



ELSEVIER

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Trauma Case Reports

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

Hawkins wiring for three-part fractures of the proximal humerus: A case series[☆]

Bradley J. Lazzari^{*}, Charlie J. Yoo, Anthony O. Kamson, Anna E. Muzio,
Ronald W. Lippe

Department of Orthopedic Surgery, UPMC Harrisburg, Harrisburg, PA, United States of America
Orthopedic Institute of Pennsylvania, Camp Hill, PA, United States of America
UPMC Pinnacle, 4300 Londonderry Rd, Harrisburg, PA 17109, United States of America

ARTICLE INFO

Keywords:
Hawkins
Humerus
DASH
Fracture

ABSTRACT

Three-part proximal humerus fractures in the elderly continue to be difficult to surgically treat. We evaluated the Hawkins wiring (HW) technique, which utilizes figure-of-eight tension band wiring, to treat three-part proximal humerus fractures involving the greater tuberosity. Currently, there is a paucity of data detailing patient outcomes and radiographic follow-up of this technique. The purpose of this case series is to evaluate patient reported outcomes and radiographic follow-up for fractures treated with this technique. Over two years, six patients at our institution underwent HW to treat three-part proximal humerus fractures. Average DASH and Oxford Shoulder scores (OSS) were 20.4 (range, 1–40) and 40 (range, 33–46) respectively. All patients had satisfactory return of function after surgery. Radiographic union was achieved in all six patients and there were no reported complications. HW technique is an efficacious treatment for three-part proximal humerus fractures in elderly patients.

Introduction

Proximal humerus fractures are the third most common fracture seen in the elderly [1,2]. Eighty-five percent of proximal humerus fractures are treated non-operatively [3], however, displaced fractures involving the greater tuberosity commonly result in severe loss of function of the shoulder and surgical intervention can be beneficial. Controversy exists regarding the optimal surgical treatment of displaced proximal humerus fractures. Proximal humerus locking plates (PHLP) can be technically challenging, especially in the elderly with osteoporosis. More recently, reverse total shoulder arthroplasty (rTSA) has shown promising results, however comes with complications such as dislocation, periprosthetic fracture, and infection [4–8]. HW, originally described in 1986, utilizes figure-of-eight tension band wiring to treat three-part proximal humerus fractures [9]. The purpose of this case series is to evaluate functional outcomes and complications treated with the HW technique.

[☆] Consent obtained by all patients.No funding was provided.

^{*} Corresponding author at: 4300 Londonderry Rd, Harrisburg, PA 17109, United States of America.
E-mail address: lazzarib@upmc.edu (B.J. Lazzari).

<https://doi.org/10.1016/j.tcr.2022.100614>

Accepted 24 January 2022

Available online 26 January 2022

2352-6440/© 2022 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Methods

A retrospective analysis of patients who underwent HW technique at our institution between January 2020 and January 2021 by a single orthopedic surgeon were evaluated. Indications for surgery were three-part proximal humerus fractures involving the greater tuberosity with gross motion at fracture site by 6 weeks of non-operative treatment. Xray and CT scans were used to evaluate fracture pattern. Inclusion criteria were three-part proximal humerus fracture involving the greater tuberosity with at least 6 months of follow up. Exclusion criteria were open fractures, nerve injury, 4-part, and head splitting fractures. Patient demographics, smoking status, BMI, medical comorbidities, hand dominance, injury mechanism, secondary injuries, and neurovascular status were assessed. Rehabilitation consisted of shoulder immobilization for 6 weeks with codman flexion exercises. Active assisted range of motion exercises were started afterwards followed by strengthening at 12 weeks. DASH and OSS questionnaires were completed to assess functional status. The average follow-up time was 250 days (range 196–285). Final radiographs were obtained at follow up.

The HW technique was performed using a standard deltopectoral approach. After reduction was achieved, a colposcopy needle was placed, followed by an 18-gauge wire, into the lesser tuberosity. The wire was subsequently brought through the greater tuberosity and finally crossed over the anterior aspect of the humerus. Drill holes were placed in the proximal humeral shaft and a second 18-gauge wire was then passed in a figure-of-8 fashion to connect both wires. The wires were then tightened and fluoroscopy was used to confirm anatomic reduction (Figs. 1–4.)

Results/conclusion

The study group consisted of five Caucasian females and one Caucasian male, with an average age of 76.5 years (range, 67–85 years). No patients smoked. The average BMI was 31.3 (range, 28–39). Two patients had type II diabetes mellitus. No patient had chronic kidney or liver disease. Four patients injured their non-dominant arm. The average operative time was 46.8 min (range, 38–53). All injuries were sustained via ground level fall. No secondary or neurovascular injuries were sustained.

Average DASH and OSS were 20.4 (range, 1–40) and 40 (range, 33–46) respectively. All patients demonstrated a satisfactory return of function after surgery. A final range of motion (ROM) showed patients achieved a minimum 140° forward flexion, 100° abduction, 110° internal rotation, and 90° external rotation. Radiographic union was achieved in all six patients as interpreted by the operating attending physician. There were no documented postoperative complications. All patients were able to resume activities of daily living.

