

A Rare Case of Lateral Displacement of Median Nerve in a Dislocated Elbow and its Management

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Learning Point of the Article:

Careful examination has to be done preoperatively to evaluate the neurology and during surgery extra precautions has to be taken during exploration, as the nerve can get entrapped both on the medial and lateral side.

Abstract

Introduction: Elbow dislocation usually presents with a deformity and swelling, yet it can also present with neurological complication. Nerve injury with dislocation is common in the pediatric age group and is reported infrequently among adults. The most common nerve involved with dislocation is the ulnar nerve followed by the median nerve. The median nerve usually slips medially during dislocation and gets entrapped posterior to the medial epicondyle or it can get entrapped between the fractured medial epicondyle. Here, we describe a unique case of posterolateral elbow dislocation in a 30-year-old female patient with having lateral displacement of the median nerve and the mechanism probably by which the nerve got displaced laterally.

Case Presentation: A 30-years-old female patient of right hand dominant came to us with a left elbow injury after a road traffic accident. Clinical and Radiological examination revealed a posterior-lateral dislocated elbow with a fracture of the radial head and lateral condyle avulsion. Clinically, there was a weakness and sensory hypoesthesia along the median nerve distribution over the left hand and forearm. Initially, closed reduction and splinting done. Later, a planned surgery with a lateral approach avulsed lateral condyle and radial head fixation done with relocation of the median nerve, which was displaced laterally.

Conclusion: There are numerous cases of elbow dislocation with nerve involvement and their complications have been previously described throughout literature. Here, we present a rare case of lateral displacement of the median nerve in a dislocated elbow and the possible mechanism with its management.

Keywords: Median nerve, elbow dislocation, nerve injury.

Introduction

Nerve injury following dislocation or fracture-dislocation of the elbow is rare [1, 2], it commonly occurs in the pediatric age group, yet it can occur rarely in adults. The most commonly involved is the ulnar nerve followed by the median nerve with an incidence of 3% [3]. Anatomically median nerve lies medial to the brachial artery, deep to bicipital aponeurosis, and anterior to brachialis muscle at the level of the elbow. Hackel et al. [4, 5] showed that the median nerve lies close to the trochlea in extension (4.8 mm in full extension and 8.4 mm in 90° flexion)

and it is located above the medial quarter of the trochlea (5.9 mm from the medial border of trochlea). As the median nerve lies medially in the elbow in relation to the distal humerus, it usually displaces medially with dislocation and gets entrapped either behind the medial epicondyle or between the fractured medial epicondyle [3].

O'Driscoll proposed mechanism of Posterolateral Rotatory Instability of elbow involves axial loading with flexion at the elbow. The Ulna-humeral joint undergoes external rotation due to eccentrically loaded triceps, while the humerus (whole-body)

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Author's Photo Gallery



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Figure 1: Pointing index demonstrated at the time of presentation.



Figure 2: Radiograph showing an Antero-posterior and lateral view of elbow showing Postero-lateral dislocation with an avulsed lateral condyle and radial head fracture. Note the significant anterior displacement of the humerus with respect to Ulna.



Figure 3: Computer Tomography with 3D reconstruction post reduction.

rotates internally due to the prominent action of the shoulder adductors and internal rotators. As the mechanical axis falls medially, the elbow joint is forced into the valgus. This valgus force along with external rotation produced at the forearm causes rupture of the elbow joint capsule and ligaments starting with Lateral Ulnar Collateral Ligament and ending with Anterior fibers of Medial Collateral Ligament (AMCL), this mechanism of disruption of ligaments and capsular structure from lateral to medial is coined as Horri's circle [6,7]. Schreiber et al. [7] Proposed an alternate theory to Horii circle by analyzing multiple online videos and suggested, that dislocation commonly occurs (Pattern 1–53%) with an axial load in an extended elbow with valgus force and external rotation of the forearm. They found that due to gross valgus deformity, the AMCL is tore more commonly, and this might be even necessary for an elbow to get dislocated in some cases. This is contrary to Horii's circle in which AMCL is the last structure to be involved. Based on this mechanism of elbow dislocation we have tried to sequence the list of events that could have caused the median nerve to displace laterally in our case.

Case Presentation

A 30-year-old Female patient with no comorbidities came to us with a left elbow injury after a road traffic accident. Clinical examination in the emergency room revealed a dislocated elbow with sensory hypoesthesia along the median nerve

distribution and pointing index (Fig. 1). Initial radiological investigations revealed a posterolateral dislocated elbow with a fracture of the radial head (Masson Type 4) and lateral condyle avulsion (AO 13A1.1) (Fig. 2). Detailed neurological examination showed weakness of flexor digitorum profundus of the index and middle finger and flexor pollicis longus weakness with sensory loss over median nerve distribution. Closed reduction and splinting was done with no further deterioration in neurology (Fig. 3,4).

