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Research Article

Treatment and Outcomes of Radial Head and Neck Fractures with the "Tripod Technique": A Case Series

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Abstract

Background: Fractures of the radial head and neck are the most common elbow fractures, which can cause elbow dysfunction and reduced quality of life (QOL). The "tripod technique" is a new, less invasive method for fixing these fractures. The objective of this study was to assess the functional outcomes of tripod technique for treatment of radial head and neck fractures.
Methods: This case series was performed on eight patients with radial head and neck fractures who were admitted to Taleghani Hospital in Tehran City, Iran, between 2021-2023, and treated with the tripod technique by a single surgeon. Patients were evaluated for demographic factors, type of trauma, fracture type, functional outcomes [Disabilities of the Arm, Shoulder, and Hand (DASH) score and Broberg and Morrey score], and surgical complications.
Results: Eight patients with median age of 40 (range: 27-57 years) were evaluated radiographically and clinically 12 months post-surgery. All fractures had healed without problems. The median DASH score was 11 (range: 11-13), and the Broberg and Morrey score was 99 (range: 90-100). The median of supination was 89° (range: 75°-90°), pronation was 89° (range: 30°-90°), extension lag was -4° (range: -35°-0°), and flexion was 139° (range: 130°-142°). Only one case of ulnar hypoesthesia was reported. No reoperations were performed.
Conclusion: In this limited case series, the tripod technique demonstrated promising functional and radiological outcomes with minimal complications as a minimally-invasive approach for radial head and neck fractures; however, studies with larger patient cohorts are needed to confirm its safety and efficacy.

Keywords: Radial Head Fractures; Radial Neck Fractures; Techniques

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Background

Radial head and neck fractures are the most prevalent types of elbow injuries, accounting for 2-5 percent of all fractures and approximately 30% of elbow-specific fractures (1, 2). The mechanism of injury typically involves axial or valgus force, such as falling on an outstretched hand, and falling is the most common cause (3-5). The proximal radius plays a crucial role in elbow stability against valgus, axial, and rotational forces, as well as in forearm rotation (6).

Consequently, open reduction and internal fixation (ORIF) of radial head and neck fractures is a technique designed to maintain biomechanics of the proximal radius and elbow stability (5-7). Various methods exist for the fixation of radial head and neck fractures, one of which is the tripod technique (7, 8).

This technique was initially introduced by Marc D. Lipman, involving the implantation of three headless compression screws (2-3 mm) orthogonally from the head to the neck of the radius, providing axial compression and fixation of proximal fragments while maintaining distal neck fragments (1, 7, 9).

The tripod technique is recommended for Mason type II and III fractures with three or fewer fragments that require surgical intervention. This technique is efficient, straightforward, and minimally-invasive, with the headless compression screws buried beneath the radial head cartilage, preventing interference with the radioulnar joint and allowing fixation outside the safe zone, as well as providing greater perpendicular compression in transverse radial neck fractures (1, 9, 10).

The tripod technique offers notable advantages, including less interference with supination, pronation, and rotational movements, as well as lower risk of fixation failure and non-union compared to other methods. Effective management of radial head and neck fractures is essential for improving outcomes and minimizing complications, including arthritis, stiffness, and joint instability. Considering the limited research available regarding the outcomes of the tripod technique, this study was conducted to further evaluate the results of radial head and neck fracture fixation with this technique in patients admitted to Taleghani Hospital in Tehran City, Iran.

Methods

This case series study involved patients with radial head and neck fractures treated using the tripod technique at Taleghani Hospital in Tehran City, from 2021 to 2023. The study protocol received ethical and scientific clearance from Research Ethics Committees of Vice-Chancellor in Research Affairs - Shahid Beheshti University of Medical Sciences, Iran (IR.SBMU.RETECH.REC.1404.737), and all participants provided written informed consent following a comprehensive briefing on the study's rationale, objectives, and intervention methodology. Exclusion criteria comprised any history of prior proximal radius surgery, pre-existing limitations in elbow motion, severe comminuted fractures, multiple fractures, elbow

dislocations, or skeletal immaturity. Case ascertainment and sample size were based on consecutive enrollment of all eligible patients aged over 18 years who presented with radial head or neck fractures characterized by a displacement exceeding 2 mm and an angulation greater than 30 degrees, provided the fracture had occurred within the preceding week. Demographic information was collected from patients' medical records, surgical details were abstracted from operative reports, and radiologic findings were evaluated using patient radiographs and clinical examinations.

