Open Access

ISSN: 2663-9491 e-ISSN: 2789-6897

ORIGINAL ARTICLE

Management of Tardy Ulnar Nerve Palsy in A Tertiary Level Hospital

Almahmud Mallik[1*], Mohammad Abdul Motalib[2], Ziaul Haque[3], Mostafizur Rahman[4], Mehedi Hasan[5], Shah Didar Imam[6]

Received: 24 July 2026
Accepted: 27 July 2026
Published Online: 29 July 2026

Published by:
Gopalganj Medical College, Gopalganj, Bangladesh

*Corresponding Author

DOI: 10.5281/zenodo.21786285

ABSTRACT

Background: *Tardy ulnar nerve palsy is a delayed ulnar neuropathy that usually develops years after elbow trauma or cubitus valgus deformity due to neglected lateral condyle fracture nonunion, leading to sensory and motor dysfunction of the hand.* ***Aim of the study:*** *This study aimed to evaluate the management of tardy ulnar nerve palsy at a tertiary-level hospital.* ***Methods & Materials:*** *This hospital-based retrospective study was conducted in the Department of Orthopedics, Monno Medical College Hospital, Manikgonj, Bangladesh, from January to December 2025 and included 28 selected patients with tardy ulnar nerve palsy. Clinical, radiological, and electrophysiological data were collected using a structured form, and patients underwent appropriate surgical management with postoperative assessment of complications and final outcome.* ***Results:*** *Among 28 patients, the mean age was 32.8 ± 11.6 years, and 71.4% were male. The most common etiology was neglected or non-united lateral condyle fracture, 64.3%, while 82.1% had elbow deformity. Sensory symptoms predominated, particularly numbness in the ring and little fingers (96.4% and 89.3%, respectively); nerve conduction study was abnormal in 92.9%. Subcutaneous anterior transposition (53.6%) was the most common procedure, and 75.0% of patients achieved an excellent or good final outcome.* ***Conclusion:*** *Tardy ulnar nerve palsy was mainly related to post-traumatic elbow deformity, especially neglected lateral condyle fracture nonunion. Most patients had longstanding neurological deficits, and surgical treatment resulted in favorable outcomes in most cases, with better sensory than motor recovery.*

Keywords: *Tardy ulnar nerve palsy, Cubitus valgus, Ulnar neuropathy, and Lateral condyle fracture nonunion*

(The Insight 2026; 9(3): 570-575)

1. *Assistant Professor, Department of Orthopaedic, Monno Medical College and Hospital, Manikganj, Bangladesh (ORCID: 0009-0009-2001-8762)*
2. *Assistant Professor, Department of Medicine, Monno Medical College and Hospital, Manikganj, Bangladesh*
3. *Assistant Professor, Department of Respiratory Medicine, Monno Medical College and Hospital, Manikganj, Bangladesh*
4. *Junior Consultant, Department of Anesthesia, Analgesia, and Critical Care Medicine, Monno Medical College and Hospital, Manikganj, Bangladesh*
5. *Assistant Professor, Department of Anesthesiology, Monno Medical College and Hospital, Manikganj, Bangladesh*
6. *Associate Professor, Department of Neuro Medicine, Monno Medical College and Hospital, Manikganj, Bangladesh*

