

World Journal of *Clinical Cases*

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REVIEW

- 1888 Endoscopic transluminal drainage and necrosectomy for infected necrotizing pancreatitis: Progress and challenges
Zeng Y, Yang J, Zhang JW

MINIREVIEWS

- 1903 Functional role of frontal electroencephalogram alpha asymmetry in the resting state in patients with depression: A review
Xie YH, Zhang YM, Fan FF, Song XY, Liu L
- 1918 COVID-19 related liver injuries in pregnancy
Sekulovski M, Bogdanova-Petrova S, Peshevska-Sekulovska M, Velikova T, Georgiev T
- 1930 Examined lymph node count for gastric cancer patients after curative surgery
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- 1939 Laparoscopic common bile duct exploration to treat choledocholithiasis in situs inversus patients: A technical review
Chiu BY, Chuang SH, Chuang SC, Kuo KK
- 1951 Airway ultrasound for patients anticipated to have a difficult airway: Perspective for personalized medicine
Nakazawa H, Uzawa K, Tokumine J, Lefor AK, Motoyasu A, Yorozu T

ORIGINAL ARTICLE**Observational Study**

- 1963 Clinicopathological features and expression of regulatory mechanism of the Wnt signaling pathway in colorectal sessile serrated adenomas/polyps with different syndrome types
Qiao D, Liu XY, Zheng L, Zhang YL, Que RY, Ge BJ, Cao HY, Dai YC

Randomized Controlled Trial

- 1974 Effects of individual shock wave therapy *vs* celecoxib on hip pain caused by femoral head necrosis
Zhu JY, Yan J, Xiao J, Jia HG, Liang HJ, Xing GY

CASE REPORT

- 1985 Very low calorie ketogenic diet and common rheumatic disorders: A case report
Rondanelli M, Patelli Z, Gasparri C, Mansueto F, Ferraris C, Nichetti M, Alalwan TA, Sajoux I, Maugeri R, Perna S
- 1992 Delayed versus immediate intervention of ruptured brain arteriovenous malformations: A case report
Bintang AK, Bahar A, Akbar M, Soraya GV, Gunawan A, Hammado N, Rachman ME, Ulhaq ZS

- 2002** Children with infectious pneumonia caused by *Ralstonia insidiosa*: A case report
Lin SZ, Qian MJ, Wang YW, Chen QD, Wang WQ, Li JY, Yang RT, Wang XY, Mu CY, Jiang K
- 2009** Transient ischemic attack induced by pulmonary arteriovenous fistula in a child: A case report
Zheng J, Wu QY, Zeng X, Zhang DF
- 2015** Motor cortex transcranial magnetic stimulation to reduce intractable postherpetic neuralgia with poor response to other therapies: Report of two cases
Wang H, Hu YZ, Che XW, Yu L
- 2021** Small bowel adenocarcinoma in neoterminal ileum in setting of stricturing Crohn's disease: A case report and review of literature
Karthikeyan S, Shen J, Keyashian K, Gubatan J
- 2029** Novel combined endoscopic and laparoscopic surgery for advanced T2 gastric cancer: Two case reports
Dai JH, Qian F, Chen L, Xu SL, Feng XF, Wu HB, Chen Y, Peng ZH, Yu PW, Peng GY
- 2036** Acromicric dysplasia caused by a mutation of fibrillin 1 in a family: A case report
Shen R, Feng JH, Yang SP
- 2043** Ultrasound-guided intra-articular corticosteroid injection in a patient with manubriosternal joint involvement of ankylosing spondylitis: A case report
Choi MH, Yoon IY, Kim WJ
- 2051** Granulomatous prostatitis after bacille Calmette-Guérin instillation resembles prostate carcinoma: A case report and review of the literature
Yao Y, Ji JJ, Wang HY, Sun LJ, Zhang GM
- 2060** Unusual capitate fracture with dorsal shearing pattern and concomitant carpometacarpal dislocation with a 6-year follow-up: A case report
Lai CC, Fang HW, Chang CH, Pao JL, Chang CC, Chen YJ
- 2067** Live births from *in vitro* fertilization-embryo transfer following the administration of gonadotropin-releasing hormone agonist without gonadotropins: Two case reports
Li M, Su P, Zhou LM
- 2074** Spontaneous conus infarction with "snake-eye appearance" on magnetic resonance imaging: A case report and literature review
Zhang QY, Xu LY, Wang ML, Cao H, Ji XF
- 2084** Transseptal approach for catheter ablation of left-sided accessory pathways in children with Marfan syndrome: A case report
Dong ZY, Shao W, Yuan Y, Lin L, Yu X, Cui L, Zhen Z, Gao L
- 2091** Occipital artery bypass importance in unsuitable superficial temporal artery: Two case reports
Hong JH, Jung SC, Ryu HS, Kim TS, Joo SP

