



TERRIBLE TRIAD OF ELBOW- SURGICAL DECODING

Orthopaedics

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ABSTRACT

The terrible triad is a commonly occurring and extremely unstable injury pattern involving the elbow, characterized by posterior dislocation of the elbow, fracture of the radial head, and fracture of the coronoid process. It is crucial to have a well-defined approach to management to prevent long-term complications, such as stiffness, particularly in extension, and residual instability, particularly in the posterolateral aspect. Treatment goals focus on achieving optimal stability to facilitate prompt joint mobilization.

KEYWORDS

INTRODUCTION:

Terrible triad is a form of elbow dislocation associating posterior or posterolateral humeroulnar dislocation with radial head fracture and coronoid process fracture due to posterolateral trauma

This injury typically occurs due to a forceful impact to the elbow, often involving compression of the hand, rotation of the forearm, supination, and valgus stress. The initial area affected is usually the lateral compartment, which includes the lateral collateral ligament

Classification And Treatment Of Radial Head Fractures

The classification and treatment principles for radial head fractures are crucial for guiding medical intervention. According to the **Mason-Johnson classification**, these fractures are categorized into four types: **Type I**, involving non-displaced fractures; **Type II**, encompassing partial articular fractures with significant displacement; **Type III**, comprising comminuted fractures across the entire radial head; and **Type IV**, indicating fractures accompanied by dislocation of the elbow joint, known as the "terrible triad" injury.



Fig 1: Classification of Radial head #

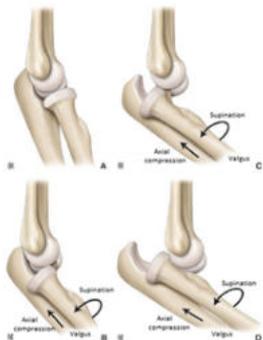


Fig 2: Mechanism of Injury

Classification And Treatment Principles Of Coronoid Fractures

Coronoid process fractures often coincide with other significant injuries to the elbow joint. The **Regan-Morrey classification** is widely used in clinical settings, categorizing these fractures into **Type I**, where there's an avulsion of the process tip; **Type II**, involving up to

50% of the process; and **Type III**, involving more than 50%. Further subgrouping into A and B groups is based on whether elbow joint dislocation is present. Type I fractures are frequently associated with the terrible triad injury.

MATERIALS AND METHOD-

Retrospective analysis of clinical, functional, Radiographic outcome of surgical treatment of terrible triad with 6 months post operative follow up using DASH (Disability of arm, shoulder, hand) and MEPS Score (Mayo elbow performance score) from 2019 to 2024.

RESULTS –

Mean age of population sustaining Terrible triad elbow among males was 33.54 years and females was 42.25 with 74% predilection for male and 26% for female. Involvement of right elbow was 54 % in comparison to left elbow which was 46%. Average DASH score for TERRIBLE TRIAD at the end of 6 months was 3.1 and MEPS Score at end of 6 months was 94.4

Approach To Terrible Triad

Lateral Approach

The patient is positioned supine, with the affected limb placed on a table and a pneumatic tourniquet applied. The lateral Kocher approach is preferred over Cadenat's posterolateral approaches due to the reduced risk of damaging the deep branch of the radial nerve and better access to the coronoid process. Key anatomical landmarks for this approach include the lateral epicondyle and the radial head, located under pronation-supination. Care must be taken during surgery as all lateral approaches come close to the radial nerve, which can be displaced by pronation. The skin incision begins vertically approximately 5 cm above the lateral epicondyle, then curves at the lateral epicondyle and follows the lateral side of the forearm down to the radial neck. The fascia is incised between the carpal ulnar extensor and the Anconeus muscle, often utilizing the existing fascial tear from trauma. Hemarthrosis is evacuated through the lateral capsule-ligament detachment, which is extended downward toward the annular ligament and then sectioned for repair at the end of surgery. Proximally, the proximal LCL is usually found to be detached, and the lateral epicondyle is exposed. Intra-ligament tears and distal detachments are less common Following hemarthrosis evacuation, exploration of the humeroradial and humeroulnar joints is performed to assess