INTRODUCTION

Tardy ulnar nerve palsy is a delayed-onset ulnar neuropathy. It develops years after elbow trauma or longstanding deformity. The condition most often follows cubitus valgus, which results from neglected or non-union fractures of the lateral humeral condyle. Tardy ulnar nerve palsy falls within the broader spectrum of ulnar neuropathy at the elbow and cubital tunnel syndrome. Cubital tunnel syndrome is the second most common compressive neuropathy of the upper limb after carpal tunnel syndrome [1-5]. Population-based and review data suggest a prevalence of roughly 1.8% to 5.9% in the general population. The reported annual incidence is about 25 per 100,000 in men and 19 per 100,000 in women [1-4]. Risk increases with repetitive elbow flexion, mechanical loading, vibration exposure, smoking, and certain occupational demands. These factors make the condition especially relevant in physically active and labor-intensive populations [4-6]. Although common ulnar entrapment around the elbow is well described, the tardy post-traumatic form is clinically distinct. Chronic valgus deformity can gradually stretch, irritate, and compress the ulnar nerve. This process produces numbness in the ring and little fingers, paresthesia, weak grip, intrinsic muscle wasting, clawing, and impaired fine motor function [7-9]. This pattern is especially important in patients with remote childhood elbow injury. Pediatric lateral condyle fractures and other elbow injuries often present late. They may heal in a malunion or nonunion, subsequently leading to deformity, instability, and tardy neuropathy in adolescence or adulthood [7,10,11]. Electrodiagnostic studies, radiography, and increasingly ultrasound is valuable for confirming the lesion, assessing severity, and planning treatment [3,5]. From a clinical standpoint, tardy ulnar nerve palsy remains important. Delayed diagnosis can result in progressive neurological deficit and potentially incomplete recovery. Management is also heterogeneous. Depending on the underlying pathology, surgeons may perform simple decompression or anterior transposition in its various forms. Other options include corrective osteotomy, medial epicondylectomy, or combined procedures [3,4,7,8,12]. Robust evidence specific to tardy ulnar nerve palsy is limited. Much of the recent literature from South and Southeast Asia consists of case reports or small institutional series. There are a few larger prospective studies [7-9]. This pattern suggests that, in regional practice, the condition is encountered but underreported, especially in

ISSN: 2663-9491 e-ISSN: 2789-6897

tertiary hospitals. In these settings, patients with neglected trauma and deformity are more likely to present. At the same time, pediatric and deformity-focused literature continues to highlight the long-term consequences of missed lateral condyle injuries. This reinforces the need for context-specific adult outcome data [7-11].

In many low-resource settings, including tertiary hospitals managing late referrals, patients often present after prolonged symptom duration, with established motor and sensory deficits, deformity, and functional impairment. Although the clinical significance of tardy ulnar nerve palsy is established, the rationale for this study is the clear gap in recent, comprehensive hospital-based data detailing the demographic profile, etiological spectrum, neurological severity, operative choices, and outcomes of surgical management for this condition. Generating such evidence is crucial for addressing under-recognition, shaping effective surgical strategies, and improving outcome prediction in orthopaedic practice. Therefore, this study aimed to evaluate the management of tardy ulnar nerve palsy in a tertiary-level hospital by describing patients' baseline characteristics, clinical and etiological profiles, preoperative neurological status, operative interventions, and surgical outcomes.

METHODS & MATERIALS

This was a hospital-based retrospective study conducted in the Department of Orthopedics, Monno Medical College Hospital, Manikgonj, Bangladesh, from January 2025 to December 2025. A total of 28 cases diagnosed with tardy ulnar nerve palsy were included in the study. Patients presenting with clinical features suggestive of tardy ulnar nerve palsy, such as numbness or tingling in the ring and little fingers, weakness of grip, intrinsic muscle wasting, clawing deformity, and symptoms related to longstanding elbow deformity or previous trauma, were enrolled purposively. Patients with acute ulnar nerve injury, generalized neuropathy, cervical radiculopathy, or incomplete clinical records were excluded. Data were collected using a structured data collection sheet. Information recorded included socio-demographic characteristics, history of trauma, duration of symptoms, affected side, occupation, clinical presentation, physical examination findings, and preoperative neurological status. Functional and neurological assessments included grip strength, pinch strength, two-point discrimination, Froment's sign, Wartenberg's sign, Tinel's sign, and McGowan grading. Radiological evaluation of the elbow and relevant electrophysiological investigations, including nerve conduction studies and electromyography, were performed where indicated. All patients underwent appropriate management according to clinical condition, including decompression, anterior transposition of the ulnar nerve, medial epicondylectomy, corrective osteotomy, or combined procedures. Postoperative follow-up was carried out to assess early complications and final functional outcome. Data were analyzed using standard statistical methods using SPSS (v. 26.0). Categorical variables were expressed as frequency and percentage, while continuous variables were presented as mean ± standard deviation.

