Case report

Emergency metacarpophalangeal arthroplasty with bone grafting for traumatic joint destruction

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ABSTRACT

Emergency arthroplasty of the metacarpophalangeal joint (MCPJ) remains a valuable treatment option in patients with MCPJ destruction but may raise challenges in the event of substantial metacarpal and/or phalangeal bone defects. We report three cases of MCPJ destruction with bone defects at the proximal first phalanx treated with emergency silicone implant arthroplasty combined with bone grafting.

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1. Introduction

Injuries to the metacarpophalangeal joints (MCPJs), bone defects raise challenges in preserving function of the involved digit. Emergency arthroplasty may provide sufficient range of motion to restore useful function. However, when the bone damage extends to the metacarpal bone and/or phalanx, prosthetic stabilization may prove difficult to achieve.

We report 3 cases of MCPJ destruction in 2 patients managed with emergency silicone implant arthroplasty combined with grafting of metacarpal bone to ensure reconstruction of the fractured first phalanx (P1).

2. Case reports

We report on 3 articular fractures of P1 in 2 patients. In both patients, the injuries were caused by a circular saw and occurred while the MCPJs were flexed. The 3 fractures were associated with bone defects at the dorsal part of the base of P1, with or without involvement of the metacarpal head (Figs. 1 and 2).

2.1. Patient #1

This 62-year-old male had a dorsal hand wound over the fifth MCPJ with complete loss of the extensor apparatus (zones 4 and 5), capsule, and ligaments. The bone lesions were as described above (Fig. 1). After wound debridement and trimming, the free cephalic fragment was prepared (Fig. 3). Fixation of the fragment to the dorsal aspect of P1 was achieved using three 1.2 mm cortical screws. The metacarpal bone was prepared using the rasps in the NeuFlex™ toolkit (DePuy, Warsaw, IN, USA). A size 20 prosthesis was implanted without difficulty into the phalangeal compartment. The palmaris longus tendon was removed using a stripper. A non-absorbable Mini-Mitek™ anchor (DePuy) was implanted into the base of the second phalanx (P2). The palmaris longus tendon was then folded into a V shape, whose apex was inserted onto the anchor and sutured to the remnants of the central slip (Fig. 4). The two lateral slips were then sutured as described by Pulvertaft [1] to the proximal stumps of the extensor digitorum communis and extensor digitiminimi, using 4/0 PDS sutures. The dorsal sling thus fashioned stabilised the prosthesis. The skin was closed using non-absorbable sutures.

The post-operative care protocol was started on day 2 after surgery. A reverse dynamic Kleinert splint [2] was fashioned from thermoforming material to maintain the MCPJ at 30° of flexion. The splint allowed active MCPJ flexion exercises followed by passive extension by the dynamic traction device. The post-operative course was rapidly favourable.

At follow-up 8 months after surgery, passive and active MCPJ flexion was 50° and active MCPJ extension was 0°. The proximal interphalangeal joint (PIP) showed 30° of flexion contracture. Follow-up imaging studies indicated osteochondral graft integration (Fig. 5).
2.2. Patient #2

A 57-year-old male presented with a dorsal hand wound extending from the second MCPJ to the distal interphalangeal joint of the fifth digit (D5). Disruption of the extensor apparatus from D2 to D5 without tissue loss was noted. The second and third MCPJs were subluxated into the palm (Fig. 2). At D4, a comminuted fracture of the shaft of P1 was managed by screw-plate fixation, and at D5, pinning in an X configuration was performed to stabilise a transverse fracture through P2.

At D2 and D3, osteotomy of the metacarpal head was performed and the two fragments were then prepared (Fig. 3). The bone graft for D2 was stabilised using four 8/10th pins, as its small size precluded screw fixation. Fixation of the graft on D3 was with three 1.2 mm cortical screws. The metacarpals were prepared using the NeuFlex™ toolkit rasps, and the two prostheses were implanted at the relevant sites (Fig. 6).

The extensor apparatus was repaired by direct suturing using separate PDS 4/0 stitches. The skin was then closed by direct suturing.

The reverse Kleinert rehabilitation programme [2] was started on day 2 after surgery.

The post-operative course was uneventful. After 10 months, the range of active and passive MCPJ flexion at D2 and D3 was 60°, passive extension was 0°, and active extension was –10°. Full range of motion was noted at the interphalangeal joints of D2 and D3. There was no motion range limitation at D4 and D5. The bone grafts remained visible after 10 months (Fig. 7).

3. Discussion

Complex traumatic injuries seem more common at the PIPJ than at the MCPJ [3]. MCPJ reconstruction has been more often reported in patients with tumours [4–7] than with trauma [8,9].
One of the options advocated after resection of a tumour of the MCPJ is arthroplasty combined with a vascularised or non-vascularised bone graft to fill the bone defect [4–7]. We describe a variant of this reconstruction option involving the use of a bone graft from the metacarpal head. The fractured or intact metacarpal head is removed and used to reconstruct the dorsal aspect of P1, thereby allowing implantation of a silicone prosthesis.

Stable fixation of the osteochondral bone graft is crucial to allow early self-rehabilitation, which is the only means of obtaining a satisfactory functional outcome [10]. Graft integration produces a strong bony sheath, ensuring that exchange arthroplasty is technically simple in the event of a fracture of the joint prosthesis.

In patients with bone defects, bone stock restoration is a prerequisite to implantation of a prosthetic joint [4–8]. However, MCPJ destruction is often due to severe lacerations with wound contamination. Consequently, graft harvesting from a different site...
is contra-indicated. When the risk of infection is high, the temporary implantation of an articulating spacer can be considered [9] as a means of allowing delayed arthroplasty with bone grafting at a time when the infectious risk is low. However, we believe that single-stage reconstruction is warranted whenever reasonable [10].

4. Conclusion

This simple and rapid treatment option allows single-stage reconstruction followed by immediate mobilisation, while allowing the subsequent use of other reconstruction methods in the event of failure.

Disclosure of interest

The authors declare that they have no competing interest.

References