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Bipolar fracture dislocation of clavicle: A report of osteosynthesis and early soft tissue reconstruction



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ABSTRACT

INTRODUCTION: Bipolar dislocation of the clavicle, also called bifocal or pan-articular dislocation or floating clavicle, is an uncommon traumatic injury. The injury of this case is also concomitant with distal third clavicle and coracoid fracture. This article aimed to report the experience of performing osteosynthesis and early soft tissue reconstruction on these injuries.

CASE REPORT: We reported a case of bipolar clavicle fracture-dislocation in concomitant with coracoid fracture in a man, aged 32 years old, successfully treated 24 days after accident by fixation of both fractures and early simultaneous reconstruction of sternoclavicular-acromioclavicular-coracoclavicular joints.

DISCUSSION: These injuries are rare and capable of causing many complications if they are treated improperly. It is compulsory to carefully assess any fractured clavicle along its whole length, both clinically and radiologically. Various options, from non-operative to operative, have been reported to manage such of these cases. Early bony fixation and soft tissue reconstruction can correct the alignment of clavicle and recover the function of sterno-clavicular and acromio-clavicular-joints promptly.

CONCLUSION: Fracture osteosynthesis and early soft tissue reconstruction can be regarded as an option treatment for bipolar fracture-dislocation of the clavicle to facilitate prompt treatment and early rehabilitation.

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1. Introduction

Bipolar fracture-dislocation of the clavicle, under the term of distal third clavicle fracture with separation of both clavicle ends (sternoclavicular (SC) and acromioclavicular (AC) joints), are uncommon traumatic injuries. The simultaneous dislocation of both ends of this long bone is commonly seen as a result of a major trauma acting through an indirect mechanism, like a violent blow on the lateral aspect of the shoulder or heavy pressing together of the shoulders in combination with a torsion of the trunk. The position of the arm in relation to the trunk and the intensity of the force probably govern the resulting lesion [1].

The common feature is a primary anterior dislocation of the medial end of the clavicle (presteral luxation) and a posterior dislocation of the acromial end. The coracoclavicular ligament behaves like a fulcrum and may be ruptured or not [1,2]. A concomitant fracture of coracoid was rarely reported.

These circumstances could be catastrophic to the patient. The separation of the SC- AC joints and fracture of the clavicle could dis-

connect trunks and the affected upper extremity. The shoulder did not have any fulcrum to perform its function as a ball-socket joint. Further disruption of the sternoclaviculoscapular linkage could also cause scapular instability that could create prolonged pain, weakness, and deformity [3].

Few articles reported about the management of this bipolar dislocation of the clavicle. Due to the scarce number of published cases have made their treatment still controversial.

This article aimed to report the experience of performing osteosynthesis and early soft tissue reconstruction of the clavicle bipolar fracture dislocation in concomitant with coracoid fracture. The presented case has been reported in line with the SCARE criteria [4].

2. Case report

A 32-year-old male, with no significant medical-surgical history, was brought to the emergency department in Dr. Hasan Sadikin Teaching Hospital, Bandung, West Java, Indonesia, as a result of motor vehicle accident (MVA). The patient had chief complaints of pain, swollen right shoulder joint (patient's hand dominance) and pain in the back especially upon inspiration. There were no history of alcohol and any drug consumption. On the clinical examination, he demonstrated swelling, deformity, and tenderness over

