

Case Series

Non-operative Management of Terrible Triad Injuries of the Elbow: A Case Series



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ABSTRACT

Background: The terrible triad (TT) injury of the elbow, consisting of ulnohumeral dislocation, radial head fracture, and coronoid process fracture, is traditionally managed surgically. However, recent studies have suggested that non-operative management may be a viable option for select patients.

Objectives: This study evaluates the outcomes of non-operative management in 17 patients with TT injuries treated between 2015 and 2023.

Methods: A retrospective review was conducted on 17 patients who met specific criteria for non-operative management, including congruent joint reduction, no intra-articular fragments, and a stable range of motion (ROM) up to 45 degrees of extension. Functional outcomes were assessed using the Mayo elbow performance index (MEPI) and the disabilities of the arm, shoulder, and hand (DASH) score. A radiographic evaluation was performed to assess joint congruency and the presence of arthritis.

Results: The mean follow-up period was 53.24 months (range: 26-96 months). The mean MEPI score was 95.29±6.95, and the mean DASH score was 5.64±4.06. The mean ROM for the affected elbow was 9.71±5.72 degrees in extension, 130.6±8.27 degrees in flexion, 65.29±10.07 degrees in supination, and 59.71±13.4 degrees in pronation. One patient developed ulnar nerve symptoms and underwent ulnar neurolysis and anterior transposition of the medial epicondyle, and two patients reported occasional painful clicking during supination and pronation.

Conclusion: Non-operative management of TT injuries can yield acceptable functional outcomes in carefully selected patients. However, the potential for reduced supination and pronation, as well as the development of post-traumatic arthritis, should be considered. Further studies with larger cohorts and longer follow-up periods are needed to validate these findings.

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Introduction

The terrible triad (TT) injury of the elbow is a complex injury involving ulnohumeral dislocation, radial head fracture, and coronoid process fracture [1, 2]. Historically, surgical intervention has been the standard of care due to the inherent instability of the elbow joint following this injury [3]. However, recent studies have explored the feasibility of non-operative management in select patients who meet specific criteria, such as a congruent joint after closed reduction and a stable range of motion (ROM) [1, 4-6].

This study aims to contribute to the evidence supporting non-operative management by presenting a case series of 17 patients treated between 2015 and 2023. We evaluated functional outcomes, ROM, and complications associated with this approach.

Methods

Between 2015 and 2023, our institution treated 17 patients with TT injuries non-operatively. The inclusion criteria for non-operative management included congruent joint reduction on both anteroposterior (AP) and lateral radiographs after closed reduction, with a humero-ulnar distance of less than 4 mm on the lateral view, no indication for surgical intervention for radial head or coronoid fractures (e.g. minimally displaced fractures or fractures that did not compromise joint stability), no block in active supination and pronation up to 60 degrees, absence of intra-articular fragments on computed tomography (CT) scan, stable and pain-free active ROM in the ulnohumeral joint, with a minimum of 45 degrees of extension, motivated and cooperative patients who were willing to adhere to a strict physiotherapy regimen.

The exclusion criteria included patients with significant joint instability or subluxation after closed reduction, displaced or comminuted radial head or coronoid fractures requiring surgical fixation, intra-articular fragments that could not be reduced conservatively, neurovascular compromise or open injuries requiring surgical intervention, history of previous elbow trauma or pre-existing elbow arthritis, and patients who were non-compliant with follow-up or physiotherapy.

All patients underwent closed reduction under conscious sedation in the operating room. Post-reduction radiographs and CT scans were obtained to confirm joint congruency and assess fracture patterns (Figures 1 and 2). Patients were referred to physiotherapy for early ac-

tive ROM exercises, with extension initially limited to 45 degrees and gradually increased weekly. Functional outcomes were assessed using the Mayo elbow performance index (MEPI) and the disabilities of the arm, shoulder, and hand (DASH) score. ROM was measured using a goniometer, and radiographic evaluation was performed to determine joint congruency, fracture union, and the presence of arthritis (Figures 3, 4, 5 and 6). Complications, including symptoms associated with the ulnar nerve and joint instability, were documented (Figures 7 and 8).

Results

The study included 17 patients (14 males and 3 females) with a mean age of 38.12 years (22-57 years). The mean follow-up period was 53.24 months (range: 26-96 months). The demographic and clinical characteristics of the patients are summarized in Table 1.