The initial plan was doing an open reduction and internal fixation through a lateral approach and exploration of the median nerve through a separate anterior incision. Under tourniquet through Kocher's approach, the lateral condyle and radial head fracture fragment was exposed, a thick cord-like structure was found entrapped between the avulsed lateral condyle and distal humerus. Further exploration revealed a torn anterior capsule and torn brachialis muscle. Intra-operative nerve stimulation showed that cord-like structure to be the median nerve. The nerve was edematous and stretched, but there was no visible contusion and the nerve was intact. The nerve was repositioned medially by neurolysis. Post neurolysis the nerve was free of stretching. Fractured fragments were fixed with 4mm Cannulated Cancellous screw and radial head with one mini compression screw. Post fracture fixation, the elbow was stable throughout the range of motion and there was no significant varus or valgus laxity (Fig. 5).

Once pain and swelling subsided patient was started with passive elbow range of movements in a hinged brace, but the weakness of index finger flexion persisted. An improvement in



Figure 4: Anteroposterior Xray after reduction of the dislocated elbow.

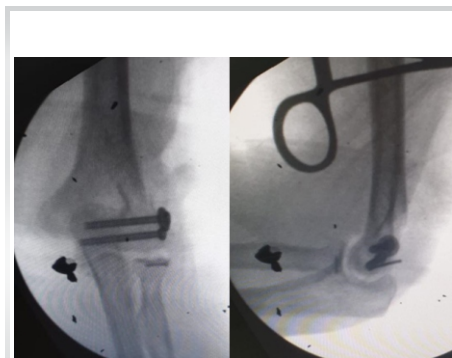


Figure 5: Intraoperative fluoroscopic image after fixation of the avulsed lateral condyle with 4 mm CC screw and Radial head with a mini fragment screw.

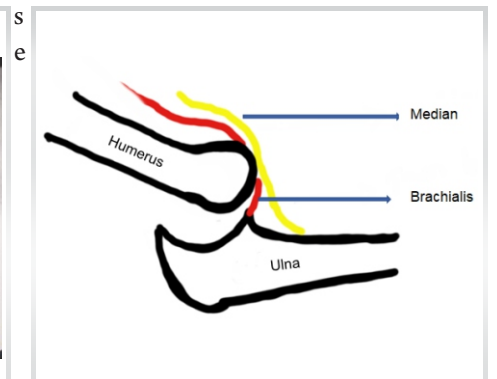


Figure 6: Diagrammatic representation of rupture of the brachialis muscle and the injury to the posterior aspect of the median nerve due to anterior displacement of the humerus (Hyperextension)



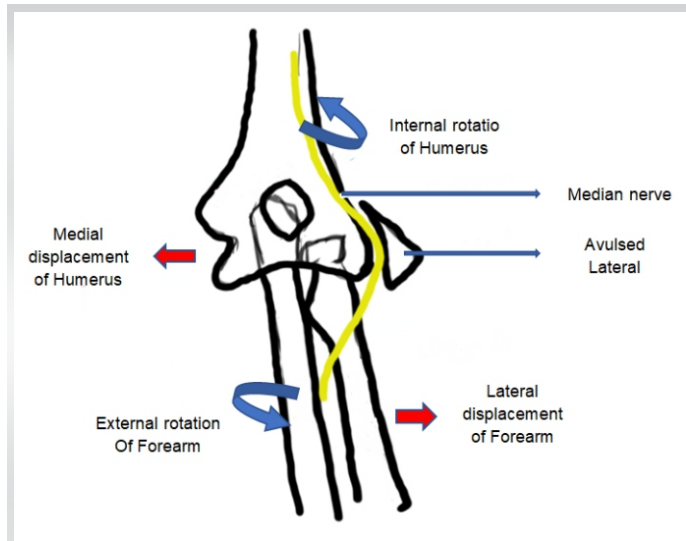


Figure 7: Diagrammatic representation showing internal rotation and medial displacement of the humerus with simultaneously external rotation and lateral displacement of the forearm causing the median nerve to be entrapped in the fracture site.

nsory distribution and motor power of Flexor digitorum profundus was noted after 8 weeks and elbow ROM recovered fully. The patient went on to recover with full motor power 12 weeks post-surgery with 2 point discrimination similar to the opposite side.

