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Terrible triade of the elbow: Practical conduct (About 20 cases)

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Abstract

Introduction: The terrible triad of the elbow (TTE) combines elbow dislocation, fracture of the radial head and coronoid process, and was individualized as a clinical entity by Hotchkiss in 1996 [1]. It follows trauma involving valgus of the elbow, supination of the forearm and axial compression. This trauma induces injury to the radial collateral ligament complex, which extends towards the capsule, reaching the ulnar collateral ligament compartment

Material and methods: This work consistes of a prospective study of 20 cases of unfortunate elbow triad treated at the "Aile IV" Orthopedic Traumatology Department of CHU Ibn Rochd in Casablanca, during the period spread between January 2018 and January 2023. Long-term results were assessed using the Mayo Clinic Elbow Performance Score (MEPS).

Results: The preferred approach is the posterolateral or lateral Cadenat approach. 12 type III radial heads were treated with mini-plates after tabletop reconstruction, 7 were treated with screws and one head was resected due to the impossibility of osteosynthesis. 11 type 1 coronoid process fractures were treated with capsular reinsertion, and the remainder with screw fixation. The lateral collateral ligament was repaired in all patients by anchoring. The medial collateral ligament was affected in 06 of our patients after intraoperative stability testing, requiring suture and anchor repair. Overall, the MEPS score ranged from 50 to 96%, with an average of 81%, including 7 excellent, 7 good, 2 good and 4 poor results.

Discussion: Described by HotchKiss in 1996, the terrible elbow triad is a rare entity accounting for only 10% of radial head fractures. Several authors advocate systematic reconstruction of the radial head, coronoid process and lateral ligament plane to limit complications. The radial head represents an important element of stability in forced valgus and posterior translation. Type II radial head fractures, and where possible type III fractures, should therefore be preserved and osteosynthesized. The coronoid process is the key element in the stability of the humero-ulnar joint. 50% of the height of the coronoid process is required to ensure sagittal stability of the humero-ulanr joint.

Conclusion: Only the restoration of elbow integrity by repairing all structures, using a standardized surgical protocol, can achieve good functional results. The aim of treatment is to restore osteoligamentous stabilization in the sagittal plane, enabling early post-operative mobilization and minimizing the risk of post-traumatic stiffness.

Keywords: Terrible triad; Elbow dislocation; Elbow instability; Traumatic elbow.

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1. Introduction

The terrible triad of the elbow (TTE) combines elbow dislocation, fracture of the radial head and coronoid process, and was individualized as a clinical entity by Hotchkiss in 1996 [1]. It follows trauma involving valgus of the elbow, supination of the forearm and axial compression. This trauma induces injury to the radial collateral ligament complex, which extends towards the capsule, reaching the ulnar collateral ligament compartment. [2] This association of lesions poses a diagnostic and therapeutic problem. Management is poorly codified, and the medium- to long-term prognosis is uncertain. The principle of treatment is twofold: restore the stabilizing bony structures (radial head and coronoid process) and repair the radial collateral ligament. [3]

2. Material and methods

This work consistes of a prospective study of 20 cases of unfortunate elbow triad treated at the "Aile IV" Orthopedic Traumatology Department of CHU Ibn Rochd in Casablanca, during the period spread between January 2018 and January 2023.

Inclusion criteria were, combination of three lesions: elbow dislocation, radial head fracture and coronoid process fracture, first episode of dislocation, time to onset less than 15 days, follow-up greater than 06 months.

Long-term results were assessed using the Mayo Clinic Elbow Performance Score (MEPS).

3. Results

3.1. Epidemiology

- The mean age of patients was 41.7 years with extremes between 20 and 80 years, and
- a frequency peak between 30 and 40 years of age.
- A predominance of males with a sex ratio of 3, with the dominant side
- affected in 64% of cases.
- MVA (55%) and falls (30%) remain by far the most frequent causes.

3.2. Radio clinical study

Figure 1 X-ray of the elbow showing a variety of dislocations: posterior elbow face (a) profile (b). Posterolateral elbow face (c) profile (d).

All patients presented with an upper-limb trauma attitude with elbow swelling, pain and IFT, with loss of bony elbow landmarks on palpation.

Posterolateral elbow dislocation was most common in 12 patients, with 8 patients presenting with a posterior variety.

Most had a type 3 radial head fracture with 64% and a type 1 coronoid process fracture with 55%.

3.3. Management

3.3.1. Initial treatment

The average time to treatment was 24-48 hours. Reduction of the dislocation was performed by external maneuver in the emergency department under sedation in all our patients.

