. Owing to their articular structure and strong ligaments, the carpometacarpal joints (CM joint), other than that of the thumb, are rarely dislocated. This type of dislocation has been reported to comprise less than 1% of injuries of the hand. Cases of palmar dislocation are especially rare, and in Japan only seven cases of multiple palmar dislocations have been reported, including the one we studied. We recently treated a 21-year-old male who collided with the side of a large car while driving a motorcycle and gripping its handlebars. As a result of the collision, the handlebar was turned strongly to the right, injuring the patient's right hand. On initial radiographic examination, a diagnosis of palmar dislocation of the second through fourth CM joints of the right hand accompanied by a metacarpal transverse fracture of the right thumb and a metacarpal oblique fracture of the small finger was made. Surgery was immediately performed under a brachial plexus nerve block of the right arm. The CM joints were easily reduced by manipulation, and no redislocation was observed postoperatively. The metacarpal fractures of the thumb and the small finger were fixed with miniscrews. Shortly after surgery, finger exercise was begun, with good results. We speculated that the patient's injury was due to rotating force around the fifth metacarpal bone.

Key words: palmar dislocation — carpometacarpal joint —
metacarpal bone — fracture

Among injuries to the hand, carpometacarpal joint (CM joint) dislocation not involving the thumb has been reported to be relatively rare, because of the CM joint structure and strong surrounding ligaments. We report here a case of palmar dislocation of the second to fourth CM joints accompanied by metacarpal fractures of the thumb and small finger.

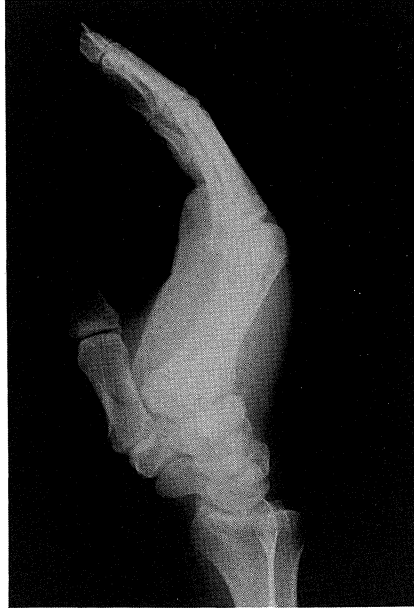
CASE REPORT

The patient was a 21-year-old male who collided with the side of a large car while driving a motorcycle and gripping its handlebars. As a result of the collision the handlebar was strongly turned to the right, resulting in injury of the patient's right hand.

On initial examination, both the palmar and dorsal sides of the right hand were severely swollen, and a mild skin lesion was noted on the distal-dorsal side of the proximal phalanges of the thumb, index, and middle fingers.



a



b



c



d

Fig 1. Pre-operative radiographs
a Anteroposterior radiograph
b Lateral radiograph
c Oblique radiograph
d Lateral radiograph

