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Case Report

A rare injury of terrible triad of elbow with ipsilateral wrist fracture - is minimal intervention enough?

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Abstract

The combination of an ipsilateral "terrible triad" injury of the elbow—comprising elbow dislocation, radial head fracture, and coronoid process fracture—with a distal end radius fracture is exceedingly rare. Such a presentation poses significant challenges in diagnosis, surgical planning, and rehabilitation. We report the case of a 50-year-old woman who sustained ipsilateral terrible triad injury of the elbow and distal end radius fracture following a fall from a ladder, landing on her outstretched hand. Radiographic evaluation also revealed a complex injury pattern. The patient underwent closed reduction and internal fixation using K-wire for both the elbow and wrist along with additional ligamento-taxis using external fixator for the wrist injuries. With a stable joint and active range of motion, the patient demonstrated a satisfactory functional improvement following an uncomplicated postoperative recovery. This case emphasizes the potential of K-wire fixation as a viable and minimally invasive method as an alternative in managing such a complex upper limb injuries.

Keywords: Radial head fracture, Coronoid process fracture, Elbow fracture-dislocation, K-wire.

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1. Introduction

The most frequent acute traumatic elbow instability is a posterolateral dislocation of the elbow joint, which is brought on by axial compression, forearm supination, and traumatic valgus elbow instability. Damage to the radial collateral ligamentous complex, which extends to the capsule and up to the ulnar collateral ligament compartment, will result from such trauma.[1] Total dislocation of the elbow joint is associated with ligament injury and fractures of the olecranon, coronoid process, radial head, or epicondyle. According to Hotchkiss, an elbow dislocation, a radial head fracture, and a coronoid process fracture constitute the "dreadful triad injury" of the elbow.[2] An ipsilateral comminuted wrist fracture further complicates management, as it introduces an additional complex and independent variable to an already challenging case.

The surgical therapy of this injury requires a thorough understanding of the anatomy and biomechanics of the joint, particularly of the many osseous and ligamentous elements that contribute to the elbow joint's stability. The main objective in treating these injuries should be to restore stability so that early range of motion may be achieved and stiffness can be avoided.[3]

Heterotopic ossification (HO), infection, synostosis, arthrofibrosis, recurrent instability, post-traumatic arthritis, stiffness, non-union, ulnar neuropathy, loosening of the implant requiring revision surgery, and symptomatic hardware are among the complications that might arise after elbow fracture-dislocation. There is a significant chance of complications when treating severe triad injuries surgically; the reoperation rate might reach 54.5%, with an average of 22 to 30%.[4,5]

Only a limited number of cases have been documented in the literature involving elbow fracture-dislocation accompanied by an ipsilateral distal radius fracture. The report highlights the clinical presentation, diagnostic

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findings, and considerations in management, emphasising the importance of early recognition and multidisciplinary care for optimal outcomes.

2. Case History

A 50-year-old woman arrived at the emergency department following a reported fall from a ladder approximately four feet high at her home, during which she landed on her outstretched hand. She sustained injuries to her left wrist and elbow. The patient is a known diabetic and is currently on medication.

On physical examination of the left wrist, no external wounds were observed. However, there was noticeable swelling, tenderness, crepitus, and deformity, along with painful and limited range of motion. The radial artery was palpable, capillary refill time was under 3 seconds, and distal sensations were preserved.

Figure 1: The initial x-ray, including anteroposterior (AP) and lateral views of the wrist, revealed a distal radius fracture

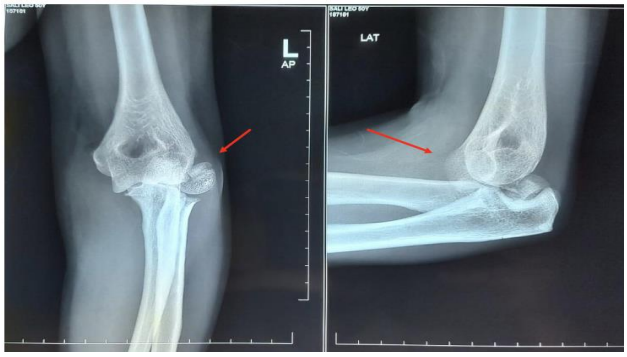

Figure 2: Anteroposterior (AP) and lateral X-ray views of the elbow demonstrated a posterolateral elbow dislocation accompanied by fractures of the radial head and coronoid process, collectively referred to as the "terrible triad" injury

