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**Prashant Kamble**

Assistant Professor,  
Department of Orthopaedics,  
KEM Hospital and Seth  
GSMC, Mumbai, Maharashtra,  
India

**Swapnil Keny**

Assistant Professor,  
Department of Orthopaedics  
KEM Hospital and Seth  
GSMC, Mumbai, Maharashtra,  
India

**Shubhranshu Mohanty**

Professor and Head of Unit,  
Department of Orthopaedics,  
KEM Hospital and Seth  
GSMC, Mumbai, Maharashtra,  
India

**Tushar Rathod**

Associate Professor,  
Department of Orthopaedics  
KEM Hospital and Seth  
GSMC, Mumbai, Maharashtra,  
India

**Corresponding Author:**

**Swapnil Keny**

Assistant Professor,  
Department of Orthopaedics  
KEM Hospital and Seth  
GSMC, Mumbai, Maharashtra,  
India

## Severe tardy ulnar nerve palsy due to cubitus valgus deformity: Use of intramuscular anterior transposition

**Prashant Kamble, Swapnil Keny, Shubhranshu Mohanty and Tushar Rathod**

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### Abstract

Tardy ulnar nerve palsy is a frequent late complication of post-traumatic cubitus valgus deformity arising due to nonunion lateral condyle humerus fracture. We present a case of a 30 year old homemaker who came with features of tardy ulnar nerve palsy (McGowan grade III) with difficulty in activities of daily living and reduced grip strength. Clinical examination revealed atrophy of hand muscles, claw hand deformity and other features suggestive of ulnar neuropathy. X-rays and CT scan confirmed the diagnosis as fracture lateral condyle humerus nonunion. Surgical intervention in the form of anterior intramuscular transfer of ulnar nerve with neurolysis without addressal of nonunion site was performed. The patient showed complete recovery of sensory and motor symptoms at six months post-op. Anterior transposition of ulnar nerve is a safe and reliable procedure which provides good functional outcomes in cases of tardy ulnar nerve palsy with low morbidity.

**Keywords:** Tardy ulnar nerve palsy, anterior transposition, cubitus valgus, non-union lateral condyle humerus

### Introduction

Tardy ulnar nerve palsy is characterized by delayed onset ulnar neuropathy and can occur due to a wide variety of pathological conditions around the elbow. Typically tardy ulnar nerve palsy is a late consequence of traumatic cubitus valgus deformity arising due to non-union or malunion of fractures of the lateral humeral condyle sustained during childhood [1]. Cubitus valgus deformity which compels the nerve to take a longer route around the retrocondylar groove along with development of intraneural fibrosis, tension neuritis, adhesions and frank entrapment of the nerve in the fracture callus may all contribute to development of late onset ulnar neuropathy [1, 2]. Surgical procedures described for the treatment of ulnar neuropathy at the elbow include in-situ decompression, endoscopic decompression, decompression with medial epicondylectomy and decompression along with anterior transposition (subcutaneous, submuscular, or intramuscular) [3]. Surgical treatment may result in inferior outcomes in cases of traumatic ulnar neuropathy especially those with cubitus valgus deformity and severe grades of ulnar nerve involvement. Also there is a paucity of literature on the outcome of surgical treatment of severe post traumatic ulnar neuropathy associated with deformity. We present a case of severe tardy ulnar nerve palsy with cubitus valgus deformity in an adult female managed with decompression and anterior intramuscular transposition of ulnar nerve with good clinical outcomes.

### Case report

The patient is a 30 year old female (homemaker) who sustained injury to the left elbow (non-dominant limb) 20 years ago due to fall on an outstretched hand. The patient was managed conservatively with above elbow cast for a period of two months. She started complaining of decreased sensation in her left ring and little finger for last six months prior to her visit to the out-patient department. She also developed weakness in her left grip strength causing difficulty in performing her regular household activities. On examination, there was sensory hypoesthesia in forearm and hand in the ulnar nerve distribution along with wasting of hypothenar muscles. There was a cubitus valgus deformity of 40° in left elbow with painless range of motion from 30° to 130° with no signs of lateral instability. Further clinical and neurological examination revealed an ulnar claw hand deformity with signs of severe

