Archives of Orthopaedic and Trauma Surgery (2019) 139:135–139
https://doi.org/10.1007/s00402-018-3072-0

HANDSURGERY

Dorsal buttress plate fixation for the treatment of fracture–dislocation of the fifth carpometacarpal joint with avulsion fracture of the hamate: a case report

Naoya Iwata[1] · Shingo Komura[2] · Akihiro Hirakawa[2] · Shigeo Kanamori[1] · Takahiro Masuda[1] · Yoshiki Ito[1] · Haruhiko Akiyama[2]

Received: 12 September 2018 / Published online: 9 November 2018

Abstract
Fracture–dislocations of the fourth and fifth carpometacarpal (CMC) joints present a complex situation. Misdiagnosis and inadequate treatment may cause malunion and residual subluxation, which lead to painful arthritis and grip weakness. Open reduction along with internal fixation is the treatment of choice, but there is no consensus on an optimal treatment approach. We applied a novel surgical technique to treat a case of a fracture–dislocation of the fifth CMC joint with avulsion fracture of the hamate using a dorsal buttress plate between the hamate and the capitate. This method allowed for achieving rigid fixation without screw insertion across the bone fragments of the hamate. We could avoid the risk of unexpected fragmentation and unexpected damage to the volar neurovascular bundles around the hook of the hamate. Six months postoperatively, bone union was achieved and the reduction of the fourth and fifth CMC joints was maintained. Range of motion of the fourth and fifth CMC joints was almost equal to that on the contralateral side. Dorsal buttress plating between the hamate and the capitate could be an alternative technique for the treatment of fracture–dislocation of the fifth CMC joint with avulsion fracture of the hamate.

Keywords Carpometacarpal joint · Fracture–dislocation · Hamate · Avulsion fracture · Buttress plate

Introduction

The fourth and fifth carpometacarpal (CMC) joints have greater range of motion (ROM) compared with the second and third CMC joints [1–4]. Therefore, if fracture–dislocations of the fourth and fifth CMC joints are misdiagnosed and not treated adequately, they may result in malunion and residual subluxation, which lead to painful arthritis and grip weakness [2–5]. In this type of injury, reduction is generally easy to obtain by the closed method, but difficult to maintain by conservative treatment [6]. For this reason, open reduction and internal fixation (ORIF) are usually applied. Even though several methods for operative fixation have been described, there is no consensus on an optimal treatment for this injury [1].

We present a case of a fracture–dislocation of the fifth CMC joint with avulsion fracture of the hamate and propose a novel surgical technique to treat this injury using a dorsal buttress plate between the hamate and the capitate.

Case presentation

A 32-year-old man visited our hospital with pain on the back of his right wrist after an accidental fall from the stairs. Radiographs and computed tomography (CT) revealed a fracture of the fourth metacarpal base and a dorsal dislocation of the fifth CMC joint with a coronal fracture of the body of the hamate (Fig. 1). The patient underwent ORIF under regional anesthesia 4 days after the injury. Through a dorsal approach using a 3-cm longitudinal incision centered over the fourth and fifth CMC joints, the extensor digitorum communis tendons were retracted radially and the dorsal

✉ Shingo Komura
s_komura@gifu-u.ac.jp

[1] Department of Orthopaedic Surgery, Kizawa Memorial Hospital, Gifu, Japan

[2] Department of Orthopaedic Surgery, Gifu University Graduate School of Medicine, Yanagido 1-1, Gifu 501-1194, Japan

Fig. 1 **a, b** Posteroanterior and oblique view radiographs of the right hand, showing the fracture–dislocation of the fourth and fifth carpometacarpal joints with avulsion fracture of the hamate. **c, d** Axial and sagittal view computed tomography images of the right hand, showing the fracture of the hamate and fourth metacarpal base. The thickness of the avulsion fragment of the hamate was 2 mm

cortex of the hamate and capitate were exposed. Due to the very thin fracture fragments of the hamate, fixing the bone fragment with a screw without breaking the fragment was considered difficult. The 2.3 mm locking plate (VariAx hand lock T-plate narrow, Stryker) was bent to fit along the dorsal surface of the hamate and the capitate. After reduction and temporary fixation of the fragment with Kirschner wires (K-wires), the plate was applied on the hamate and the capitate and fixed with a cortical screw into the capitate. The plate provided a buttress effect for the bone fragment of the hamate. An additional locking screw was inserted into the capitate and the previously placed cortical screw was replaced with a locking screw. Both locking screws remained monocortical to prevent inadvertent damage to the flexor tendons, nerve, and artery on the volar side. Buttress plating provided anatomical reduction and stability of the fifth CMC joint; however, proximal displacement of the fourth metacarpal base fracture with multiple fragments remained. Therefore, we also performed percutaneous K-wire fixation for the fourth and fifth CMC joints while maintaining the reduction of the fracture by distal traction of the fourth metacarpal (Fig. 2).