- 2098** Anesthetic management of a patient with preoperative R-on-T phenomenon undergoing laparoscopic-assisted sigmoid colon resection: A case report
Li XX, Yao YF, Tan HY
- 2104** Pembrolizumab combined with axitinib in the treatment of skin metastasis of renal clear cell carcinoma to nasal ala: A case report
Dong S, Xu YC, Zhang YC, Xia JX, Mou Y
- 2110** Successful treatment of a rare subcutaneous emphysema after a blow-out fracture surgery using needle aspiration: A case report
Nam HJ, Wee SY

LETTER TO THE EDITOR

- 2116** Are biopsies during endoscopic ultrasonography necessary for a suspected esophageal leiomyoma? Is laparoscopy always feasible?
Beji H, Chtourou MF, Zribi S, Kallel Y, Bouassida M, Touinsi H
- 2119** Vaginal microbes confounders and implications on women's health
Nori W, H-Hameed B

ABOUT COVER

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Unusual capitate fracture with dorsal shearing pattern and concomitant carpometacarpal dislocation with a 6-year follow-up: A case report

Chien-Cheng Lai, Hsu-Wei Fang, Chih-Hung Chang, Jwo-Luen Pao, Chun-Chien Chang, Yeong-Jang Chen

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Abstract

BACKGROUND

Isolated capitate fractures are rare carpal fractures. Following high-energy injuries, capitate fractures are usually associated with other carpal fractures or ligament injuries. The management of capitate fractures depends on the fracture pattern. Here, we report an unusual capitate fracture with a dorsal shearing pattern and concomitant carpometacarpal dislocation, with a 6-year follow-up. To the best of our knowledge, this fracture pattern and surgical management have not been previously reported.

CASE SUMMARY

A 28-year-old man presented with left-hand volar tenderness and decreased grip strength that persisted for one month after a traffic accident. Radiography showed a distal capitate fracture with carpometacarpal joint incongruence. Computed tomography (CT) revealed a distal capitate fracture with carpometacarpal joint dislocation. The distal fragment was rotated by 90° in the sagittal plane, and an oblique shearing fracture pattern was noted. Open reduction and internal fixation (ORIF) with a locking plate were performed using the dorsal approach. The imaging studies performed 3 mo and 6 years following surgery revealed a healed fracture, and the Disabilities of the Arm, Shoulder, and Hand and visual analog scale scores were significantly improved.

CONCLUSION

CT can detect capitate fractures with dorsal shearing pattern and concomitant carpometacarpal dislocation. ORIF using a locking plate are possible.

Key Words: Isolated capitate fracture; Carpometacarpal dislocation; Dorsal intercarpal ligament; Case report

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Core Tip: Isolated capitate fractures with distal fragment rotated by 90° in the sagittal plane, dorsal shearing pattern and concomitant carpometacarpal dislocation have not been previously reported. Open reduction and internal fixation with a locking plate using the dorsal approach are possible. Long term radiological and clinical outcomes, including the Disabilities of the Arm, Shoulder, and Hand and visual analog scale scores were improved significantly.

