Injury Extra (2005) **36**, 316–318

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CASE REPORT

Fourth metacarpal base fracture in association with coronal hamate fracture

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Accepted 14 December 2004

Case report

A 26-year-old male presented to the outpatient clinic complaining of pain in the dorsum of his right hand. He was a right hand dominant security guard who had sustained a work related injury 4 days previously. The patient was kicked on the dorsum of the right hand. The injury occurred with his hand in the position of a clenched fist. No other significant injuries were incurred. He was unable to extend the fingers at the level of the metacarpophalangeal joints due to severe pain at the dorsal carpometacarpal level. There was no associated neurovascular deficit and the skin overlying a region of significant contusion was intact. Plain radiographs of the right hand had been obtained in the accident and emergency department on the day after the event and the case had been treated with an ulnar gutter slab in the manner of a metacarpal base fracture. Anteroposterior and lateral radiographs taken at the outpatient clinic showed evidence of an undisplaced fourth metacarpal base fracture (Figs. 1 and 2) but no unequivocal evidence of carpal involvement. A clinically disproportionate degree of swelling on the dorsum of the hand was present. A CT scan showed (Fig. 3) a vertical split fracture of the fourth metacarpal with dorsal displacement. A comminuted, displaced dorsal hamate fracture was also evident with dorsal displacement.

The patient underwent open reduction and internal fixation of the hamate fracture through a dorsal approach. The fracture was fixed with two Liebinger screws (Fig. 4). The affected hand was immobilised for a 2-week period before commencing full mobilisation. Three months following the injury, movement of the metacarpophalangeal joints was pain-free and grip strength is comparable to the contralateral limb. The fracture is now fully healed.

Discussion

Hamate fractures are relatively rare representing 2–4% of carpal fractures.[8] Coronal fractures of the hamate represent a small subset of this fracture group. They can be difficult to diagnose as plain radiographs can fail to clearly demonstrate the abnormality.[3] Due to the mechanism of injury, an associated carpometacarpal dislocation involving the fourth and fifth metacarpal bases may be present.[3–5,7] This fracture pattern is inherently unstable because of the action of the long flexor and extensor tendons. Early diagnosis is essential to minimize the risk of painful arthritis, muscle imbalance and potential loss of grip strength. This case is of interest as it also involves an associated dorsally displaced fourth metacarpal base.

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1572-3461
doi:10.1016/j.injury.2004.12.058

Figure 1 Pre-operative anteroposterior view.

The injury is seen to occur with high-energy trauma causing axial loading of the ring finger metacarpal. The impact of a clenched fist against a solid object is a typical example.[7] This case occurred in a clenched fist that was kicked leading to axial loading and resultant intra-articular fractures. The fracture type has been classified by Cain et al.[2] who have analysed CMC joint injury. This case is most similar to a type 3 injury.

Figure 2 Pre-operative lateral view.

Figure 3 Sagittal CT view.

Cadaveric studies have helped to elucidate the pathomechanics and pathoanatomy involved and have shown that the position, direction and transmission of force through the ring finger metacarpal determines the resultant fracture pattern.[9] In a recent study, Yoshida et al.[9] analysed fractures patterns using twenty fresh frozen cadaver upper extremities, hamate fractures were seen in 45% of cases. Fourth metacarpal base fractures constituted only 15% of cases and a combination of the two, as discussed here, was not recorded. It would therefore seem most likely that this injury occurred with a significant axial load transmitted through the shaft of the fourth metacarpal in a position of slight flexion. Notably, no dislocation was evident and the tomograms show that the fracture lines in both the metacarpal and hamate are congruent. The CT

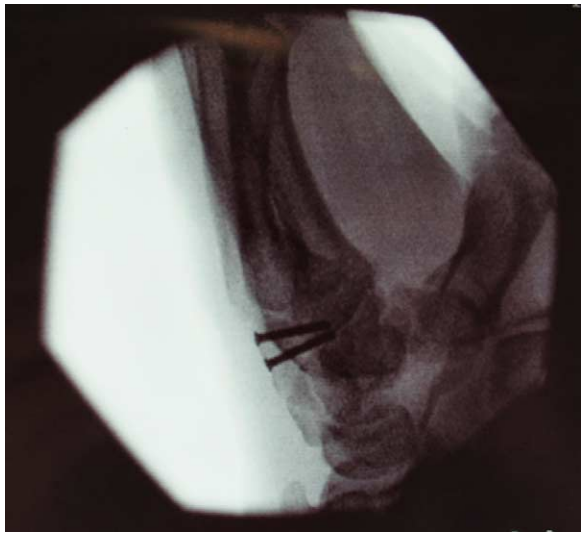

Figure 4 Liebinger screw fixation.

images appear to suggest that the hamate and fourth metacarpal fractured as a single unit. Cain et al.[2] has stated that the degree of small MC palmar flexion is the determinate of the type and degree of hamate injury. The small MC ulnar-side base-hamate ligament and the ring MC ulnar base-hamate ligament have also been shown to be involved in the transmission of force in fourth metacarpal CMC joint trauma.[9]

This injury proved difficult to evaluate with standard anteroposterior and lateral radiographs. It has been previously shown that the articulation of the hamate with the fourth and fifth metacarpal bases can be better demonstrated with the forearm pronated 30° from the routine anteroposterior position.[1] Another position advocated is the 45° of pronation oblique image.[2] Computerised axial tomography is a useful adjunct in the diagnosis of these injuries.[4–7,9] Early investigation with three dimensional computed tomography (3D-CT) has been advocated.[7] In this particular case, multiple axial views provided adequate definition of the fracture lines.

This patient underwent early exploration through a single dorsal incision. Following fixation with Liebinger mini-screws, the fracture was treated as a standard fourth metacarpal base fracture with an ulnar gutter slab and early mobilization. Notably, the patient benefited from almost immediate amelioration of pain levels once the hamate was reduced.

Conclusion

This case has shown that once the hamate is fixed, this unusual fracture pattern can be successfully managed with standard fourth metacarpal fracture protocols. It would suggest that early standard CT is warranted for all cases of fourth metacarpal base fracture where clinical findings greatly exceed the generally expected norms for such trauma. Early explorative intervention is recommended because it definitively delineates the degree of injury involved in addition to significantly reducing the severity of dorsal carpal pain.

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