International Journal of Surgery Case Reports 88 (2021) 106538

Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.elsevier.com/locate/ijscr

Case report

# Intramedullary headless compression screw fixation for midshaft fractures of the clavicle: A case report study

Mohamed Hamdi Elgawadi *, Ahmed Galal Sharafeldin

*Orthopedic Department, Mouwasat Hospital, Dammam, Saudi Arabia*

ARTICLE INFO

*Keywords:*
Clavicle-headless-intramedullary-screw-compression-midshaft

ABSTRACT

Historically, displaced midshaft clavicle fractures have been managed conservatively. However, recent literature has supported operative management of displaced and shortened clavicle fractures. Several options exist for surgical fixation, including plating and intramedullary (IM) fixation. IM fixation has the potential advantages of a smaller incision and decreased dissection and soft-tissue exposure and less prominent hardware.

Rockwood and Hagie pins represented the most popular form of IM fixation during the last two decades,but concerns exist regarding stability and complications. The use of alternative IM implants, such as Kirschner wires, titanium elastic nails, and cannulated screws, also has been described in limited case series. However, concerns persist regarding the complications associated with the use of these implants, including implant failure, migration, skin complications, prominent screw head and construct stability. Our technique describes intramedullary fixation of midshaft clavicle fractures using a single headless compression screw (HCS) 4.5–6.5-mm. which is simple, affordable, and allows intramedullary compression, stability, load sharing, little periosteal stripping, very limited skin incision and rapid recovery after surgery.

## 1. Introduction

Midshaft clavicle fractures are among the most common skeletal injuries, and they are usually treated conservatively [1]. Absolute indications of surgical treatment include cases with open fractures, vascular compromise, progressive neurological deficit and cases with floating shoulder. Other relative indications include cases with polytrauma, shortening or displacement more than 2 cm, impending skin disruption, intolerability of the patient to prolonged conservative treatment, and symptomatic non-union.

Surgical procedures include intramedullary pinning with Kirschner wires, Rush pins, Knowles pins, Steinmann pins, Hagie pins, elastic stable intramedullary nails, external fixation, and compression plating [2,3]. Each method has its pros and cons.

In this study we describe a technique of open intramedullary fixation of recent midshaft clavicular fractures using a 4.5 headless compression screw.

## 2. Case report

Between July 2020 and October 2020, surgery was undertaken on 2 fresh midshaft clavicular fractures in 2 consecutive patients as a prospective study. Both fractures were the result of fall with direct impact to the shoulder. All patients gave informed consent for inclusion in the study. They were 2 male patients aged 29 and 15 years old with right sided fractures in right handed patients with no past medical or surgical history and no drug allergies. All fractures were closed, one fracture was comminuted with single butterfly fragment and the other was simple transverse.

Surgery was performed the next day for both cases. The main indications for surgery are intolerability to conservative treatment in active patients having their fractures displaced 1.5–2 cm and rejecting prolonged immobilisation.

For the operative technique, the patient is placed supine semisitting with a folded towel under the affected shoulder. An incision 2 cm long is made over the fracture. Exposure of the fracture is made with the least soft tissue dissection. The medial fragment is delivered out of the wound and drilled with a 3.2 mm drill bit from the fracture site until a cortical resistance is encountered. The lateral fragment is delivered out of the wound and drilled with a 3.2 mm drill bit from the fracture site and directed posterolateral until its tip perforates the posterior cortex and can be felt beneath the skin. Each fragment is tapped separately with 4.5

* Corresponding author at: 10 Zahawy Street, Nasr City, Cairo, Egypt.
*E-mail address:* dr.m.gawadi82@gmail.com (M.H. Elgawadi).

https://doi.org/10.1016/j.ijscr.2021.106538
Received 25 August 2021; Received in revised form 17 October 2021; Accepted 19 October 2021
Available online 22 October 2021

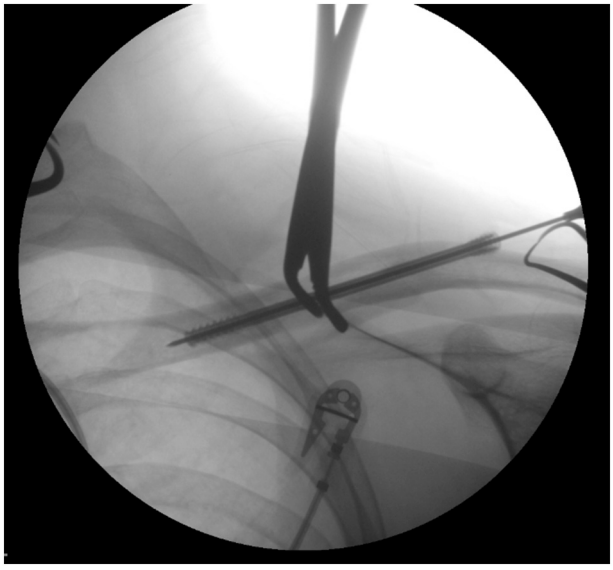

**Fig. 1.** Intraoperative flourscopy showing insertion of the screw on guide wire from posterolateral to anteromedial while holding the reduction with clamp.