RESULTS

A total of 28 patients with tardy ulnar nerve palsy were included in the study. The mean age of the participants was 32.8 ± 11.6 years. Most patients belonged to the 21 to 30 years age group (8, 28.6%) and the 31 to 40 years age group (8, 28.6%). This was followed by 41-50 years (5; 17.9%), ≤20 years (4; 14.3%), and >50 years (3; 10.7%). Males were predominant, accounting for 20 (71.4%), while females represented 8 (28.6%). Regarding occupation, manual laborers formed the largest group (9; 32.1%), followed by housewives (5; 17.9%), service holders (5; 17.9%), students (4; 14.3%), farmers (3; 10.7%), and businessmen (2; 7.1%). The dominant hand was right-sided in 26 (92.9%) patients and left-sided in 2 (7.1%) patients. The affected side was right in 16 (57.1%) cases and left in 12 (42.9%) cases. The mean duration of symptoms was 19.4 ± 10.2 months (*Table I*).

Table I: Baseline characteristics of the study participants (*n*=28)

Variables	Category	Frequency (n)	Percentage (%)
Age group (years)	≤20	4	14.3
	21 to 30	8	28.6
	31 to 40	8	28.6
	41 to 50	5	17.9
	>50	3	10.7
	Mean ± SD	32.8 ± 11.6	
Sex	Male	20	71.4
	Female	8	28.6
Occupation	Manual laborer	9	32.1
	Housewife	5	17.9
	Student	4	14.3
	Service holder	5	17.9
	Farmer	3	10.7
	Business	2	7.1
Dominant hand	Right	26	92.9
	Left	2	7.1
Affected side	Right	16	57.1
	Left	12	42.9
Duration of symptoms (months)	Mean ± SD	19.4 ± 10.2	

Regarding clinical presentation, the most common symptom was numbness in the ring and little finger, present in 27 (96.4%) patients. Other common findings included sensory deficit in 25 (89.3%), tingling sensation in 24 (85.7%), weak grip strength in 23 (82.1%), positive Tinel's sign at the elbow in 22 (78.6%), and pain around the elbow in 20 (71.4%) patients. Motor deficit was present in 19 (67.9%) cases, Froment's sign was positive in 18 (64.3%), and difficulty in fine movements was found in 17 (60.7%) patients. Hand muscle wasting was noted in 14 (50.0%), Wartenberg's sign in 13 (46.4%), and clawing of the ring and little finger in 9 (32.1%) patients (*Table II*).

ISSN: 2663-9491 e-ISSN: 2789-6897

Table II: Clinical presentation of the study cases

Variables	Frequency (n)	Percentage (%)
Pain around elbow	20	71.4
Numbness in ring and little finger	27	96.4
Tingling sensation	24	85.7
Weak grip strength	23	82.1
Hand muscle wasting	14	50
Clawing of ring and little finger	9	32.1
Difficulty in fine movements	17	60.7
Positive Tinel's sign at elbow	22	78.6
Froment's sign positive	18	64.3
Wartenberg's sign positive	13	46.4
Sensory deficit present	25	89.3
Motor deficit present	19	67.9

In terms of etiology, the most frequent cause was neglected or non-united lateral condyle fracture, seen in 18 (64.3%) patients. Malunited distal humeral fracture and old elbow dislocation or other trauma were each found in 4 (14.3%) cases. Post-infective deformity and other causes were each present in 1 (3.6%) patient. Overall, elbow deformity was present in 23 (82.1%) cases, and the mean cubitus valgus angle was 21.6 ± 7.4 degrees (*Table III*).

Table III: Etiology and deformity profile

Variables	Frequency (n)	Percentage (%)
Neglected or non-united lateral condyle fracture	18	64.3
Malunited distal humeral fracture	4	14.3
Old elbow dislocation or other trauma	4	14.3
Post-infective deformity	1	3.6
Others	1	3.6
Elbow deformity present	23	82.1
Cubitus valgus angle, degree	21.6 ± 7.4	

Assessment of preoperative neurological and functional status showed that 13 (46.4%) patients were in Grade II, 8 (28.6%) were in Grade III, and 7 (25.0%) were in Grade I. Intrinsic muscle wasting was found in 14 (50.0%) patients, sensory loss in the ulnar distribution in 25 (89.3%), and claw hand deformity in 9 (32.1%) patients. The mean grip strength was 17.8 ± 5.1 kg, the mean pinch strength was 3.9 ± 1.4 kg, and the mean two-point discrimination was 8.6 ± 2.7 mm. An abnormality in the nerve conduction study was observed in 26 (92.9%) patients (*Table IV*).

