



ORIGINAL ARTICLE

# Evaluation of functional outcome after nonsurgical management of terrible triad injuries of the elbow



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**Background:** Terrible triad (TT) is one of the severe injuries of the elbow that generally requires surgery. Nonsurgical treatment has recently been applied in selected cases of TT injury. Evaluation of the results of this treatment was the main aim of this study.

**Methods:** In a prospective cohort study, 10 patients with a mean follow-up of 30.6 months were evaluated. The inclusion criteria included a congruent joint after closed reduction, no indication for surgery of the coronoid and radial head fractures, no block in supination and pronation up to 60°, no intra-articular fragments, and a free and stable joint with ulnohumeral extension up to a minimum of 45°. Mayo Elbow Performance Index and Disabilities of the Arm, Shoulder, and Hand score were used for assessment of the functional outcome. A standard physical examination to record elbow range of motion was also performed.

**Results:** For the affected and the contralateral elbows, respectively, the mean extension of the elbow was 11° ± 7° and 0.0° ± 2°; the mean flexion was 131° ± 9° and 140° ± 10°; the mean supination was 58° ± 17° and 85 ± 7°; and the mean pronation was 53° ± 23° and 85° ± 7°. The mean Disabilities of the Arm, Shoulder, and Hand score was 4.76 ± 5.17. The mean Mayo Elbow Performance Index was 95 ± 8.16.

**Conclusion:** Nonsurgical management of the TT injury can result in acceptable functional outcomes when a patient meets the criteria set for nonsurgical treatment.

**Level of evidence:** Level IV; Case Series; Treatment Study

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**Keywords:** Nonsurgical management; terrible triad; elbow; injury; functional outcome; complication

Management of a fracture-dislocation injury of the elbow is difficult and usually associated with a high rate of complications.<sup>15</sup> These include joint stiffness, instability, ulnar nerve symptoms, and post-traumatic arthritis.<sup>6,8</sup> Terrible triad (TT) injury, one of the most severe injuries of the elbow, refers to a complex injury with the combination of ulnohumeral joint dislocation, radial head fracture, and coronoid process

fracture.<sup>11</sup> The classic approach to this fracture-dislocation is internal fixation of the coronoid fracture or anterior capsule repair, fixation of the radial head or its replacement with a prosthesis, and lateral collateral ligament repair. Medial collateral ligament repair or an external hinge fixator may be indicated in cases with persistent instability.<sup>9,12</sup> Owing to the complexity of this injury, surgical management of the TT can result in a poor outcome if not all 3 components of the TT are adequately treated.<sup>3</sup>

Nonoperative management of the TT may be a successful option for the right patient.<sup>2,7</sup> However, it is a new concept, and more assessment of this approach is necessary to further explore the strengths and weaknesses of this option. The aim

This study was approved by the Institutional Review Board of the Iran University of Medical Sciences: No. 94-04-196-27154.

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of this study was to report the result of nonoperative treatment of the TT in patients who met our criteria for this therapeutic approach.

## Materials and methods

This is a prospective cohort study. A total of 63 patients with documented TT injury of the elbow were referred to our center during 2009-2014. Fourteen patients who met the inclusion criteria were treated without any surgery. The inclusion criteria were as follows: a congruent joint on both anterior-posterior (AP) and lateral radiographs after closed reduction with ulnohumeral distance <4 mm on the lateral radiograph; no indication for surgery of the radial head or coronoid process; no block in active supination and pronation up to 60°; no intra-articular fragments; and a free and stable joint in painless active range of motion (ROM) in the ulnohumeral joint to a minimum of 45° of extension. The patients' motivation and co-operation levels should also be considered (Table I).

