



## Carpometacarpal Dislocations of the 2<sup>nd</sup> to 5<sup>th</sup> Ray Associated with Multiple Other Injuries in a High Energy, Motor Vehicle Accident. A Case Report

Constantinos D Apostolou\*, Vassiliki Markopoulou, Michail Laloudakis, Stefanos Eustathiou, Dimitrios Mirgiotis and Christos Garnavos

Orthopaedic Department, Evangelismos Hospital, Athens, Greece

\*Corresponding Author: Constantinos D Apostolou, Orthopaedic Department, Evangelismos Hospital, Athens, Greece.

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### Abstract

**Objective:** We present the treatment of an uncommon type of injury in a high energy trauma and we report our approach and results.

**Case:** A 28 years old male patient admitted in our hospital after a high energy, motor vehicle accident with multiple injuries. The patient had abdominal bleeding, anterior shoulder dislocation, a subtrochanteric fracture on the right hip and complex ligament instability of the left knee with PLC, ACL, LCL and MCL tear. On the right hand he had fracture of the proximal phalanx of the index finger, dorsal dislocation of the 2<sup>nd</sup>-5<sup>th</sup> CMCJ and also fractures of the hamate and trapezium.

The patient has been treated with multiple medical treatments such as embolization of a branch of the right deep femoral artery, laparotomy, splenectomy, femoral osteosynthesis with a long Gama IM nail for the right proximal femur fracture and closed reduction for the carpometacarpal dislocations right hand and closed reduction of shoulder dislocation. A few days later he has been transferred to theatre again for definite treatment of the right hand fractures with closed reduction and percutaneously K-wire fixation. Treatment of the PLC injury of the left knee followed a few days later, revealed tear of the common peroneal nerve so referred for common peroneal nerve repair with sural nerve graft.

The K-wires stayed in situ for 8 weeks for the CMC dislocations and for 4 weeks for the proximal phalanx fracture and removed in the clinic. A futuro splint applied for further 2 weeks and the patient started physiotherapy for his right hand. Six months post his injury the patient presents excellent functional recovery of his hand. His DASH score gradually improved from 30, 3 months post injury, to 1,66 in 6 months after intensive physiotherapy.

**Conclusion:** Fracture dislocations of the multiple carpometacarpal joints of the fingers can be part of major high energy trauma with multiple, life threatening, injuries and can be missed as the major injuries can take all the attention. This injury can be associated with other fractures of the wrist and the hand such as with trapezium, hamate and proximal phalanx. We treated this injury with closed reduction and percutaneously K-wire fixation. This treatment can provide satisfactory results with excellent functional outcome and patient satisfaction.

**Keywords:** Carpometacarpal; Dislocations; High Energy; Motor Vehicle Accident

### Introduction

Carpometacarpal (CMC) dislocations of the wrist are rare injuries of the hand which represent approximately 1% of osseous hand injuries [2]. Simultaneous multiple fractures of the wrist and hand trapezium, hamate and proximal phalanx of index finger have been infrequently cited in the English literature occurring in a very

small percentage of hand injuries. The most common mechanism of the injury is the hyperflexion of the metacarpal heads. These injuries usually require a great force, and diagnosis can be missed or delayed because of the high likelihood of other severe concomitant injuries. Performing a secondary survey, according to ATLS principles is mandatory for diagnosis of this type of injuries. Treatment

is controversial and can be either conservative or operative. We report a case of dislocations of the second to fifth carpometacarpal joints and associated fractures of the trapezium and the hamate in a 28-year-old motorcyclist.

### Case Presentation

A 28 year old right-handed patient who was a doctor just finished medical school, was admitted to the emergency department of our Hospital, after a motorcycle accident with a GCS 15/15. The patient has been treated with ATLS protocol and investigated accordingly. He has been diagnosed with an hemorrhagic contusion and epidural hematoma of right frontal lobe with signs of subarachnoid hemorrhage, left-sided pneumothorax, spleen rupture, active bleeding through the right deep femoral artery, subtrochanteric fracture of right femur, anterior dislocation of left shoulder, complex ligamentous injury of the left knee, and second to fifth dorsal carpometacarpal joints dislocation of right hand, fractures of trapezium and hamate and fracture of proximal phalanx of index finger. The latter injury of the wrist is the reason of this case report, as the literature review is extremely limited for this cases. The carpometacarpal dislocations of the hand occurring in less than 1% of hand injuries. Also in patients with life threatening injuries, carpometacarpal dislocation can be missed as the major injuries can take all the attention.