Table IV: Preoperative neurological and functional status

Variables	Frequency (n)	Percentage (%)
Grade I	7	25
Grade II	13	46.4
Grade III	8	28.6
Intrinsic muscle wasting	14	50
Grip strength (kg)	Mean ± SD	17.8 ± 5.1
Pinch strength (kg)	Mean ± SD	3.9 ± 1.4
Two-point discrimination, mm	Mean ± SD	8.6 ± 2.7
Sensory loss in ulnar distribution	25	89.3
Claw hand deformity	9	32.1
Nerve conduction study abnormal	26	92.9

Radiological and electrophysiological findings showed that old lateral condyle nonunion on X-ray was present in 18 (64.3%) patients, while cubitus valgus deformity on X-ray was found in 21 (75.0%) patients. Joint degenerative changes were seen in 6 (21.4%) cases. The mean nerve conduction velocity was 36.8 ± 8.9 m/s. EMG abnormality was present in 20 (71.4%) patients, and conduction block was found in 13 (46.4%) patients (*Table V*).

ISSN: 2663-9491 e-ISSN: 2789-6897

Table V: Radiological and electrophysiological findings

Variables	Frequency (n)	Percentage (%)
X-ray showing old lateral condyle nonunion	18	64.3
Cubitus valgus deformity on X-ray	21	75
Joint degenerative changes	6	21.4
Nerve conduction velocity, m/s	Mean ± SD	36.8 ± 8.9
EMG abnormality present	20	71.4
Conduction block present	13	46.4

Among the operative procedures, subcutaneous anterior transposition was the most commonly performed surgery in 15 (53.6%) patients. This was followed by submuscular anterior transposition in 4 (14.3%), simple decompression in 3 (10.7%), intramuscular anterior transposition in 2 (7.1%), and combined procedures in 2 (7.1%) patients. Medial epicondylectomy and corrective osteotomy were each performed in 1 (3.6%) patient (*Table VI*).

Table VI Operative procedures performed

Type of surgery	Frequency (n)	Percentage (%)
Simple decompression	3	10.7
Anterior transposition, subcutaneous	15	53.6
Anterior transposition, intramuscular	2	7.1
Anterior transposition, submuscular	4	14.3
Medial epicondylectomy	1	3.6
Corrective osteotomy only	1	3.6
Combined procedure	2	7.1

In the early postoperative period, pain improved in 18 (64.3%) patients, paresthesia improved in 16 (57.1%), and sensory improvement was documented in 14 (50.0%) patients. Improvement in grip strength was observed in 9 (32.1%) patients, while motor weakness improved in 8 (28.6%). Postoperative complications included wound infection in 2 (7.1%), elbow stiffness in 2 (7.1%), and hematoma in 1 (3.6%) patient. The mean hospital stay was 4.8 ± 1.9 days (*Table VII*).

Table VII Early postoperative outcomes and complications

Variables	Frequency (n)	Percentage (%)
Pain improved	18	64.3
Paresthesia improved	16	57.1
Motor weakness improved	8	28.6
Grip strength improved	9	32.1
Sensory improvement present	14	50
Wound infection	2	7.1
Hematoma	1	3.6
Elbow stiffness	2	7.1
Hospital stays (days)	4.8 ± 1.9	

