



Distal clavicle fractures treated by anteroinferior plating with a single screw: Two case reports

Xin-Lei Zhao, Yan-Qing Liu, Jian-Guo Wang, You-Cai Liu, Jia-Xuan Zhou, Bei-Yu Wang, Yi-Jun Zhang

Specialty type: Surgery

Provenance and peer review:

Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): 0

Grade B (Very good): B

Grade C (Good): 0

Grade D (Fair): 0

Grade E (Poor): 0

P-Reviewer: Rezus E, Romania

Received: September 17, 2023

Peer-review started: September 17, 2023

First decision: September 28, 2023

Revised: October 8, 2023

Accepted: October 11, 2023

Article in press: October 11, 2023

Published online: October 26, 2023



Xin-Lei Zhao, Yan-Qing Liu, Jian-Guo Wang, You-Cai Liu, Jia-Xuan Zhou, Bei-Yu Wang, Yi-Jun Zhang, Department of Orthopaedic Surgery, The First Affiliated Hospital of Baotou Medical College, Inner Mongolia University of Science and Technology, Baotou 014010, Inner Mongolia Autonomous Region, China

Corresponding author: Yi-Jun Zhang, MM, Chief Doctor, Full Professor, Department of Orthopaedic Surgery, The First Affiliated Hospital of Baotou Medical College, Inner Mongolia University of Science and Technology, No. 41 Linyin Road, Kundulun District, Baotou 014010, Inner Mongolia Autonomous Region, China. 18047211187@189.cn

Abstract

BACKGROUND

For the treatment of distal clavicle fractures, each treatment method has its own advantages and disadvantages, and there is no optimal surgical solution.

CASE SUMMARY

Based on this, we report 2 cases of distal clavicle fractures treated utilizing an anterior inferior plate with a single screw placed in the distal, in anticipation of providing a better surgical approach to distal clavicle fracture treatment. Two patients were admitted to the hospital after trauma with a diagnosis of distal clavicle fracture, and were admitted to the hospital for internal fixation of clavicle fracture by incision and reduction, with good postoperative functional recovery.

CONCLUSION

With solid postoperative fixation and satisfactory prognostic functional recovery, this technique has been shown to be simple, easy to perform and effective.

Key Words: Distal clavicle fractures; Anteroinferior; Plating; Single screw; Case report

©The Author(s) 2023. Published by Baishideng Publishing Group Inc. All rights reserved.

Core Tip: Distal clavicle fractures account for about 12%-21% of all clavicular fractures and about 25% of distal clavicle fractures are unstable. For conservative treatment of distal clavicle fractures, complications including high incidence of nonunion, abnormal appearance and dysfunction are likely to ensue. Thus, surgical treatment is recommended by scholars. So far, none of the treatment methods has been proven to be the best. Here, we report 2 cases of distal clavicular fractures successfully treated by anteroinferior plating with a single screw placed at the distal fragment. This technique has been shown to be simple, easy to operate and effective, which has not been reported previously as far as we are aware.

Citation: Zhao XL, Liu YQ, Wang JG, Liu YC, Zhou JX, Wang BY, Zhang YJ. Distal clavicle fractures treated by anteroinferior plating with a single screw: Two case reports. *World J Clin Cases* 2023; 11(30): 7502-7507