On physical examination of the hand, there was swelling and deformity over the dorsal aspect of the hand. There was also a palpable characteristic step-off created by the bases of the metacarpals. As the patient intubated immediately at the emergency room we couldn't examine the active motion and sensation of the hand. Vascular assessment revealed normal both a palpable radial and ulna arteries pulse and capillary refill < 2 sec.

Plain radiographs ,an anteroposterior and an oblique view, of the right hand showed complete dorsal dislocations of the second to fifth carpometacarpal joints (Figure 1).

The patient was intubated at the emergency department and after shoulder dislocation reduction and embolization of right deep femoral artery, he was transferred in theatre where laparotomy and splenectomy took place. After that, IMN of femur fracture with long G nail was performed. Closed reduction of CMC was attempted by applying longitudinal traction to the involved digits with pressure over the bases of the dislocated metacarpals and a dorsal back slab was placed for immobilization. The knee investigated further with an MRI, which revealed PLC, ACL, MCL and LCL rupture. Brain and thorax trauma were treated conservatively.

The patient was treated surgically for his hand injury, one week later; for definite treatment of the CMC dislocations with closed reduction and percutaneous K-wire fixation. The dorsal dislocation of the second to fifth carpometacarpal joints reduced, under image intensifier guidance with traction and then fixation was performed using K-wires. The second and fifth metacarpal stabilized with transverse K-wires that pinned from ulnar from fifth to second metacarpal and from radial from second to fifth metacarpal. We inserted all fixation wires through the radial or ulnar aspects, to avoid tethering of the extensor tendons and allow free motion of them. Two other dorsal K-wires used to immobilize the 3<sup>rd</sup> and 4<sup>th</sup> metacarpals. The fracture of the proximal phalanx of the index finger was also stabilized with K-wires with the same technique through the radial and ulnar aspects of the phalanx.

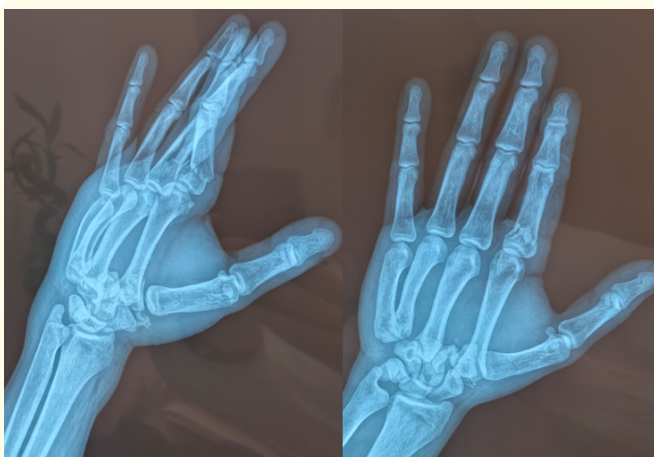
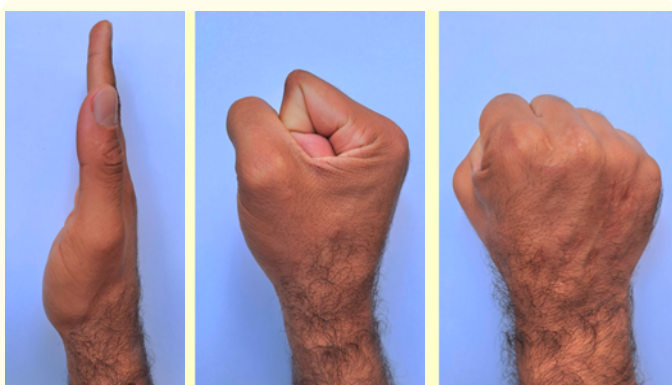


Figure 1: Anteroposterior and oblique radiographs.