Surgical fixation was performed on eight patients using the Kocher approach combined with the tripod technique. In patients with head and neck fractures, the head fragment was first fixed by a 2-mm mini-screw, and then fixation of the neck fragment was completed using three 2-mm headless compression screws (Figure 1). In cases with simple neck fracture, tripod fixation was done as fixation method. All surgical procedures were performed by a single surgeon under regional anesthesia and tourniquet control. Post-surgery, the patients' arms were immobilized using a splint for a duration of two weeks. Following this period, they progressively began active motion exercises to aid in recovery and restore functionality.

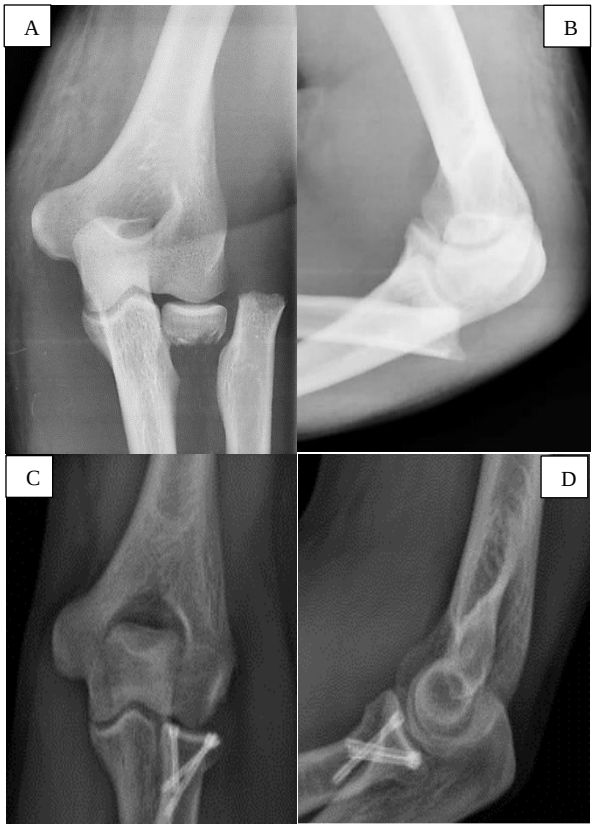

Figure 1. Pre-operation anteroposterior (AP) (A), pre-operation lateral (B), post-operation AP (C), and post-operation lateral (D) plain radiographs of a 39-year-old man's left elbow after tripod technique surgery

Functional outcomes and union status on radiographs were measured 12 months after surgery. For functional assessment, standard criteria for elbow range of motion (ROM), pain intensity [Visual Analogue Scale (VAS) score], and functional outcomes were assessed using the Disabilities of the Arm, Shoulder, and Hand (DASH) score (11) and Broberg and Morrey score (12).

Statistical Analysis: Quantitative data were described by median and ranges, whereas percentages were used to describe categorical data. Non-parametric Mann-Whitney U test was used to determine a significant difference between two hands in grip strength. A P-value < 0.05 was considered statistically significant. Analysis was performed using R software (version 4.4.1).

Results

Demographic Characteristics: The study involved eight patients, comprising seven men and one woman, with a median age of 40 years (range: 27-57 years), and there were no cases of non-response or loss to follow-up. All patients were right-hand dominant; however, the injured hand corresponded to the dominant hand in only three cases (37.5%). The primary mechanisms of trauma were identified as falls from heights and motor vehicle collisions, each contributing to three cases (37.5%). Additionally, falls on flat surfaces accounted for two cases (25%) (Table 1).

Type of Fracture: In terms of fracture types, four patients presented with radial neck fractures, three patients had Mason type III radial head fractures, and one patient exhibited a combined Mason type III radial head and neck fracture. The median interval between trauma and surgery was 4.5 days (range: 2-7 days) (Table 1).

Table 1. Patients' characteristics and clinical parameters

Patients' characteristics and clinical parameters		Cases (n = 8)
Age (year) [median (range)]		
Gender [n (%)]	Men	7 (87.5)
	Women	1 (12.5)
Dominant hand [n (%)]	Right	8 (100)
	Left	0 (0)
Injured hand [n (%)]	Right	3 (37.5)
	Left	5 (62.5)
Trauma mechanism [n (%)]	Falls on flat surfaces	2 (25.0)
	Falling from height	3 (37.5)
	Motor vehicle collisions	3 (37.5)
Fracture type (Mason classification) [n (%)]	Radius neck	4 (50.0)
	Radius head (Mason III)	3 (37.5)
	Radius head and neck	1 (12.5)
Time between trauma and surgery (day) [median (range)]		4.5 (2-7)

Functional Assessment: ROM assessment showed a median supination of 89° (range: 75°-90°), pronation of 89° (range: 30°-90°), extension lag of -4° (range: -35°-0°), and flexion of 139° (range: 130°-142°).