URL: <https://www.wjgnet.com/2307-8960/full/v11/i30/7502.htm>

DOI: <https://dx.doi.org/10.12998/wjcc.v11.i30.7502>

INTRODUCTION

Distal clavicle fractures account for about 12%-21% of all clavicular fractures and about 25% of distal clavicle fractures are unstable[1]. For conservative treatment of distal clavicle fractures, complications including high incidence of nonunion, abnormal appearance and dysfunction are likely to ensue. Thus, surgical treatment is recommended by scholars[2-4]. The surgical treatment methods include hook plating, coracoclavicular (CC) stabilization, locking plating, multiple transacromial pins, and *etc.* Each method has its own advantages and disadvantages. The hook plating method is associated with multiple complications such as subacromial irritation, plate migration, osteolysis and other problems[5,6]. CC stabilization has been recommended with satisfactory clinical outcome[7,8]. It can also be performed with minimal invasion under arthroscopic assistance, yet this technique is associated with risks of manipulation on coracoid. The locking plating method is to a large degree limited by the bone mass at the distal fragment of the fracture. The fixation effect cannot be guaranteed since it's likely that insufficient screws are placed given the limited bone mass. Indeed, there were reports of cases with fixation failure after locking plate treatment and the implants had to be removed from some patients eventually[9]. Some scholars advocate plating combined with coracoclavicular fixation[10,11]. This will obviously increase total operation in addition to boosting medical cost, which has to be taken into consideration. Problems upon treatment with multiple pins method include acromioclavicular joint interference, pin migration, irritation, as well as forced removal of the implant[12]. So far, none of the treatment methods mentioned above have been proven to be the best. Here, we report 2 cases of distal clavicular fractures successfully treated by anteroinferior plating with a single screw placed at the distal fragment. This technique has been shown to be simple, easy to operate and effective, which has not been reported previously as far as we are aware. These two patients consented to publication of this report.

CASE PRESENTATION

Chief complaints

Case 1: A 38-year-old Chinese man hit his right shoulder and suffered pain and swelling in the distal part of the right clavicle after the injury for hours.

Case 2: A 57-year-old Chinese man hit his left shoulder and suffered pain and swelling in the distal part of the left clavicle after the injury for hours.

History of present illness

Case 1: He fell while riding his bicycle and hit his right shoulder on the hard ground 5 h before.

Case 2: He fell to the ground and hit left shoulder 2 h before. No significant personal or family history.

History of past illness

No relevant past illness history.

Personal and family history

No significant personal or family history.

Physical examination

Case 1: Obvious swelling of the right shoulder with pain and limited functional movement of the right shoulder joint.

Case 2: Obvious swelling of the left shoulder with pain and limited functional movement of the left shoulder joint.

Laboratory examinations

Laboratory examinations showed no significant abnormalities.

Imaging examinations

Case 1: The radiograph (Figure 1) showed a fracture of the distal right clavicle.

Case 2: The radiograph (Figure 2) showed a fracture of the distal left clavicle.

FINAL DIAGNOSIS

Case 1

A fracture of the distal right clavicle.

Case 2

A fracture of the distal left clavicle.

TREATMENT

Case 1

The operation was performed 2 d after injury. The patient was placed in the beach-chair position, subjected to brachial plexus block anesthesia. A parallel incision was made along the lateral lower edge of the clavicle. After the fracture was exposed, a molded anterior-inferior reconstruction plate (Baide Medical, Jiangsu, China) was placed while the reduction was maintained by an assistant pressing the proximal end of clavicle fracture. The distal hole of the plate was placed in a proper position so that a screw could be accurately placed at the distal fragment. Under fluoroscopy, a single screw with length of 3.5 cm and diameter of 3.5 mm was inserted to form a double cortical fixation at the distal fragment of the fracture. Firm control force was felt while the screw was tightened. 3 screws were inserted at the proximal end of the fracture subsequently. The right clavicle exhibited no displacement within itself while moving right shoulder fully, which indicated firm and reliable fixation effect had been achieved. The wound was irrigated and sutured while the ligaments were not treated during the operation. The patient was encouraged to start shoulder movement after the pain subsided. He was not allowed to load the operated shoulder for 6 wk.

Case 2

The operation was performed 8 h after injury with the same operation procedure as that in case 1.