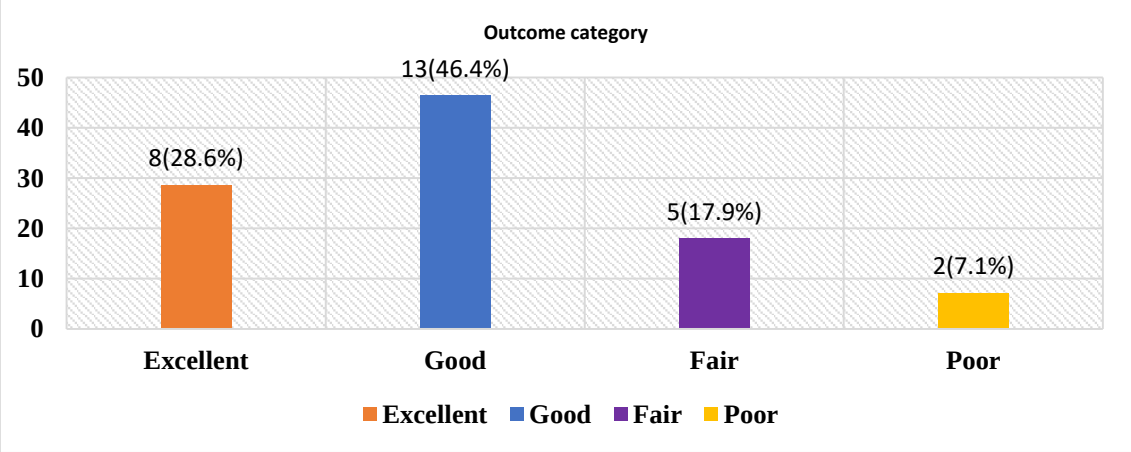

Figure 1: Final outcome of surgical management

Final outcome assessment showed that 13 (46.4%) patients had a good outcome and 8 (28.6%) had an excellent outcome. A fair outcome was observed in 5 (17.9%) patients, while a poor outcome was found in 2 (7.1%) patients. Overall, 21

ISSN: 2663-9491 e-ISSN: 2789-6897

patients (75.0%) achieved an excellent or good surgical outcome (*Figure 1*).

DISCUSSION

This study demonstrates that tardy ulnar nerve palsy in a tertiary hospital setting was predominantly a post-traumatic deformity-related neuropathy, with 18/28 patients (64.3%) having neglected or non-united lateral condyle fractures and 23/28 (82.1%) showing elbow deformity with a mean cubitus valgus angle of 21.6 ± 7.4°. This pattern is consistent with the modern understanding of tardy ulnar nerve palsy, which identifies cubitus valgus after childhood lateral condyle nonunion as the classic underlying lesion [13]. It also aligns with recent trauma-focused reports, including Fan et al., who treated 16 patients with traumatic cubitus valgus and tardy ulnar nerve palsy, and Gupta et al., who reported complete neurological recovery in all 9 patients after Milch osteotomy for cubitus valgus greater than 20° [7,14]. Saeed et al. similarly reported favorable recovery in post-traumatic McGowan grade II and III disease, supporting the view that structural deformity is a major driver of chronic ulnar nerve stretch and late neuropathy [15]. Clinically, our patients presented mainly with sensory-dominant but functionally important symptoms: numbness in 96.4%, tingling in 85.7%, sensory deficit in 89.3%, weak grip in 82.1%, and motor deficit in 67.9%. Chronic denervation was also frequent, with intrinsic wasting in 50.0% and clawing in 32.1%. These findings are comparable to contemporary cubital tunnel literature, which shows that sensory complaints usually predominate initially, whereas weakness and intrinsic wasting become more common with delayed presentation [13,16-18]. In the multicenter SUN study, Song et al. found significant postoperative improvement in patient-reported pain and function after decompression, while Burns et al. showed that poorer baseline function predicted worse postoperative recovery [16,17]. Likewise, Giladi et al. reported that symptomatic and functional recovery is most apparent in the early postoperative period, especially for pain and paresthesia [18]. Our cohort had a mean symptom duration of 19.4 ± 10.2 months, which likely explains the relatively high burden of muscle wasting and clawing compared with earlier-presenting idiopathic cubital tunnel cohorts. The electrophysiological profile in our series also suggests advanced disease. Abnormal nerve conduction studies were present in 92.9%, the mean conduction velocity was 36.8 ± 8.9 m/s, EMG abnormality was found in 71.4%, and conduction block was found in 46.4%. Tong et al., in a review of 146 severe cubital tunnel cases, found that although surgery significantly improved outcomes, complete recovery was less likely in patients with older age, longer disease duration, and absent sensory conduction [19]. This supports our observation that long-standing disease, deformity, and preoperative motor involvement may have limited the speed and extent of recovery.