**Fig. 2.** Clinical photograph showing the small incision utilized over the fracture site with a puncture wound for screw insertion posterolateral.

mm tap and its length is measured independently, average medial length was 30 mm and the lateral length was 60–65 mm, the total screw length was (85 and 80 mm). A stab incision is then made over the protruding tip posterolateraly. The screw is then introduced from the hole in the posterior aspect of the lateral fragment over the guide wire and advanced into the lateral fragment, then into the medial fragment after reducing the fracture and holding it with a small bone holding forceps (Fig. 1).

Compression across the fracture site is seen clearly after the threads traverse into the medial fragment. In comminuted case the butterfly fragment is kept undisturbed with its soft tissue attachment and circlaged with absorbable strong vicryl suture no 2.

5 CC cancellous chips was added for the comminuted fracture.

The wounds are closed after meticulous haemostasis with intradermal suturing for better scar which is desired in such cases. Cosmesis is considered an advantage of this procedure and is desired specially if the case was female (Fig. 2). Operative time ranged between 25 and 35 min for a single fracture, with minimal blood loss.

The arm is held in a sling for one week after surgery and then light daily activities are allowed. Patients are discharged the next day.

Patients are discouraged from driving, heavy lifting or raising the arm above their heads until bony union is apparent.

Radiographs are taken every two weeks until union was apparent by six to eight weeks in both cases in the form of a bridging superior and inferior callus around the fracture, and then at six months. The follow-up period was 9 months for the comminuted case and 7 months for the simple case (Figs. 3, 4).

Quick DASH score done at 2 months were 22.7 and 25 and score done at 6 months were 11.4 and 13.6.

Neither superficial nor deep infection was noticed. Change of screw position was not encountered in any case, the heads of the screws were not prominent.

This work has been reported in line with the SCARE 2020 criteria [4].

## 3. Discussion

Midshaft clavicular fractures are usually treated conservatively, and some may require internal fixation. Plating has many advantages, including rotational stability and ability to restore the normal clavicle length. However, plating has several complications, including infection, plate breakage, nonunion, a large exposure required for fixation and removal, and refracture after plate removal [5,6].

External fixation preserves the internal environment around the fracture, but for clavicular fractures it is cumbersome in addition to its cost and the almost inevitable complication of pin tract infection.

There have been many reports [6,7] intramedullary fixation with wires and pins and partially threaded screws.

High rates of union and low disability scores were recorded in most cases, but these methods lack some important features which are fulfilled in our study:

- They do not possess a lag effect as an integral part of their design.
- Prominent screw head as the partially threaded cancellous screw.
- Some results are complicated by occasional migration through skin with subsequent infection and loss of fixation, or more serious migration into vital organs [6,7].
- Lastly, limited cosmetic scar which is desirable in such cases specially if the case was female.

Our method has the advantages of intramedullary fixation, with less surgical trauma to soft tissues than plating, the screw is load sharing Screw removal would require a small incision.

Rotational instability is theoretically a disadvantage of intramedullary fixation of the clavicle, and this might be true with wires, while in our method, the fixation was stable enough to hold anatomical reduction in all directions intraoperatively, and there was no change in screw position at follow-up. The reason may be the three-point fixation