Figure 2: Radiographs after fixation with percutaneous K-wires.

The CMC K-wires removed at eight weeks post surgery and a futuro splint was applied for further 2 weeks. Active ROM exercises were started even before K-wires removal and the patient started physiotherapy sessions for his right hand. Physiotherapy emphasized on both strengthening exercises and earning full range of motion. The DASH score was calculated in 3 and 6 months post operative and improved from 30 to 1.6.



**Figure 3:** An excellent result 6 months post operative.

## Discussion

Polytrauma patient requires good physical examination in order not to be misdiagnosed especially in cases that level of consciousness is affected or a life-threatening injury occurs where time is of essence and getting all the attention. Every sign, like swelling or deformity of limbs should be evaluated and be examined in high energy incidents like our patient [3,4]. In addition, CMC dislocations are not so common injuries and can be easily misdiagnosed [5]. When in doubt, after X-ray evaluation, a CT scan can be extremely helpful for the diagnosis and also can give you further information about the type of fracture and the displacement of the fragments in order the clinician to have the best possible treatment and the appropriate preoperative planning [5].

In our case, the clinical signs of swelling and deformity and the characteristic palpable step-off created by the bases of the metacarpals guided us to the diagnosis of carpometacarpal dislocation. Due to the severity of patient's condition, the patient was intubated immediately in the emergency room, and it could be impossible to be examined properly, so our high clinical suspicion guided us to the diagnosis and helped us not to miss this uncommon clinical injury.

Stability at the finger CMC joints is provided by a system of four ligaments [1]. There is a high degree of variation with dorsal, multiple palmar, and two sets of interosseous ligaments (only one between the long and ring metacarpals). The interosseous ligaments

are the strongest and have a V configuration with the base of the V oriented toward the fourth metacarpal. ROM of the index and long CMC joints is limited to less than 5 degrees. The 2<sup>nd</sup> metacarpal has a particularly stable configuration through its wedge-shaped articulation with the trapezoid [6]. The direction of CMC joint dislocation may be volar or dorsal depending on the direction of the force, with dorsal dislocations being the most common, as in our case. These injuries usually require high energy forces, like traffic accidents, falling from height in an outstretched hand. On the other hand, low energy mechanism, due to its relative mobility, the fifth CMCJ is most frequently involved in single-joint dislocation, as well as 80% of multiple dislocations.

As for the treatment strategy, it has yet to obtain a consensus. Some reports value open reduction to guarantee anatomical reduction, the drainage of local hematoma and the prevention of tendon trans fixation and it is definitely needed in the patients with interposed tissues, with subacute and chronic injuries [3,7]. There are various treatment options including casting, closed reduction and percutaneous pinning (CRPP), and open reduction internal fixation, however, the optimal treatment is still controversial. The closed reduction is recommended in all CMC joint dislocations. Adding a K-wire fixation can create a secure fixation and achieve an excellent outcome [8]. Early surgery is recommended and should be aimed to restore perfect anatomical alignment. Surgeon should have a low threshold for open reduction in case of gross swelling or inability to get an anatomical closed reduction. The method of K-wire fixation presented here, has resulted a good outcome in our practice. We fixed the dislocated CMCJ by inserting K-wires from the radial and ulnar borders of the hand and also K-wires stabilizing the base of the 3<sup>rd</sup> and 4<sup>th</sup> metacarpals proximally. This prevents extensor tendons tethering by the K-wires. We have chosen this method because K-wire stabilization provides enough stability to allow for early active mobilization of the fingers whilst not requiring implant removal, with a lower rate of implant-related soft tissue complications. K-wires allow for early mobilisation and early restoration of full range of flexion and extension even while the K-wires are in place [Figure 2], assuring good functional outcome and early return to work [9]. [Figure 3]. K-wires should be removed at six to eight weeks post procedure, (eight in our case), with an additional 2 weeks of splint protection and the physiotherapy started even before K-wires removal. All other joints remained mobile throughout the postoperative period. The functional prognosis depends on the precocity of diagnosis and appropriate reduction and vigorous rehabilitation [10]. Delayed diagnosis or treatment could lead to poor outcomes including malunion and residual subluxation, which lead to painful arthritis and grip weakness, but early recognition [11]

and treatment of these injuries can provide satisfactory results with excellent wrist and fingers functionality and a high degree of patient satisfaction.