Postoperatively, the patient wore a removable splint for 5 weeks and the K-wires were removed after 4 weeks. A total of 6 months after the surgery, bone union was achieved and the reduction of the fourth and fifth CMC joints was maintained (Fig. 3). The patient could start working just as he was able to before the injury, without any pain, instability, or complaints about the prominence of the plate. The ROM of the fourth and fifth CMC joints was almost equal to that on the contralateral side. The ROM of the wrist and grip strength of the affected hand were extension 70°, flexion 70°, and 52 kg, which was 87.5%, 77.8%, and 94.5% of the contralateral side (80°, 90°, and 55 kg), respectively. The shortened disabilities of the arm, shoulder, and hand questionnaire (Quick DASH) score was 2.25.

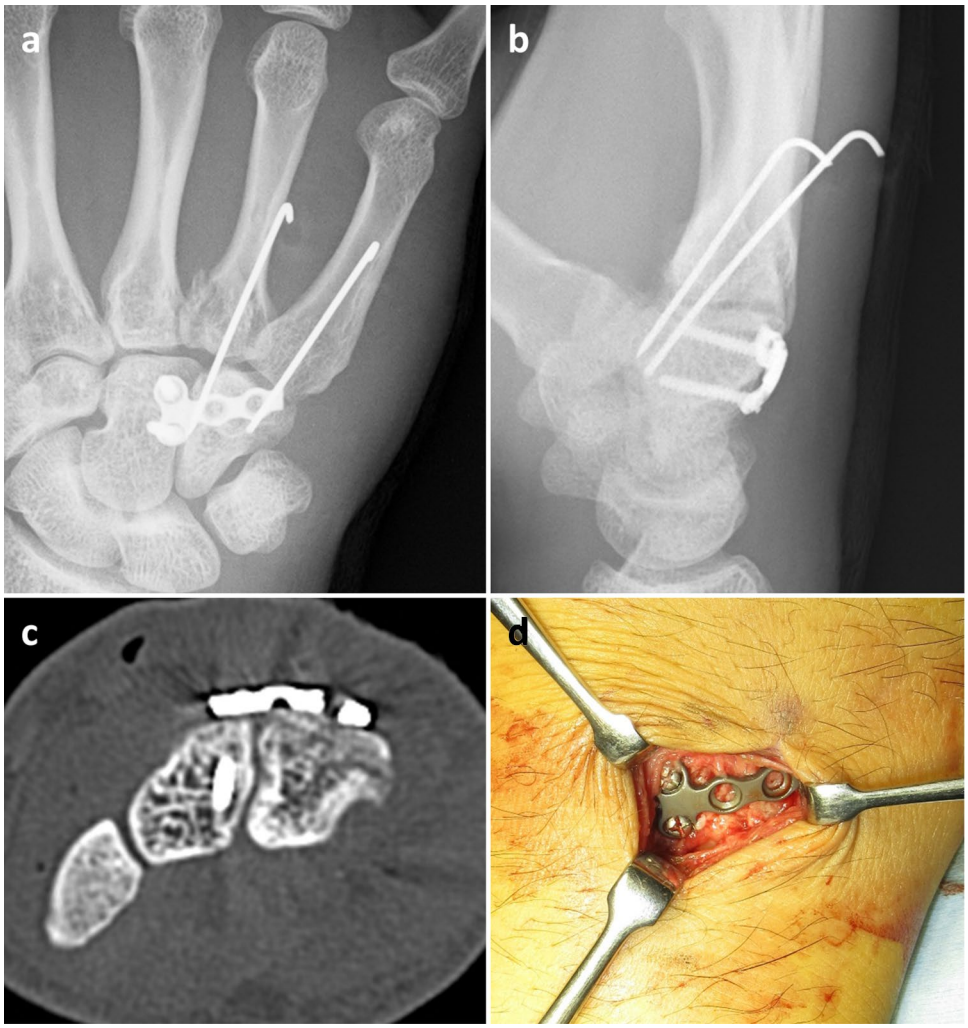

Fig. 2 **a, b** Postoperative radiographs demonstrate anatomical reduction of the bone fragment of the hamate and the fifth carpometacarpal joint. **c** Postoperative axial view computed tomography demonstrates anatomical reduction of the bone fragment of the hamate by dorsal buttress plating between the hamate and the capitate. **d** Intraoperative picture after plate fixation