neuropathy-weakness of intrinsic hand muscles, positive Card test, positive Wartenberg and Froment's sign, atrophy of first dorsal web space, positive Tinel's sign and weak flexor digitorum profundus of the little finger (Figure 1). Clinical tests for thoracic outlet syndrome and double crush syndrome were negative. A clinical diagnosis of late onset ulnar neuropathy at the elbow with grade 3 severity (according to McGowan's classification) was established [4]. Electrodiagnostic tests and nerve conduction studies confirmed ulnar neuropathy at the elbow. Radiological examination (X-ray-AP & lateral views) revealed fracture non-union of lateral condyle of distal humerus. CT scan confirmed the findings of non-union along with features of early arthritis (Figure 2). We presented treatment options; anterior transposition alone or combination of anterior transposition and osteotomy for correction of valgus deformity to the patient. As the patient had a painless elbow range of motion and no additional signs of lateral instability, she did not wish to undergo surgical correction for valgus deformity. Hence, the patient was planned for surgical decompression of ulnar nerve (neurolysis) along with

anterior transposition of the nerve by intramuscular technique without corrective osteotomy.

The surgery was performed in a tertiary care institution by a specialist-experienced surgeon. The surgical incision extended 3 cm proximal and 3 cm distal to the medial epicondyle. Intraoperatively, the ulnar nerve was found thickened and inflamed at the cubital tunnel. Special care was taken to preserve the median antebrachial cutaneous nerve and the extrinsic blood supply of the ulnar nerve during tissue handling. All potential sources of ulnar nerve compression (medial intermuscular septum, arcade of Struthers, osseous abnormalities at the medial epicondylar groove, arcuate ligament of Osborne, deep aponeurosis of flexor pronator mass, ligament of spinner) were identified and released (Figure 3). Postoperatively, the patient was advised a knuckle bender splint for claw hand and passive elbow range was started on day 3. At six months post op, sensory symptoms resolved completely and patient regained complete motor power and hand grip strength as assessed by dynamometer (Figure 4).

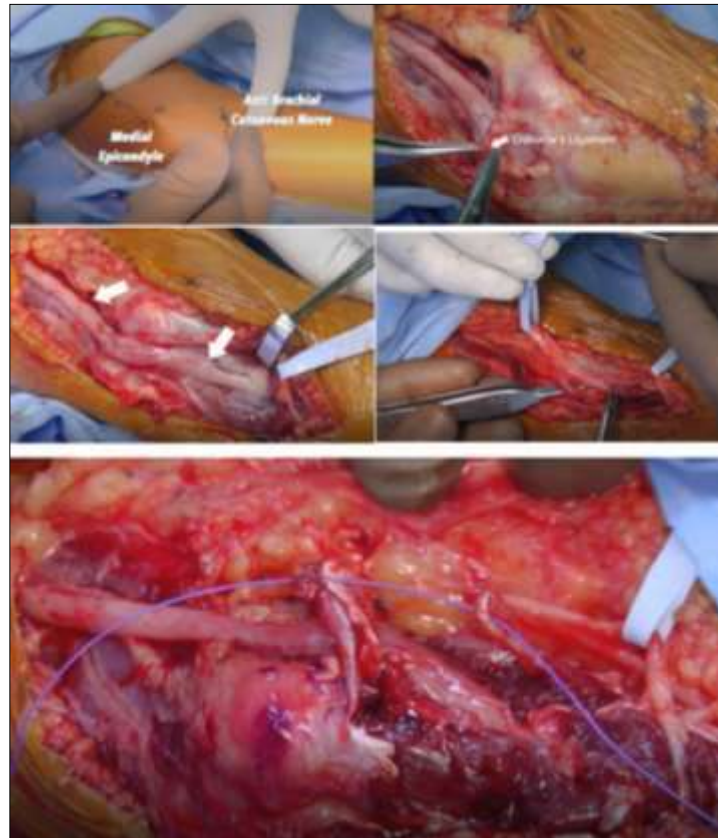


**Fig 1:** Pre-operative clinical examination demonstrates: A) Left cubitus valgus deformity; B) Severe wasting of hypothenar muscles (arrow); C) Ulnar claw hand deformity (arrow); D) Positive froment's sign (arrow)



**Fig 2:** Pre-operative X-rays (AP and Lateral views) & CT scan confirming the diagnosis of non-union lateral condyle humerus with cubitus valgus deformity