Regarding surgery, subcutaneous anterior transposition was the most common procedure in our study, performed in 15/28 (53.6%), and transposition overall was used in most patients. This differs from much of the idiopathic cubital tunnel literature. Chen et al. found no significant difference between simple decompression and anterior transposition in motor nerve conduction or clinical scores overall [20]. Said et al. also reported no clear revision advantage for either procedure in idiopathic disease, while Wade et al., in a network meta-analysis of 30 studies and 2,894 limbs, estimated that 87% of patients improved after surgery and suggested that open in situ decompression had the best safety profile [21,22]. However, these broader analyses largely focus on idiopathic compression rather than deformity-associated tardy palsy. In post-traumatic elbows with valgus deformity, adhesions, or nerve tension, transposition remains more logical and is often recommended [13,21]. Our early postoperative outcomes showed greater sensory than motor recovery, with pain improved in 64.3%, paresthesia in 57.1%, and sensory improvement in 50.0%, whereas motor weakness improved in only 28.6% and grip strength in 32.1%. This pattern is biologically plausible and agrees with previous studies showing that pain and paresthesia improve sooner than intrinsic muscle recovery [17,18,23]. The final outcome was excellent or good in 21 of 28 patients (75.0%). This is somewhat lower than some modern cubital tunnel series, such as Han et al., who reported 95% good or excellent outcomes, Liu et al., who found 57.4% excellent and 22.6% good results after long-term follow-up, Frantz et al., who reported 92% patient satisfaction, Davis et al., who found 91.05% symptomatic improvement, and Ergen et al., who noted symptom resolution in 89% of patients [24-28]. Our outcome is closer to Saeed et al., who reported 65% good results with 95% functional improvement in grade II and III tardy palsy [15]. The relatively lower success in our series likely reflects delayed presentation, the high frequency of deformity, 28.6% grade III disease, and 50% intrinsic wasting at baseline. Complications in our study were acceptable but not negligible, with wound infection (7.1%), elbow stiffness (7.1%), and hematoma (3.6%). Bacle et al. reported that across four techniques, more than 90% of patients were cured or improved, with low overall recurrence [29]. Liu et al. reported no major complications in their long-term transposition series, whereas Hutchinson et al. found that the long-term reoperation rate was 25% after in situ decompression versus 12% after subcutaneous transposition [24, 28]. Taken together, these findings suggest that no single procedure is universally superior, but that procedure selection should be individualized to pathology. Clinically, our data imply that patients with neglected lateral condyle nonunion, cubitus valgus, prolonged symptoms, sensory loss, and electrophysiological abnormality should be referred early, before fixed intrinsic wasting and clawing develop. In tertiary trauma settings, prevention and timely correction of pediatric elbow deformity may reduce the future burden of tardy ulnar nerve palsy.

LIMITATIONS

This study had several limitations, including a small sample size, a single-centre design, and a short postoperative follow-up, which may limit the generalizability of the findings and the assessment of long-term outcomes. In addition, the absence of a comparison group and the use of different operative procedures may have influenced the interpretation of surgical effectiveness.

CONCLUSION

Tardy ulnar nerve palsy in this study was mainly associated with post-traumatic elbow deformity, particularly neglected lateral condyle fracture nonunion. Most patients presented with longstanding sensory and motor deficits, and surgical management produced favorable outcomes in the majority, although recovery was better for sensory symptoms than motor weakness. Early diagnosis and timely intervention may improve functional outcome and help prevent irreversible nerve damage.

RECOMMENDATIONS

Patients with post-traumatic elbow deformity, especially cubitus valgus following lateral condyle fracture nonunion, should be evaluated early for ulnar nerve involvement. Early referral, prompt surgical intervention in appropriate cases, and

regular follow-up are recommended to improve outcomes and reduce the risk of permanent motor deficit and hand deformity.

