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Case report

A rare combined injury of dorsal fracture-dislocation of four carpometacarpal joints and trapezium, trapezoid and distal radius bone fractures

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Summary. Delayed diagnosis and incorrect treatment of carpometacarpal fracture-dislocations can both be associated with a poor prognosis. Here, we report a rare case with an unusual injury presentation, involving the dorsal dislocation of four ulnar carpometacarpal joints, associated with a fracture of the trapezium, a burst fracture of the trapezoid bone and an extra-articular fracture of the third distal of the radius. The first surgical approach, as confirmed by CT scans, resulted unsatisfactory. A second surgery involving an open reduction and pinning with K wires was performed. Post-operative follow-up lasting nine months revealed an excellent surgical outcome. (www.actabiomedica.it)

Key words: multiple carpometacarpal dislocation, radius fracture concomitant carpal lesions, open reduction internal fixation, metacarpal bones

Introduction

Carpometacarpal (CMC) joint dislocations represent less than 1% of all wrist and hand injuries, 70% of which are either missed or differently diagnosed (1, 2).

CMC joint dislocations can be a product of a high-energy trauma, such as a motor-vehicle accident or a fall from significant height, or of a low-energy trauma, such as a fall onto the hand. These accidents are typically associated with other traumatic injuries such as carpal fractures or a metacarpal base avulsion (3).

Incorrect or delayed diagnosis and treatment of this type of traumas could result in poor outcomes, such as a reduced grip strength, joint deformity or instability and degenerative arthritis.

Clinical Case

A 29-year-old right-handed male was involved in motorcycle-car crash at an approximate speed of 50 km/h. Clinical examination in the emergency room revealed diffused swelling over the dorsum of his left hand and the presence of small finger paresthesia. Radiographic examination and CT scan of his wrist showed dorsal dislocation of four ulnar carpometacarpal joints, associated with a fracture of the trapezium, a burst fracture of the trapezoid bone and an extra-articular fracture of the third distal of the radius (23 A3 according to the AO classification). The thumb carpometacarpal and the interphalangeal joints were intact.

The patient went through immediate surgery, under general anesthesia. Surgical evaluation of the car-