Discussion

HW technique is a viable option for treatment of three-part proximal humerus fractures. Currently, the main surgical options for elderly 3-part proximal humerus fractures are PHLP and rTSA. Recent meta-analysis showed rTSA has better forward flexion, equal abduction, less external rotation, and increased complications but fewer revision surgeries compared to PHLP [4]. When compared to our results, HW achieved similar results for range of motion and patient reported outcome measures without the associated complications and revision surgery rates. Another recent study comparing PHLP and rTSA showed similar DASH scores to our results [8]. Patients with osteoporosis undergoing open reduction internal fixation with locking plates are at increased risk of screw cutout and reoperation [10]. Recent studies have shown that rTSA for failed internal fixation provides significant functional improvement and pain relief from pre-operative status with a higher complication rate than primary rTSA [6]. HW is a less extensive surgery that provides



Fig. 1. Left three-part proximal humerus fracture.

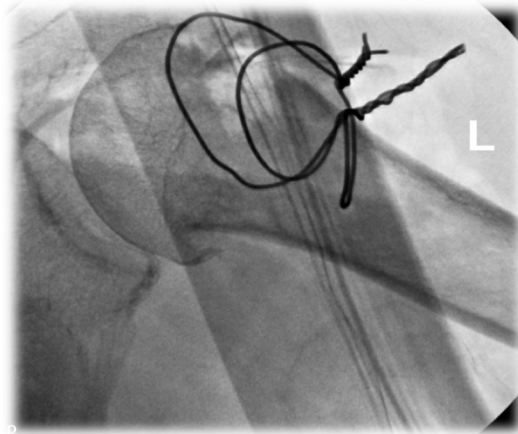


Fig. 2. Intraoperative AP and axillary radiographs.

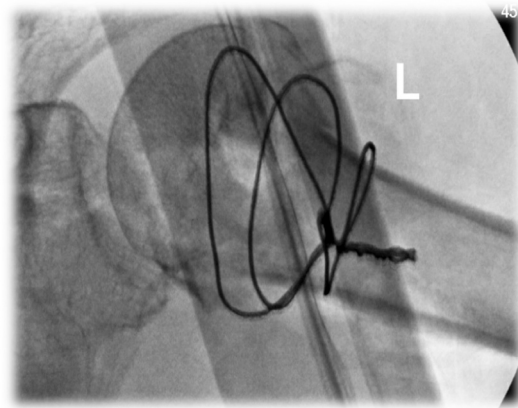


Fig. 3. Intraoperative AP and axillary radiographs.



Fig. 4. Final radiograph demonstrating fracture union.

similar functional outcomes to rTSA without the additional risk of infection, periprosthetic fracture, or dislocation.

Limitations of our case series include small sample size and low patient diversity. Further research is needed to compare this technique to other current surgical techniques. The HW technique provides another effective and less invasive treatment option for elderly patients that sustain three-part proximal humerus fractures involving greater tuberosity.

Declaration of competing interest

None.

References

- [1] A.K. Gupta, J.D. Harris, B.J. Erickson, et al., Surgical management of complex proximal humerus fractures—a systematic review of 92 studies including 4500 patients, *J. Orthop. Trauma* 29 (2015) 54–59.
- [2] V.K. Kancherla, A. Singh, O.A. Anakwenze, Management of acute proximal humeral fractures, *J. Am. Acad. Orthop. Surg.* 25 (2017) 42–52.
- [3] T.F. Schlegel, R.J. Hawkins, Displaced proximal humeral fractures: evaluation and treatment, *J. Am. Acad. Orthop. Surg.* 2 (1994) 54–78.
- [4] Heri Suroto, *EFORT Open*, Oct 2021. PMID 34760293.
- [5] D. Gallinet, X. Ohl, L. Decroocq, et al., Is reverse total shoulder arthroplasty more effective than hemiarthroplasty for treating displaced proximal humerus fractures in older adults? A systematic review and meta-analysis, *Orthop. Traumatol. Surg. Res.* 104 (2018) 759–766.
- [6] E. Sebastia-Forcada, Outcomes of reverse total shoulder arthroplasty for proximal humeral fractures: primary arthroplasty versus secondary arthroplasty after failed proximal humeral locking plate fixation, *J. Orthop. Trauma* 31 (8) (2017) e236–e240.
- [7] F. Grubhofer, K. Wieser, D.C. Meyer, et al., Reverse total shoulder arthroplasty for acute head-splitting, 3- and 4-part fractures of the proximal humerus in the elderly, *J. Shoulder Elb. Surg.* 25 (10) (2016) 1690–1698.
- [8] P. Luciani, R. Procaccini, M. Rotini, F. Pettinari, A. Gigante, Angular stable plate versus reverse shoulder arthroplasty for proximal humeral fractures in elderly patient, *Musculoskelet. Surg.* (2020 Jun 5), <https://doi.org/10.1007/s12306-020-00669-5>.
- [9] R.J. Hawkins, R.H. Bell, K. Gurr, The three-part fracture of the proximal part of the humerus. Operative treatment, *J. Bone Joint Surg. Am.* 68 (9) (1986) 1410–1414.
- [10] C. Thanasas, G. Kontakis, A. Angoules, D. Limb, P. Giannoudis, Treatment of proximal humerus fractures with locking plates: a systematic review, *J. Shoulder Elb. Surg.* 18 (2009) 837–844.