World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(CASE REPORT)

Bilateral Terrible Triad of the Elbow Associated with an Olecranon Fracture: A Rare Case and Therapeutic Challenge

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World Journal of Advanced Research and Reviews, 2025, 28(01), 201-207

Publication history: Received on 20 August 2025; revised on 25 September 2025; accepted on 29 September 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.28.1.3359

Abstract

Introduction: The terrible triad of the elbow (TTE) is a complex injury combining a radial head fracture, a coronoid process fracture, and a posterior elbow dislocation. Its bilateral occurrence is exceptional. We report an original case of bilateral TTE complicated by an olecranon fracture on the dominant side, to analyze the specificities of its management.

Case Report: A 34-year-old man, right-handed, with no significant medical history, was the victim of a 7-meter fall. Radiological assessment revealed a bilateral TTE (Regan-Morrey type 3 coronoid fractures and Mason type 3 radial head fractures) associated with a Duparc type 3 olecranon fracture on the right. Surgical management involved a sequential "from the inside out" repair ("Lasso" suture of the left coronoid, osteosynthesis of the radial heads, lateral ligament repair). The right posterior approach allowed for coronoid fixation with a screw and olecranon fixation with a plate, along with ligament repair.

Discussion: This case, one of the few described of bilateral TTE with an olecranon fracture, results from high-energy trauma. The therapeutic strategy follows established principles: anatomical repair of bony structures (prioritizing the coronoid and radial head), systematic stabilization of the lateral ligament complex, and early mobilization. The choice of techniques (suture vs. screw for the coronoid, osteosynthesis vs. radial head arthroplasty) must be adapted to the fracture type and patient profile.

Conclusion: Bilateral TTE is a rare entity that requires meticulous and individualized surgical planning. Robust anatomical repair and early rehabilitation are key to optimizing functional outcomes and minimizing the risk of stiffness and osteoarthritis.

Keywords: Terrible Triad of The Elbow; Elbow Dislocation; Bilateral Fracture; Olecranon Fracture; Osteosynthesis; Ligament Repair

1. Introduction

Initially described by Hotchkiss in 1996, the terrible triad of the elbow (TTE) is a complex injury combining a fracture of the radial head, a fracture of the ulnar coronoid process, and a posterior dislocation of the elbow [1]. This entity remains a therapeutic challenge due to its persistent instability and high risk of long-term complications such as osteoarthritis and stiffness [2]. While unilateral TTE is already rare, its bilateral occurrence is exceptionally reported in the literature. The association of an olecranon fracture with this triad further complicates the presentation, disrupting the essential anteroposterior stability of the joint [3].

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We present here an original case of bilateral terrible triad, complicated by an olecranon fracture on the dominant side. The objective of this report is to analyze the clinical specificities, the adopted surgical strategies (internal fixation, ligament repair), and to discuss the challenges of rehabilitation in this exceptional context of multiple injuries.

2. Case report

A 34-year-old man, a laborer, right-handed, with no significant medical history, was the victim of an accidental fall from the first floor (approximately 7 meters high) with landing on both outstretched hands. The initial trauma caused a craniofacial injury and injuries to both elbows.

The initial clinical examination revealed a bilateral deformed posture of the elbows. Standard radiography of both elbows confirmed a bilateral terrible triad, associated with an olecranon fracture on the right. A CT scan of the elbows with 3D reconstructions detailed the injuries:

- **Left side:** Posterior elbow dislocation associated with a fracture of the coronoid process classified as stage 3 according to Regan-Morrey and a fracture of the radial head classified as type 3 according to Mason.
- **Right side:** Posterior elbow dislocation with a stage 3 coronoid process fracture (Regan-Morrey), a type 3 radial head fracture (Mason), and a transverse olecranon fracture type 3 according to the Duparc classification.

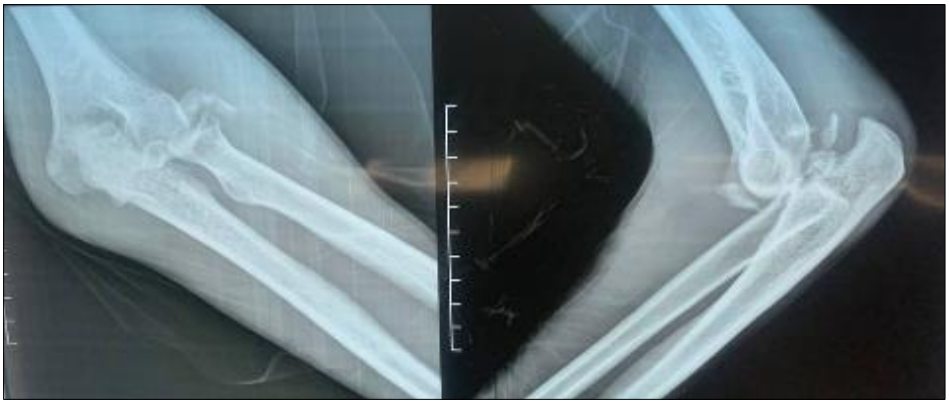

Figure 1 X RAY of left elbow

Figure 2 X RAY of right elbow

2.1. Surgical Treatment

Treatment was surgical and performed in a single stage for both elbows.