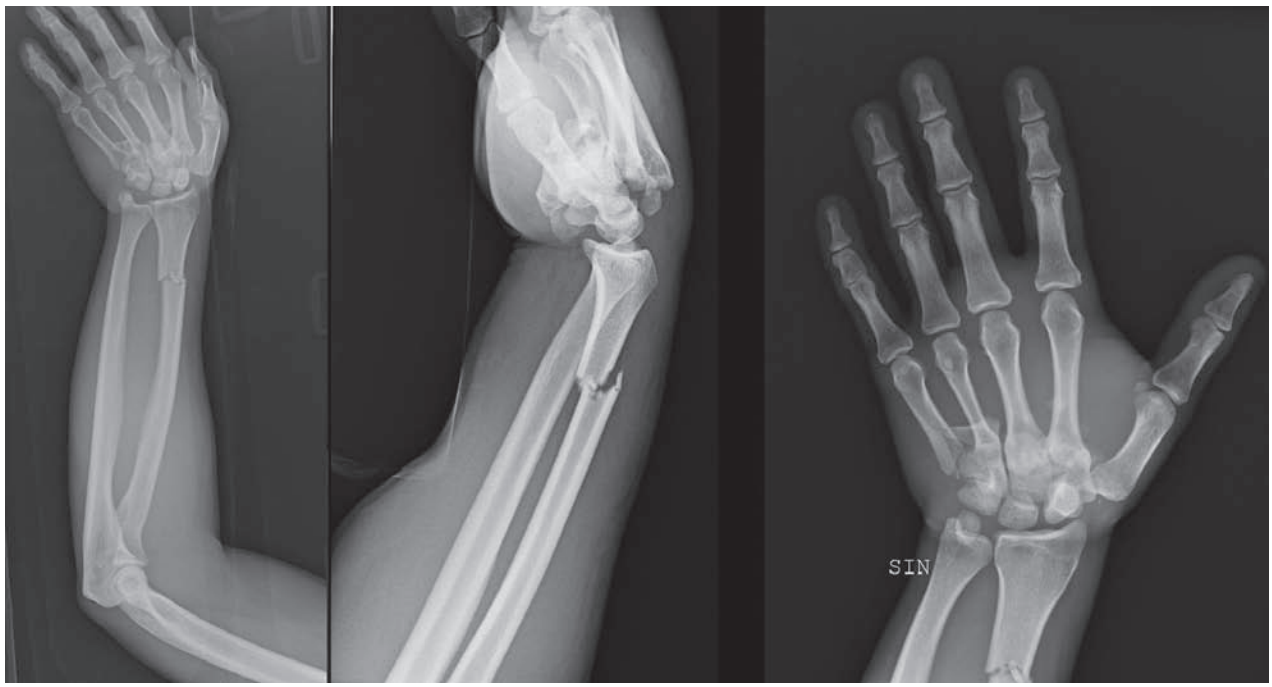

Figure 1a. Initial X-rays showing dorsal dislocation of the fourth ulnar carpometacarpal joint, associated with a fracture of the trapezium, a burst fracture of the trapezoid bone and an extra-articular fracture of the third distal of the radius.Initial X-rays showing dorsal dislocation of the fourth ulnar carpometacarpal joint, associated with a fracture of the trapezium, a burst fracture of the trapezoid bone and an extra-articular fracture of the third distal of the radius

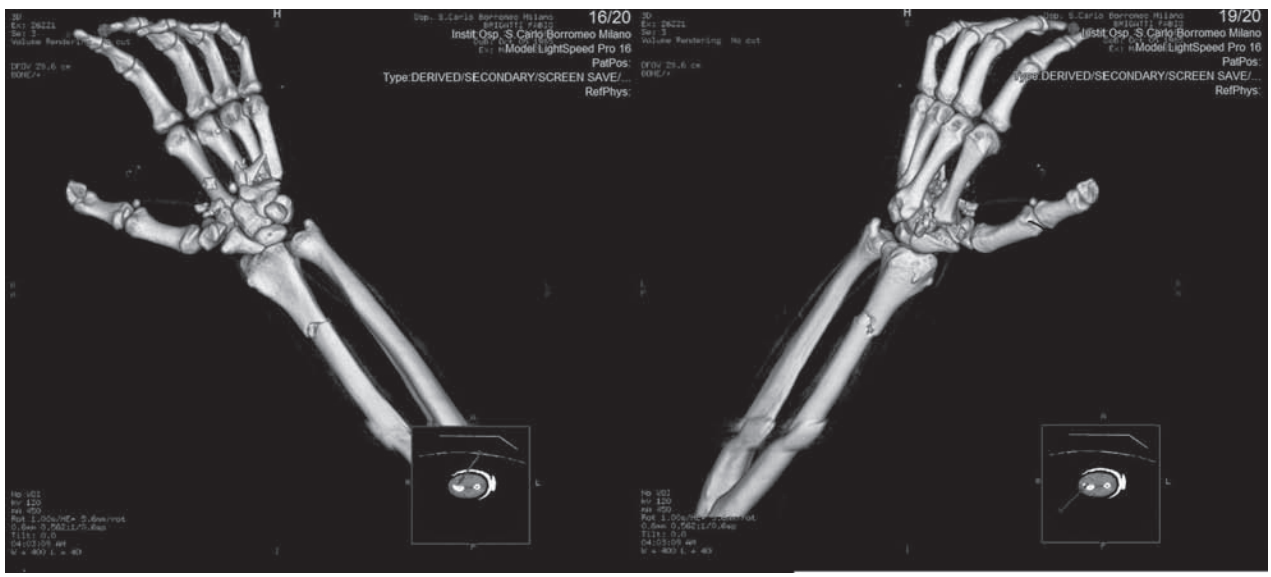

Figure 1b. Pre-operative 3D-CT of the injured hand

Figure 2. Post-operative X-rays showed unsatisfactory reduction of the carpometacarpal joints