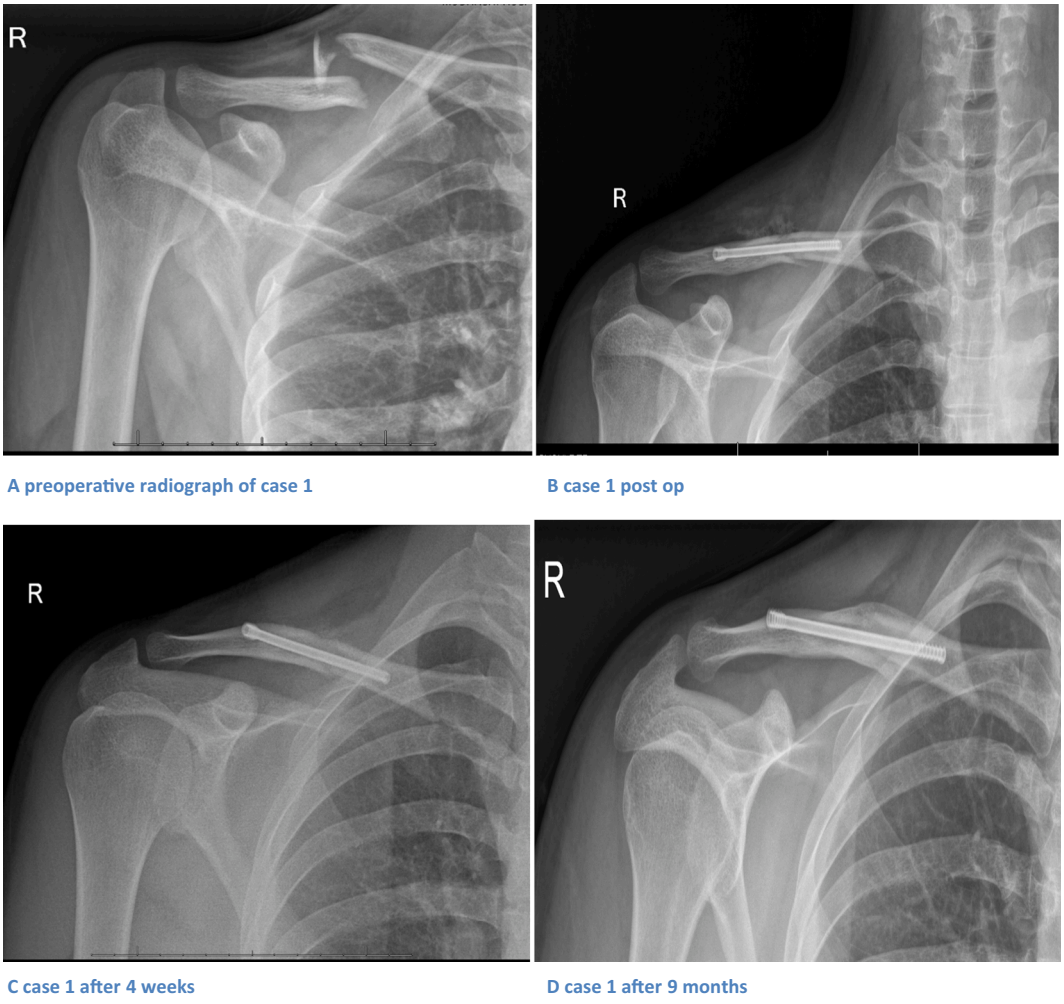


**Fig. 3.** Case 1 radiographs.

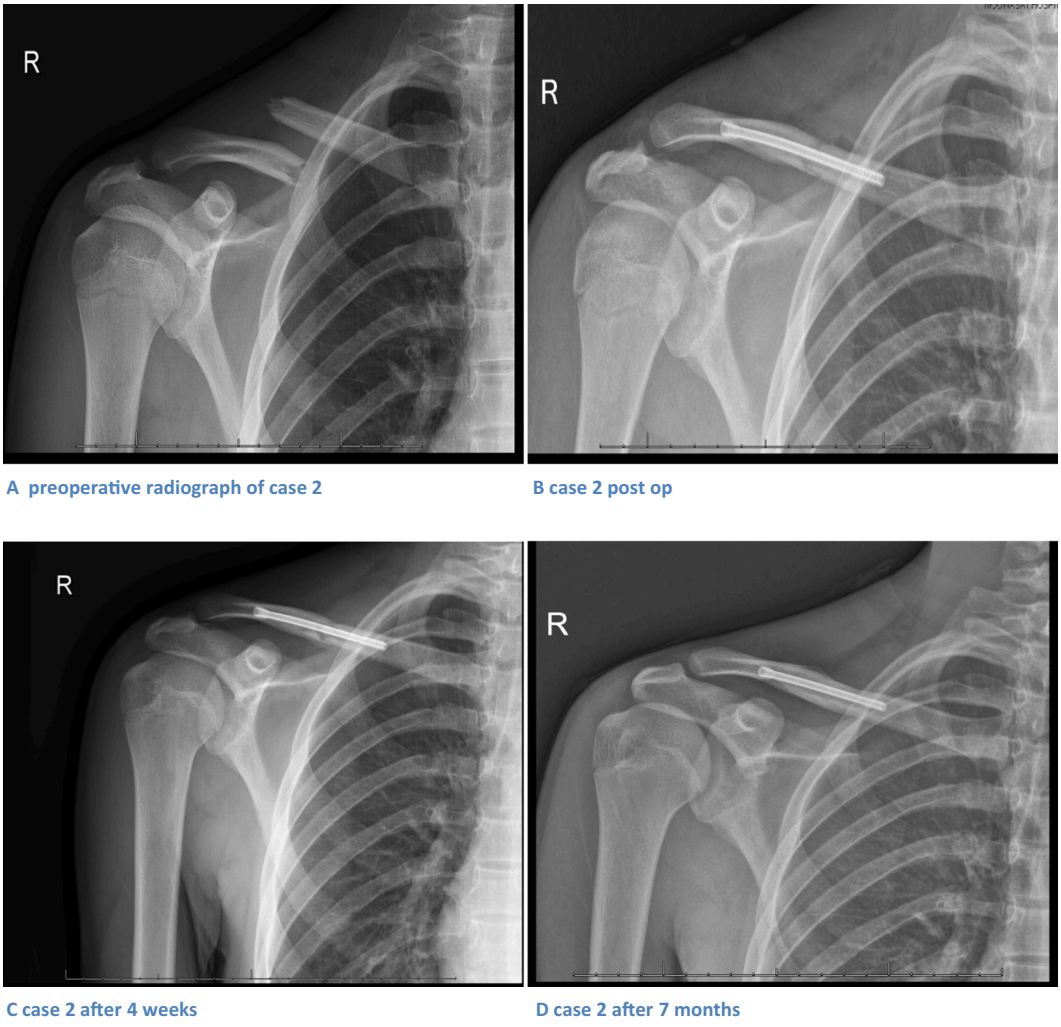


**Fig. 4.** Case 2 radiographs.

offered by the curvature of the bone, the relatively large diameter of the screw that almost fills the medullary cavity, in addition to the intramedullary compression applied by the lag effect of the compression screw.

Also the 6.5 mm diameter screws can be used in larger diameter clavicles.

## 4. Conclusion

The technique of intramedullary headless compression screw is simple, affordable. It allows intramedullary compression, stability, load sharing, little periosteal stripping, very limited skin incision and rapid recovery after surgery.

## Funding

No other funding sources.

## Ethical approval

Not applicable.

## Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

## Registration of research studies

Not applicable.

## Guarantor

The corresponding author.

## Provenance and peer review

Not commissioned, externally peer-reviewed.

## Declaration of competing interest

The author and co-author have nothing to disclose.

Source of support in the form of grants, equipment, or other items: “none”.

Financial remuneration the authors, or any member of their family, may have received related to the subject of the article: “none”.

Institutional Review Board approval: “not applicable”.

## References

[1] Nonoperative treatment compared with plate fixation of displaced midshaft clavicular fractures. A multicenter, randomized clinical trial, J Bone Joint Surg Am. 89 (1) (2007), https://doi.org/10.2106/JBJS.F.00020, 1-10.