- **Left elbow:** Approach via a lateral Kocher incision. Repair followed an "inside out" sequence:
- Coronoid process: Repair using a "Lasso" suture with a slow-absorbing suture, with anterior capsular anchoring and passage of the sutures posteriorly through two bone tunnels.
- Radial head: Osteosynthesis with two screws.
- Ligament stabilization: Repair of the annular ligament and reinsertion of the lateral collateral ligament (LCL) using a bone anchor.

Figure 3 Repair coronoid process using a "Lasso" suture with a slow-absorbing suture, with anterior capsular anchoring and passage of the sutures posteriorly through two bone tunnels

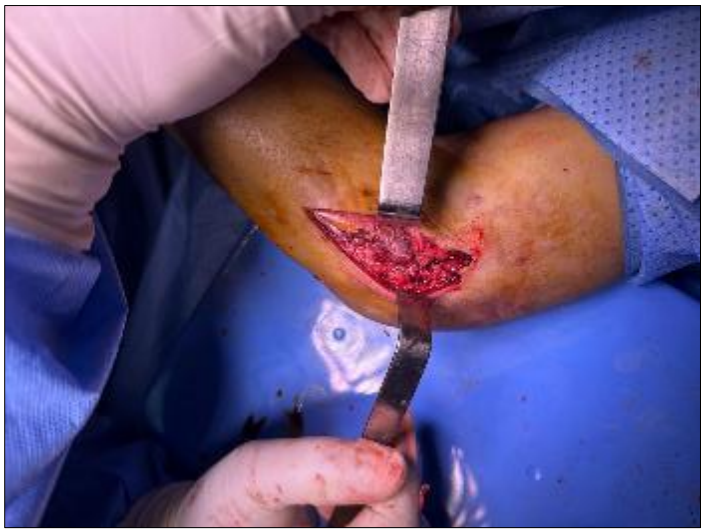

Figure 4 Repair of the annular ligament and reinsertion of the lateral collateral ligament (LCL) using a bone anchor

- **Right elbow:** Posterior midline approach, utilizing the olecranon fracture. The repair sequence was as follows:
- Fixation of the coronoid process with a lag screw.
- Osteosynthesis of the radial head with a screw.
- Osteosynthesis of the olecranon with a compression plate and screws.
- Reinsertion of the medial collateral ligament (MCL) using an anchor.

Figure 5 Posterior midline approach

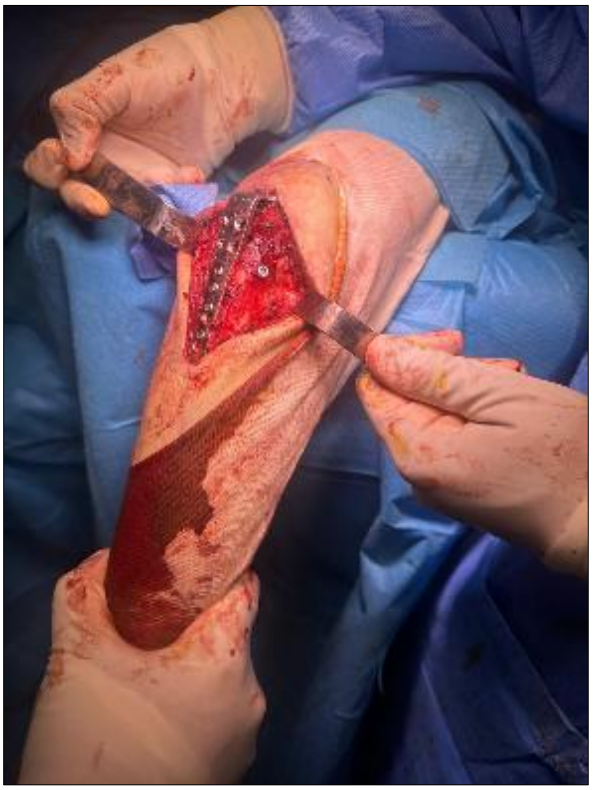

Figure 6 Right elbow repair

2.2. Postoperative Course

Both elbows were immobilized in a brachio-antebrachio-palmar (BABP) splint in slight flexion for 2 weeks, followed by the use of hinged elbow braces locked in extension and flexion for 4 weeks, allowing for progressive early passive and active rehabilitation.