The mean MEPI score was 95.29 ± 6.95 , and the mean DASH score was 5.64 ± 4.06 . The mean ROM for the affected elbow was 9.71 ± 5.72 degrees in extension, 130.6 ± 8.27 degrees in flexion, 65.29 ± 10.07 degrees in supination, and 59.71 ± 13.4 degrees in pronation. The functional outcomes and complications are summarized in Table 2.

All radial head fractures achieved union, while 7 coronoid fractures (41.2%) showed fibrous union. One patient developed ulnar nerve symptoms that underwent ulnar neurolysis and anterior transposition of the medial epicondyle, and 2 patients reported occasional painful clicking during supination and pronation. No cases of recurrent dislocation or significant joint instability were observed.

Discussion

Non-operative management of TT injuries has gained traction in recent years, particularly for patients who meet specific stability criteria [4, 5]. Our findings are consistent with previous studies, which have reported acceptable functional outcomes with non-operative treatment in select patients. However, the potential for reduced supination and pronation, as well as the development of post-traumatic arthritis, remains a concern. The mean MEPI score of 95.29 in our study is comparable to that reported by Chan et al., who found a mean MEPI score of 94 in their cohort of non-operatively managed TT injuries [4]. Similarly, the mean DASH score of 5.64 in our study is slightly higher than the 4.76 reported by Najd Mazhar et al. suggesting a minor reduction in func-

Table 1. Demographic and clinical characteristics of the patients

Patient	Sex	Age (y)	Injured Elbow	Injury Mechanism	Follow-up (m)	Coronoid Fracture Type (Regan-Morrey)	Radial Head Fracture Type (Mason)
1	Male	37	Right	Fall	48	I	II
2	Female	42	Left	Fall	40	II	I
3	Male	36	Left	Fall	90	II	I
4	Male	34	Left	MVA	34	II	II
5	Male	51	Right	Fall	96	I	I
6	Male	33	Right	Fall	65	II	I
7	Male	29	Left	MVA	28	I	II
8	Male	50	Left	Contact sport	26	II	II
9	Male	55	Right	Fall	36	II	II
10	Male	24	Left	Fall	75	II	I
11	Male	30	Right	Fall	32	II	II
12	Female	47	Left	MVA	42	I	I
13	Male	22	Right	Fall	70	II	I
14	Male	57	Left	Fall	50	II	II
15	Male	26	Right	Contact sport	65	II	I
16	Female	44	Left	Fall	63	II	II
17	Male	31	Right	Fall	45	II	I

MVA: Motor vehicle accident.



Figure 1. Anteroposterior radiograph of the elbow joint after closed reduction.



Figure 2. Lateral radiograph of the elbow joint after closed reduction.

Table 2. Functional outcomes and complications

Patient	Extension	Flexion	Supination	Pronation	MEPI Score	DASH Score	Complications
1	20	120	55	40	85	14.2	Painful click, ulnar nerve symptoms
2	10	135	40	65	100	3.1	None
3	5	140	70	55	100	1.2	None
4	10	125	60	75	85	10.5	None
5	10	125	70	65	100	1.5	None
6	10	120	70	40	100	1.8	None
7	0	135	75	60	100	1	None
8	10	115	60	45	100	5.2	Painful click
9	20	130	70	45	80	12.3	None
10	15	145	65	70	100	7.5	None
11	10	130	75	50	90	6.2	None
12	5	135	70	70	100	4.5	None
13	15	125	50	50	90	9.5	None
14	10	140	60	70	100	5.5	None
15	5	130	80	80	100	1.5	None
16	10	130	70	55	90	6.8	None
17	0	140	70	80	100	3.5	None

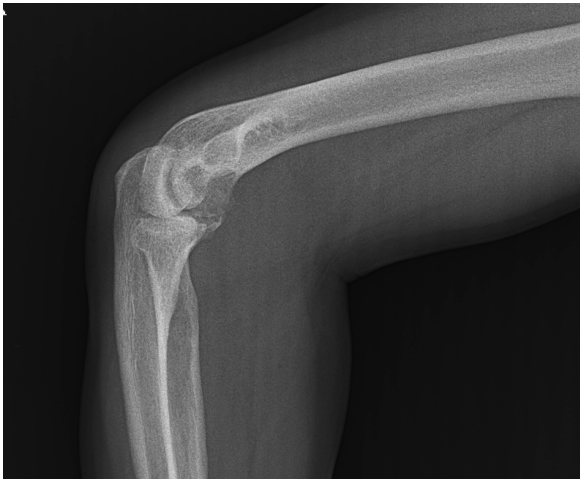
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Abbreviations: MEPI: The Mayo elbow performance index; DASH: The disabilities of the arm, shoulder, and hand.