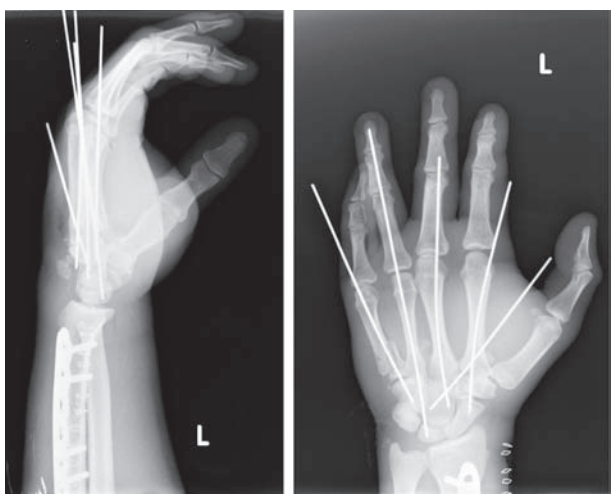

Figure 3. X-rays after definitive surgery showing good reduction with intramedullary K-wires technique

pometacarpal joints revealed dorsal instability. Since the injured area had already been stressed from the trauma and the subsequent hematoma, in order to obtain safer soft tissue conservation, we decided not to use a tourniquet.

We began with a less invasive reduction and internal fixation of the radial fracture distally and through a dorsal incision, according to the Thompson's approach.

Figure 4. a) Control X-ray after K-wires removal. b) Radiographs of the 9 month of follow-up showing a good fracture healing

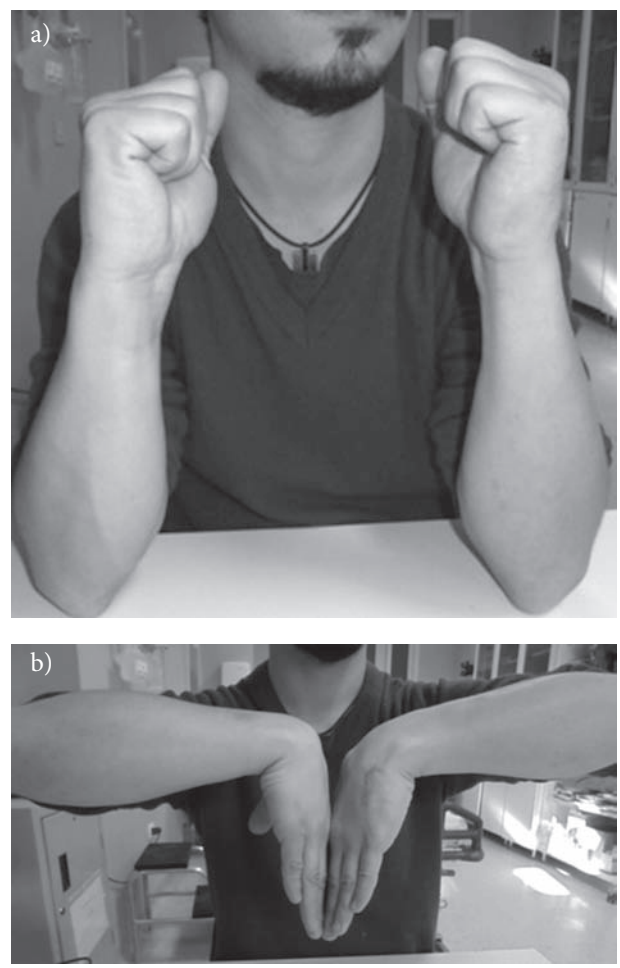

Figure 5 a , b. Clinical outcome at the 9th month of follow-up shows a wrist mobility comparable to the contralateral hand

A LCP 3.5 plate with bridge technique was preferred and the antebrachial fascia was not stitched up. We continued with the reduction of the carpometacarpal joints, using a closed reduction with Kirschner wires (K-wires). The first K-wire was introduced crosswise through the bases of the metacarpal joints. The second and third K-wires were placed to fix the second, third and fifth metacarpal joints. There were not remarkable vascular lesions and so decompressive fasciotomy was not performed. An intrinsic plus in a short arm splint was applied instead of K-wire fixation of both the base of the fifth metacarpal bone and the comminuted fracture of the trapezoid bone.

Post-operative X-ray and new CT scan results were far below expectations. However, due to the marked swelling of the hand, the next surgery could only be performed 5 days later. During this period of time, the left hand was raised with overhead trap traction 5 times every day for 20-30 min, with the thumb aligned with the radial shaft axis and the forearm in a neutral position.

Once clinical re-evaluation confirmed complete resolution of the symptoms, an open reduction and internal fixation with K wires were performed again. A first transverse incision was carried out with dorsal approach through the fourth inter-metacarpal space. The fourth and fifth metacarpal fractures were reduced and stabilized with intramedullary K-wires and temporary metacarpal-carpal arthrodesis. Using the same surgical technique and operating through the second intermetacarpal space, the second and the third carpometacarpal joints were fixed. The last K-wire was placed to better repair the base of the second metacarpal joint. To enhance quick fracture healing, we preserved the soft tissue attachments.