**Fig 3:** Intraoperative images showing A) Incision centered over the median epicondyle with approximate position of median antebrachial cutaneous nerve marked; B) Release of Osborne's ligament (arrow); C) The nerve appears swollen and inflamed in its course behind the retrocondylar groove (arrow); D) Thorough decompression of nerve and release of flexor pronator fascia; E) Final picture showing tension free course of the nerve after anterior transposition and preparation of intramuscular bed



**Fig 4:** Post-operative clinical examination reveals complete recovery of muscle strength, negative Froment's sign and reversal of hypothenar muscle wasting (Signs of neural recovery)

## Discussion

Tardy ulnar nerve palsy is a frequent late complication of old neglected fractures around the elbow, most commonly due to fracture lateral condyle with cubitus valgus deformity. "Cubital Tunnel syndrome" or ulnar neuropathy at the elbow can manifest in either one of these three variants- hypermobility (subluxation), fixed compression and dynamic compression<sup>[5]</sup>. As most cases of tardy ulnar nerve palsy have an underlying mechanical characteristic of etiology, non-operative or conservative form of treatment is rarely advocated and surgical decompression is the most common form of treatment. Amongst the myriad of surgical procedures available, anterior transposition of the nerve is commonly performed to achieve clinically significant outcomes.

The ulnar nerve is subjected to longitudinal strain and mechanical compression during elbow flexion as its courses behind the medial epicondyle. This is further exacerbated in cases of cubitus valgus deformity and can lead to intraneural fibrosis and tension neuritis. Anterior transposition of the nerve relieves the strain and tension by placing the nerve anterior to the elbow joint axis. The procedure also reduces the nerve ischaemia which is the most important reason for improvement in clinical features. Meticulous decompression of the ulnar nerve, preservation of the blood vessels accompanying the nerve and creating an appropriate intramuscular bed following transposition that ensures no kinking during elbow range of motion are key steps in the surgical procedure.

Isolated in-situ decompression of the ulnar nerve produces insufficient relief of longitudinal strain and has been associated with less favorable outcome. Medial epicondylectomy has become a less popular technique due to risk of iatrogenic injury to medial collateral ligament and increased post-operative pain<sup>[5,6]</sup>. Three methods of anterior transposition of nerve are described: subcutaneous, submuscular and intramuscular. Subcutaneous transposition of the nerve places the nerve at risk of slippage back into the groove and is also associated with aggressive scar formation by dermal fibroblasts<sup>[7]</sup>. The likelihood that the nerve needs to kink again to re-enter its intramuscular route is very high and it further stretches the nerve during elbow extension. Submuscular transfer places the nerve directly over the elbow joint capsule which increases the risk of adhesions and limits the normal 22 mm excursion required at the elbow<sup>[5]</sup>. Mortazavi *et al.* reported functional outcome of 10 patients with McGowan's grade III ulnar neuropathy due to post traumatic valgus deformity and found the results of the procedure comparable to cases of severe idiopathic cubital tunnel syndrome<sup>[8]</sup>. We preferred a complete intramuscular transfer in our case which offers the most ideal environment for neural healing without the risk of slippage and recurrence.

Attempt at osteosynthesis of lateral condyle non-union has been associated with complications such as osteonecrosis and loss of elbow range of motion<sup>[9]</sup>. Use of combined procedure (osteotomy for deformity correction and ulnar nerve transposition) has also been reported to be effective in correcting valgus deformity along with improvement in ulnar nerve symptoms<sup>[10]</sup>. Since our patient had no evidence of lateral instability and also gave no consent for osteotomy, we preferred to perform isolated anterior transposition of the nerve without addressing the deformity or non-union. Poor prognostic factors such as advanced age, longer duration of

symptoms and high grades of pre-operative nerve damage (intrinsic hand muscle weakness and atrophy) are known to produce poor results after operative intervention. In our case, complete motor and sensory recovery was achieved by decompression and anterior transposition with excellent outcome (Modified Bishop score: 9).

## Conclusion

Traumatic cubitus valgus deformity can result in tardy ulnar nerve palsy. Ischaemic insult due to longitudinal strain and mechanical compression during elbow flexion is the root cause of clinical symptoms. Decompression and anterior transposition of ulnar nerve is a safe and attractive option due to its simplicity, reliability and low morbidity. Creation of an intramuscular bed provides an ideal environment for nerve healing. Anterior transposition of the nerve can provide good functional outcome in cases of severe ulnar neuropathy due to post traumatic cubitus valgus deformity with low morbidity.

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## Competing interest

Authors declare that they have no competing interests

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