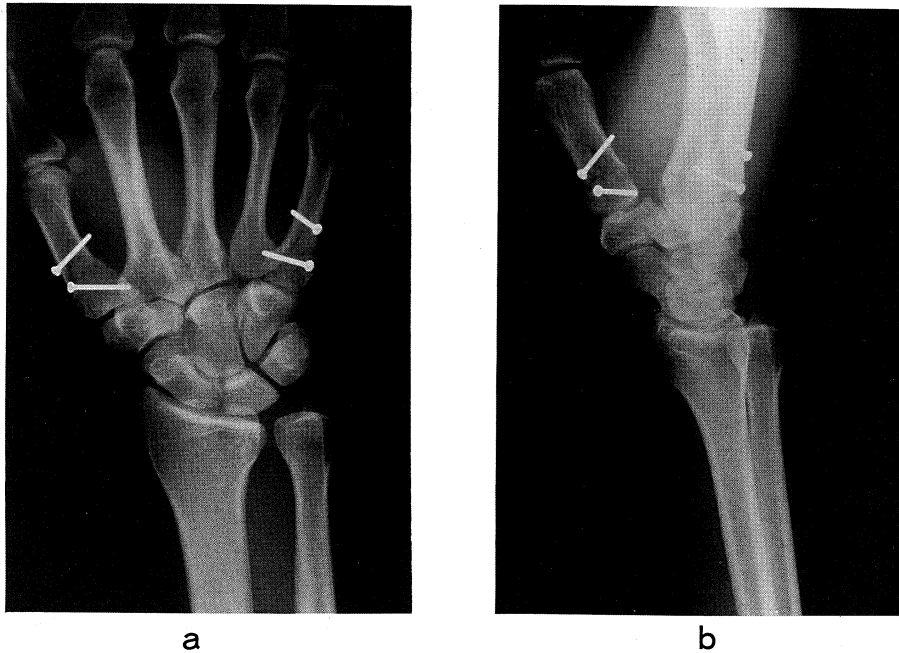


Fig 2. Radiographs taken immediately after operation
 a Anteroposterior radiograph
 b Lateral radiograph

Extension and flexion of the fingers of the right hand were possible, and no sensory disturbance was detected.

An initial anteroposterior radiograph of the right hand revealed malalignment of the second through fourth CM joints, a metacarpal transverse fracture of the thumb, and a metacarpal oblique fracture of the small finger. Lateral and oblique views revealed palmar dislocation of the second through fourth CM joints. A lateral tomogram did not reveal fracture of the carpals or an avulsion fracture of the dorsal bases of the metacarpal bones (Fig 1).

This case was diagnosed as palmar dislocation of the second to fourth CM joints of the right hand, accompanied by a metacarpal transverse fracture of the right thumb and a metacarpal oblique fracture of the right small finger. Surgery was immediately performed under a brachial plexus nerve block of the right arm. When manual force was applied to the CM joints, the dislocation was readily reduced to the anatomical position by distal traction alone, with no sign of redislocation. The metacarpal fractures of the thumb and the small finger were operatively reduced, and fixed with miniscrews (Fig 2). Since redislocation did not occur despite the application of stress to the CM joints under fluoroscopic examination immediately after the operation, the patient was advised to start finger exercises at once instead of undergoing plaster fixation or percutaneous pinning fixation using a Kirschner wire. No redislocation has been observed. At present, seven weeks after surgery, the patient is pain-free and, although a slight difference in abduction and extension of the thumb has

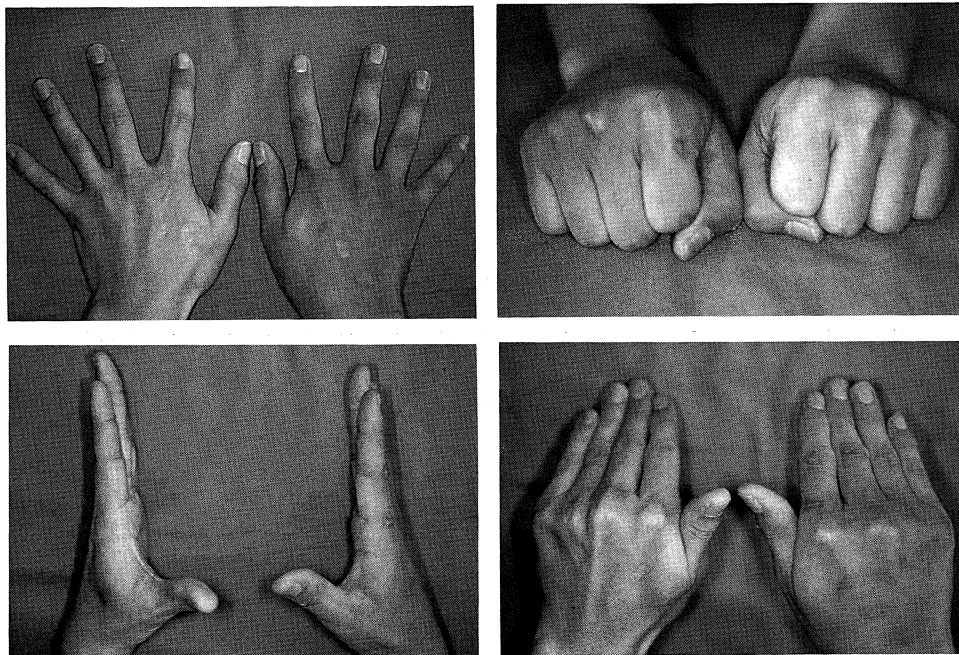


Fig 3. Photographs taken seven after operation

been noted between the right and left hands, the range of motion of the second to fifth fingers in the right hand is normal, and the patient has no difficulty in carrying out activities of daily life with the hand (Fig 3).