Temporary immobilization was performed using a posterior splint, with radiological monitoring of the reduction followed by additional CT scanning.

3.3.2. Surgical treatment

Figure 2 Intraoperative view of repair time

Figure 3 Table-top mini-screw reconstruction of a cervicocephalic fracture fracture of the radius.

- The patient is positioned supine, elbow flexed on an arm table under general anesthesia.
- The preferred approach is the posterolateral or lateral Cadenat approach.
- 12 type III radial heads were treated with mini-plates after tabletop reconstruction, 7 were treated with screws and one head was resected due to the impossibility of osteosynthesis.

- 11 type 1 coronoid process fractures were treated with capsular reinsertion, and the remainder with screw fixation.
- The lateral collateral ligament was repaired in all patients by anchoring.
- The medial collateral ligament was affected in 06 of our patients after intraoperative stability testing, requiring suture and anchor repair.
- All our patients benefited from immobilization with a posterior plaster cast splint for 2 to 3 weeks.

3.3.3. Functional results

Overall, the MEPS score ranged from 50 to 96%, with an average of 81%, including 7 excellent, 7 good, 2 good and 4 poor results.

At medium- and long-term follow-up, we noted 4 cases of neuroalgo-dystrophic syndrome in our series, 6 cases of stiffness and 3 cases of valgus instability. Residual periodic pain was found in 8 patients.

4. Discussion

Described by HotchKiss in 1996, the terrible elbow triad is a rare entity accounting for only 10% of radial head fractures according to Van Riet and Morrey [4]. This lesion association represents a complex trauma of the elbow that poses a diagnostic and therapeutic problem, leading to bone and ligament injuries that threaten the elbow's stability over the course and long term, with a high rate of complications and uncertain outcomes.

Shaoliang et al in 2019 found 92 cases, 63H/29F with an average age of 41 years, which concurs with our results. According to most series, falls remain the most frequent cause, whereas in our context MVAs were more frequent [7 ,8].

Several authors advocate systematic reconstruction of the radial head, coronoid process and lateral ligament plane to limit complications [10]. In our series, one radial head was completely resected, resulting in secondary instability. The radial head represents an important element of stability in forced valgus and posterior translation. Type II radial head fractures, and where possible type III fractures, should therefore be preserved and osteosynthesized. However, in comminuted fractures that cannot be osteosynthesized, prosthetic replacement allows reconstruction of the lateral stability column [11].

Rupture of the medial collateral ligament, common in elbow dislocation, gives the radial head an important stabilizing role [12]. The coronoid process is the key element in the stability of the humero-ulnar joint. 50% of the height of the coronoid process is required to ensure sagittal stability. Terada [14] recommends systematic fixation to achieve anatomical reduction and restore anterior column stability. Some authors recommend capsular reinsertion using an anchor, or retrograde lacing supported by the olecranon. Type II and III fractures require stable osteosynthesis using screws or plates.

McKee et al [15] found damage to the radial collateral ligament in all cases. As this ligament is isometric, careful reinsertion at the elbow's center of rotation, located at the center of the lateral epicondyle, is necessary to avoid varus or posterolateral instability. The decision to perform a medial approach for repair of the medial collateral ligament is taken only in cases of persistent sagittal instability. If the elbow is still unstable after adequate treatment, an external elbow fixator is required. Despite prompt management with good repair of the osteoligamentous structures, terrible triads constitute a complex trauma whose therapeutic results are more often than not uncertain. In the study published by Ring et al [17] of 11 patients with terrible triads of the elbow, seven were judged unsatisfactory and three as therapeutic failures. In the series by Pugh et al [16] involving 36 cases of terrible triad, the authors reported four cases of stiffness, two cases of proximal radioulnar synostosis and one case of posterolateral instability; humeroulnar osteoarthritis was found in 17% of cases.

5. Conclusions

Managing the terrible triad of the elbow remains a challenge for orthopaedic surgeons. Only the restoration of elbow integrity by repairing all structures, using a standardized surgical protocol, can achieve good functional results. The aim of treatment is to restore osteoligamentous stabilization in the sagittal plane, enabling early post-operative mobilization and minimizing the risk of post-traumatic stiffness.The lateral approach allows treatment of the TR and lateral collateral ligament, as well as anterior capsular repair. This approach restores sagittal stability in the majority of cases. If instability in extension persists after repair of the lateral osteoligamentous structures, a medial approach should be taken to repair the medial collateral ligament complex.

Bone stabilization and soft-tissue damage to the elbow must be sufficiently stable to allow rapid mobilization, thereby limiting elbow stiffness.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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