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ORIGINAL ARTICLE

Evaluation of the Functional Outcome of Surgical Treatment of Terrible Triad Fracture Dislocation of the Elbow

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Background The terrible triad of the elbow is the name given to elbow dislocation associated with fractures of the coronoid process of the ulna and the radial head. Our objectives are that to evaluate the functional outcomes of patients with surgically treated terrible triad of the elbow.

Subjects and Methods A retrospective evaluation was performed using the MEPS score (Mayo Elbow Performance Score) of patients diagnosed with terrible triad of the elbow who underwent surgical treatment.

Results 20 patients (fifteen men and five women) in the mean follow-up 6 months were evaluated. 65% excellent and 35% good results were obtained. The time elapsed until surgery, final flexion-extension range greater than 100° and flexion contracture of less than 30° were shown to have a statistically significant relationship with a good final clinical result.

Conclusion Despite the severity of the injuries found in the terrible triad of the elbow, most of the patients evaluated here achieved elbow stability with good clinical results. The factors that led to better clinical results were surgery not more than 7 days after the injury, flexion-extension range greater than 100° and flexion contracture less than 30°.

Keywords Elbow stability, Mayo elbow performance score, Terrible triad fracture dislocation elbow.

INTRODUCTION

The terrible triad of the elbow is the name given to elbow dislocation associated with fractures of the coronoid process of the ulna and the radial head. Besides bone injuries, the elbow dislocation may be associated with ligament injuries, specifically lateral collateral ligament, medial collateral ligament and anterior capsule which are important articular stabilizers. These injuries lead to a high articular instability [1-4]. The terrible triad fracture may be caused by high and low energy trauma. It occurs from falls on the outstretched hand with the elbow in hyperextension associated with valgus stress. A resulting anterior strength leverages the ulna out of the humeral trochlea. The fracture of the coronoid process is a consequence from its impact against the trochlea. The fracture of the radial head is caused by the valgus stress to which the elbow has been submitted. This position also promotes failure of the lateral ulnar collateral ligament and consequent posterolateral dislocation of the radial head. In some cases, high kinetic energy trauma can evolve to rupture of the medial ligament of the elbow complex. The conservative treatment has unsatisfactory outcomes, with joint stiffness, recurrent instability and joint osteoarthritis. The treatment of choice is surgery. The osteosynthesis of fractures and repair of ligament injuries allow the stabilization of the elbow joint and early mobility [5-8]. The radial head fractures are preferably treated with osteosynthesis. When reconstruction of the fracture is not possible, usually when there is great comminution of the fragments, resection of bone fragments is preformed and the radial head is replaced by a prosthesis [9-12]. The repair of ligament injuries is critical to maintaining the stability of the elbow. The repair of the lateral ligament complex is always needed; this structure is always the first to be damaged evolving with rotatory posterolateral instability. The medial ligament complex

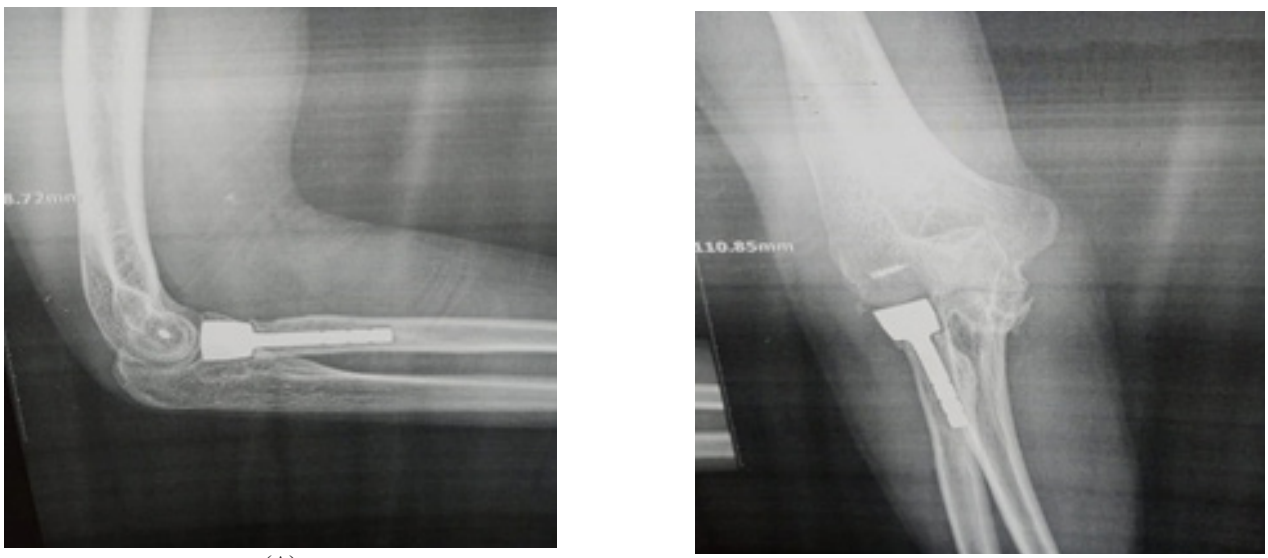
is explored and repaired during surgery if the joint is still unstable after repairing of lateral ulnar collateral ligament [13, 14]. According to coronoid process fracture, elbow stability can be achieved without coronoid fixation if a coronoid process fracture does not involve anteromedial facet or the fracture is less than 50% of the coronoid. Coronoid fractures can be effectively treated without fixation when intraoperative elbow stability is achieved through functional ROM after reconstruction for a radial head fracture and lateral collateral ligament complex injury repair [15-17].