DISCUSSION

Anatomically, the CM joints, other than that of the thumb, have hard articular capsules and, on both the palmar and dorsal sides, strong carpometacarpal ligaments. This structure contributes to stability rather than mobility of these joints,¹⁾ and explains why dislocation of the CM joint is rare, accounting for less than 1% of injuries of the hand.²⁾ The CM joint of the thumb is a saddle joint with great mobility. However, the other CM joints are intermetacarpally connected with each other, and at the central second and third CM joints, the metacarpal bones in addition form a wedge-shaped articular surface together with the trapezium, the trapezoid and the capitate, resulting in a strong interlocking joint with little mobility which serves as a power-communicating pathway.³⁾ On the other hand, the fourth and fifth CM joints on the ulnar side resemble the saddle joint in having little mobility and being involved in the generation of grasping force.⁴⁾ In addition, the second to fifth CM joints, unlike that of the thumb, are equipped with carpometacarpal and intermetacarpal ligaments on both the palmar and dorsal sides. The metacarpal bones are distally connected by transverse metacarpal ligaments, contributing to their extremely limited mobility.⁵⁾

To our knowledge, there have been 181 cases of CM joint dislocation not involving the thumb reported in Japan, including those we have studied. Of these, 143 (79%) were dorsal, 15 (8%) were palmar, 118 (65%) were multiple

TABLE 1. List of the cases with dislocation of the CM joint in Japan

CM joint	Dorsal	Volar	Central	Divergent	indistinct	Total
2	5	4	0	0	0	9
3	1	1	0	0	0	2
4	4	0	0	0	1	5
5	37	3	2	0	5	47
2·3	6	0	0	0	1	7
3·4	1	0	0	0	1	2
4·5	61	1	0	0	1	63
2·3·4	1	1	0	0	0	2
3·4·5	1	0	0	1	0	2
2·3·4·5	21	5	0	2	7	35
1·2·3·4·5	5	0	0	1	1	7
Total	143	15	2	4	17	181

and 63 (35%) were single dislocations. There have been only six (3%) reports of multiple palmar dislocations similar to the one we treated (Table 1).

Shephard *et al*⁴⁾ explained the mechanism of dorsal dislocation of CM joints other than that of the thumb sustained in a motorbike accident as follows: Direct force is applied from the palmar side to the dorsal side by the handlebar onto the metacarpal bases, with the wrist joint extended. However, Waugh *et al*¹⁾ noted that even though many such injuries were caused by direct force, there were some attributable to indirect longitudinal force.

Among previously reported palmar dislocations of the CM joints, many with elucidated mechanisms were caused by direct force from the dorsal side of the metacarpal bases to the palmar side, and most were accompanied by a dorsal dermal lesion.^{6,7)} On the other hand, as reported by Gunther *et al*,⁸⁾ some CM injuries have been attributed to rotating force. In the present case, the finding of no dermal lesion on either the dorsal metacarpal bases or the dorsal side of the distal metacarpal bones, the fact that the patient was grasping the handlebar when he collided with the side of a large car and was injured when the handlebar turned strongly to the right as a result of the collision, and the fact that the metacarpal bone of the right small finger sustained an oblique fracture, suggest that the injury was caused by indirect rotating force around the fifth metacarpal bone rather than by direct force. Namely, supination force was added to the distal carpals relatively because the metacarpals were fixed strongly to the handlebar, and this caused palmar dislocation of the metacarpal bones against the distal carpals.

SUMMARY

- 1) A case of palmar dislocation of the second to fourth CM joints was studied.
- 2) Since stability of the CM joints was obtained by manipulation reduction alone without fixation, finger exercise was begun shortly after surgery with good results.
- 3) We speculate that the patient's injuries were caused by rotating force around the fifth metacarpal bone.

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