FUNDING
No funding sources

CONFLICT OF INTEREST
None declared

ETHICAL APPROVAL
The study was approved by the Institutional Ethics Committee

REFERENCES

1. *An TW, Evanoff BA, Boyer MI, Osei DA. The prevalence of cubital tunnel syndrome: a cross-sectional study in a US metropolitan cohort. JBJS. 2017 Mar 1;99(5):408-16.*
2. *Burahee AS, Sanders AD, Shirley C, Power DM. Cubital tunnel syndrome. EFORT Open Rev 6 (9): 743–750 [Internet]. 2021*
3. *Mezian K, Jačisko J, Kaiser R, Machač S, Steyerová P, Sobotová K, Angerová Y, Naňka O. Ulnar neuropathy at the elbow: from ultrasound scanning to treatment. Frontiers in neurology. 2021 May 14;12:661441.*
4. *Anderson D, Woods B, Abubakar T, Koontz C, Li N, Hasoon J, Viswanath O, Kaye AD, Urits I. A comprehensive review of cubital tunnel syndrome. Orthopedic reviews. 2022 Sep 15;14(3):38239.*
5. *Nyman E, Dahlin LB. The unpredictable ulnar nerve—ulnar nerve entrapment from anatomical, pathophysiological, and biopsychosocial aspects. Diagnostics. 2024 Feb 24;14(5):489.*
6. *Miettinen L, Ryhänen J, Shiri R, Karppinen J, Miettunen J, Auvinen J, Hulkkonen S. Work-related risk factors for ulnar nerve entrapment in the Northern Finland Birth Cohort of 1966. Scientific reports. 2021 May 11;11(1):10010.*
7. *Gupta RK, Khiyani R, Majumdar KP, Potalia R. Cubitus Valgus with Tardy Ulnar Nerve Palsy–Functional Outcome of Milch Osteotomy without Anterior Transposition of Ulnar Nerve. Malaysian Orthopaedic Journal. 2020 Jul;14(2):120.*
8. *Anuar-Ramdhan IM, Remli R, Abdul-Rashid AH, Ibrahim S. Cubitus valgus with tardy ulnar nerve palsy-is anterior transposition of the ulnar nerve always necessary? A case report. Malaysian Orthopaedic Journal. 2020 Jul;14(2):126.*
9. *Biakto KT, Nong I, Kurniawan T. Functional outcome of tardy ulnar nerve palsy manifests after 25 years due to nonunion of lateral epicondyle left humerus treated by ulnar nerve transposition: a case report. International Journal of Surgery Case Reports. 2024 Jan 1;114:109098.*
10. *Trisolino G, Antonioli D, Gallone G, Stallone S, Zarantonello P, Tanzi P, Olivotto E, Stilli L, Di Gennaro GL, Stilli S. Neglected fractures of the lateral humeral condyle in children; which treatment for which condition?. Children. 2021 Jan 18;8(1):56.*
11. *Bašković M, Pešorda D, Zaninović L, Hasandić D, Lohman Vuga K, Pogorelić Z. Management of pediatric elbow fractures and dislocations. Children. 2024 Jul 27;11(8):906.*
12. *Natroshvili T, van de Warenburg MS, Heine EP, Slater NJ, Walbeehm ET, Bartels RH. Conservative treatment of ulnar nerve compression at the elbow: a systematic review and meta-analysis. Archives of Plastic Surgery. 2023 Jan;50(01):070-81.*
13. *Rubin G, Orbach H, Bor N, Rozen N. Tardy ulnar nerve palsy. JAAOS-Journal of the American Academy of Orthopaedic Surgeons. 2019 Oct 1;27(19):717-25.*
14. *Fan C, Yushan M, Liu Y, Bahesutihan Y, Liu K, Yusufu A. Treatment outcome of tardy ulnar nerve palsy associated with traumatic cubitus valgus by supracondylar shortening wedge rotary osteotomy and ulnar nerve in situ tension release. BMC Musculoskeletal Disorders. 2022 Apr 20;23(1):369.*
15. *Saeed A, Zafardar U, Awais M, Akram M. Outcome of neurolysis combined with anterior submuscular transfer of ulnar nerve in McGowan Grade II and III tardy ulnar nerve palsy. J Pak Med Assoc. 2014 Dec 1;64(12 Suppl 2):167-72.*