OUTCOME AND FOLLOW-UP

Case 1

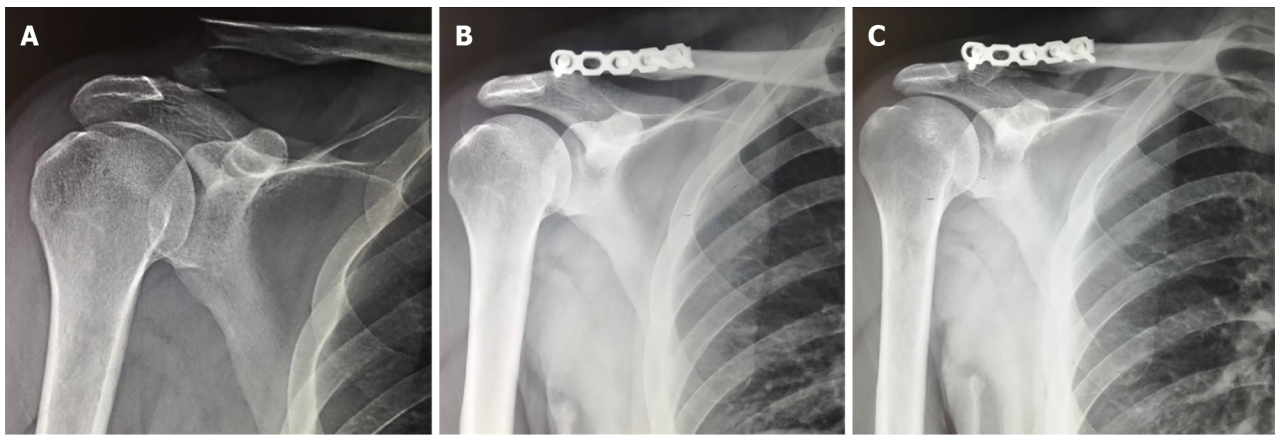
At follow-up examination after 1 year post operation, X-ray (Figure 1) showed that fracture reduction was not lost and union was achieved. At six months post operation, the patient was already pain free and back to his previous work with his right shoulder moving fully free. He felt comfortable after operation and was very satisfied with the local appearance and function in the right shoulder (Figure 3).

Case 2

At follow-up examination after 6 mo post operation, X-ray (Figure 2) showed that the reduction at the fracture site remained in good condition and the left clavicle was well healed. He was satisfied with both the local appearance and function in the left shoulder (Figure 4). He resumed most of his activities before the injury at 6 mo after the operation.

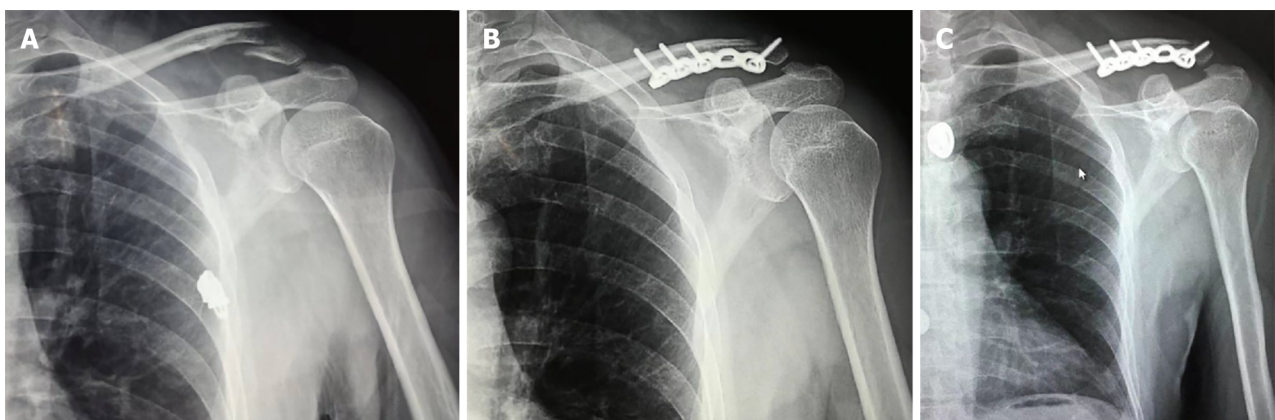
DISCUSSION

Surgical treatment of unstable distal clavicle fractures can greatly promote fracture healing and reduce related complications. Because the distal fragment of the fracture is small and flat, it is difficult to fix the fracture directly. When the plate is positioned on the superior surface of the clavicle, the screws tend to be quite short. If the number of screws at the distal fragment of the fracture is small, the fixing effect might be disturbing. Different approaches have been invented so as to strengthen the fixation effect of superior plating. For example, Kaipe *et al*[13] placed a second plate on the anterior surface of the clavicle while Yoo *et al*[14] added several cerclage wires. We made full use of the anatomical advantage of the greater anterior-posterior diameter of the distal clavicle and placed the plate on the anteroinferior surface of the clavicle, where the length of the screw at the distal fragment could be significantly much longer. With just one single screw placed at the distal fragment, the grip force increases significantly, achieving satisfactory fixing effect while there is no need to



