

Multiple Complex Carpometacarpal Fracture Dislocations: A Rare case series of 10 patients and Review of Literature

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Abstract:

Background: Multiple Carpometacarpal Fracture dislocations are rare varieties of hand injuries. They become even uncommon when associated with a Divergent variety. High index of suspicion is necessary when examining such a patient of high velocity injury with hand swelling and especially associated with patient having polytrauma. Good anteroposterior and a Good Lateral view are priority in diagnosis. Computed Tomography scan has greatly increased the level of accurate diagnosis. We present a case series of ten cases of carpometacarpal dislocation of 2nd, 3rd, 4th or 5th fingers associated with comminuted fracture base of 2nd, 3rd, 4th and 5th metacarpal followed up for an average period of 15 months. Prompt diagnosis and early open reduction and internal fixation along with relatively early mobilization helped in complete fracture union and normal carpometacarpal joints alignment and a good functional outcome. **Patients and Methods:** Ten patients having multiple metacarpal bases fractures associated with carpometacarpal joint dislocations were open reduced and fixed with multiple Kirschner wires. Out of these two cases were associated with polytrauma. These cases were followed up for an average period of one year. American Society for Surgery of the Hand (ASSH) Total Active Flexion (TAF) score system was used to assess the functional status of all the patients at the end of good motivated physiotherapy. **Results:** Union rate of 100% was achieved in all ten cases at the end of average eight to ten weeks. Functional outcome was excellent in 90% and good in 10% of patients. Out of ten patients, one patient got postoperative wound infection but was controlled with regular dressings and intravenous antibiotics.

Keywords: multiple divergent complex; carpometacarpal fracture dislocations.

Introduction

Carpometacarpal (CMC) fracture dislocations occur as a result of high velocity trauma [1]. Carpometacarpal fracture dislocations especially of the ulnar four fingers are relatively infrequent [2]. The reported incidence is around 0.02% to 1% [2]. Complex dislocation of the metacarpophalangeal (MCP) joint was originally described by Farabeuf, in 1876 [3]. Dislocation without fracture is rare, and it most often involves the carpometacarpal joint of the little finger [3]. The volar or dorsal displacement of metacarpals is determined by the direction of the force applied to the hand at the time of injury and position of hand. It is rare for multiple carpometacarpal dislocation to occur without associated fracture. Divergent carpometacarpal fracture dislocations are even rarer. To achieve a "divergent variant" of multiple carpometacarpal dislocations a torsional force is required [4]. Simultaneous CMC dislocations may be dorsal and volar. Dorsal dislocations are more frequent. The reason, why the dorsal dislocations are more common, is that stronger static (dorsal ligaments) and dynamic (wrist extensors) restraints may cause the failure of bone dorsally,

with the subsequent rupture of the volar ligaments [5].

The diagnosis is of paramount importance to restore the anatomical congruity of the articular surfaces of the carpometacarpal joints and unfortunately it is missed most of the times and requires a good deal of clinical suspicion and a good anteroposterior and specially a lateral radiographs [2].

Various methods of fixation and reduction have been mentioned in literature but complex fracture dislocations are better reduced under vision and accurately with open reduction and internal fixation with Kirschner wires [3,6].

Patients and Methods

A prospective study was conducted at our institute from March 2014 to October 2015. Ten consecutive patients with closed ipsilateral multiple metacarpal base fractures with carpometacarpal joint dislocations who were admitted to our institution were enrolled in the study. Patients with two or more metacarpal fracture dislocations were included in the study. Two patients had associated polytrauma injuries including head injury. No patient was lost to follow-up. The minimum age of the patients in our series was 21 years, and the maximum was 55 years, with mean age of 35 years. Of all ten cases, the majority (more than 50%) were in the 21–30-year-old age group. Nine patients were male, and one patient was female. Right hand was involved in eight patients and left in two patients. Roadside accidents with high-energy trauma were the mode of injury in most cases (eight cases) in our series. The second most common causes of these fractures were industrial accidents (one case) or fall (one case).

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Figure 1: A, B- Antero-posterior and lateral X-ray views of two of the patients, showing fractures of base of metacarpals fracture along with dorsal dislocation of the carpometacarpal joints. C. Clinical picture showing extensive hand swelling.

Most common pattern was 2nd, 3rd, 4th and 5th metacarpal fractures bases and dislocations which was present in six patients and the least common was little finger with index finger (one patient). Other three patients had fracture bases of 3rd, 4th and 5th metacarpals with dislocations.