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Figure 3. Elbow extension 3 years after closed reduction.



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Figure 4. Elbow flexion 3 years after closed reduction.



Figure 5. Elbow pronation 3 years after closed reduction..

tional outcomes [7]. The development of mild arthritic changes in 29.4% of our patients is consistent with previous reports, highlighting the potential for long-term joint degeneration even in patients with initially stable reductions. This finding underscores the importance of careful patient selection and close follow-up to monitor for late complications.

While this study provides valuable insights into the non-operative management of TT injuries of the elbow, several limitations should be acknowledged. The study included only 17 patients, which limits the generalizability of the findings. A larger cohort would provide more robust evidence and allow for subgroup analyses. The patients included in this study were carefully selected based on specific criteria for non-operative management. This selection bias may limit the applicability of the findings to a broader population of TT injuries, many of which may not meet these criteria. The study was conducted retrospectively, which may introduce recall bias and limit the ability to control for confounding variables. A prospective study design would provide stronger evidence. The mean follow-up period was 36.5 months, with a range of 24 to 62 months. While this provides valuable medium-term outcomes, longer follow-up is necessary to assess the long-term effects of non-operative management, particularly the progression of post-traumatic arthritis. The study did not include a

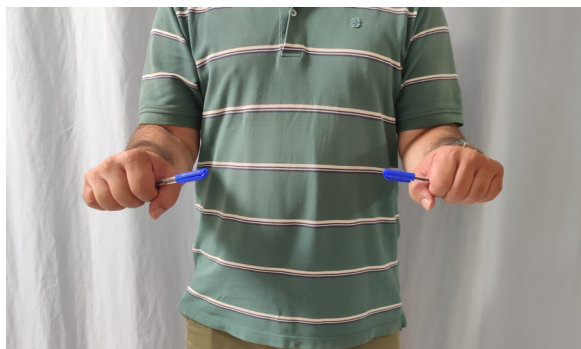


Figure 7. Anteroposterior radiograph of the elbow joint 3 years after closed reduction.



Figure 6. Elbow supination 3 years after closed reduction

control group of patients who underwent surgical management. A direct comparison between surgical and non-operative management would provide more comprehensive insights into the relative benefits and drawbacks of each approach. The study was conducted at a single institution, which may limit the generalizability of the findings to other settings with different patient populations and treatment protocols. While all patients were referred to physiotherapy, there may have been variability in the specific protocols and adherence to these protocols, which could influence the outcomes. The assessment of arthritic changes was based on radiographic findings, which may not fully capture the clinical signifi-



Figure 8. Lateral radiograph of the elbow joint 3 years after closed reduction.

cance of these changes. Advanced imaging techniques, such as magnetic resonance imaging (MRI), can provide more detailed information. Functional outcomes were assessed using patient-reported measures (MEPI and DASH scores), which may be subject to bias. Objective measures of elbow function and stability could provide additional insights. While the study reported complications such as ulnar nerve symptoms and painful clicking, the small sample size limits the ability to draw definitive conclusions about the incidence and management of these complications.

Conclusion

Non-operative management of TT injuries can yield acceptable functional outcomes in carefully selected patients. However, the potential for reduced supination and pronation, as well as the development of post-traumatic arthritis, should be considered. Further studies with larger cohorts and longer follow-up periods are needed to validate these findings and refine the criteria for non-operative management.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Research Ethic Committee of [Iran University of Medical Sciences](#), Tehran, Iran (Code: IR.IUMS.REC.1403.966), Tehran, Iran. All participants provided written informed consent before participating in the study.

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Authors' contributions

Conceptualization: Farid Najd Mazhar; Methodology, software, validation and formal analysis: Bushra Zareie; Investigation and resources, Data collection: Hooman Shariatzade and Farid Najd Mazhar; Writing the original draft: Meisam jafari kafiabadi; Review & editing: Omid mahmoudi nasab; Visualization and Supervision: Reza Mohammadi and Sajjad Mohammadnabi.

Conflict of interest

The authors declared no Conflict of interest.

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