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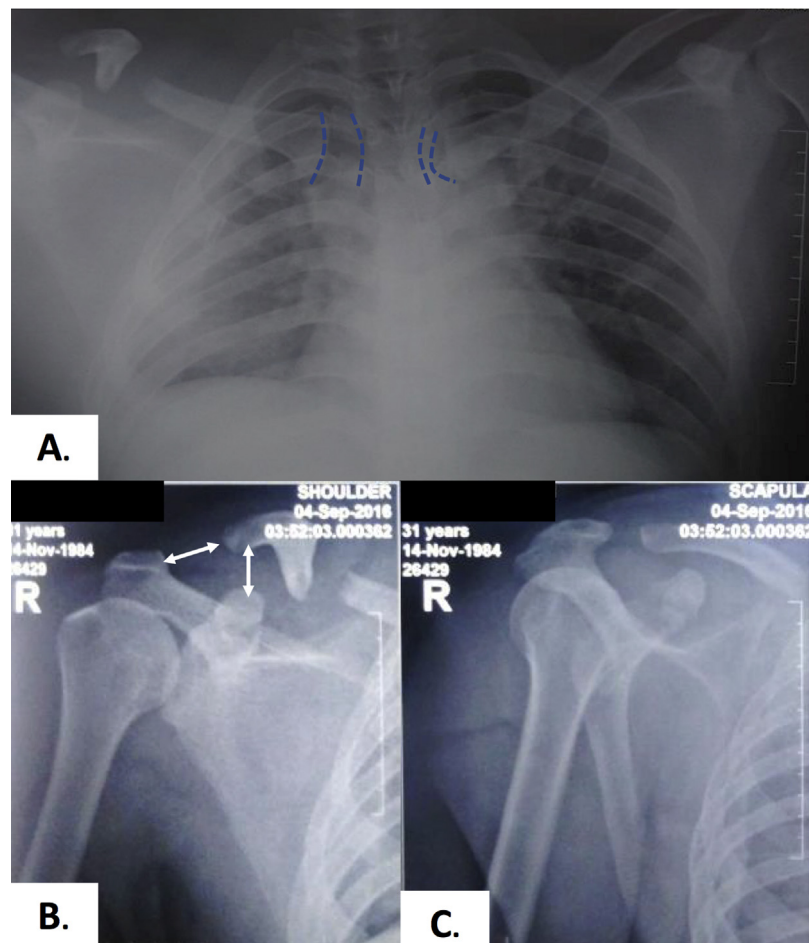


Fig. 1. Pre-Operative X-Ray Examination (A). Chest X-Ray Anterior-Posterior showed the widening Right sterno-clavicular joint and bone discontinuity of distal third right clavicle complete displaced, (B). Shoulder True AP X-Ray showed the widening of right acromio-clavicle and coracoclavicle distance. (C) Shoulder Scapular Y View X-Ray.

the anterolateral part of the shoulder, accompanied by a painful range of motions in all directions.

A review of the radiographic imaging was performed. There was a widening of the right SC joint, compared to the opposite side, the right AC joint separation Rockwood type V. Bone discontinuities of distal third clavicle Allman type II group IIB, coracoid Kuhn type II (Fig. 1), and the 1st, 2nd, 3rd, and 4th posterior aspect of right ribs were also demonstrated. Conventional serial chest X rays were taken to observe any lung contusion.

The affected upper extremity injury was immobilized under the arm sling and we planned to perform osteosynthesis for the fractures and open reduction-early soft tissue reconstruction for the dislocation of the SC-AC joints to promote early rehabilitation. Due to insurance problems and family agreement, the operation could only be performed 23 days after the injuries occurred.

Furthermore, the surgical procedure was performed by senior shoulder surgeon (HN), and shoulder fellowship trained surgeon (RP) in the beach-chair position with the hip flexion 60°, and the patient's position far lateral on the operating table to allow arm extension to facilitate exposure and mobilization of the shoulder for scapula reduction to the clavicle. We used the direct extension clavicle approach to expose the clavicle fracture, SC joint, AC joint, and coracoid process. After the deltotracheal fascia was then elevated as a full thickness flap, we identified the fracture site, removed the fibrotic tissue and performed fracture reduction and fixation, using a one compression screw and reconstruction plate as a neutralizing plate. We tried to preserve the soft tissue as much as possible to pro-

mote bone healing. After we succeeded in fixing a clavicle in one unit, we continued to reconstruct the SC- AC joint simultaneously.

