

Case Report

Refracture of a malunited clavicle: angular deformity as an under-recognized biomechanical risk factor

Lalit Panchal, Sagar Bagwe*, Bhushan Rathod, Akash Ambhore

Department of Orthopaedics, Fortis SL Raheja hospital, Mumbai, Maharashtra, India

Received: 24 January 2026

Accepted: 20 February 2026

***Correspondence:**

Dr. Sagar Bagwe,

E-mail: Bagwesv@Gmail.Com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Angular deformity in clavicle fractures is often considered acceptable in adults when displacement and significant shortening are absent. However, altered biomechanics resulting from angular malunion may predispose to refracture. We report a 40-year-old male with a previously malunited clavicle fracture treated non-operatively who sustained a refracture following minor trauma. After failure of conservative management, open reduction and internal fixation with a clavicular reconstruction plate was performed. This case highlights angular malunion as an under-recognized biomechanical risk factor for clavicle refracture in adults and suggests that angular deformity should be considered during initial fracture assessment.

Keywords: Clavicle fracture, Malunion, Refracture, Angulation, Biomechanics

INTRODUCTION

Management of midshaft clavicle fractures has evolved over the past two decades, with increasing evidence supporting operative fixation in selected adult patients.¹⁻³ Established surgical indications include complete displacement, shortening greater than 2 cm, comminution, and skin compromise. Isolated angular deformity without displacement is frequently managed conservatively.

Pediatric studies have demonstrated higher refracture rates in angulated clavicle fractures compared to completely displaced fractures.⁴ Angular deformity alters clavicular length and load transmission across the sternoclavicular and acromioclavicular joints, leading to altered biomechanics and reduced shoulder strength.⁵⁻⁷ Adult data addressing refracture following angular malunion remain limited, making this case clinically relevant.

CASE REPORT

A 40-year-old healthy male presented with right shoulder and clavicular pain following a fall with direct lateral

impact. He reported a previous right clavicle fracture at the age of 28 years that had been treated non-operatively. Although he returned to daily activities, he experienced intermittent pain and reduced shoulder strength.

Radiographs revealed a refracture of the right clavicle adjacent to a previous angular malunion, with shortening compared to the contralateral side (Figure 1). Initial treatment consisted of immobilization using an arm sling for five weeks. Due to persistent pain and absence of radiological signs of union, surgical intervention was planned.

Through a standard anterior approach, thick periosteal flaps were elevated. A spiral oblique midshaft fracture was identified approximately 4 cm medial to a malunited distal clavicle segment, which demonstrated nearly 100 degrees of anterior angulation (Figure 2). Fracture was freshened and reduced using bone-holding forceps. Temporary fixation was achieved with a Kirschner wire, followed by lag screw fixation using a 3.5-mm cortical screw (Figure 2). An eight-holed clavicular reconstruction plate was applied in neutralization mode. Post-operative period was uneventful. Shoulder mobilization started immediately

postoperatively. Weight lifting on right upper limb was allowed at 6 weeks, after radiological signs of union.

At 2-month follow-up, the patient achieved a painless full range of shoulder motion with significant improvement in strength. Radiographs demonstrated satisfactory alignment and progression toward union (Figure 3).

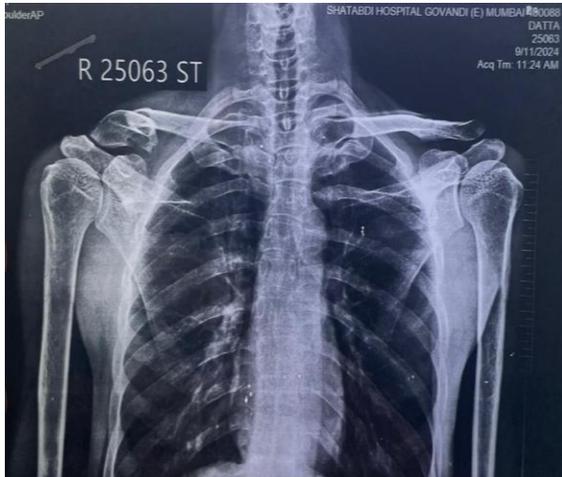


Figure 1: Pre-operative X-ray.