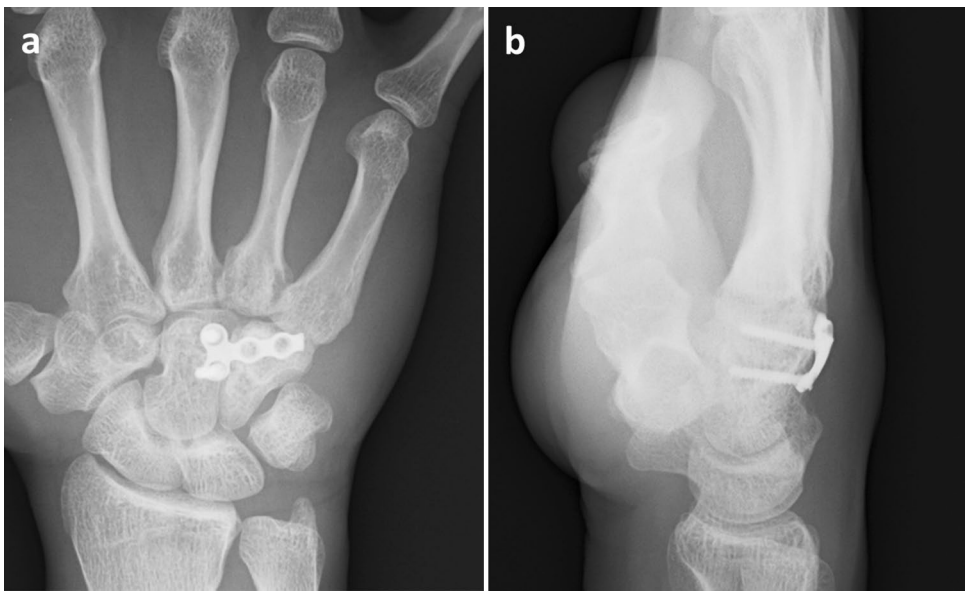

Fig. 3 **a, b** Posteroanterior and lateral view radiographs at 6 months after surgery, showing bone union of the hamate and fourth metacarpal base, and maintaining anatomical reduction of the fifth carpometacarpal joint

Discussion

Because of the rarity of fracture–dislocations of the fourth and fifth CMC joints, there is no consensus regarding optimal treatment for this injury. Valente et al. reported that noninvasive reduction and pinning were the most efficacious and certain in terms of healing [7]. In contrast, Schortinghuis et al. reported that ORIF of unstable ulnar CMC joint dislocations produced excellent results [8]. Open reduction was advised to achieve reduction of the hamate fracture fragment involving the articular surface to inspect interposition of the dorsal CMC ligament in the fracture site [6].

A variety of methods, such as K-wire fixation, screw fixation, and bridging plate, have been reported for internal fixation [1, 8, 9]. A screw can provide more rigid fixation than the K-wire; however, we should consider the size of the fragment when using it. The avulsion fragment of the hamate is sometimes very tiny and thin; therefore, there is a risk of unexpected fragmentation caused by screw fixation. Indeed, in our case, the thickness of the avulsion fragment was 2 mm and screw fixation could not be applied. Tan et al. reported dorsal buttress plate fixation between the hamate and metacarpals for fracture–dislocations of the fourth and fifth CMC joints [3]. To preserve the mobility of the fourth and fifth CMC joints and to allow for early rehabilitation, the distal end of the plate is not fixed to the metacarpal base. Although they reported excellent results, this method also cannot avoid direct screw insertion across small bone fragments of the hamate.

We performed dorsal buttress plate fixation between the hamate and capitate for fracture–dislocation of the fifth CMC joint with avulsion fracture of the hamate. We believe that one of the main benefits of our method is achieving rigid fixation without screw insertion across the bone fragments of the hamate, thereby avoiding the risk of unexpected fragmentation. Even though we needed additional percutaneous K-wire fixation for the fourth and fifth CMC joints due to the concomitant fourth metacarpal base fracture, buttress plating independently provided anatomical reduction and stabilization of the fifth CMC joint fracture-dislocation. Next, considering that the ulnar artery and the deep branch of the ulnar nerve are positioned near the hook of the hamate, our method, which needs no screw insertion into the hamate, can also prevent unexpected damage to the volar neurovascular bundles around the hook of the hamate. Moreover, monocortical screw fixation of the plate can minimize the risk of damage to volar neurovascular bundles and flexor tendons as well.