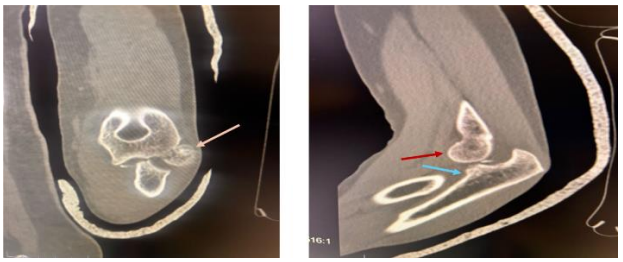

Figure 3: CT images highlighting the terrible triad injury. Radial head fracture (Pink); Coronoid fracture (Blue) and subluxation of elbow joint (Red)

Examination of the left elbow also revealed no open wounds, but swelling, tenderness, and deformity were present. Movements of the elbow were painful and restricted. The radial artery remained palpable, with a capillary refill time of less than 3 seconds, and distal sensation was intact.

The patient was referred for radiological evaluation. X-ray imaging revealed a comminuted intra-articular fracture of the distal end of the left radius, positive ulnar variance along with distal radioulnar joint (DRUJ) subluxation [Piano key sign positive] (**Figure 1**). Additionally, findings included a posterolateral elbow dislocation, a radial head fracture, and a coronoid process fracture of the ulna—collectively known as the "terrible triad" of the elbow (**Figure 2** and **Figure 3**).

2.1. Management

Initially, in the emergency department, the elbow dislocation was reduced and an above-elbow back slab was applied with the forearm in a mid-prone position and the elbow flexed at 90 degrees. The following day, the patient was placed in a supine position under a brachial plexus block (BPB). A closed reduction of the distal radius was performed, followed by internal fixation with K-wires and wrist spanning External fixation and stabilization of the distal radioulnar joint were also carried out using K-wire. Additionally, closed reduction and internal fixation of the elbow were done with ulno-humeral K-wire fixation at 100 degrees of elbow flexion (**Figure 4**A-C). An above-elbow back slab was reapplied, this time with the forearm in supination.

2.2. Follow-up evaluation

At four weeks post-operatively, the ulnohumeral K-wire and the DRUJ K-wire were removed in the outpatient department (OPD) (**Figure 4**D-F). The DRUJ K-wire was removed because it was loosely attached. The back slab was also removed. The elbow was assessed for varus-valgus stability, and upon examination, it was found to be stable with active elbow range of movements (**Figure 5**). Range of motion exercises and physiotherapy were started under direct supervision of operating surgeon.

At six weeks post-operation, the distal radius K-wires and external fixator were removed, and the patient was placed in a below-elbow cast. Three weeks later, the cast was also removed. The elbow's range of motion was between 30° of

flexion to 100° of flexion with forearm supination and pronation measuring 45° each. (**Figure 6**A-D). Additionally, a 50° dorsiflexion and 60° palmar flexion was noted at wrist. Radiological follow up done after 3 months of index surgery (**Figure 7**). The possibility of requiring radial head replacement cannot be ruled out if peripheral stiffness or limited pronation and supination continues.

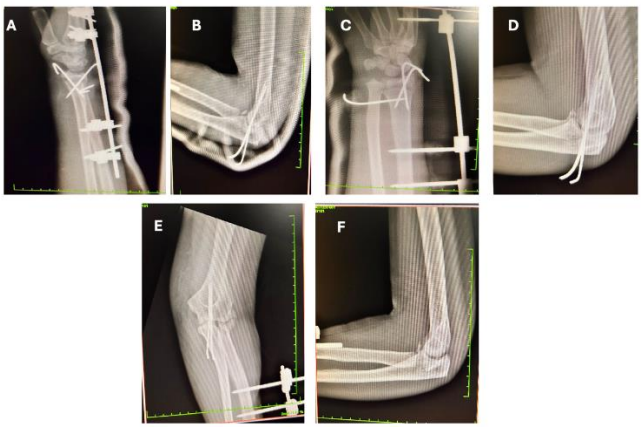

Figure 4: A-B): Primary surgical radiographs; **C)**: Negative ulnar variance restored; **D)**: 4-weeks before removal of ulno-humeral K wire in Lateral view; **E**): 4-weeks before removal of ulno-humeral K-wire in Antero-posterior view; **F)**: 2-weeks after removal of ulno-humeral K-wire

Figure 5: Assessment of varus and valgus instability during follow-up

Figure 6: The range of movements assessed during follow-up visit; **A)**: 30° flexion at elbow; **B**): 100° flexion at elbow; **C)**: 45° pronation at forearm; **D)**: 45° supination at forearm

Figure 7: Anteroposterior and lateral radiographs of the elbow (following the removal of ulnohumeral K-wires) and wrist (following removal of external fixator and K-wires) taken three months postoperatively.