We harvested graft from a semitendinosus tendon with several reasons, such as simplification of the patient's positioning, limited donor site morbidity, decreased operative time, and adequate graft tissue size. We obtained the semitendinosus graft size 280 mm × 4.5 mm. Then, preparation of the graft was performed. The graft was divided in two purposes; 170 mm × 4.5 mm for the AC joint reconstruction, and 110 mm × 4.5 mm for the SC joint reconstruction. Preparation was continued to the graft pre-tensioning.

In this case, the preferred technique was figure-of-eight SC joint soft tissue reconstruction. We exposed the SC joint with preservation of the periosteal sleeve and then removed the fibrotic tissue around the joint. Drill holes were created in both clavicle and manubrium sternum. Suture passers were used to facilitate graft passage and secured with multiple no 2 the braided non-absorbable suture materials.

Moreover, the incision was extended laterally, resembled to saber incision to expose coracoid fracture. Then, we identified the coracoid fracture line, reduced and fixated it with compression screw and washer. Placement of the clavicle bone tunnels for AC-CC reconstruction reproduced their anatomical relation to the distal clavicle. The first guide pin for reconstructing the coracoid ligament was placed on the 45-mm medial from the distal clavicle and posterior to midline clavicle in coronal plane. The second guide pin for reconstructing the trapezoid ligament was placed on the 20-mm medial from the distal clavicle and frontal to midline clavicle in coronal plane. Then, we reamed the tunnels with similar size

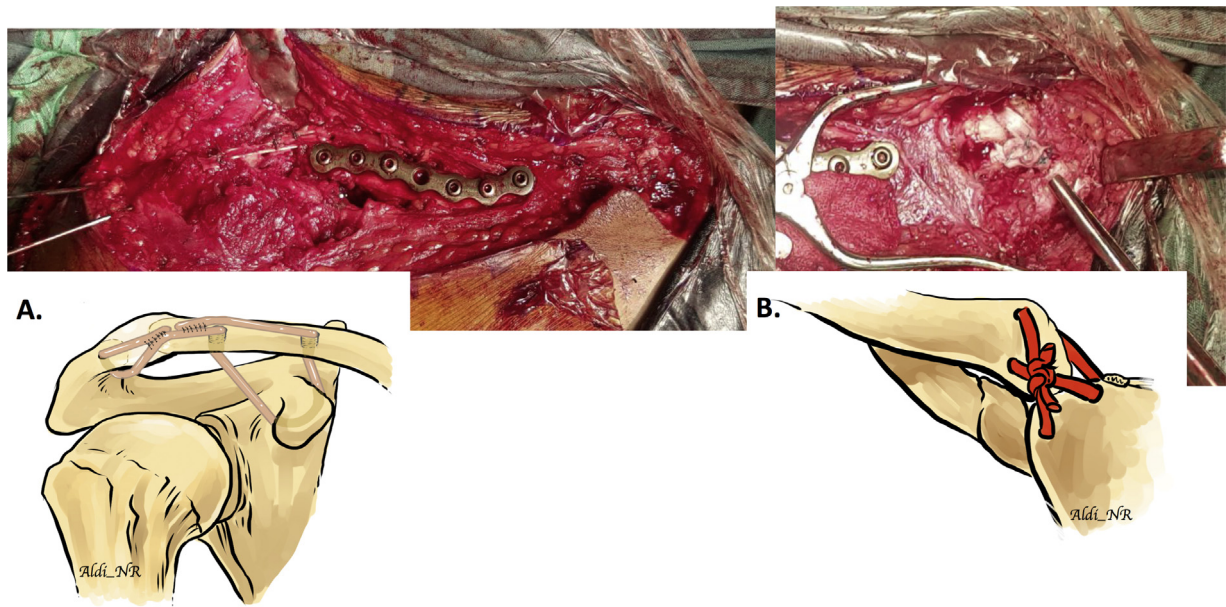


Fig. 2. Pictures demonstrating intra-operative procedure and illustration during A. AC joint soft tissue reconstruction and osteosynthesis distal clavicle fracture B. SC joint soft tissue reconstruction.

