Management of Combined Open Fractures of Thumb Metacarpal and Trapezium (Surgical Tip)

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Abstract Management of an unusual injury of combined open fractures of the first metacarpal shaft and trapezium due to crush injury in a 21-year-old man was reported in this paper. Surgical management included irrigation, debridement, and reduction of the first metacarpal fracture followed by external fixation extending from the first metacarpal to the distal radius and primary wound closure. After 1 year of surgery, follow-up functional and radiographic evaluations were satisfactory, and most of the daily activities were pain-free.

Keywords Fracture · Metacarpal · Trapezium
External fixation

Introduction

Either the fracture of carpal trapezial bone or the fracture of thumb metacarpal shaft is less common than usual [1–3, 5, 8], and fractures of trapezium are frequently associated with other carpometacarpal injuries [3, 5]. As an alternative management option for the comminuted combined open fractures of thumb metacarpal and trapezium, we hereby present such a case that was managed with external fixation and primary soft tissue repair.

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Case Report and Surgical Tip

A 21-year-old male army recruit sustained a crush injury to his right-dominant hand thenar area due to his hand getting caught in the firing mechanism of a weapon in the maneuvers area. After presenting to the emergency department, examination revealed swelling, tenderness, and moderately contaminated open wound in the thenar area. The open wound was in an irregular pattern, exposing the thenar muscles and fractured thumb metacarpal. The thumb and its metacarpal bone were deformed and shortened. There was no sign of vascular insufficiency or neurologic impairment of the thumb. The plain radiographs showed displaced and comminuted fracture of the thumb metacarpal shaft in association with comminuted and slightly collapsed trapezium body fracture (Fig. 1). According to the open wound and radiographic characteristics, we classified the injury as Gustilo type-IIIa open fracture.

In the operating room, under axillary anesthesia, irrigation and debridement were performed. Examination of the wound under anesthesia revealed that thenar muscles were moderately crushed and stripped from the bone, but the flexor tendons were intact. For the management of fractures, reduction of the thumb metacarpal fracture was done easily by direct exposure from the wound and followed by external fixator application extending from the head of the thumb metacarpal to the distal radius on the dorsal side with slight distraction (Fig. 2). Thenar muscles were evaluated as viable and covering the bone after the thumb metacarpal fracture was reduced, thus, primary wound closure was made after the fractures were fixed, without any attempt to repair the injured muscles (Fig. 3).

Beginning from the first postoperative day, active movement of the thumb was encouraged. There was no problem with the soft tissue healing, and no sign of infection

Figure 1 Radiograph showing thumb metacarpal shaft and trapezium fractures. Note both fractures are comminuted with some degree of collapse of trapezium and marked displacement of the thumb metacarpal shaft fracture.

was encountered at the postoperative period. After 4 weeks of fixation, x-rays showed good evidence of union in good alignment. To avoid stiffness of the adjacent joints and reflex sympathetic dystrophy, external fixator was removed, and physical examination showed no signs of pathological movement and local tenderness at the fracture sites. A removable wrist orthosis with a thumb support was prescribed and the patient was ordered to remove the orthosis during the day to make active-passive wrist and thumb range of motion exercises for 1 month, and then, the orthosis was restricted.

Subsequent radiographic and clinical examinations at the postoperative 1 year follow-up showed no evidence of either significant mal-alignment or arthritis of the first carpometacarpal joint (Fig. 4). When expressed as a percentage of the thumb of the uninjured hand, total active motion (TAM) at the metacarpophalangeal and interphalangeal joints was 100% and was graded as excellent [7]. Grip strength was 95%, and pinch strength was 85% of that uninjured side, and only mild pain and functional impairment in strenuous activities were noted.

Discussion

Fracture of trapezium is rare and comprises 3–5% of all carpal bone fractures [1–3, 5, 8, 6]. There is a frequent

Figure 2 Radiograph showing fracture reduction of the thumb metacarpal shaft followed by stabilization of both bone fractures with a dorsally applied external fixator, with slight distraction (postoperative first day).

Figure 3 Photographs of the original open wound **a** after the fractured thumb metacarpal was reduced, **b** after the external fixator was applied and wound closure completed.

association between the fracture of trapezium and other carpometacarpal injuries, where thumb metacarpal fracture is the most common associated injury [1, 3, 5, 8]. The mechanism of fracture of trapezium may be direct or indirect with a resultant trapezium body or ridge fracture [1, 5, 8]. McGuigan and Culp reported trapezium body fractures as a result of high-energy injuries and commonly associated with Bennett's fractures [6]. Like the trapezium body fractures, comminuted thumb metacarpal shaft fractures are also the

Figure 4 Radiograph at the last follow-up visit (postoperative 1 year) showed the evidence of union in good alignment and no sign of arthritic changes at the first carpometacarpal joint.

result of high energy injuries, usually due to direct trauma and often associated with soft tissue injury [8].

Trapeziometacarpal joint, which is a biconcave–convex saddle type joint, has a large range of motion due to its bony architecture, and its ligamentous and capsular structures provide most of its stability. With this anatomical structure, it contributes to prehension, opposition, and circumduction of the thumb, and it is loaded with the transmission of the forces especially during pinching and grasping [4, 9]. Articular congruency of trapeziometacarpal articulation should be provided surgically in displaced intra-articular fractures occurring in either side of the joint if satisfactory functional and radiological outcomes are the goals [3, 5, 6]. The mostly advocated surgical treatment of choice for the displaced intra-articular fractures of the either side of trapeziometacarpal joint is open reduction and internal fixation with pins or screws, and sometimes, closed reduction with percutaneous pin fixation [2, 3, 5, 6]. Some investigators recommended distraction with external fixation for some comminuted fractures of trapezium that otherwise internal fixation would be impossible. However, there has not been any such a published report, experiencing this method [6]. Most of the thumb metacarpal shaft fractures can be managed by closed means or surgically by closed reduction and percutaneous fixation or open reduction and internal fixation. However, comminuted shaft fractures are usually associated with soft tissue injuries and may require external fixator to manage [8].

In the presented case, the primary treatment of choice for the management of combined open fractures of thumb metacarpal and trapezium was reduction of the thumb metacarpal fracture followed by application of an external fixator extending from the first metacarpal head to the distal radius with slight distraction and primary wound closure. The reasons why we preferred this method were: first, the comminution of the fracture fragments and slightly collapsed trapezial body fracture; second, although not as strong an indication as the first, it was moderately contaminated type-IIIa open fracture. Both reasons forced us not to make

internal fixation. To avoid the short- and long-term potential hazards of the external fixation and distraction such as pin tract infection, joint stiffness, and reflex sympathetic dystrophy, we removed the fixator and encouraged range of motion exercises as soon as the radiographic features showed healing of the fractures.

Although the long-term follow-up results are not available, short term clinical and radiographic results encouraged us about the efficiency of external fixation as an alternative treatment method in these kinds of injuries as presented in this paper.

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