Discussion

Nerve injury with elbow dislocation is primarily a problem occurring in children [3, 6, 7, 8, 9] and it occurs rarely in adults. Diagnosis of median nerve palsy in a dislocated elbow is usually delayed in children and they present at a later stage [3]. Matev sign is a radiological sign of entrapment of the median nerve behind the medial epicondyle in a dislocated elbow, where there is cortical depression along with interrupted periosteal reaction [9]. Ultrasound and Magnetic Resonance Imaging (MRI) is a gold standard investigation in the initial evaluation and confirmation of diagnosis. Ultrasound helps in identifying dynamic compression of the nerve, while, MRI is useful in tracing the course of the nerve in an acute entrapment and to see for signs of chronic neuropathy in chronic entrapment [3, 10, 11]. Various mechanism has been reported on how the median nerve is involved with elbow dislocation. Hallet [1] classified median nerve involvement in the pediatric age group into three Types and further two types were added by Al. Quattan [10] and McCarthy et al. [8] (Table 1). All the five types of nerve entrapment reported previously had median nerve displaced towards the medial side with dislocation. Here, we report a unique case, where the median nerve in an adult has been displaced laterally.

Beverly et al. reported a case of Anterior Interosseous nerve (AIN) palsy in a 15-year-old pediatric patient post-reduction, in a dislocated elbow which went on to full recovery with

Types	Position of median nerve Entrapment	Pathogenesis	Described by
Type-1	Posteriorly behind medial epicondyle	As medial collateral ligaments ruptures the nerve slips posterior to the epicondyle during reduction/ injury	
Type-2	Through a bone tunnel in medial epicondyle	Due to Medial epicondyle fracture, the nerve is caught in between the fracture fragments.	
Type-3	Looped within the ulnohumeral joint	The nerve gets stretched over the dislocated joint and during reduction its gets trapped inbetween the ulnohumeral joint.	
Type-4	Combination of Type 1 and Type 2	It's a severe form a nerve injury in which the nerve gets entrapped both in the fracture site as well as in the ulnohumeral joint	
Type-5	In an unossified medial epicondyle fracture	Median nerve is entrapped between the avulsed medial epicondyle and distal humerus, median nerve symptoms can have a delayed presentation.	

conservative management [12]. Our case had median nerve entrapped between the fracture lateral condyle yet there was only palsy of the muscles supplied by AIN. On reviewing the literature of AIN palsy in supracondylar fracture and cadaveric dissection of AIN by Vincelet et al. [13], we found AIN was divided into two zones. Zone 1 was a transitional zone 45 mm from the humeral intercondylar line and ends at a place where it enters the interosseous membrane, 117 mm from the intercondylar line. Zone 2 is from the point where it enters the interosseous membrane to the pronator quadratus muscle, this entire length of Zone 2 is fixed by fibrous bands. Their dissection also revealed AIN fascicles to be located over the posterior aspect of the median nerve. They concluded that AIN palsy in a supracondylar fracture occurs due to direct injury to the posterior aspect of the median nerve by anteriorly displaced proximal fragments and by the stretching of the AIN in zone 2 (as zone 2 is fixed) . Similarly, in our case, a posterolateral dislocation there is hyperextension at the elbow, which translates the humerus anteriorly giving a direct blow to the posterior aspect of the median nerve and significantly stretching the Zone 2 of AIN, leading to its palsy. If nuerodeficit in our case was due to nerve entrapment, it would have involved other muscles supplied by the median nerve. AIN palsy in our case should be due to stretching of the zone 2 of AIN because of the direct injury to the posterior fascicles of the median nerve.

In our case, the following sequence of events should have occurred which had led to the lateral displacement of the median nerve. The initial Hyperextension during elbow dislocation probably have caused the rupture of a brachialis muscle, a similar case reported by Krych et al. [14], this rupture would have exposed the posterior surface of the median nerve, causing direct injury to the posterior fascicles (fascicles of AIN) and stretching of the zone two fibers leading to AIN palsy (Fig. 6). Subsequent external rotation of the forearm with internal rotation of the whole body along with valgus force at the elbow joint might have caused radial head fracture and avulsion of the



lateral condyle. Further internal rotation of the anteriorly displaced humerus along with valgus deformity might have displaced the distal humerus medially and internally rotated, exposing the fractured surface to the median nerve (Fig. 7). This normally would not have occurred if the brachialis muscles were intact. The muscle located posterior to the nerve would have normally protected the nerve from the fracture site and with an intact brachialis, the nerve would have just slipped medially with internal rotation of the humerus causing the usual type of median nerve displacement.

Conclusion

Elbow dislocation can be associated with neurological complications such as nerve entrapment; we present a very rare case of lateral displacement of the median nerve in a

posterolaterally dislocated elbow. Careful examination has to be done pre-operatively to evaluate the neurology and during surgery extra precautions have to be taken during exploration, as the nerve can get entrapped both on the medial and lateral side.

Clinical Message

Although median nerve commonly displaces medially with the elbow dislocation, lateral displacement can also occur and careful exploration of the fractured fragments in such patients is essential to prevent iatrogenic injury to the nerve. Nerve involvement in elbow dislocation occurs commonly in children's, but can also occur in adults. Brachialis muscle rupture is an essential event for lateral displacement of the median nerve.

Declaration of patient consent : The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient's parents have given their consent for patient images and other clinical information to be reported in the journal. The patient's parents understand that his names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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