In contrast, the disadvantage of this method is with regard to fixing the capitohamate joint. However, it has been well-recognized that the distal row of the carpal bones is kept tightly bound with intrinsic ligaments and the capitohamate joint has negligible intercarpal motion [10, 11]. Therefore, it is assumed that temporary fixation of the capitohamate joint could be acceptable. In our case, although the short-term functional results were good and there were no intra- and early postoperative complications related to our method, there is no clarity yet regarding late postoperative complications due to long-term fixation of the capitohamate joint. We need to focus on the failure of the implant and the degenerative change of the capitohamate joint and consider the necessity of hardware removal.

Nevertheless, this case report has the limitation of short follow-up periods. Studies with a greater number of patients and longer follow-ups would be necessary to reveal the usefulness of this method. Indeed, conventional methods (e.g., K-wire pinning and mini-screw fixation) are still very useful for simple ulnar CMC fracture–dislocation. However, especially in those with small, thin, or comminuted fragments, which are difficult to treat by conventional methods, our method may be more appropriate as a salvage procedure. We hope that our surgical approach might help surgeons in treating fracture–dislocations of the ulnar CMC joint.

Conclusion

We present a case of a fracture–dislocation of the fifth CMC joint with avulsion fracture of the hamate treated with a novel surgical technique using a dorsal buttress plate between the hamate and the capitate. This method could be an alternative technique for the treatment of fracture–dislocation of the fifth CMC joint with avulsion fracture of the hamate.

Acknowledgements The authors report no benefits, grants, or assistance from any party.

Funding There is no funding source.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent Informed consent was obtained from the patient.

References

1. Bushnell BD, Draeger RW, Crosby CG, Bynum DK (2008) Management of intra-articular metacarpal base fractures of the second through fifth metacarpals. J Hand Surg Am 33(4):573–583.

https://doi.org/10.1016/j.jhsa.2007.11.019. (**PubMed PMID: 18406963**)

2. Mozaffarian K, Vosoughi AR, Hedjazi A, Zarenezhad M, Nazmi MK (2012) The safest direction of percutaneous pinning for achieving firm fixing of the fifth carpometacarpal joint. J Orthop Sci 17(6):757–762. https://doi.org/10.1007/s00776-012-0279-8. (**PubMed PMID: 22878673. Epub 2012/08/10**).
3. Tan ES, Chao TS (2016) Dorsal buttress plate fixation of ulnar carpometacarpal joint fracture dislocations. Tech Hand Up Extrem Surg 20(2):77–82. https://doi.org/10.1097/BTH.0000000000000119. **(PubMed PMID: 27077465)**
4. Kim JK, Shin SJ (2012) A novel hamatometacarpal fracture-dislocation classification system based on CT scan. Injury 43(7):1112–1117. https://doi.org/10.1016/j.injury.2012.02.019. **(PubMed PMID: 22463840. Epub 2012/03/29)**
5. Ebraheim NA, Skie MC, Savolaine ER, Jackson WT (1995) Coronal fracture of the body of the hamate. J Trauma 38(2):169–174. **(PubMed PMID: 7869431)**
6. Cain JE, Shepler TR, Wilson MR (1987) Hamatometacarpal fracture-dislocation: classification and treatment. J Hand Surg Am 12(5 Pt 1):762–767. **(PubMed PMID: 3655238)**
7. Valente M, Saggin G, Alecci V (2009) Pure isolated dorsal dislocation of the fifth carpometacarpal joint. Chir Organi Mov 93(2):97–100. https://doi.org/10.1007/s12306-009-0029-z. **(PubMed PMID: 19711009. Epub 2009/05/26)**
8. Schortinghuis J, Klasen HJ (1997) Open reduction and internal fixation of combined fourth and fifth carpometacarpal (fracture) dislocations. J Trauma 42(6):1052–1055. **(PubMed PMID: 9210540)**
9. Cano Gala C, Pescador Hernández D, Rendón Díaz DA, López Olmedo J, Blanco J (2013) Fracture of the body of hamate associated with a fracture of the base of fourth metacarpal: a case report and review of literature of the last 20 years. Int J Surg Case Rep 4(5):442–445. https://doi.org/10.1016/j.ijscr.2013.01.023. **(PubMed PMID: 23557937; PubMed Central PMCID: PMCPMC3731683. Epub 2013/02/13)**
10. Savelberg HH, Otten JD, Kooloos JG, Huiskes R, Kauer JM (1993) Carpal bone kinematics and ligament lengthening studied for the full range of joint movement. J Biomech 26(12):1389–1402. **(PubMed PMID: 8308044)**
11. Garcia-Elias M, An KN, Cooney WP, Linscheid RL, Chao EY (1989) Stability of the transverse carpal arch: an experimental study. J Hand Surg Am 14(2 Pt 1):277–282. **(PubMed PMID: 2703675)**