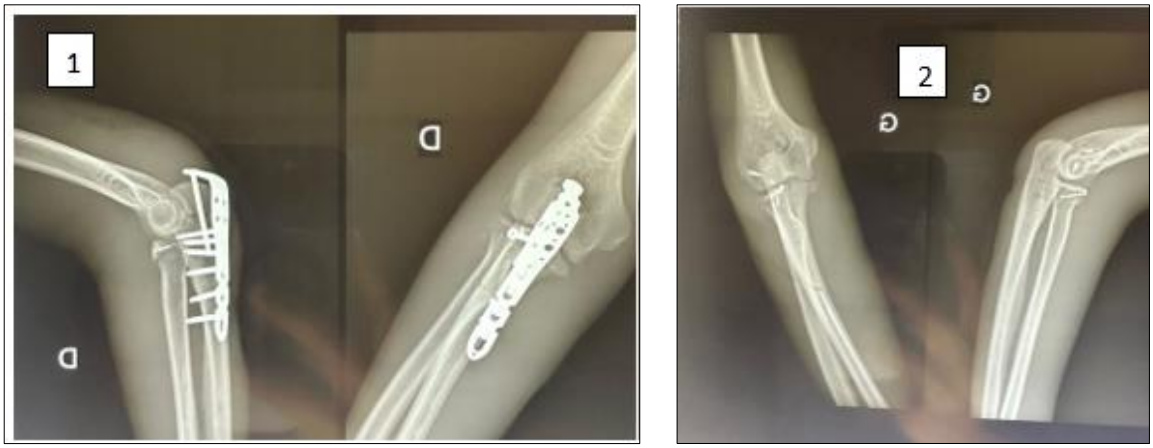

Figure 7 Postoperative X-rays of both elbows (1) right (2) left

3. Discussion

This case illustrates a rare and complex form of bilateral TTE, associated with an olecranon fracture on the dominant side. This combination of injuries results from a high-energy traumatic mechanism, confirming data from the literature where falls from height represent a primary etiology of complex TTE [4].

3.1. Surgical Strategy and Repair Sequence

Our management followed the principles established by Pugh et al. [5]: priority repair of bony structures (coronoid then radial head) before ligament stabilization. The "inside out" sequence was applied to the left side, while the right olecranon fracture provided direct posterior access, allowing for anatomical reduction and fixation under direct visual control, as recommended by recent guidelines [6]. The technical choice for the coronoid was adapted to each case: a "Lasso" technique [7] on the left for an accessible fracture, offering good biomechanical stability [8], and a lag screw on the right for a larger volume fracture (type III), ensuring the superior rigidity required in a context of major instability [9]. Osteosynthesis of the radial head with screws was chosen bilaterally, reflecting the trend to preserve the radial head in a young patient with satisfactory bone quality, despite comminution [10].

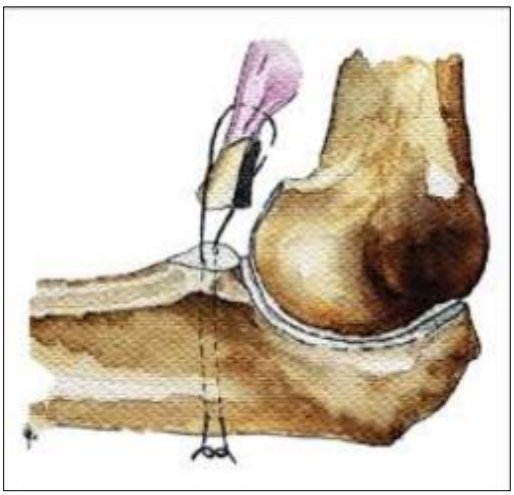

Figure 8 lasso suture

3.2. Management of Ligament Injuries

The systematic repair of the LCL, performed on both sides, is a cornerstone of treatment to restore posterolateral stability [11]. The decision not to repair the MCL on the left, based on intraoperative stability after bony and lateral repair, is supported by literature which only recommends medial repair in case of residual instability [12].

3.3. Specifics of the Olecranon Fracture

The addition of an olecranon fracture (present in approximately 27% of concomitant injuries according to Medina et al. [4]) adds a component of posterior instability. Its rigid fixation with a plate is essential to restore the olecranon buttress, a key element of stability in extension [13].

3.4. Early Rehabilitation

Our early mobilization protocol (< 15 days) aligns with current standards which demonstrate better functional outcomes and less joint stiffness [6]. This is crucial in a bilateral context where simultaneous recovery is imperative for the patient's autonomy.

Limitations and Challenges

The bilaterality of the injury is a prognostic factor poorly understood due to its rarity. The long-term impact of the additional olecranon fracture on the development of osteoarthritis requires close monitoring. Finally, the choice of radial osteosynthesis over arthroplasty for comminuted type III fractures can be debated but was justified here by the patient's age and the absence of extensive cartilage damage.

4. Conclusion

This exceptional case of bilateral TTE with an olecranon fracture underscores the importance of a surgical strategy tailored to each injury, based on:

- Anatomical and robust bony repair, prioritizing the coronoid and radial head.
- Systematic stabilization of the lateral ligament complex.
- Early mobilization to prevent ankylosis.

Medium- and long-term evaluation using functional scores (MEPS, QuickDASH) and radiological monitoring are essential to detect residual instability or degenerative arthritis. This case argues for a multimodal and individualized approach in the management of these complex elbow traumas.

Compliance with ethical standards

Disclosure of conflict of interest

No conflit 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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