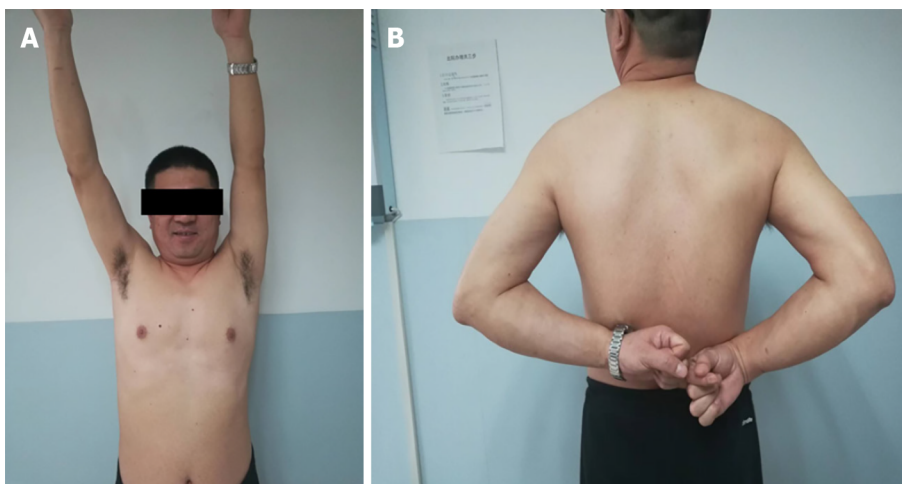
DOI: 10.12998/wjcc.v11.i30.7502 Copyright ©The Author(s) 2023.

Figure 1 Radiographic findings. A: Preoperative; B: 1 wk postoperative; C: 1 year postoperative.



DOI: 10.12998/wjcc.v11.i30.7502 Copyright ©The Author(s) 2023.

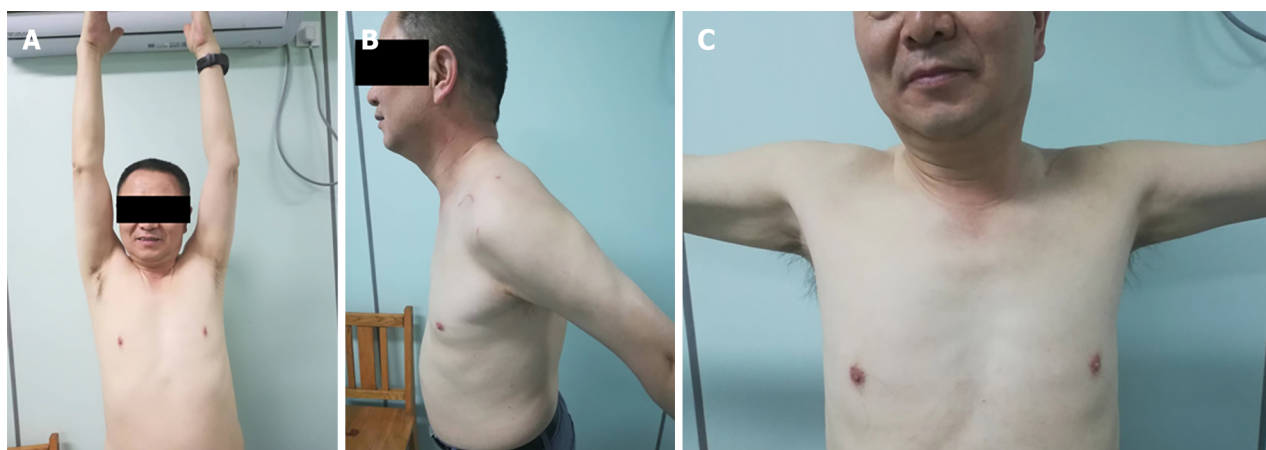
Figure 2 Radiographic findings. A: Preoperative; B: 1 wk postoperative; C: Half a year postoperative.



