



Terrible triad of the elbow: treatment protocol and outcome in a series of eighteen cases

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KEYWORDS

Elbow dislocation
Terrible triad
Hinged external fixator
Instability

ABSTRACT

The terrible triad is an uncommon injury, which includes an elbow posterior dislocation with fractures of the radial head and coronoid process of the ulna. In addition there is rupture of the lateral and medial collateral ligaments. The short-term and long term results are historically poor, with a high rate of complications. The main objective of this study is to report the results of a multicentre study of patients who sustained the terrible triad injury focusing on surgical treatment in order to offer a standardized surgical protocol.

We retrospectively review the results of surgical treatment of eighteen terrible triads from a multicentre study of 226 elbow dislocations. At an average follow up of 31.5 months postoperatively, all eighteen patients returned for clinical examination, functional evaluation, and radiographs. The mean MEPS score value was 78 (25–100), which correspond to three excellent results, ten good results, three fair results, and two poor results. Five early and three late complications were reported.

This particular case of elbow dislocation is very unstable and leads to many complications. The surgeon should attempt to restore stability by preserving the radial head whenever possible or replacing it with prosthesis otherwise, by repairing the lateral collateral ligament and performing fixation of the coronoid fracture. If after anatomical restoration of stability elements, the elbow remains unstable, options include repair of the medial collateral ligament or stabilization assumed by hinged external fixator.

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Introduction

Among elbow dislocations, the terrible triad is a specific injury described by Hotchkiss [1] with concomitant fractures of radial head and coronoid process of the ulna, ligamentous disruptions and posterior dislocation of the elbow. This injury is complex with rupture of elements of the different components of the elbow's stability: the anterior column by fracture of the coronoid process of the ulna and the medial and lateral columns by disruption of ligaments. In addition the presence of radial head fracture affects the lateral column. As a consequence, the terrible triad is an injury which damages the primary and secondary stabilizers of the elbow [2]. This injury generates a severe acute instability at the time of injury, and far away from the initial trauma, may induce chronic elbow instability, ectopic bone formation, chronic pain, stiffness and arthritis. Few clinical series have been published [3–5], and due to the difficulty of

positive diagnosis and treatment protocol, there is a lack of information available regarding ideal techniques for treatment.

The purpose of this study is to report the results of a retrospective multicentre study of 18 patients with terrible triad injuries to evaluate surgical treatment modalities in order to offer a standardized surgical protocol.

Materials and methods

Between 2000 and 2008, screening a multicentre national database driven by the authors, 226 elbow dislocations were identified. The inclusion criteria were defined as follows: an elbow dislocation with at least a fracture of the coronoid and radial head, and a minimal follow-up of 6 months for evaluation. Exclusion criteria were: 1) others associated injuries such as olecranon fractures, 2) Monteggia fracture, 3) concomitant ipsilateral wrist, hand or shoulder injuries, or 4) an isolated closed treatment for the injured elbow. From the initial 226 cases, 18 elbow dislocations with inclusion criteria parameters were identified and were selected for evaluation. As the study didn't modify any treatment protocol, according to our National Law, Ethics committee approval was not needed.

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Table 1
Type of injuries for each component and treatment

Case	RH	Treatment	CP	Treatment	Surgical approach	LCL	MCL
1	3	ORIF	1	Suture	L	TO	-
2	3	Prosthesis	1	-	L	TO	TO
3	3	ORIF	1	-	L	TO	-
4	3	ORIF	1	-	L	S	-
5	3	ORIF	2	-	L	-	-
6	3	Prosthesis	1	-	L	TO	-
7	3	Prosthesis	1	-	L	-	-
8	3	Prosthesis	1	-	L	TO	-
9	3	Prosthesis	1	-	L	TO	-
10	2	ORIF	1	-	L	TO	-
11	3	Prosthesis	1	-	L	S	-
12	2	ORIF	2	-	L	S	-
13	2	ORIF	1	-	L	-	-
14	3	Prosthesis	3	Screw	L & M	-	-
15	3	ORIF	1	-	L & M	S	S
16	2	Resection	1	-	L	-	-
17	2	ORIF	2	Screw	L & M	S	TO
18	3	ORIF	1	-	L	TO	-

ORIF: open reduction and internal fixation; TO: trans-osseous fixation; S: direct suture; RH: radial head fracture; CP: coronoid process fracture; LCL: lateral collateral ligament; MCL: medial collateral ligament; L: lateral approach; M: medial approach and "-": not repaired.