SUBJECTS AND METHODS

This study included 20 patients with terrible triad fracture dislocation elbow. The age of the patient ranged from 22-61 years with the mean value of 36.30 years (±SD 12.29). 15 patients were males (75%) and 5 patients were females (25%). 11 patients (55%) were affected on the left side, while 9 patients (45%) were affected on the right side. In order to evaluate the clinical data, we used medical records and classification and to classify fractures, imaging exams such as radiography and computed tomography. In all cases, it was a posterolateral dislocation of the elbow joint with associated fractures of the radial head and coronoid process of the ulna.

Operative technique:

In all cases, a lateral surgical approach was carried out through the Kocher interval, between the extensor carpi ulnaris and anconeus muscles or Kaplan's approach uses the interval between the extensor digitorum communis and the extensor carpi radialis brevis. The radial head is then assessed. Depending on the patient's age, degree of comminution, and bone quality, it is decided whether to fix the radial head fracture or replace it with an arthroplasty.in this study, in 13 patients fixation of radial head fractures was done, while in 7 patients radial head prosthesis replacement was done. lateral collateral ligament complex repair was performed using metal anchors placed in the central region of the lateral epicondyle of the humerus, at the isometric point. in this study, we didn't need to fix the coronoid fractures in any patient due to intraoperative elbow stability was achieved through functional ROM after reconstruction for a radial head fracture and LCL complex injury (Figure 1).



(A) (B)

Figure 1: case of terrible triad fracture dislocation elbow. Radial head prosthesis replacement and LCL ligament repair by a bony anchor were done. (A) Lateral view follow up 6 months X-Ray. (B) AP view follow up 6 months X-Ray.

Assessment:

The patients were evaluated clinically by means of MEPS (Mayo Elbow Performance Score) which quantifies pain, mobility, stability and function, classifying the results through a scoring system in which 90 to 100 points is considered excellent; 75 to 89, good: 60 to 74, fair; and less than 60, poor [18]. In addition, goniometry was used to measure the flexion, extension, pronation and supination of the affected limb. In the imaging assessment, radiographs were produced in anteroposterior and lateral views on the operated elbow.

RESULTS

In this study, the final results according to the Mayo Elbow Performance Score after 6 months follow up in 20 patients were graded as excellent in 13 patients (65%), good in 7 patients (35). Fifteen patients (75%) were entirely free of elbow pain, five (25%) had mild pain which was felt after heavy work, no patient had pain at rest. In this study, a total of 18 patients (90%) recovered the functional arcs of motion for both flexion-extension and pronation-supination the average range of elbow flexion and extension is between 0 and 150. For the