DOI: 10.12998/wjcc.v11.i30.7502 Copyright ©The Author(s) 2023.

Figure 3 A year postoperative, patient had satisfactory functional outcome. A: Antexion raise; B: Internal rotation.

repair the ligaments. It is also possible to fix smaller fracture fragment with our method. Anterior-inferior plating does not need to interfere with acromioclavicular joint and postoperative patients feel more comfortable. The upwarping of the proximal end of the distal clavicle fracture is the main harmful stress potentially causing fixation failure. Our method of anterior-inferior plating may prevent screw evulsion since the single anterior-posterior screw is perpendicular to the unfavorable upwarping stress. Furthermore, the screw drilling direction is upward and backward, which can potentially



DOI: 10.12998/wjcc.v11.i30.7502 Copyright ©The Author(s) 2023.

Figure 4 Half a year postoperative, patient had satisfactory functional outcome. A: Antexion raise; B: Rear protraction; C: Abduction.

reduce the damage to subclavian nerves and vessels. The anteroinferior plate is relatively well concealed and covered by soft tissues, which maximally reduces plate protrusion as well as patient's discomfort leading to less demand for plate removal. The site of surgical incision could move relatively more downward, which is also advantageous in cosmetic sense. Some of these advantages have been noticed by scholars in the treatment of midshaft clavicular fractures using anteroinferior plating method[15,16].

CONCLUSION

Based on our experience, it is feasible to treat unstable distal clavicle fractures by anteroinferior plating with a single screw placed at the distal fragment, which is simple and reliable. A long anterior-posterior screw alone could effectively control the smaller distal fragment, which, in our view, is the first. Due to the small number of cases, the effectiveness of this method awaits more observation and verification.

ACKNOWLEDGEMENTS

We thank the patients and their families.

FOOTNOTES

Author contributions: Zhao XL and Zhang YJ contributed to manuscript writing and editing, and data collection; Zhang YJ was responsible for the case report's overall organization; Liu YQ, Wang JG, and Liu YC were involved in helping to critically revise the manuscript for important intellectual content and have given final approval of the version to be published; Zhou JX and Wang BY procured the radiograph images, and labeled them; all authors have read and approved the final manuscript.

Supported by Science Foundation Project of Baotou Medical College, No. BYJJ-YF-2018006.

Informed consent statement: Informed written consent was obtained from the patient for publication of this report and any accompanying images.

Conflict-of-interest statement: All the authors declare that there are no competing interests in this study.

CARE Checklist (2016) statement: The authors have read the CARE Checklist (2016), and the manuscript was prepared and revised according to the CARE Checklist (2016).

Open-Access: This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <https://creativecommons.org/licenses/by-nc/4.0/>

Country/Territory of origin: China

ORCID number: Xin-Lei Zhao 0009-0000-2604-8246; Yi-Jun Zhang 0009-0007-8326-6152.