The median grip strength in the operated hand was 38.6 kg (range: 24.6-43.4 kg), and in the contralateral hand, it was 43.4 kg (range: 26.1-46.1 kg). According to the non-parametric Mann-Whitney U test, there were no statistically significant grip strength differences between operated and contralateral hand (P = 0.382).

The median DASH score was 11 (range: 11-13), indicating good postoperative function. The median Broberg and Morrey score was 99 (range: 90-100), with excellent results reported in 5 patients (62.5%) and good results in 3 patients (37.5%). The median pain intensity based on the VAS score was 0.5 (range: 0-2), indicating very little pain in patient post-surgery (Table 2).

Table 2. Post-operative functional outcomes after 12 months

Functional outcomes		Cases (n = 8)[median (range)]
ROM	Supination	89 (75, 90)
	Pronation	89 (30, 90)
	Extension lag	-4 (-35, 0)
	Flexion	139 (130, 142)
Grip strength	Operated hand	38.6 (24.6, 43.4)
	Contralateral hand	43.4 (26.1, 46.1)
DASH score		11 (11, 13)
Broberg and Morrey score		99 (90, 100)
VAS		0.5 (0, 2)

ROM: Range of motion; DASH: Disabilities of the Arm, Shoulder, and Hand; VAS: Visual Analogue Scale

Complications: The only documented complication was ulnar hypoesthesia, observed in a 44-year-old male patient following a radial neck fracture caused by a fall. No complications were observed in the remaining patients.

Discussion

ORIF using screws for head and neck fractures has achieved good results and enabled rigid fixation of radial head and neck to the shaft. The screws can be placed outside the safe zone for optimal fixation without causing any impingement or stiffness owing to well-buried heads (1, 4, 9). Screw fixation requires smaller surgical exposure, and screw head coverage can be easily achieved through soft tissue, annular ligament, and capsular repair due to low implant prominence (13), resulting in less soft tissue irritation and less interference with elbow movement. The vascular supply to radial head and neck was minimally disturbed (5). The results of the present study indicate that the tripod technique provides favorable outcomes in treating radial head and neck fractures. Improvements in ROM (supination, pronation, flexion, extension) and reduced pain (VAS score) in the evaluated patients confirm the effectiveness of this method. The average Broberg and Morrey score of 96.7 and DASH score of 11.4 also indicate good postoperative function.

These findings are consistent with previous studies. Lipman et al. also reported that the tripod technique using headless compression screws provided excellent functional outcomes with fewer complications (1).

Similarly, Model et al. demonstrated that this technique was an effective and safe method for treating radial head and neck fractures. All the patients achieved union by 12 weeks after surgery. The average postoperative Quick DASH score was 5.9 (range: 0-23). The mean flexion was 139°, and the mean extension was -8°. There were no major postoperative complications. Five patients had minor complications, and no patients required a reoperation (9).

Wu et al. also showed that fixation with headless compression screws led to earlier union and fewer complications compared to plate fixation. The time to bone union was shorter after headless compression screw fixation compared to plate fixation. Additionally, complication and revision rates were lower in headless compression screw fixation than plate fixation. All patients achieved bone union after screw fixation, compared with 67% after plate fixation (5).

Duckworth et al. reported that using screw fixation for Mason III fractures provided rigid fixation and excellent functional outcomes. There were neither arthritic changes nor heterotrophic ossification noted on radiographs within the follow-up period, and all cases had bony union within 3 months of surgery. The average elbow flexion was 149° (range: 145°-160°), and average fixed flexion was 5.5° (range: 3°-10°). Five patients achieved full pronation and supination. At the most recent follow-up (range: 12-52 months), all patients reported no pain, were stable, and had no functional limitation. The average Broberg-Morrey score was 98.8 (range: 93-100); qualitatively, five fell into the excellent group while the remaining patients fell in the good group (14). In the present study, only one patient experienced ulnar hypoesthesia.

Conclusion

The tripod technique is a minimally-invasive and effective surgical method that offers favorable outcomes in treating radial head and neck fractures. Improvements in ROM, reduced pain, and good postoperative function demonstrate the efficacy of this technique. However, the choice of treatment method should be based on individual patient characteristics and fracture type. Additionally, appropriate timing of surgery can help reduce complications.