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INTRODUCTION

Capitate fractures are rare and usually associated with other carpal bone fractures or ligament injuries. The reported incidence of these fractures is 0.42-4.9% of all adult carpal fractures[1-3]. The most frequent injury mechanism is a fall on an outstretched hand. With a greater energy injury mechanism, more neighboring structures may be injured. Greater arc perilunate fracture-dislocation is typically a high-energy injury with several bone fractures, including the scaphoid, capitate, and triquetrum. Scaphocapitate syndrome is a rare, greater arc fracture in which the proximal capitate fragment rotates 90°-180° in the sagittal plane[4,5]. The treatment of capitate fractures depends on the fracture pattern and associated injuries. Short-arm cast immobilization is indicated for isolated non-displaced capitate fractures. Displaced capitate fractures associated with injuries to neighboring structures, including carpal fractures and ligament tears, require surgical treatment[5,6]. Isolated capitate fractures have rarely been reported; when they have, fracture types have also been reported[5]. Most of these studies were small case series[3,5]. In this study, we report a case of capitate fracture with dorsal shearing fracture-dislocation of the distal pole that was treated using plate fixation. To our knowledge, this fracture pattern and surgical management have not been previously reported.

CASE PRESENTATION

Chief complaints

A 28-year-old man presented with left-hand pain that persisted for one month after he was hit by a car while riding a motorcycle.

History of present illness

Medical records were obtained and retrospectively examined after obtaining approval from the institutional review board of our hospital. Multiple injuries were found, including a brain concussion, spleen laceration, and left pelvic and femoral shaft fractures. The patient was taken to another hospital, where he received treatment. One month after discharge, he visited our clinic because of pain in his left hand.

History of past illness

There was no history of past illness.

Personal and family history

There was no personal and family history.

Physical examination

During the physical examination, left carpal volar tenderness with decreased grip strength was noted.



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Figure 1 A fracture of the distal capitate with carpometacarpal joint dislocation is seen. A and B: Radiography; C and D: Computed tomography of the left hand.

Laboratory examinations

Blood test results were within normal limit.

Imaging examinations

Radiography of the left hand showed a distal capitate fracture with carpometacarpal joint incongruence (Figure 1A and B). Computed tomography of the left hand revealed a distal capitate fracture with carpometacarpal joint dislocation (Figure 1C and D).

FINAL DIAGNOSIS

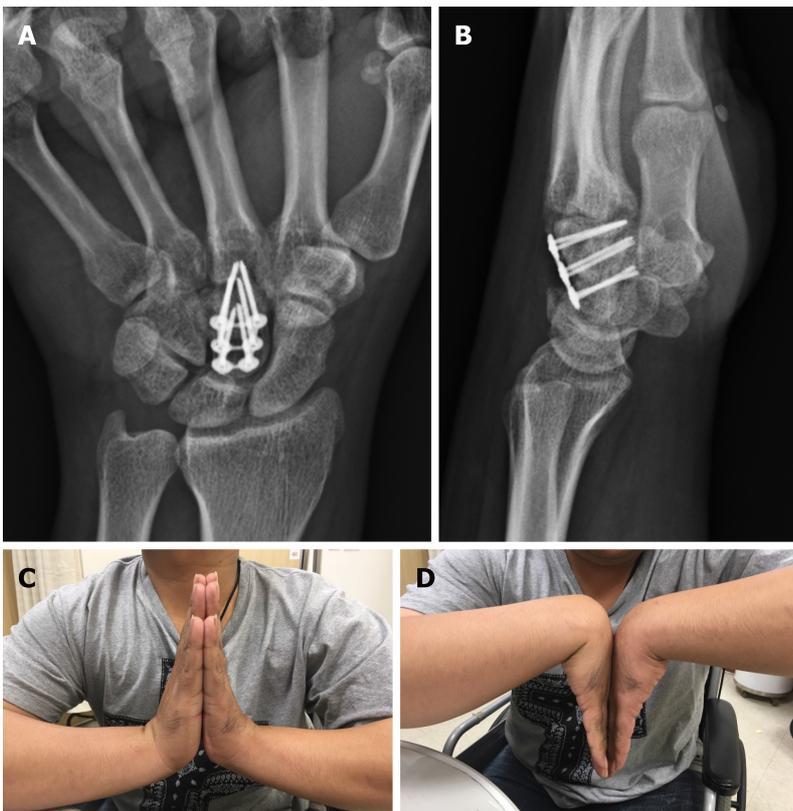
The patient was diagnosed with capitate fracture with dorsal shearing pattern and concomitant carpometacarpal dislocation of the left hand.