S-Editor: Liu JH

L-Editor: A

P-Editor: Yu HG

REFERENCES

- 1 Neer CS 2nd. Fractures of the distal third of the clavicle. *Clin Orthop Relat Res* 1968; **58**: 43-50 [PMID: 5666866]
- 2 Robinson CM, Cairns DA. Primary nonoperative treatment of displaced lateral fractures of the clavicle. *J Bone Joint Surg Am* 2004; **86**: 778-782 [PMID: 15069143 DOI: 10.2106/00004623-200404000-00016]
- 3 Nordqvist A, Petersson C, Redlund-Johnell I. The natural course of lateral clavicle fracture. 15 (11-21) year follow-up of 110 cases. *Acta Orthop Scand* 1993; **64**: 87-91 [PMID: 8451958 DOI: 10.3109/17453679308994539]
- 4 Banerjee R, Waterman B, Padalecki J, Robertson W. Management of distal clavicle fractures. *J Am Acad Orthop Surg* 2011; **19**: 392-401 [PMID: 21724918 DOI: 10.5435/00124635-201107000-00002]
- 5 Kashii M, Inui H, Yamamoto K. Surgical treatment of distal clavicle fractures using the clavicular hook plate. *Clin Orthop Relat Res* 2006; **447**: 158-164 [PMID: 16505714 DOI: 10.1097/01.blo.0000203469.66055.6a]
- 6 Tambe AD, Motkur P, Qamar A, Drew S, Turner SM. Fractures of the distal third of the clavicle treated by hook plating. *Int Orthop* 2006; **30**: 7-10 [PMID: 16235083 DOI: 10.1007/s00264-005-0019-1]
- 7 Blake MH, Lu MT, Shulman BS, Glaser DL, Huffman GR. Arthroscopic Cortical Button Stabilization of Isolated Acute Neer Type II Fractures of the Distal Clavicle. *Orthopedics* 2017; **40**: e1050-e1054 [PMID: 28968475 DOI: 10.3928/01477447-20170925-06]
- 8 Hsu KH, Tzeng YH, Chang MC, Chiang CC. Comparing the coracoclavicular loop technique with a hook plate for the treatment of distal clavicle fractures. *J Shoulder Elbow Surg* 2018; **27**: 224-230 [PMID: 29054381 DOI: 10.1016/j.jse.2017.08.017]
- 9 Hessmann M, Gotzen L, Kirchner R, Gehling H. [Therapy and outcome of lateral clavicular fractures]. *Unfallchirurg* 1997; **100**: 17-23 [PMID: 9132949 DOI: 10.1007/s001130050090]
- 10 Tiefenboeck TM, Boesmueller S, Binder H, Bukaty A, Tiefenboeck MM, Joestl J, Hofbauer M, Ostermann RC. Displaced Neer Type IIB distal-third clavicle fractures-Long-term clinical outcome after plate fixation and additional screw augmentation for coracoclavicular instability. *BMC Musculoskelet Disord* 2017; **18**: 30 [PMID: 28114982 DOI: 10.1186/s12891-017-1398-3]
- 11 Nandra R, Kowalski T, Kalogrianitis S. Innovative use of single-incision internal fixation of distal clavicle fractures augmented with coracoclavicular stabilisation. *Eur J Orthop Surg Traumatol* 2017; **27**: 1057-1062 [PMID: 28540473 DOI: 10.1007/s00590-017-1977-x]
- 12 Kwak SH, Lee YH, Kim DW, Kim MB, Choi HS, Baek GH. Treatment of Unstable Distal Clavicle Fractures With Multiple Steinmann Pins-A Modification of Neer's Method: A Series of 56 Consecutive Cases. *J Orthop Trauma* 2017; **31**: 472-478 [PMID: 28876271 DOI: 10.1097/BOT.0000000000000850]
- 13 Kaipel M, Majewski M, Regazzoni P. Double-plate fixation in lateral clavicle fractures-a new strategy. *J Trauma* 2010; **69**: 896-900 [PMID: 20093980 DOI: 10.1097/TA.0b013e3181bedf28]
- 14 Yoo JH, Chang JD, Seo YJ, Shin JH. Stable fixation of distal clavicle fracture with comminuted superior cortex using oblique T-plate and cerclage wiring. *Injury* 2009; **40**: 455-457 [PMID: 19100545 DOI: 10.1016/j.injury.2008.05.028]
- 15 Hulsman MH, van Heijl M, Houwert RM, Timmers TK, van Olden G, Verleisdonk EJ. Anteroinferior vs superior plating of clavicular fractures. *J Shoulder Elbow Surg* 2016; **25**: 448-454 [PMID: 26671776 DOI: 10.1016/j.jse.2015.09.005]
- 16 Baltes TPA, Donders JCE, Kloen P. What is the hardware removal rate after anteroinferior plating of the clavicle? A retrospective cohort study. *J Shoulder Elbow Surg* 2017; **26**: 1838-1843 [PMID: 28478898 DOI: 10.1016/j.jse.2017.03.011]



Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

Telephone: +1-925-3991568

E-mail: bpgoffice@wjgnet.com

Help Desk: <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