It is recommended that in the future, more studies with larger sample sizes be conducted to investigate the outcome of tripod technique surgery.

Conflict of Interest

The authors declare no conflict of interest in this study.

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References

1. Lipman MD, Gause TM, Teran VA, Chhabra AB, Deal DN. Radial Head Fracture Fixation Using Tripod Technique With Headless Compression Screws. *J Hand Surg Am*. 2018;43(6):575.e1-.e6. doi: 10.1016/j.jhsa.2018.03.009. [PubMed: 29709352].
2. Salkhori O, Kalantar SH, Yaghoubi S, Fard SB, Asadifar A, Salehi M, et al. Bilateral Radial Head and Neck Nondisplaced Fracture, a Challenge for Treatment: A Case Report. *J Orthop Spine Trauma*. 2024;10(2):98-100. doi: 10.18502/jost.v10i2.15528.
3. Rhyou IH, Kim KC, Kim KW, Lee JH, Kim SY. Collateral ligament injury in the displaced radial head and neck fracture: correlation with fracture morphology and management strategy to the torn ulnar collateral ligament. *J Shoulder Elbow Surg*. 2013;22(2):261-7. doi: 10.1016/j.jse.2012.10.020. [PubMed: 23352469].
4. Rosenblatt Y, Athwal GS, Faber KJ. Current recommendations for the treatment of radial head fractures. *Orthop Clin North Am*. 2008;39(2):173-85, vi. doi: 10.1016/j.ocl.2007.12.008. [PubMed: 18374808].
5. Wu PH, Shen L, Chee YH. Screw fixation versus arthroplasty versus plate fixation for 3-part radial head fractures. *J Orthop Surg (Hong Kong)*. 2016;24(1):57-61. doi: 10.1177/230949901602400114. [PubMed: 27122514].
6. Li SL, Lu Y, Wang MY. Is cross-screw fixation superior to plate for radial neck fractures? *Bone Joint J*. 2015;97-b(6):830-5. doi: 10.1302/0301-620x.97b6.34868. [PubMed: 26033065].
7. Smith AM, Morrey BF, Steinmann SP. Low profile fixation of radial head and neck fractures: surgical technique and clinical experience. *J Orthop Trauma*. 2007;21(10):718-24. doi: 10.1097/BOT.0b013e31812e5168. [PubMed: 17986889].
8. Rebgetz PR, Daniele L, Underhill ID, Öchsner A, Taylor FJ. A biomechanical study of headless compression screws versus a locking plate in radial head fracture fixation. *J Shoulder Elbow Surg*. 2019;28(4):e111-e6. doi: 10.1016/j.jse.2018.10.008. [PubMed: 30685273].
9. Model Z, Merchan N, Rozental TD, Harper CM. Outcomes of Radial Head Fractures Treated With the "Tripod Technique". *J Hand Surg Am*. 2022;47(6):582.e1-.e5. doi: 10.1016/j.jhsa.2021.06.014. [PubMed: 34332815].
10. Burkhart KJ, Wegmann K, Müller LP, Gohlke FE. Fractures of the Radial Head. *Hand Clin*. 2015;31(4):533-46. doi: 10.1016/j.hcl.2015.06.003. [PubMed: 26498543].
11. Hudak PL, Amadio PC, Bombardier C. Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand) [corrected]. The Upper Extremity Collaborative Group (UECG). *Am J Ind Med*. 1996;29(6):602-8. doi: 10.1002/(sici)1097-0274(199606)29:6<602::Aid-ajim4>3.0.Co;2-l. [PubMed: 8773720].
12. Broberg MA, Morrey BF. Results of delayed excision of the radial head after fracture. *J Bone Joint Surg Am*. 1986;68(5):669-74. [PubMed: 3722222].

13. Iacobellis C, Visentin A, Aldegheri R. Open reduction and internal fixation of radial head fractures. *Musculoskelet Surg*. 2012;96(Suppl 1):S81-6. doi: 10.1007/s12306-012-0186-3. [PubMed: 22447441].

14. Duckworth DG, Avakian Z, Chien C. Newly defined fracture pattern specific to Mason III radial head fractures: fracture description, management and outcomes using screw fixation. *ANZ J Surg*. 2012;82(6):434-8. doi: 10.1111/j.1445-2197.2012.06094.x. [PubMed: 22548755].