TREATMENT

The patient underwent surgical treatment after serial examinations. Under general anesthesia, he was positioned supine with an arm table. Through a dorsal approach, a longitudinal skin incision was made over the 3rd carpometacarpal joint, followed by blunt dissection. The extensor tendon was identified and protected. The dorsal intercarpal ligament, distal fragment of the capitate fracture, and ruptured capsule were identified. After removing fibrotic tissue, the distal fragment of the capitate fracture was rotated by 90° in the sagittal plane, and an oblique shearing fracture pattern was observed. After reduction and repair of the capsule, we fixed the fracture using Strut Plate 1.3 (DePuy Synthes, Paoli, PA, United States), a mini-locking plate. The wound was closed in layer.

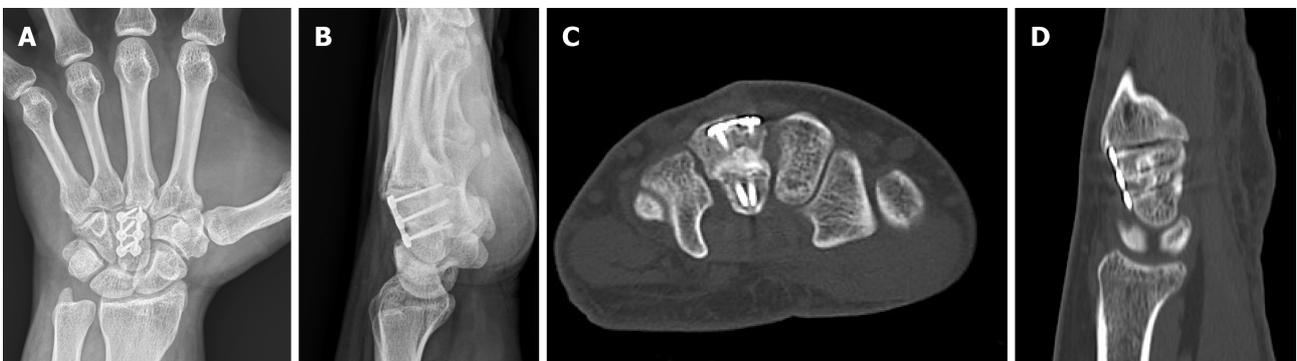
OUTCOME AND FOLLOW-UP

The patient was discharged three days after the operation. His hand was immobilized with a short-arm splint for 2 wk. Finger active range of motion rehabilitation were allowed immediately after operation. Wrist active range of motion and forearm rotation were allowed 2 wk postoperatively. Full weight-bearing was allowed 4 wk postoperatively, and he returned to his electronic technician job. The 3-month postoperative radiographs demonstrated appropriate plate and screw placement with no fracture site collapse (Figure 2A and B). His grip strength increased, and the left carpal volar tenderness resolved. The flexion/extension of the left wrist was comparable to that of the dominant right wrist (Figure 2C and D). Radiography and computed tomography performed 6 years later revealed a healed fracture with no avascular necrosis of the capitate (Figure 3). Figure 4 shows clinical photos of the left wrist six years postoperatively. The flexion/extension of the left wrist and forearm rotation are comparable to that of the dominant right wrist. Clinical outcomes were evaluated using the Disabilities of the Arm, Shoulder and Hand (DASH) and visual analog scale (VAS) scores at 3 mo and 6 years postoperatively. The DASH scores decreased from 45.0 to 18.3, while the VAS scores decreased from 3 to 0 at three



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Figure 2 The flexion/extension of the left wrist is comparable to that of the dominant right wrist. A and B: Radiography; C and D: Clinical photos of the left wrist three months postoperatively. Appropriate plate and screw placement with no fracture site collapse is observed.