Anteroposterior and lateral radiographs were taken of the involved hand. There were comminuted fractures of the base of the involved metacarpals with dorsal dislocation of the involved carpometacarpal joints. In anteroposterior view, only fractures of metacarpal base were visible. Therefore lateral view is very important to avoid missing any associated injuries. In our case series also, the lateral view revealed dorsal dislocation of involved carpometacarpal joints which could have been easily missed if a good lateral view was not taken (fig 1A,B)

In our cases also there were irreducible complex varieties of divergent carpometacarpal fracture dislocation which were open reduced with multiple Kirschner wires which led to good healing and overall good to excellent functional outcome.

Eight patients were operated on day one. Two patients who had associated head injury were taken up after a week after stabilization of head injury status. Those two patients had good functional recovery due to delayed surgery and stiffness due to head injury.

Final functional Outcomes were based on The DASH score and the American Society for Surgery of the Hand (ASSH) Total Active Flexion (TAF) score [7,8] The ASSH TAF score grades results as excellent (flexion ≥ 220), good (flexion 120–80), or poor (flexion ≤ 80).

A DASH Score of 0 points reflects no disability, whereas a score of 100 points signifies maximum disability. The occurrence of deformity, pain, loss of strength and sensitivity were also considered.

Surgical Technique: The patients were taken up for surgery under brachial plexus block. In some patients an attempt was made for closed reduction and pinning [1]. But due to extensive swelling it was not possible (Fig

1C). We then proceeded for open reduction and internal fixation. Dorsal based incisions were taken, one in between 2nd and 3rd metacarpal base and another in between 4th and 5th metacarpal base depending upon the involved metacarpal base fractures and dislocations. In the first incision, skin and subcutaneous tissues were incised and dissected. Extensor tendons were carefully retracted. The 2nd, 3rd metacarpal fracture and dislocation was reduced by a 2mm Kirschner wire. Similarly the 4th and 5th carpometacarpal dorsal dislocations were reduced by 2mm kirschner wires each through another dorsal based incision between 4th and 5th metacarpal. If, the 5th metacarpal could not be reduced with this incision, a separate for the 5th metacarpal was made medially near the ulnar side of the base of the 5th metacarpal, according to Foucher [8]. Reduction was confirmed by image intensifier. (Fig 4)

Adequate soft tissue closure was achieved to avoid extensor tendon irritation. Wound was closed without drainage. Strict hand elevation was given for 24–48 h to control pain and swelling, and mobilized actively thereafter. Intravenous antibiotic in the form of 3rd generation Cephalosporins were given for first 48 hours. After closing skin and subcutaneous tissues over layers, all the patients were given a below elbow cock-up immobilization splint for four weeks.

Patients were followed up regularly every five days for change of dressings since these types of high velocity injuries are associated with postoperative swelling and wound gaping. Only one patient had postoperative serosanguinous discharge from the surgical wound. He was given intravenous antibiotics for a week and changes of dressing were done. At the end of two weeks after confirming healthy wound status, the stitches were removed for all other patients. Immobilization splint was continued for a total of 4-5 weeks postoperative period (Fig 2B).

After which gradual supervised active and passive physiotherapy was started. It appears to be universally accepted, that mobilization of the hand should occur

before week four, although no high level evidence has been conducted [9].

Patient regained good functional range of movements in about 8 weeks. After about average of eight to ten weeks of postoperative period X- rays showed good union of the fracture (Fig 2C). All the implants including Kirschner wires and cortical screws were removed. After that, the patient was started on a regimen of rigorous physiotherapy.

All the patients had good range of functional recovery in terms of wrist movements, movements at the carpometacarpal joints and fist making. One patient who had an associated head injury had stiffness in extension of the fingers. He was taken for manipulation under Brachial plexus Block. Block decreased the excessive sympathetic activity and helped in good physiotherapy.

At four to six months follow- up period, the serial X-rays showed complete healing of the fracture sites and good alignment of all the carpometacarpal joints (Fig 2D).

Discussion

The carpometacarpal joints are anatomically stable joints. Stability arises as a result of interlocking saddle joints, volar and dorsal ligaments, and intermetacarpal ligaments, and protection by the long flexor and extensor tendons and intrinsic muscle [10, 11].

Multiple carpometacarpal fracture dislocations are a result of high velocity injury. Mostly as a result of motor vehicular accidents, fall from heights or as a result of direct trauma like fist or in assaults [2, 11]. The injury can be open or closed depending on the amount of force producing it.

The third metacarpal articulation with the capitate is

located more proximally than the carpal articulations of the other metacarpals, producing a “key-stone” relationship [2,4] which is usually the center around which dislocations or fracture dislocations can occur.