majority of the activities, an elbow flexion arc of 100 degrees (between 30 and 130 degrees) is sufficient which is considered as the functional arc of motion. Also, Most activities can be completed with an arc of forearm rotation of 100 degrees (from 50 degrees of pronation to 50 degrees of supination). One patients (5%) recovered the functional arc only for flexion-extension, and one patient (5%) did not recover either the flexion-extension or the pronation-supination arc. The mean flexion-extension arc of motion was 123.75° (range, 115-130), the mean flexion contracture was 8.8, the Pronation averaged 75.75° on the injured elbow (range, 60-80), and the Supination averaged 78.75° in the injured elbow (range, 60-85), Nine patients (45%) had complete extension of the elbow without extension lag. seven patients (35%) had lost less than 10 degrees of extension, three (15%) lost 10 to 20 degrees, one (5%) lost 30 degrees. (Figure 2) regarding complications, one patient (5%) had significant limited range of motion due to non-united radial head fracture after fixation by plate and radial head synostosis .then, the patient was satisfied with these results specially there was no pain during the motion and refused any intervention for that. one patient (5%) developed moderate lateral elbow pain and limitation of elbow range of motion due to overstuffing of the joint by large sized implants. then, radial head prosthesis removal was done with capsular release. After that, the patient started early range of motion with physiotherapy and the symptoms was improved with a better range of motion. Two patients in this study (10%) developed superficial infection, which were managed by conservative daily dressing and antibiotic. The final outcome was affected significantly by time lapse before surgery. No significant relation between the final results and the age, the sex, the occupation, and side of injury.

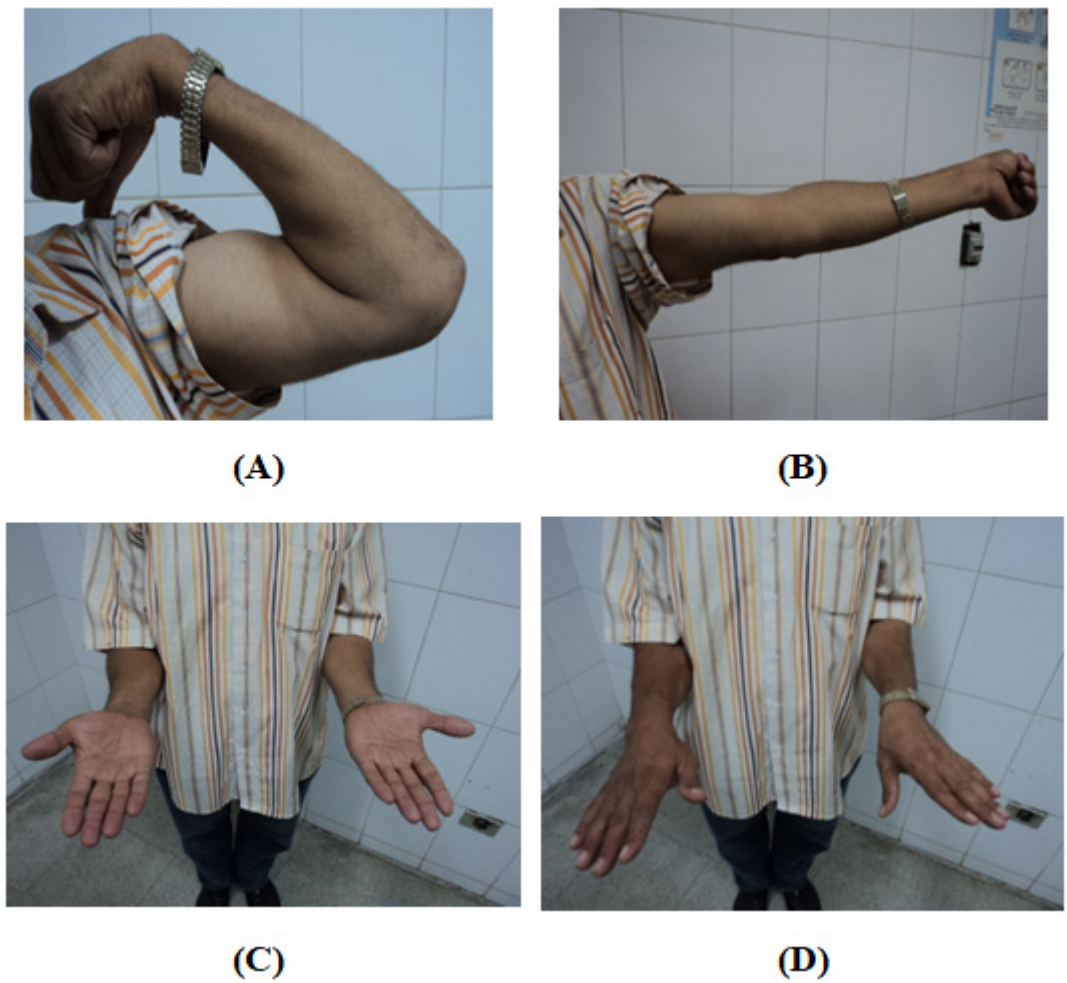


Figure 2: follow up range of motion of a patient after 6 months from the surgery.
A. Range of flexion 6 months post-operatively; B. Range of extension 6 months post-operatively; C. Range of supination 6 months post-operatively; D. Range of pronation 6 months post-operatively.