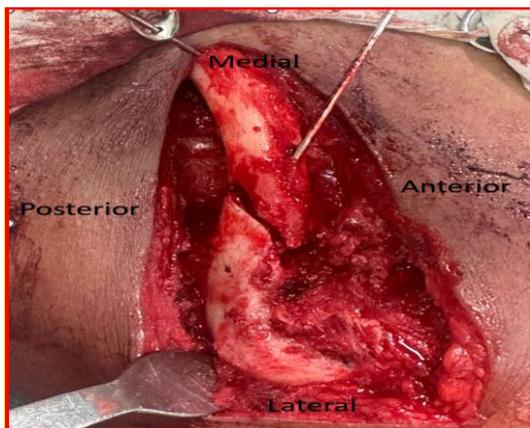


Figure 2: Intraoperative image showing malunited old fracture distal to reduced fresh fracture line.



Figure 3: Postoperative X-ray.

DISCUSSION

Clavicular angulation alters load transmission and creates stress concentration at the site of malunion. Axial loading results in compressive forces on the concave side and tensile forces on the convex side of the callus, predisposing it to failure under relatively low-energy trauma.^{4,8} Even modest shortening or angular deformity has been associated with reduced shoulder strength and patient dissatisfaction.^{6,7,9}

Masnovi et al demonstrated higher refracture rates in angulated clavicle fractures compared to completely displaced fractures, suggesting that angular deformity may represent a greater biomechanical risk than displacement alone.⁴ Although these findings are well established in pediatric populations, adult cases of refracture following angular malunion are rarely reported. Plate fixation allows restoration of clavicular length and alignment, thereby correcting altered biomechanics and reducing refracture risk.^{1,2,10-12}

CONCLUSION

Angular malunion of the clavicle is an under-recognized risk factor for refracture in adults. Refracture occurring adjacent to a malunited segment should be managed surgically to restore alignment and prevent further biomechanical compromise. Consideration of angular deformity during initial fracture management may help prevent refracture and improve long-term outcomes.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

REFERENCES

1. Canadian Orthopaedic Trauma Society. Nonoperative treatment compared with plate fixation of displaced midshaft clavicular fractures. *J Bone Joint Surg Am.* 2007;89(1):1-10.
2. McKee MD, Whelan DB, Schemitsch EH, Michael D. Operative versus nonoperative care of displaced midshaft clavicular fractures. *J Bone Joint Surg Am.* 2012;94(8):675-84.
3. Xu J, Xu L, Xu W, Yudong G, Jianguang X. Operative versus nonoperative treatment of midshaft clavicular fractures. *J Shoulder Elbow Surg.* 2014;23(2):173-81.
4. Masnovi ME, Mehlman CT, Eismann EA, Douglas AM. Pediatric refracture rates after angulated clavicle fractures. *J Orthop Trauma.* 2014;28(11):648-52.
5. Chalmers PN, Van Thiel GS, Ferry ST. Is skin tenting secondary to displaced clavicle fracture more than a theoretical risk? *Am J Orthop.* 2015;44:E414-6.
6. De Giorgi S, Notarnicola A, Tafuri S, Giuseppe S, Lorenzo M, Biagio M. Conservative treatment of clavicle fractures. *BMC Res Notes.* 2011;4:333.
7. McKee MD, Pedersen EM, Jones C, David JGS, Hans JK, Emil HS, et al. Deficits following nonoperative

- treatment of displaced clavicle fractures. *J Bone Joint Surg Am*. 2006;88(1):35-40.
8. Sankarankutty M, Turner BW. Fractures of the clavicle. *Injury*. 1975;7(2):101-6.
 9. Ledger M, Leeks N, Ackland T, Wang A. Short malunions of the clavicle: an anatomic and functional study. *J Shoulder Elbow Surg*. 2005;14(4):349-54.
 10. Robinson CM, Court-Brown CM, McQueen MM, Wakefield AE. Estimating the risk of nonunion following nonoperative treatment. *J Bone Joint Surg Am*. 2004;86(7):1359-65.
 11. Hill JM, McGuire MH, Crosby LA. Closed treatment of displaced middle-third clavicle fractures gives poor results. *J Shoulder Elbow Surg*. 1997;6(9):428-33.
 12. Mathieu PA, Marcheix PS, Hummel V, Denis V, Christian M. Anatomical study of the clavicle. *Surg Radiol Anat*. 2014;36(1):11-5.

Cite this article as: Panchal L, Bagwe S, Rathod B, Ambhore A. Refracture of a malunited clavicle: angular deformity as an under-recognized biomechanical risk factor. *Int J Res Orthop* 2026;12:537-9.