Many a times these carpometacarpal dislocations are associated with carpal bone fracture and avulsion fractures of metacarpal bases or stress fractures of the interosseous ligaments [11]. They are also associated many a times with polytrauma patients when the attending surgeon might miss out the hand injuries in view of other associated life threatening injuries. In such cases the diagnosis is most often missed [5, 11].

Both dorsal and volar fracture dislocations are possible which depends on the amount and the direction of the force producing the injury. Among these, dorsal are more common. Gunther suspected a rotatory mechanism with the hand firmly fixed and forces causing the carpus to rotate on a fixed metacarpal base [4]. Only dislocations are rare. That mostly happens for the fifth carpometacarpal joint because the stability goes on decreasing towards the ulnar side [2]. Given the number of static stabilizers surrounding the CMC joints, it is far rarer to have pure, multiple CMC dislocations without a simultaneous fracture. In these cases, also there are dorsal articular fractures of the 2nd and 3rd, 4th or 5th metacarpal bases depending on the patients' injury.

High index of suspicion is necessary for all patients with gross swelling of the hand and a grossly normal anteroposterior view of the radiogram. The key to a radiographical diagnosis lies in the subtle loss of joint space and the loss of the parallel articular surfaces of the CMC joints, which are seen on the antero-posterior projections. After dislocation, this parallelism is lost and



Figure 2: A-Intraoperative image intensifier picture of one of the patients showing adequate reduction and joint reduction. B- Healthy wound status after 3 weeks. C- 8 weeks postoperative x-ray showing bony union. D- x-ray taken at 1 year follow-up period. E- Fist making and excellent range of movements in a patient

there is an overlap, and possibly an offset of the base of the fifth metacarpal [4, 5, 11].

In one of our cases also, on anteroposterior view there was profound loss of articular surfaces with the fifth metacarpal base subluxed out (Fig 1AB). There is a marked overlap of the articular surfaces. An oblique view or a true lateral view is very valuable for accurate diagnosis. Nalebuff opined that oblique views are better.[4, 5] (Fig 1 B). In our cases, also an oblique view was taken which clearly showed comminuted fracture of 2nd, 3rd, 4th or 5th metacarpal bases with dislocation of 2nd, 3rd, 4th, 5th carpometacarpal joints depending on each patients' injury.

Other radiographic views which can be taken are pronation views for visualizing carpometacarpal joint of index finger and supination view for carpometacarpal joint visualization of the ring and little fingers. Now a days, Computed Tomography scans are also done to visualize accurately the joint congruity and also to see if there are any concomitant fracture of the carpal bones [6, 11].

Delayed diagnosis is associated with complications like carpometacarpal joint arthritis and painful restriction of joint movements [12] and ultimately further carpal collapse [13]. Earlier reports say that these injuries are associated with a little disability. But many studies have proven otherwise. Bunnel recommended that reduction is necessary to "restore proper mechanics of hand and muscle balance" especially of the intrinsics [2].

Indications for surgery include; open fractures, intraarticular fractures, angulation of the fracture greater than 30 degrees, rotational deformity greater than ten degrees and gross (>5mm) shortening of the metacarpal. Various methods of reduction and fixation are known in literature which includes plaster slab immobilization, closed reduction and pinning, open reduction and pinning with Kirschner wires. All techniques have their own outcomes. These types of complex divergent dislocations require open reduction and pinning. Open reduction is also indicated for cases like this where there is massive edema, interposed ligaments and avulsion base fragments [1,6,11]. Under vision reduction and good alignment are added advantages of open reduction. A literature study by Bushnell et al., concluded that the second and third metacarpal base have been generally more successful with open reduction and internal fixation as opposed to conservative management[9]. Excellent results with long term stability without pain were achieved. More severe cases might require immediate arthrodesis [6]. Of course it has the disadvantage of added surgical soft tissue trauma.

Our reduction maneuver used the increased mobility of the ulnar to metacarpals to reestablish ulnar column stability. Two dorsal based incisions were taken. First incision was centered in between 2nd and 3rd metacarpal bases. Since the 3rd metacarpal usually acts as a pivot

around which other metacarpals dislocate, [2,4] it was reduced first which helped in the reduction of other metacarpal dislocations [13]. In one case, a compression screw was added to increase the reduction stability for the 2nd metacarpal. Another dorsal based incision centered in between 4th and 5th metacarpals bases was taken to reduce 4th and 5th carpometacarpal joints. Reduction was duly checked under image intensifier especially in the lateral and oblique views. Congruity of the articular surfaces was confirmed.