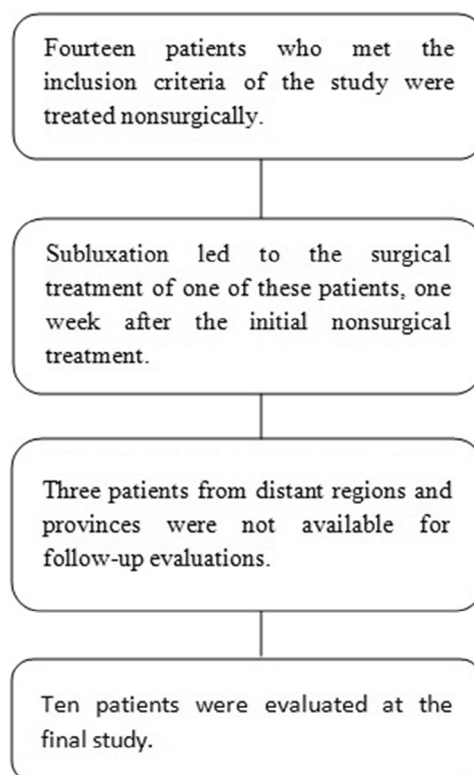
These criteria were the same as those that were introduced during earlier investigations, including some minor differences.<sup>2,7</sup> Subluxation in the lateral view of the ulnohumeral joint (>4 mm) led to the surgical treatment of 1 of these patients 1 week after the initial nonsurgical treatment. Because our center is the main referral center for hand surgery in our country and the patients had been referred from different regions of the country, patients living in distant areas were not usually available for follow-up evaluations. This led to the exclusion of 3 more patients. Finally, 10 patients were thoroughly evaluated in the study (Fig. 1).

In total, 9 male patients and 1 female patient with a mean age of 38.7 years (range, 27-54 years) were included. The mean follow-up period of the patients was 30.6 months (range, 24-46 months). The clinical and demographic characteristics of the patients are detailed in Table II.

Considering a combination of ulnohumeral joint dislocation, radial head fracture, and coronoid process fracture, the TT injury was confirmed in all of the patients. The coronoid fractures were classified using the Regan-Morrey classification system.<sup>14</sup> The radial head fractures were classified using the Mason classification system.<sup>10</sup> Accordingly, 7 type II and 3 type I coronoid fractures were observed in our patients. In addition, 8 type II and 2 type I radial head fractures were identified. In 5 patients, both coronoid and radial head fractures were classified as type II fractures; in the other cases, at least 1 of these fractures was classified as type I.

**Table I** Inclusion criteria for nonsurgical treatment of terrible triad injury in our hand surgery department

Congruency of plain radiographs and computed tomography scan after closed reduction with humeroulnar distance <4 mm on lateral radiograph
No indication for surgery in any part of the injury (radial head and coronoid)
No block in active supination and pronation up to 60°
No intra-articular fragments
Free and stable joint in painless active range of motion in the humeroulnar joint to a minimum of 45° of extension
Motivated and cooperative patient



**Figure 1** Flow chart of inclusion and exclusion of patients.

## Therapeutic approach

Before the start of treatment, the complexity of the injury was explained to the patient. Each patient was informed about the therapeutic options and probable complications and outcome. In the operating room, closed reduction was performed under conscious sedation for the elbow fracture-dislocation.

Subsequently, lateral and AP radiographs and coronal, axial, and sagittal computed tomography scans were taken to evaluate the coronoid and radius fractures and other potential concomitant fractures more accurately. If no indication for surgery was observed in any of the fractures, active ROM was assessed 3 to 5 days after the reduction. In the case of a stable elbow at 45° of extension and no block to supination and pronation up to 60°, and regarding other inclusion criteria of the study, the patients were identified to be eligible for the nonsurgical approach. In the case that a patient accepted the nonsurgical treatment, the patient was referred to the corresponding physiotherapist. Under the close supervision of the physiotherapist, early active flexion-extension and supination-pronation exercises were started. The extension was limited to 45° at the beginning of the exercise, and then it was increased by 10°-15° per week. For those patients who lived in other cities and provinces, commuting was not a viable option; hence, the therapeutic strategy was different. In these cases, the affected elbow was placed in a hinge elbow functional brace, and the brace was locked in 45° of extension. After that, the extension was increased 10°-15° per week until full extension was obtained. Two patients with delayed referrals were also included after primary reduction in other health care facilities. In these cases, if the elbow was stable and no painful ROM or block to the motion was observed, a conservative treatment was implemented without considering the type of radial head or coronoid fracture. Weekly lateral and AP radiographs

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