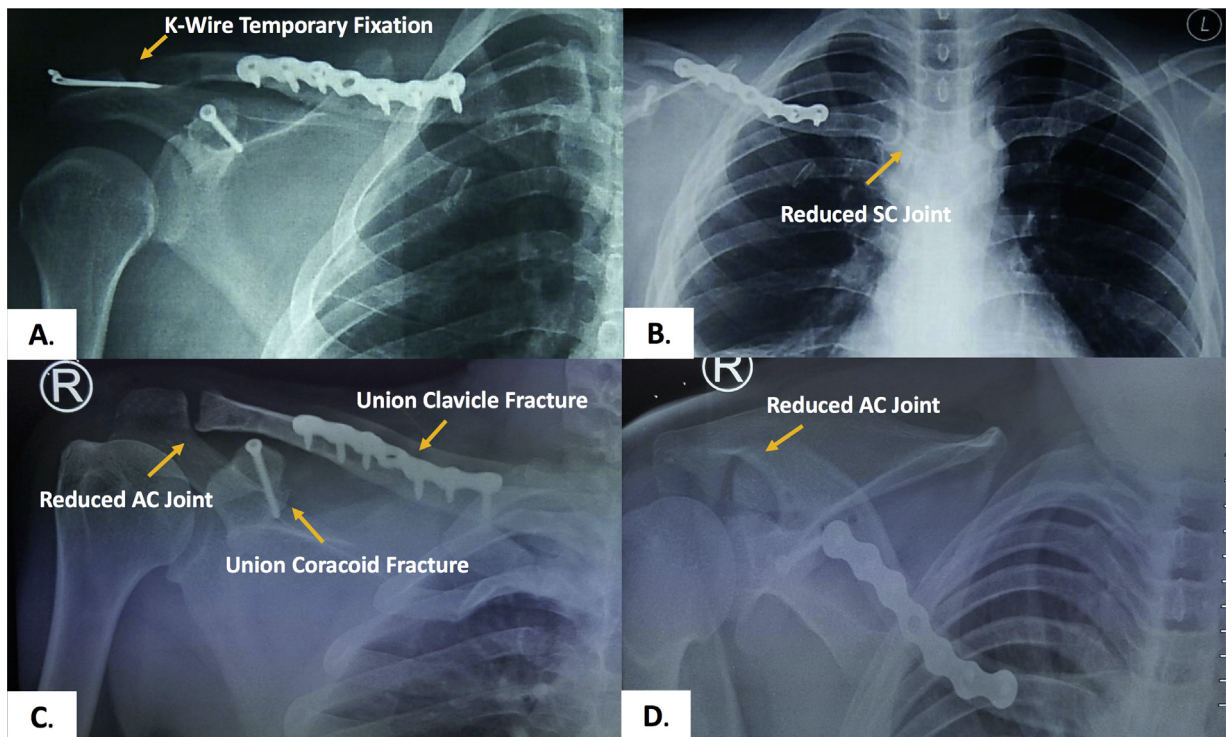


Fig. 3. Post-Operative X ray. (A) Immediate Shoulder Anterior-Posterior (AP) X-Ray (B) 6-months post –operative Chest X-Ray (C) 6-months post-operative Shoulder AP X-Ray (D) 6-months-post-operative Zanca View X-Ray.

to the diameter of the graft. The shuttle suture was passed under-surface of the coracoid process and brought through the tunnels, using the suture passer. The graft, then, was inserted using the shuttle suture with the configuration as shown on the illustration (Fig. 2). The graft was knotted and fixed under reduction of the AC joint, maintained by the blunt device. The graft was arranged so that the remaining length of the graft could be lateralized to augment the superior capsule repair of the AC joint. The two parallel Kirschner wires were inserted from the acromion to the distal

clavicle to maintain anteroposterior alignment (Fig. 2). The delto-trapezial fascia closure was an imminent step. The large fascia flap was closed tight with interrupted non-absorbable suture. The deep dermal layer was closed with buried 3.0 absorbable sutures and a running subcuticular stitch was used for skin closure.