The marked multi-fracture of the trapezoid bone could not be further stabilized. Post-operative radiograph showed a satisfactory reduction. Both the wrist and hand were immobilized for 3 weeks using an intrinsic plus in a short arm splint. By the end of this period, a wrist-thumb support was preferred. The percutaneous K-wires securing the CMC joints and the wrist support were removed 7 weeks later. The patient had been instructed to initiate passive movement exercises of his fingers a few days after the definitive surgical procedure was performed.

Upon removal of the K-wires, an intense program of active mobilization was applied. Physical therapy was performed for 6 weeks to avoid soft tissue retraction near the same area, along with a two-month magnetic therapy. Radiographs in anterior-posterior (AP) and lateral/oblique projections of the hand and the wrist were carried out 2 weeks and one, two, four and nine months after the surgical procedure.

Monthly follow-up measurements of wrist mobility after K-wire removal and at the final (9 month) follow-up revealed the following measurements.

With forearm in supine position, wrist mobility included dorsal flexion of 30° (50°) volar flexion of 40° (40°), ulnar deviation of 20° (30°), radial deviation of 10° (20°), flexion of the metacarpophalangeal of 70° (80°) on the injured hand and the contralateral dominant hand, respectively. Supination and pronation were comparable. No further complications occurred.

Discussion

In rare cases, high energy trauma can cause unusual injuries of the metacarpal, carpal and forearm bones (4). Index and middle finger carpometacarpal joints are supported by thick ligaments that contribute to functional stability and the disruption of this complex is an unusual event. Disruption between the second and the third metacarpal joint corresponds to Linsfranc's fracture dislocation of the foot (5). The direction of the dislocation is typically determined by the force of the trauma. Metacarpal dislocation without a fracture is a rarity due to the presence of the ligaments and attachments of the wrist flexor muscles. It is important to always consider the possibility of this type of lesion when a high energy trauma of the hand occurs in order to proceed to satisfactory patient recovery (6). Massive edema of the hand is also a sign to carefully consider.

Accurate radiographic evaluation is the key for early diagnosis. Anteroposterior and oblique views should be performed routinely, but when a suspicion of a dislocation exists, a supplementary view of the lateral projection is indispensable (7, 8). In high-equipped emergency departments, CT scan with 3D reconstruction of the hand is a fast and valid tool. The

intermetacarpal angle screening test for ulnar-sided carpometacarpal fracture dislocations are useful tests, but CT scan typically offers more functional data for operative planning when necessary (9).

In our case, a similar "floating-wrist" injury was induced by a complex mechanism of trauma. Fracture of the distal radius associated by metacarpal fracture dislocation and the fracture of the trapezium and trapezoid bones results in an increased risk of compartment syndrome. Immediate osteosynthesis of the distal radius contributes to convert the complex fracture pattern to a more elementary lesion.

In our opinion, when a complex trauma with carpometacarpal fracture dislocation occurs, close reduction and stabilization with K-wires is not a good option, as it is extremely difficult to obtain safe reduction, and even traction itself increases the damage to the soft-tissue.

The use of a C-arm during intervention is not always reliable when multiple dislocations of the carpometacarpal bones occur and an open surgery seems more trustworthy. Since only LCP plates were available we used the Thompson approach. However, we would have preferred the Henry approach if anatomical long distal radius plates were available.

In our case, we found it easier to begin with the IV and V metacarpal fracture dislocation and contrary to the equivalent treated of the Linsfranc lesions of the foot, even though the reduction of the second metatarsal dislocation is crucial. Upon reduction of the IV and V metacarpal fracture dislocation, the hand was more stable and reduction of the second and third carpometacarpal fracture dislocations were technically less demanding. In our opinion, also considering the patient's (young) age, K-wires were the best option to provide stability, as we avoided using plates or screws for definitive arthrodesis. Lastly, we also underline the importance of physical therapy and local massage to reduce edema in the post-operative period (10).

In conclusion, carpometacarpal joint dislocations require an accurate and prompt diagnosis for an early treatment to lead to a satisfactory outcome.

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