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CASE REPORT

Divergent dislocation of the ring and little finger carpometacarpal joints – a rare injury pattern

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Hand injuries due to longitudinal forces in the line of the metacarpals demonstrate unusual dislocation patterns. We describe a case of volar intra-articular fracture dislocation of the ring finger carpometacarpal joint in association with a pure dorsal dislocation of the little finger carpometacarpal joint. Open reduction supplemented with Kirschner wire fixation restored normal carpometacarpal joint anatomical relations and achieved an excellent clinical result.

CASE REPORT

A 24-year old general operative presented after punching a stone wall and injuring his dominant right hand. Examination revealed generalised swelling of his right hand and wrist with tenderness over the ring and little finger metacarpal bases. There was no angular or rotational deformity of the digits. There was no evidence of neurovascular deficit or tendon injury.

Routine radiographs revealed a volar intra-articular fracture dislocation of the ring finger carpometacarpal joint in association with a dorsal dislocation of the little finger carpometacarpal joint (fig 1). Under general anaesthetic the little finger carpometacarpal joint was reduced closed while the fracture-dislocation of the ring finger carpometacarpal joint required open reduction. Intraoperatively it was found that while the metacarpal base was reducible, it was grossly unstable due to the displacement of a 30-40% intra-articular fragment. The main articular fragment was reduced under direct vision and transfixed to the carpus with 2 $\times$ 1.6 mm Kirschner wires (fig 2). A volar slab was applied for three weeks, following which the wires were removed and an intensive physiotherapy rehabilitation programme was commenced.

At 6 months post-surgery he had a full range of finger and wrist movements and was functioning in his previous occupational capacity. His mean grip strength was found to be 32 kg in the right hand and 29 kg in his left hand.

DISCUSSION

Traumatic injury to the CMC joints was first described by Blandin in 1844, when he reported a case that involved a dorsal dislocation of the index and middle finger metacarpal bases (*10*). Dorsal

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Fig. 1. — Radiographs of the hand demonstrating volar intra-articular fracture dislocation of the fourth carpometacarpal joint in association with a dorsal dislocation of the fifth carpo-metacarpal joint.

Fig. 2. — Intra-operative radiograph showing satisfactory reduction of both joints and stabilisation of the fourth carpo-metacarpal joint with a Kirschner wire.

Fig. 3. — Radiograph at six months post injury demonstrating satisfactory healing and congruent reduction of joint surfaces, with no evidence of degenerative change in the fourth or fifth carpo-metacarpal joints.

dislocation of one carpometacarpal joint in association with a volar fracture subluxation of an adjacent carpometacarpal joint is an exceedingly rare phenomenon with only a few cases previously reported in the literature (*2, 8*).

The base of the transverse metacarpal arch of the hand is formed by the carpometacarpal joints of the digits. The fixed central unit of the arch, the index and long metacarpals, is relatively rigid and has interdigitating articulations with the trapezoid and capitate. These joints are further supplemented by the inter-metacarpal and interosseous ligaments which add soft tissue support to the stable bony architecture. The articulation of the middle finger metacarpal with the capitate is located more proximal than the other carpal articulations and produces the so-called "key-stone" effect. This is one of the reasons why the CMC joints of the ring and little finger metacarpals are more commonly injured when compared to the other CMC joints. The ring and little finger metacarpals articulate with the hamate, which is saddle shaped at its distal articulation. Given its saddle shape, the CMC joint of the little finger allows motion not only in gliding but also in rotation, permitting opposition to the thumb and a greater arc of motion (*6*). El-Shennawy *et al* (*5*) have recently demonstrated the three dimensional kinematics of the CMC joints using a com-

bination of motion analysis and three-dimensional reconstruction of computed tomography images. They found that although the little finger CMC joint has the greatest range of motion, it is in fact the result of the cumulative ring and little finger CMC joint motions. Consequently, in the case of adjacent carpometacarpal joint dislocations it is critical to restore anatomical position in both joints in attempting to achieve the best possible outcome.

The ring and little finger metacarpals are the most commonly injured and are typically dorsally displaced. De Beer *et al* (*4*) reviewed ten patients with closed multiple CMC dislocations and found all ten dislocations to be in the dorsal direction. Cain *et al* (*3*) have previously described a possible mechanism for little finger CMC dislocation associated with fracture dislocation of the ring finger CMC joint. They stated that the force of the injury transmits an axial load through the ring finger metacarpal onto the carpus. When this force is great enough, a fracture occurs through the metacarpal resulting in shortening of the metacarpal. The load is then transferred to the little finger metacarpal resulting in dorsal dislocation of that carpometacarpal joint. A significant degree of force is required to disrupt the CMC articulation, and the majority of dislocations are accompanied by avulsion fractures of the involved bones. It is flexion during impact that results in dorsal dislocation of the metacarpal bases. However in our case, there was a divergent dislocation of the metacarpal bases. We hypothesise that the predominant vector of force through the ring metacarpal must have been of “extension” or “dorsiflexion”, thus resulting in volar dislocation of the base of the ring metacarpal. A fracture then occurred at the base of the of the ring metacarpal resulting in shortening of the ring metacarpal. This then resulted in the load being transferred to the head of the fifth metacarpal and as the volar stabilising are much stronger and more anatomically defined, pure dorsal dislocation of the ring finger carpometacarpal joint occurred.

When diagnosed early, carpometacarpal dislocations are usually managed by closed reduction and stabilisation with Kirschner wires. However associated basal metacarpal fractures may prevent closed reduction and necessitate open reduction (*1*). Diffuse swelling may obscure the deformity and the absence of a true lateral radiograph can make recognition of this injury pattern difficult (*7*). While the diagnosis was apparent in our case, Cain *et al* (*3*) have recommended a 45° pronation oblique view in facilitating good visualisation of fourth and fifth carpometacarpal injuries. A delay in diagnosis often mandates open reduction while failure to diagnose the dislocation inevitably results in diminished grip strength, posttraumatic CMC arthritis and a suboptimal outcome. With restoration of normal anatomical relations, an excellent functional result can be expected as any associated loss of mobility can be compensated by the adjacent joints (*9*).

In summary we report the unusual pattern of dorsal dislocation of the little finger carpometacarpal joint in association with a volar intra-articular fracture dislocation of the ring carpometacarpal joint. Open reduction supplemented with Kirschner wire stabilisation followed by intensive rehabilitation resulted in a pain free hand and wrist and an excellent functional result.

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