3. Discussion

The "terrible triad of the elbow", first identified by Hotchkiss in 1996, is a very unstable kind of fracture-dislocation that included simultaneous radial head or neck and coronoid process fractures.[2] Only two cases have been reported in the literature from Saudi Arabia, with no cases documented in Indian literature.

Several mechanisms are believed to contribute to this type of injury, including longitudinal compression, external rotational forces, and valgus stress applied to a semi-flexed elbow, ultimately resulting in elbow dislocation. The exact mechanism is influenced by the position of the forearm and elbow joint at the time of impact.

The significant complication rates and historically poor outcomes foreshadow this injury pattern's classification as "terrible." Range of motion restriction, chronic instability, delayed consolidation, pseudoarthrosis, and proximal radioulnar synostosis are some of its side effects. Conservative therapy typically has poor outcomes and leads to arthrosis, recurrent instability, or extreme elbow stiffness from extended immobilization.[6]

The elbow is regarded as one of the body's most stable joints because of its many soft tissue and bone features. Treating the elbow is more challenging because to its intricate anatomical structure and greater functional requirements.[7]

Additionally, Forearm double injuries are rare, which emphasises the value of a comprehensive clinical examination and radiographs of the joints above and below

the injury site. Because of the high rate of missed injuries, a comprehensive diagnostic assessment of these injuries is essential. The recommendations do not yet specify how to treat this kind of damage. Fracture pattern, displacement, stability, patient age, and physical activity are some of the variables that affect fracture care.

When surgical intervention is required for radial head fractures, open reduction and internal fixation (ORIF) is generally considered the preferred method. This is because the radial head plays a crucial role in resisting valgus stress, and its resection in the context of fracture-dislocations can result in Essex-Lopresti instability and subsequent arthrosis. Therefore, preserving the radial head should be prioritized whenever possible.[8] The proper selection of implant size is crucial for successful radial head arthroplasty. An undersized prosthetic head results in a limited contact area and may lead to laxity of the lateral collateral ligament (LCL). Conversely, an oversized implant can disrupt joint congruence and place excessive tension on the LCL, which may contribute to postoperative stiffness.[9] In studies by Kamaludin NAA et al in 2018,[10] Alharbi A et al[11] reported cases where ORIF with radial head arthroplasty was done.

In our case, we chose closed reduction with K-wire fixation and ligamento-taxis, following standard orthopedic practice. By the fourth week, the previously unstable elbow had become stable, likely indicating successful healing of the lateral ulnar collateral ligament through this minimally invasive approach. The type 1 coronoid fracture also showed good healing. The radial head was preserved, as it contributed to maintaining lateral stability of the elbow joint.

4. Conclusion

This case demonstrates an upper extremity injury combination that had been less reported previously. Despite the complexity of such injuries, perhaps the patient demonstrated favorable functional recovery with no immediate complications. In this case of an ipsilateral terrible triad injury accompanied by a wrist fracture, the coronoid process fracture was identified as a Regan-Morrey type I lesion, involving only the tip of the coronoid. As the fracture was undisplaced, conservative management was appropriately chosen. This aligns with our protocol, where non-operative treatment is suitable for type I coronoid fractures. However, in cases of Regan-Morrey type II or III coronoid fractures—where displacement is present—open reduction and internal fixation (ORIF) is typically indicated to restore joint stability and function, inviting more complications. K-wire provided a practical and minimally invasive technique as a substitute for more sophisticated fixation techniques.

To maximize functional results, early detection and a multidisciplinary surgical approach are crucial. Trauma surgeons must be aware of this uncommon injury constellation in order to prevent missed diagnosis and guarantee thorough treatment. Larger randomized controlled trials (RCTs) are required to confirm the safety, reliability, and long-term effectiveness of K-wire fixation in terrible triad injuries as well as to provide standardized treatment procedures, while the outcome in this case was encouraging.

5. Source of Funding

None.

6. Conflict of Interest

None.

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