The fractures of the radial head were classified according to the Mason's classification [1,5]. The fractures of the coronoid process of the ulna were classified according to Morrey-Regan based on the percentage of the process fragment separated from the ulna [1,4,5].

All eighteen patients were reviewed for clinical examination, functional evaluation, and radiographs of the injured elbow. Outcome was evaluated using Mayo Elbow Performance Score (MEPS) [6] and classified as follows: excellent when over 90 points; good, from 75 to 89 points; fair, from 60 to 74 points; and poor, inferior to 60. Other criteria were the flexion-extension arc of motion, the amplitude of flexion, the level of flexion contracture, and degree of extension gap. Radiographic signs of degenerative arthritis were also rated according to Broberg and Morrey [7]. Different other criteria were included for evaluation on plain radiographs, i.e. heterotopic bone formation, radial head restoration and coronoid process union. Average follow-up of this study was 31.5 months and ranged from 7 to 97 months.

Results

In the eighteen patients included, the mean age of the 6 females and 12 male patients was 43.8 years (range, 19–56). None terrible triad had an associated ulnar nerve damage, open wound trauma or vascular compromise. The fractures of the radial head were type II in five cases and thirteen were type III. The fractures of the coronoid process were fourteen types I, three types II, and one type III.

All patients of this study were treated surgically (Table 1). Treatment was done as follows: manual external manoeuvres for reduction of the dislocation under anaesthesia; joint stability testing after reduction; coronoid process repair (1 lasso-type suture, 2 ORIF by medial approach, 15 not repaired); radial head fractures surgery (10 ORIF, 7 radial head prosthesis, 1 radial head resection). For ligaments repair, 13 lateral collateral ligaments were fixed either by direct suture (5), or trans-osseous fixation (8). Medial collateral ligaments were repaired in only 3 cases, by direct suture (1) or trans-osseous fixation (2). In a specific case of a woman 43-years old who sustained a terrible triad treated only from the lateral side, we have added a hinged external fixator because of persistent instability of the injured elbow (Figure 1). Initial trauma was a posterior dislocation of the right elbow

(dominant) with a Mason III radial head and Morrey I coronoid fractures. Acute instability of the elbow was still present after replacement of the radial head by a prosthesis and suture of the lateral collateral ligament complex. To get stabilisation of the joint, protect sutures and allow early motion, additional lateral insertion of this hinged fixator was carried out.

Five postoperative complications were seen with two cases of wound dehiscence, one dislocation of the humeroulnar joint and two radial heads prosthesis dislocations. Late complications were limited to one radioulnar cross-union, one ulnar nerve neurapraxia with pain and one atypical cutaneous pain of the forearm.

Global functional result, according to MEPS, was of 78, representing three excellent, ten good, three fair and two poor results. An objective positive outcome was seen in 13 of the 18 patients (72%). The mean flexion was 135° and the mean extension deficit was 21°. Sixteen patients had a normal pronation (89%) and fourteen (78%) a normal supination (Table 2). As a global result, twelve of the eighteen patients had a functional arc of motion, according to the criteria of Morrey [8].

Radiographic evaluation (Table 3) was available for seventeen of the patients. We found one persistent dislocation of the elbow, one non-union of the radial head and six non-unions of the coronoid process. Elbow post-traumatic arthritis was seen as moderate in four patients, little in five and none in eight. Heterotopic bone formation around the elbow joint was present in 11 of the 17 patients.

Discussion

The terrible triad of the elbow causes extensive damage to the ligaments and osseous structures, which provides acute elbow stability. For adequate evaluation of all injured items, complete radiographic evaluation must be done after reduction, and the best treatment protocol must be based on its results. Positive diagnosis may be difficult, as disruption of the ligaments is not seen on x-rays. Majority of terrible triads will require open repair and isolated closed management is not an adequate treatment [5,9] as re-dislocation can occur even with application of a posterior splint.

Surgical treatment of terrible triads of the elbow needs a complete repair of osseous and ligamentous lesions to get a

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