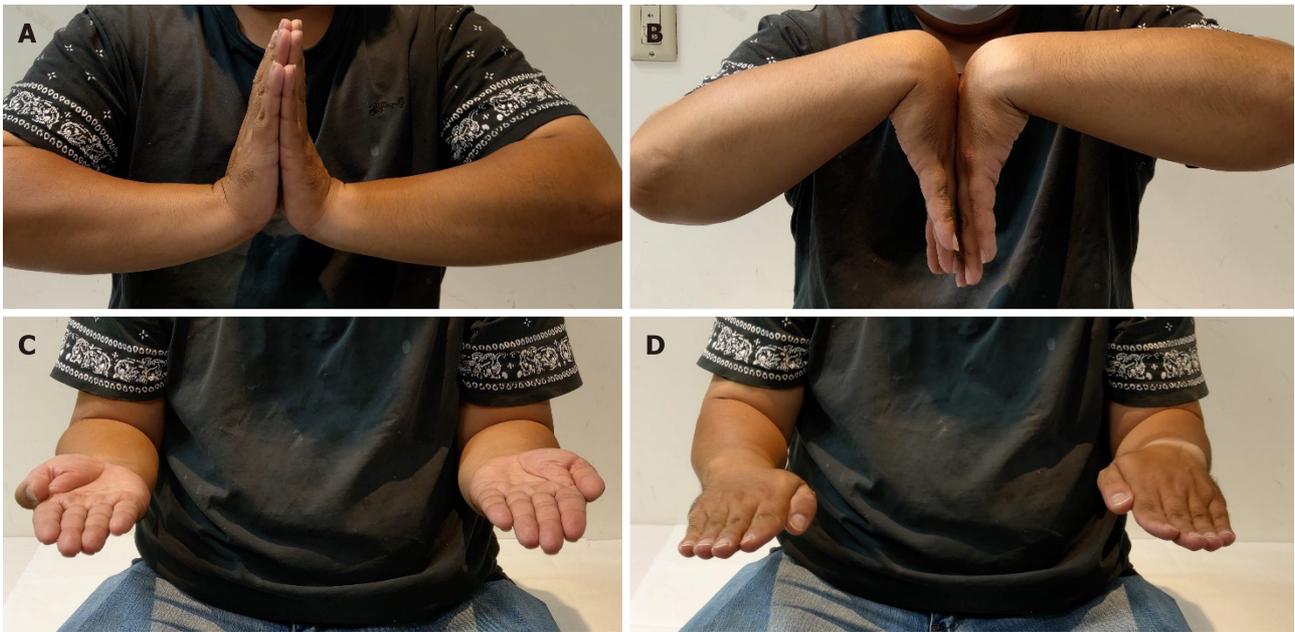
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Figure 3 A healed fracture with no avascular necrosis of the capitate is seen. A and B: Radiography; C and D: Computed tomography of the left hand six years postoperatively.

months and six years postoperatively, respectively. No complications were noted in this patient.