The Kirschner wire was removed three weeks postoperatively. During the first 4–6 weeks, the patient wore an abduction brace to protect the surgical repair against the pull of the gravity. The brace might be removed for grooming and supine- passive range of

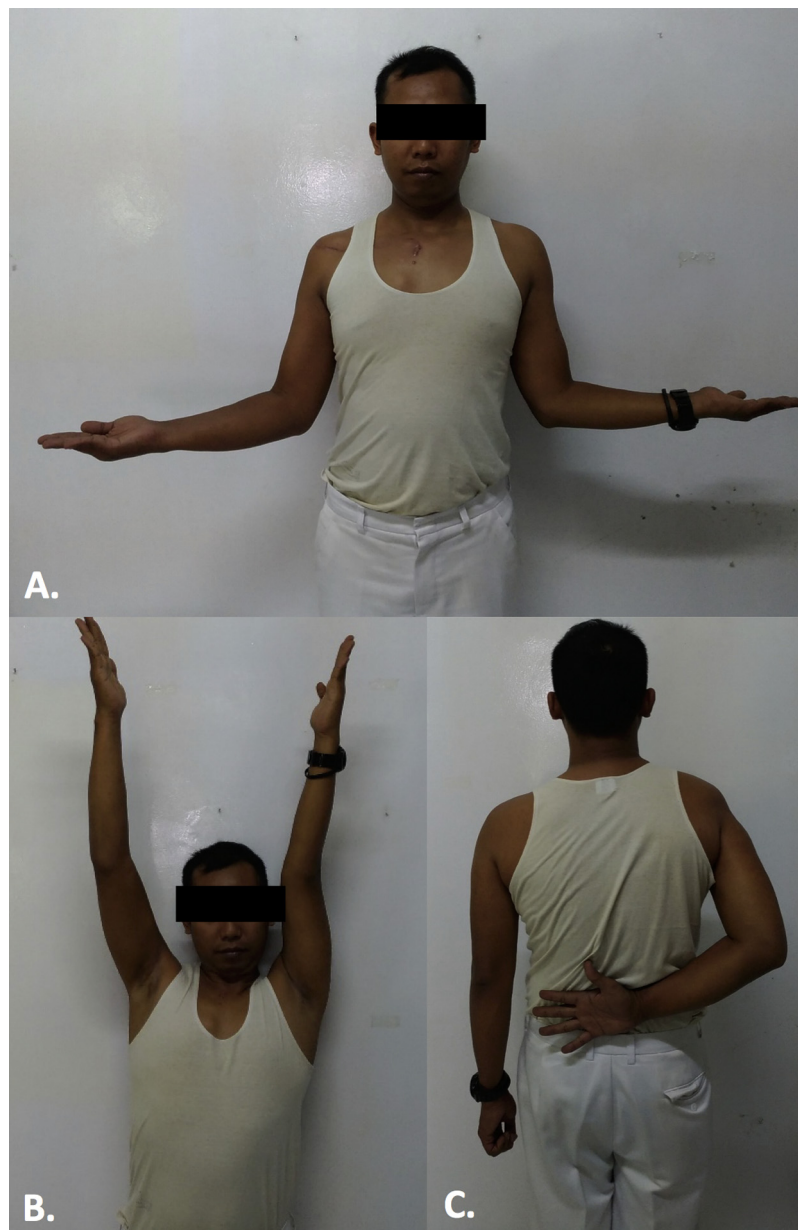


Fig. 4. Range of Motion Examination 6 months after operation A. External Rotation of Shoulder Joint B. Elevation of Shoulder Joint C. Internal Rotation of Shoulder Joint.

motion exercises especially abduction and external rotation gradually of the shoulder joint to prevent stiffness. After 6–8 weeks, the graft had obtained the stability to begin with upright range of motion. After 3 months, strengthening exercise was begun. Weight training might begin after 3–5 months postoperatively.