DISCUSSION

The terrible triad is a type of elbow dislocation injury where the radial head and coronoid process of the ulna are concurrently fractured, ligaments are torn, and the elbow is posteriorly dislocated [1-4]. This injury is complicated because it involves the rupturing of ligaments in the medial and lateral columns as well as the anterior column, which was damaged by the ulna's coronoid process. Additionally, the lateral column has been damaged by the radial head fracture. Because of this, the terrible triad is an injury that damages the elbow's primary and secondary stabilizers. This injury causes a severe acute instability at the time of damage and may result in persistent elbow instability, ectopic bone formation, chronic pain, stiffness and arthritis. Joint stiffness, recurring instability, and joint osteoarthritis as a result of immobilization are unsatisfactory results of conservative treatment [5-8]. Surgery is the preferred therapy. In this study, the final results according to the Mayo Elbow Performance Score after 6 months follow up were graded as excellent in 13 patients (65%), good in 7 patients (35). These results were comparable with the results of Brigato *et al*., [19] who reported on the longest follow-up study, which involved 14 patients and 15 elbows (one bilateral case). and lasted a mean follow up of 14.8 months. They assessed the results by using the clinical function rating index modified by Mayo. Their study showed that the results were excellent in 2 patients, good in 10 and poor in 2. Leandro *et al*., [20] reported on 19 patients retrospectively with terrible triad injury and the mean follow-up was 50.3 months. The clinical assessment was made to measure elbow range of motion, and the MEPS score was applied. They found excellent and good results were obtained for 15 patients (79%). In our study, a total of 18 patients (90%) recovered the functional arcs of motion for both flexion–extension and pronation-supination. One patients (5%) recovered the functional arc only for flexion–extension, and one patient (5%) did not recover either the flexion–extension or the pronation-supination arc. The mean flexion–extension arc of motion was 123.75° (range, 115-130), the mean flexion contracture was 8.8, the Pronation averaged 75.75° on the injured elbow (range, 60-80), and the Supination averaged 78.75° in the injured elbow (range, 60-85), Nine patients (45%) had complete extension of the elbow without extension lag. seven patients (35%) had lost less than 10 degrees of extension, three (15%) lost 10 to 20 degrees, one (5%) lost 30 degrees. Chi Zhang *et al*., [21] reported his experience on 21 patients assessed following surgical management of terrible triad injury after a mean follow-up of 32 months. the mean flexion–extension arc of all patients was 126.0 ± 4.8°, the mean flexion contracture was 9.52 ± 2.15°, the mean flexion was 135.5 ± 4.8°, the mean pronation arc was 70.5 ± 2.6°, the mean supination arc was 68.6 ± 2.2° and the mean forearm rotation arc was 139.0 ± 4.1° in our study. According to coronoid process fracture, we didn't fix any coronoid fracture in the whole 20 patients due to intraoperative elbow stability was achieved through functional ROM after reconstruction for a radial head fracture and LCL complex injury. According to the coronoid fracture, the fact that the coronoid process fracture wasn't fixed had no effect on the extension-flexion arch in the clinical assessment in the present study. These results suggest that the fixation of coronoid fractures in terrible triad injuries are not necessary if radial head and LCL complex are completely restored and the elbow joint stability is achieved.According to Antoni *et al*., [21] reattaching the anterior capsule in terrible triad injuries with coronoid tip fractures did not enhance the ultimate clinical and radiological results. They determined that if a coronoid process fracture does not affect the anteromedial facet or the fracture is less than 50% of the coronoid height, elbow stability can be accomplished without coronoid fixation. In a series of 14 terrible triad injuries with type I or II coronoid fractures treated without fixation, Papatheodorou *et al*., [15]. Found excellent results with no residual instability. They found that type I or II coronoid fractures can be adequately treated without fixation when intraoperative elbow stability is obtained with functional ROM after reconstruction for a radial head fracture and LCL complex injury.

CONCLUSION

Terrible triad fracture dislocation of elbow is an uncommon injury that require a thorough understanding of elbow anatomy and biomechanics for proper management. Restoration of the bony stabilizing structures and radial collateral ligament repair are a mandatory to restore the elbow stability and congruency for a better functional results. Early surgical procedure within first 7 days after the injury gives a better functional outcome results. When intraoperative elbow stability and functional ROM are obtained following reconstruction for a radial head fracture and LCL complex injury, coronoid fractures can be treated effectively without fixation.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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