Fig 3: Lateral approach to terrible triad**Posterior Approach**

Bryan and Morrey - Extensive Posterior Approach to the Elbow
Position the patient in the lateral decubitus position or with a 45 to 60-degree tilt, using sandbags under the back and hip for support. Position the limb across the chest. Make a straight posterior incision along the midline of the limb, extending from 7 cm distal to the tip of the olecranon to 9 cm proximal to it. Identify the ulnar nerve proximally at the medial border of the medial head of the triceps and free it from its tunnel distally to its first motor branch. In total joint arthroplasty, transpose the nerve anteriorly into the subcutaneous tissue. Elevate the medial aspect of the triceps from the humerus along the intermuscular septum to the level of the posterior capsule. Incise the superficial fascia of the forearm distally for approximately 6 cm to the periosteum of the medial aspect of the olecranon. Carefully reflect the periosteum and fascia medially to laterally as a single unit. The weakest portion of the reflected tissue is at the medial junction between the triceps insertion and the superficial fascia and periosteum of the ulna. Maintain continuity of the triceps mechanism at this point; carefully dissect the triceps tendon from the olecranon when the elbow is extended to 20 to 30 degrees to reduce tension on the tissues, then reflect the remaining portion of the triceps mechanism. To expose the radial head, reflect the Anconeus subperiosteally from the proximal ulna, providing a wide exposure of the entire joint.

Posterolateral Approach

To perform an olecranon osteotomy and anterior transposition of the ulnar nerve, extend the distal limb of the incision along the subcutaneous border of the ulna. Extend the proximal limb of the incision to facilitate better mobilization of the lateral head of the triceps muscle and exposure of the olecranon. Ensure careful isolation and protection of the radial nerve and the profunda brachii artery. If the triceps muscle is contracted due to fixed elbow extension, free the aponeurosis from proximal to distal in a tongue-shaped flap and retract it distally to its insertion. If the triceps muscle is not contracted, make a longitudinal division in the midline through the muscle and aponeurosis, continuing the dissection through the periosteum of the humerus, the joint capsule, and along the lateral border of the olecranon. Begin the skin incision 10 cm proximal to the elbow on the posterolateral aspect of the arm, extending it distally for 13 cm. Deepen the dissection through the fascia, exposing the triceps aponeurosis distally to its olecranon insertion. For a contracted triceps, free and retract the aponeurosis in a tongue-shaped flap, incising the remaining muscle fibers to the bone in the midline. For a non-contracted triceps, perform a midline longitudinal division of the muscle and aponeurosis, continuing the dissection through the periosteum of the humerus, the joint capsule, and along the lateral border of the olecranon. Elevate the periosteum along with the triceps muscle from the posterior surface of the distal humerus for 5 cm. For broader exposure, continue subperiosteal stripping on each side, releasing the muscular and capsular attachments to the condyles and exposing the anterior surface while carefully avoiding injury to the ulnar nerve. Strip the periosteum conservatively to prevent significant damage to the bone's blood supply, which could result in osteonecrosis. The head of the radius should be visible at the distal end of the wound. If the elbow is fixed in complete extension with a contracted triceps, flex it to a right angle for wound closure. Fill the distal defect in the triceps tendon with the inverted V-shaped portion of the triceps fascia and close the proximal part by suturing the remaining two margins of the triceps.

DISCUSSION

The case series highlights the management of the terrible triad of the elbow, a complex injury involving posterior dislocation of the elbow, fracture of the radial head, and fracture of the coronoid process. This injury pattern poses significant challenges due to its instability and potential long-term complications, such as stiffness and residual instability. Therefore, a well-defined approach to management is essential to achieve optimal stability and facilitate prompt joint mobilization.

A thorough understanding of the anatomy of the elbow joint is crucial for effective management. Key structures include the radial head, ulnar coronoid process, and various ligaments, such as the medial collateral ligament complex (MCLC) and the lateral collateral ligament complex (LCLC). These structures play a vital role in maintaining stability and facilitating movement.

The surgical approach to the terrible triad typically involves a combination of lateral, posterior, and posterolateral approaches, depending on the specific requirements of each case. Careful attention to anatomical landmarks and structures is essential to minimize the risk of complications, such as nerve damage, and to ensure adequate exposure for surgical intervention.

In summary, the management of the terrible triad of the elbow requires a multidisciplinary approach, involving careful assessment of the injury, classification of associated fractures, and selection of appropriate surgical techniques. The ultimate goal is to achieve optimal stability and functional outcomes while minimizing the risk of long-term complications.