When he presented to us 6 months after surgery, he had no deformity over the clavicle, and no functional disability. He did not feel any night pain and consume any pain killer. He was able to perform daily activity as usual. Plain radiographs at final follow-up showed a reduced SC and AC joints with union of the lateral end of clavicle fracture (Fig. 3). We also evaluated SC joint integrity, using serendipity view, and AC joint integrity, using axillary view (Fig. 3). ASES (American Shoulder and Elbow Surgeon) score at 6-months follow-up was good outcome (84/100) and the range of motion in the shoulder was normal with full range of abduction, elevation, and rotations (Fig. 4). We evaluated that there was no winged scapula, which probably could be caused by the sternoclavicle-scapular linkage disruption (Fig. 5).

3. Discussion

Bipolar fracture dislocations of the clavicle are rare, and there has been no definitive incidence of these injuries reported in the literatures. Since the previous description by Porral in 1831, only a handful of individual case reports and the case series of Beckman and Sanders et al. have been reported in the literature [5–7].

As bipolar injury of the clavicle is a rarity, there is not much evidence-based literature on the best method of treatment. Treatment modalities include non-surgical options such as attempts at reduction and the use of a plaster cast, figure of eight harness, and arm slings [8–10]. Furthermore, surgical treatment includes the use of Kirschner wires and screws, hooked plates, reconstruction plates, tension bands, and ligamentous reconstruction [1,11,12].

Non-operative treatment on the bipolar dislocation was followed by re-subluxation, residual deformity, persistent pain in lateral end, and weakness of the affected shoulder joint. Nevertheless, several literatures stated that the range of motion can be

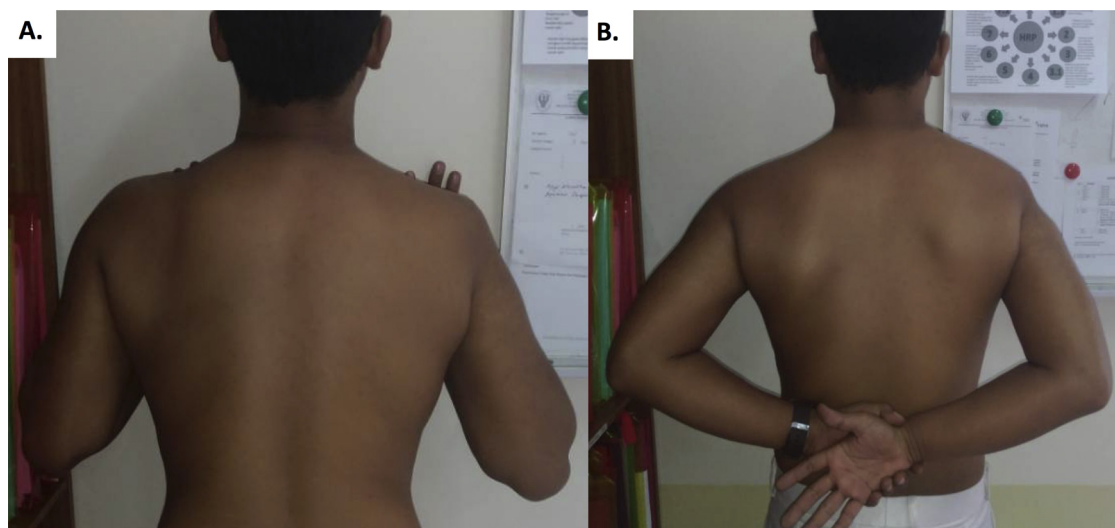


Fig. 5. No Right Winged Scapula 6 months after surgery.

obtained in satisfactory range. [9] Operative treatment, reported in several publications, gave intraoperative complications, risk of possible re-dislocation or loss of reduction, and post-operative devices/implant failure.