Postoperatively plaster immobilization splint was given for 4 to 6 weeks. There are conflicting reports as to when to start postoperative mobilization process. Common complications that result because of prolonged immobilization include stiffness of hand joints, tendon adhesions and muscle weakness [3]. Dowden emphasized that early controlled motion must be balanced with sufficient immobilization at areas of injury (ie, fractures and dislocations) to ensure that adequate healing occurs [14].

In our cases we started passive and gradual active mobilization of the fingers at carpometacarpal joints. Good range of movements was achieved at end of six to eight weeks. Radiological union was achieved by then at an average of eight to ten weeks. At this stage all the implants were removed and more intense physiotherapy was started. Nine patients regained full functional recovery with excellent range of movements (Fig 2E). One patient had good range of movements and a good functional score.

Conclusion

Multiple carpometacarpal dislocations are rare variety of hand injuries especially when associated with fracture base of 2nd, 3rd, 4th or 5th metacarpal base. Such injuries are associated with high velocity and major force. So a high index of suspicion should be maintained and an attempt should be made to look for other associated injuries especially in a polytrauma patient. Good quality radiographs are mandatory for accurate diagnosis especially lateral views or oblique views. Early open reduction and internal fixation is very important for these types of fracture dislocations in which there is gross swelling and failure to reduce it by closed means. Relatively early mobilization helps in preventing disability and finger stiffness and consequent wrist joint arthritis and gives a good overall functional range of movements and good grip strength.

References

1. Yuri M. Lewicky, and Joseph E. Sheppa- Closed-Reduction Percutaneous Pinning of a Complex Divergent Carpometacarpal Fracture-Dislocation Involving the 4 Ulnar Carpometacarpal Joints: American Journal of Orthopaedics. April 2009;38(4):191-193.
2. Richard A Berger, Arnold-Peter C Weiss: Green's Operative Hand Surgery Volume 1 Lippincott Williams & Wilkins 2004:539-543.
3. Eurico Monteiro & Pedro Negrão & Vitor Vidinha & Manuel Gutierrez & Rui Pinto- Open irreducible fracture/dislocation of the four ulnar metacarpals at the metacarpophalangeal joints: case report: Eur Orthop Traumatol Vol3 Number 4 2012
4. Supradeeptha C, Kumar Yashwanth, Batra AV, Shandilya SM, Prasad SJ ; Divergent Carpometacarpal Fracture Dislocation-An Uncommon Injury Pattern. J Trauma Treat 2: 165.
5. Yasir Salam Siddiqui et al.,: Multiple Carpometacarpal Fracture dislocation of the Hand – An Uncommon Pattern of Injury Which is Often Missed: A Case Report with Review of Literature-Journal of Clinical and Diagnostic Research. 2011 June, Vol-5(3): 618-620
6. Rockwood and Greens fractures in adults 7th Revised edition edition. 2009; Wolters Kluwer
7. Soni A, Gulati A, Bassi J.L, Singh D, Saini U.C: Outcome of closed ipsilateral metacarpal fractures treated with mini fragment plates and screws: a prospective study: J Orthopaed Traumatol 2012; 13:29–33
8. Biz C, Iacobellis C. Comparison of percutaneous intramedullary Kirschner wire and interfragmentary screw fixation of displaced extra-articular metacarpal fractures. Acta Biomed. 2014 Dec 17;85(3):252-64
9. Haughton D.N, Jordan D, Malahias M, Hindocha S, and Khan W : Principles of Hand Fracture Management: The Open Orthopaedics Journal, 2012, 6, (Suppl 1: M5) 43-53
10. Syed Faraz Anwar: Divergent Carpometacarpal Fracture Dislocation: Journal of the College of Physicians and Surgeons Pakistan 2013, Vol. 23 (4): 301-302
11. CYL Woon, KC Chong, CO Low. Carpometacarpal joint dislocations of the index to small finger: three cases and a review of literature. Injury Extra 2006; 37, 466- 472.
12. Henderson JJ, Arafa MA. Carpometacarpal dislocation. An easily missed diagnosis. J Bone Joint Surg Br. 1987 Mar;69(2):212-4
13. Hardy MA. Principles of metacarpal and phalangeal fracture management: a review of rehabilitation concepts. J Orthop Sports Phys Ther. 2004 Dec;34(12):781-99.
14. T. Bell, SJ Chinchalkar, K Fabe-. Postoperative management of carpometacarpal joint fracture dislocation of the hand: a case report: Can J Plastic surg 2010;18(3):e37-e40.

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