[2] Vinzenz Smekal, Alexander Irenberger, Peter Struve, Markus Wambacher, Dietmar Krappinger, Franz Sebastian Kralinger, Elastic stable intramedullary nailing versus nonoperative treatment of displaced midshaft clavicular fractures-a randomized, controlled, clinical trial, J. Orthop. Trauma 23 (2) (2009) 106–112, https://doi.org/10.1097/BOT.0B013E318190CF88.
[3] A. Khalil, Intramedullary screw fixation for midshaft fractures of the clavicle, Int. Orthop. 33 (5) (2009) 1421, https://doi.org/10.1007/S00264-009-0724-2.
[4] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, for the SCARE Group, The SCARE 2020 guideline: updating consensus Surgical CAse REport (SCARE) guidelines, Int. J. Surg. 84 (2020) 226–230.
[5] O. Böstman, M. Manninen, H. Pihlajamäki, Complications of plate fixation in fresh displaced midclavicular fractures, J Trauma. 43 (5) (1997) 778–783, https://doi.org/10.1097/00005373-199711000-00008.
[6] L. Pc, H. Ch, C. Jc, L. Cc, C. Cy, C. Sh, Infection after surgical reconstruction of a clavicle fracture using a reconstruction plate: a report of seven cases, Kaohsiung J. Med. Sci. 24 (1) (2008) 45–49, https://doi.org/10.1016/S1607-551X(08)70073-1.
[7] J. Leppilahti, P. Jalovaara, Migration of Kirschner wires following fixation of the clavicle-a report of 2 cases, Acta Orthop. Scand. 70 (5) (1999) 517–519, https://doi.org/10.3109/17453679909000992.