A pictographic representation of the management of the different case scenarios encountered has been listed below.

Case 1-**Fig 4:** Pre-Op Clinical Image**Fig 5:** Pre Op X Ray

27/Male Came With Chief Complaints Of Pain, Restricted Movement And Clw Of Size 3x1 Cm Over Right Elbow
A/H/O RTA Self-Fall From Two Wheeler
O/E- Dp Present, No Dnvd
Vitally Stable

Intra-op Images**Fig 6:** Intraop Picture Of Elbow Joint Via The- Posterior Approach

A straight posterior incision was taken along the midline of the limb, extending from 7 cm distal to the tip of the olecranon to 9 cm proximal to it. ulnar nerve was identified proximally at the medial border of the medial head of the triceps and was free from its tunnel distally to its first motor branch. Nerve was transposed anteriorly into the subcutaneous tissue triceps was elevated medially from the humerus along the intermuscular septum to the level of the posterior capsule. Incision of the superficial fascia of the forearm distally for approximately 6 cm to the periosteum of the medial aspect of the olecranon. Periosteum was exposed

**Fig 7:** Post Op X Ray

It was operated with open reduction internal fixation with DCP (dynamic compression plate) over ulna and suture disc to repair LCL (lateral collateral ligament) and kept in slab for 4 weeks for strict immobilisation of elbow joint.

Post Op Clinical Image:



Fig 8: Elbow Neutral
Fig 9: Shoulder Internal Rotation
Fig 10: Elbow Flexion

3 Months Post-Op:



Fig 11: Elbow Supination
Fig 12: Elbow Pronation

Case 2:



Fig 13: Pre-op Elbow Xray
Fig 14: Pre-op Xray

40/Male Presented with Pain Over Left Elbow
A/H/O Self Fall From Two Wheeler
O/E- DP Present, No DNVD
Vitality Stable
Intra Op Images



Fig 15: This Is Intra-Op Images of Proximal Ulna Fixation Via Lateral Approach

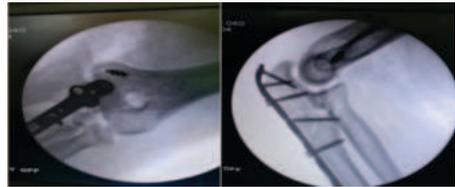


Fig 16: Post-Op Xray



Fig 17: Post Operative Xray With ORIF Plating With Ulna Hook Plate And Anchor Suture To Repair Lateral Collateral Ligament



Fig 18: Post-Op and 3 Months Follow-Up Showing Elbow Flexion, Extension, Supination, Pronation

Case 3



Fig 19: Pre-Op x-ray.

came to casualty with c/o pain and dislocation of right elbow joint
A/h/o Self Fall
O/e-DP Present, No DNVD
Intra-Op



Fig 20: Intra-Op Image by Lateral Approach



Fig 21: Post Op Xray

Post Op Clinical Images:



Fig 22: Post-Op Elbow Supination



Fig 23: Post-Op Elbow Pronation

Case 4:
Rutik Gopal With C/o Elbow Dislocation



Fig 24: Pre-op Xray



Fig 25: Post Reduction

Post Op Xray:



Fig 26: Case Was Operated With Suture Disc And Anchor Suture

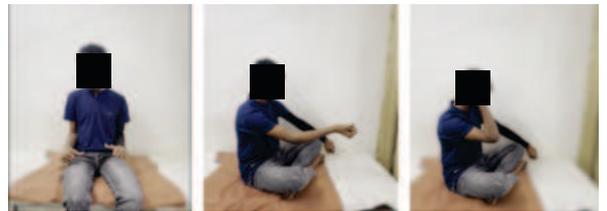


Fig 27: Post Op Follow Up 3 Month

Case 5:
Female Had an RTA With Both Bone Forearm Fracture With L Tear



Fig 28: Pre-Op Xray



Fig 29: Post Op X Ray with Radial Head Replacement And Both Bone Fixed With DCP



Fig 30: Intra Op Images



Fig 31: Intra-Op



Fig 32: Post Op Follow Up



Fig 33: Post-Op Elbow Supination and Pronation.