In the case of our patient, surgery was the only remaining alternative for reducing completely displaced distal third clavicle fracture Allman type II group IIB, coracoid process fracture Kuhn type II, and AC joint separation Rockwood type V. Based on these circumstances, it was necessary to perform open reduction-internal fixation of distal third clavicle and coracoid process, followed by open reduction- soft tissue reconstruction of the SC and AC joints sub-sequentially. The aim of the simultaneous open correction was also to prevent their re-dislocation as well as those late sequelae. We chose to perform directly to early soft tissue reconstructions for SC and AC joints to reduce Kirschner wire temporary fixation duration, prevent re-dislocation of the joints when stability and healing were obtained by the graft, and promote early rehabilitation to obtain satisfactory range of motions and clinical outcomes. Anatomic reconstruction is the key to achieve success and good functional outcome in bipolar fracture- dislocation as seen in various ligament reconstruction surgeries and joint restoration surgeries.

4. Conclusion

Fracture osteosynthesis and early soft tissue reconstruction for bipolar fracture-dislocation of the clavicle can be regarded as an option to facilitate prompt treatment and early rehabilitation. We believe fracture osteosynthesis and early soft tissue reconstruction should be offered to young patients especially in cases with high physical demands.

Conflict of interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

Sources of funding

The authors declare that sponsors had no such involvement.

Ethical approval

The patient received an explanation of the procedures and possible risks of the surgery, and gave written informed consent.

Consent

The patient received an explanation of the procedures and possible risks of the surgery, and gave written informed consent.

Author contribution

Renaldi Prasetia (RP) contributed to perform the operation, to collect, to analyze data, to draft manuscript, to create illustration and to approve for publishing

Hermawan Nagar Rasyid (HNR) contributed to perform the operation, to collect, to analyze data, to revise the manuscript and to approve for publishing.

Guarantor

Guarantor in this study are Hermawan Nagar Rasyid (HNR).

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References

- [1] Rafaella Scapinelli, Bipolar Dislocation of The Clavicle. 3D CT imaging and delayed surgical correction of a case, *Arch. Orthop. Trauma Surg.* 124 (2004) 421–424.
- [2] F. Cook, M. Horowitz, Bipolar clavicular dislocation, *J. Bone Joint Surg. Am.* 69 (1987) 145–147.
- [3] H.N. Rasyid, T. Nakajima, K. Hamada, H. Fukuda, Winging of the scapula caused by disruption of sternoclavicular linkage: report of 2 cases, *Shoulder Elbow Surg.* 9 (2000) 144–147.
- [4] R.A. Agha, A.J. Fowler, A. Saetta, I. Barai, S. Rajmohan, D.P. Orgill, SCARE Group, The SCARE statement: consensus-based surgical case report guidelines, *Int. J. Surg.* 34 (2016) 180–186.
- [5] M.A. Porral, Observation d'un double luxation de la clavicule droite, *Le Journal de Médecine et de Chirurgie Pratique* 2 (1831) 78–82.

- [6] T. Beckman, A case of simultaneous luxation of both ends of the clavicle, *Acta Chir. Scand.* 56 (1924) 156–163.
- [7] J.O. Sanders, F.A. Lyons, C.A. Rockwood Jr., Management of dislocations of both ends of the clavicle, *J. Bone Joint Surg. A* 72 (3) (1990) 399–402.
- [8] F. Gearenand, W. Petty, Panclavicular dislocation, *J. Bone Joint Surg. A* 64 (3) (1982) 454–455.
- [9] D.O. Eni-Olotu, N.J. Hobbs, Floating clavicle – simultaneous dislocation of both ends of the clavicle, *Injury* 28 (4) (1997) 319–320.
- [10] A.S. Jain, Traumatic floating clavicle: a case report, *J. Bone Joint Surg. B* 66 (4) (1984) 560–561.
- [11] A.J. Arenas, T. Pampliega, J. Iglesias, Surgical management of bipolar clavicular dislocation, *Acta Orthop. Belg.* 59 (2) (1993) 202–205.
- [12] A. Schuh, C.N. Onse, T. Schmickal, L. Kleine, Operative treatment of bipolar clavicular dislocation: a case report, *J. Orthopaedic Case Rep.* 2 (2) (2012) 21–23.

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