16. *Song JW, Waljee JF, Burns PB, Chung KC, Gaston RG, Haase SC, Hammert WC, Lawton JN, Merrell GA, Nassab PF, Yang LJ. An outcome study for ulnar neuropathy at the elbow: a multicenter study by the surgery for ulnar nerve (SUN) study group. Neurosurgery. 2013 Jun 1;72(6):971-82.*
17. *Burns PB, Kim HM, Gaston RG, Haase SC, Hammert WC, Lawton JN, Merrell GA, Nassab PF, Yang LJ, Chung KC. Predictors of functional outcomes after simple decompression for ulnar neuropathy at the elbow: a multicenter study by the SUN study group. Archives of physical medicine and rehabilitation. 2014 Apr 1;95(4):680-5.*
18. *Giladi AM, Gaston RG, Haase SC, Hammert WC, Lawton JN, Merrell GA, Nassab PF, Song JW, Yang LJ, Chung KC, Surgery of the Ulnar Nerve Study Group. Trend of recovery after simple decompression for treatment of ulnar neuropathy at the elbow. Plastic and reconstructive surgery. 2013 Apr 1;131(4):563e-73e.*
19. *Tong J, Dong Z, Xu B, Zhang C, Gu Y. Predictors of surgical outcomes for severe cubital tunnel syndrome: a review of 146 patients. Acta neurochirurgica. 2018 Mar;160(3):645-50.*
20. *Chen HW, Ou S, Liu GD, Fei J, Zhao GS, Wu LJ, Pan J. Clinical efficacy of simple decompression versus anterior transposition of the ulnar nerve for the treatment of cubital tunnel syndrome: a meta-analysis. Clinical neurology and neurosurgery. 2014 Nov 1;126:150-5.*
21. *Said J, Van Nest D, Foltz C, Ilyas AM. Ulnar nerve in situ decompression versus transposition for idiopathic cubital tunnel syndrome: an updated meta-analysis. Journal of hand and microsurgery. 2019 Apr;11(01):018-27.*
22. *Wade RG, Griffiths TT, Flather R, Burr NE, Teo M, Bourke G. Safety and outcomes of different surgical techniques for cubital tunnel decompression: a systematic review and network meta-analysis. JAMA network open. 2020 Nov 24;3(11):e2024352.*
23. *Huang W, Zhang PX, Peng Z, Xue F, Wang TB, Jiang BG. Anterior subcutaneous transposition of the ulnar nerve improves neurological function in patients with cubital tunnel syndrome. Neural regeneration research. 2015 Oct 1;10(10):1690-5.*
24. *Liu XH, Gong MQ, Wang Y, Liu C, Li SL, Jiang XY. Anterior subcutaneous transposition of the ulnar nerve affects elbow range of motion: a mean 13.5 years of follow-up. Chinese Medical Journal. 2018 Feb 5;131(03):282-8.*
25. *Frantz LM, Adams JM, Granberry GS, Johnson SM, Hearon BF. Outcomes of ulnar nerve anterior transmuscular transposition and significance of ulnar nerve instability in cubital tunnel syndrome. Journal of Shoulder and Elbow Surgery. 2019 Jun 1;28(6):1120-9.*
26. *Davis GA, Lal T, Hearps SJ. Risk factors and outcomes in 385 cases of ulnar nerve submuscular transposition. Journal of Clinical Neuroscience. 2021 May 1;87:8-16.*
27. *Ergen E, Ertem K, Karakaplan M, Kavak H, Aslantürk O. Review of anterior submuscular transposition of ulnar nerve for cubital tunnel syndrome. Nigerian Journal of Clinical Practice. 2021 Aug 1;24(8):1170-3.*
28. *Hutchinson DT, Sullivan R, Sinclair MK. Long-term reoperation rate for cubital tunnel syndrome: subcutaneous transposition versus in situ decompression. Hand. 2021 Jul;16(4):447-52.*
29. *Bacle G, Marteau E, Freslon M, Desmoineaux P, Saint-Cast Y, Lancigu R, Kerjean Y, Vernet E, Fournier J, Corcia P, Le Nen D. Cubital tunnel syndrome: comparative results of a multicenter study of 4 surgical techniques with a mean follow-up of 92 months. Orthopaedics & Traumatology: Surgery & Research. 2014 Jun 1;100(4):S205-8.*