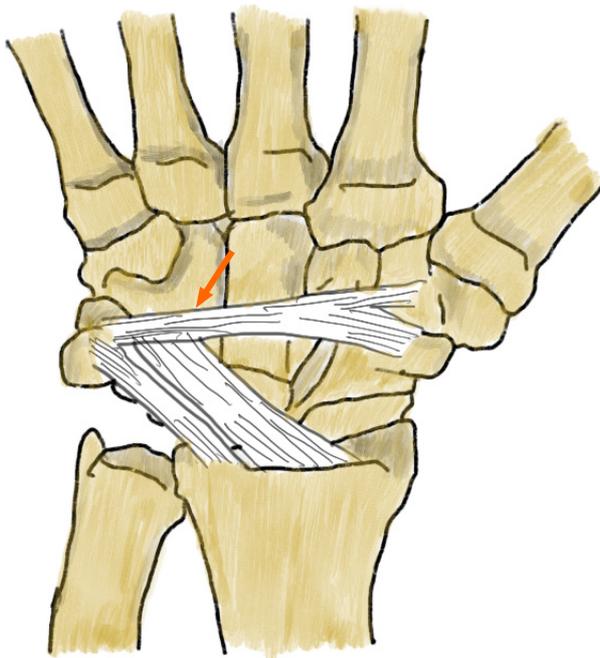
DISCUSSION

Four common capitate fracture patterns have been described: Transverse pole, transverse body, verticofrontal, and parasagittal[6]. Moran *et al*[5] reported the largest retrospective case series, which included 53 patients classified into three groups: capitate body (including stellate comminuted, oblique high and low, and transverse high and low), avulsion tip (including dorsal and volar tip avulsions), and shear depression (including coronal shear and dorsal depression) fractures. In our study, the patient presented with a dorsal shearing fracture of the distal pole with concomitant carpometacarpal dislocation and fracture fragment rotated by 90° in the sagittal plane. To our knowledge, this is the first such reported case. The common mechanism of injury is direct axial loading on the third metacarpal



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Figure 4 Clinical photos of the left wrist six years postoperatively. A and B: The flexion/extension of left wrist; C and D: Forearm rotation are comparable to that of the dominant right wrist.



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Figure 5 The proposed mechanism of injury. The fragment is rotated by 90° because the dorsal intercarpal ligament blocks the proximal part of the fragment and due to direct axial loading on the third metacarpal base with an extremely outstretched hand.

base with an outstretched hand. On the dorsal aspect, the dorsal intercarpal (DIC) and dorsal radiocarpal ligaments provide stability to the carpal bones, including the scaphoid and lunate[7]. In our study, the distal fragment of the capitate fracture was rotated by 90° in the sagittal plane with carpometacarpal dislocation. The possible mechanisms of injury leading to a 90° rotated fragment were blocking of the proximal part of the fragment by the DIC ligament and direct axial loading on the third metacarpal base with an extremely outstretched hand (Figure 5). Michael *et al*[8] reported the *in vivo* kinematics of the carpals during extreme wrist flexion and extension. In extreme extension, the capitate extends more than the scaphoid and lunate. The pressure between the dorsal aspect of the capitate and the DIC ligament also increases. As axial loading increases on the third metacarpal base, fracture-

dislocation may occur.

The management of capitate fractures should be determined by the fracture location and concomitant injuries. The treatment options include surgical and non-surgical treatments. Open reduction and internal fixation with Kirschner wires or headless cannulated compression screws in displaced fractures and fracture dislocations have been reported[2,5,9,10]. For rigid fixation, stability and early rehabilitation, we used a locking plate to fix the unique fracture pattern, and the fracture was healed at the final follow-up. The most common complication after a capitate fracture is nonunion[3,5,6], with a reported nonunion rate of 19.6%[11]. Other complications have also been reported, including nonunion followed by avascular necrosis[12] and post-traumatic degenerative arthrosis of the mid-carpal joint[5]. In our case, no complications occurred. For diagnosis, physical examinations and radiographic images of the hand were important. If follow-up CT of the hand was available, the fracture pattern of capitate could have been precisely assessed and the surgical plan could be adequately prepared. To avoid nonunion complications, open reduction with rigid internal fixation with a locking plate could be an appropriate approach.

CONCLUSION

An unusual capitate fracture with a dorsal shearing fracture and concomitant carpometacarpal dislocation can be identified using computed tomography. Open reduction and internal fixation using locking plates are possible.

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FOOTNOTES

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