Finally the treatment of patients with multiple injuries must be done in trauma centers that have the ability to treat different injuries from different medical specialties and requires the collaboration of many different specialties such as General Surgeons, Interventional Radiologists, ICU doctors, Orthopaedics, Neurosurgeons, and Thoracic Surgeons as was done in our case. Increased team vigilance and completion of trauma protocols will prevent misdiagnosis of these rare injuries, which in this case could result in high disability.

### Conclusion

Fracture dislocations of the multiple carpometacarpal joints of the fingers can be part of major high energy trauma with multiple, life threatening, injuries and can be missed as the major injuries can take all the attention. This injury can be associated with other fractures of the wrist and the hand such as with trapezium, hamate and proximal phalanx. We treated this injury with closed reduction and percutaneously K-wire fixation. This treatment can provide satisfactory results with excellent functional outcome and patient satisfaction.

Carpometacarpal dislocations of second to fifth fingers associated with fractures of trapezium, hamate and proximal phalanx of index finger represent a tiny percentage of all injuries of hand and wrist regions [1,2]. Diagnosis can be missed or delayed in poly-trauma patients with multiple major injuries. This is the report of a 28 year old patient suffered a motorcycle accident admitted to E.R. and diagnosed with brain, thorax, abdomen and vascular injuries, femur fracture, knee instability and also wrist trauma which wasn't missed in the first place. CMC dislocation and index fracture treated surgically with K-wire fixation and after a six-month follow-up he has very good functional results.

### Bibliography

1. "Rockwood and Green's Fractures in Adults". Vol 1, 6<sup>th</sup> edition Lippincott Williams and Wilkins
2. Green DP. "Green's Operative Surgery of the Hand". 5<sup>th</sup> edition Elsevier (2007).
3. Georgios Kalinterakis, *et al.* "Carpometacarpal Dislocation of the Third to Fifth Fingers and an Associated Fracture of the Hamate in a Military Paratrooper". *Case Report in Orthopaedics* (2020).

4. Gopal Tukaram Pundkare and Aniket Machindra Patil. "Carpometacarpal Joint Fracture Dislocation of Second to Fifth Finger". *Clinics in Orthopedic Surgery* 7.4 (2015): 430-435.
5. R Gvozdenovic and L Soelberg Vadstrup. "Total carpometacarpal joint dislocation combined with trapezium fracture, trapezoid dislocation and hamate fracture". *Chirurgie de la Main* 34.5 (2015): 264-268.
6. Praveen Bhardwaj, *et al.* "Fracture dislocations of the carpometacarpal joints of the fingers". *Journal of Clinical Orthopaedics and Trauma* 11.4 (2020): 562-569.
7. Hiroo Kimura, *et al.* "Open Reduction for Dorsal Dislocation of Second to Fifth Carpometacarpal Joints: A Case Report". *Journal of Wrist Surgery* 10.2 (2021): 164-168.
8. Sitthiphong Suwannaphisit, *et al.* "Multiple carpometacarpal joint fracture-dislocation from the second to fifth: A case report". *Annals of Medicine and Surgery (London)* 76 (2022): 103596.
9. Mozaffarian K, *et al.* "The safest direction of percutaneous pinning for achieving firm fixing of the fifth carpo- metacarpal joint". *Journal of Orthopaedic Science* 17.6 (2012): 757-762.
10. Nikhil Jawaharlal, *et al.* "An Uncommon Presentation of Fracture-dislocation of the 4<sup>th</sup> and 5<sup>th</sup> Carpometacarpal Joints with Volar Displacement and its Management". *Journal of Orthopaedic Case Reports* 11.9 (2021): 24-28.
11. Naoya Iwata, *et al.* "Dorsal buttress plate fixation for the treatment of fracture-dislocation of the fifth carpometacarpal joint with avulsion fracture of the hamate: a case report". *Archives of Orthopaedic and Trauma Surgery* 139.1 (2019): 135-139.