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# A Prevalence and Electrophysiological Evaluation of Cubital Tunnel Syndrome Among Prolonged Mobile Phone Users of Collegiate

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***ABSTRACT***

***Background:***

*Cell phone elbow refers to the compression of the ulnar nerve located behind the elbow, which can lead to sensations of tingling or numbness in the hand. This condition often arises from activities such as prolonged cell phone use, sleeping with the elbow flexed, or maintaining a bent arm position for extended durations. Cubital tunnel syndrome is recognized as the second most prevalent form of entrapment neuropathy affecting the upper limb.*

***Aim of the study:***

*For a better understanding of these clinical findings with electrophysiological tests like nerve conduction velocity study of the ulnar nerve in the cubital tunnel syndrome.*

***Objectives:***

*To find out prevalence & co-relation between prolonged mobile phone users and cubital tunnel syndrome by clinical & electrophysiological evaluation of cubital tunnel syndrome among collegiate of Uka Tarsadia University.*

***Methods:***

*The candidates were screened according to inclusion and exclusion criteria. Total fifty-eight subjects were included in this underwent clinical and electrophysiological assessment of cubital tunnel syndrome. The outcome measures were: PRUNE, ULTT-4, Nerve conduction study.*

***Results:***

*Consequences of this learning demonstrations a significant correlation amongst the prolonged mobile phone users and cubital tunnel syndrome so alternative hypothesis is retained. Results of NCV parameters like motor nerve latency 1and amplitude of right elbow show a significant difference between groups. Latency 2, left amplitude and amplitude of right wrist does not show a significant difference between symptomatic and asymptomatic group.*

***Conclusion:***

*This study shows a significant correlation between the prolonged mobile phone users and cubital tunnel syndrome so alternative hypothesis is retained. Results of nerve conduction studies found a positive significant difference in NCS between symptomatic and asymptomatic groups, so in that alternative hypothesis is retained.*

***Keywords:***

*Cubital tunnel syndrome, Nerve conduction velocity study, Prolonged mobile phone users.*

## 1. Introduction:

Cubital tunnel syndrome represents a prevalent form of peripheral compression neuropathy affecting the upper extremities. The rise in mobile phone usage has resulted in a trend among young individuals to flex their elbows close to their ears during conversations. This sustained posture while using phones has contributed to a notable increase in the duration of phone calls, with 52% of individuals maintaining their elbows flexed at angles less than 90° even while engaging in typing activities. [1, 15, 5]

Ulnar nerve can be entrapped at various upper extremity sites, with elbow entrapment being most common. The term 'Cubital tunnel syndrome' was introduced in 1958. Patients often experience pain, paraesthesia, and weakness, potentially leading to disability. [2,3]

Ulnar neuropathy at the elbow (UNE) represents a prevalent entrapment syndrome characterized by paresthesia in the fourth and fifth fingers, as well as weakness or atrophy of the ulnar intrinsic muscles. This condition can manifest at four distinct anatomical sites: the medial intermuscular septum, the retroepicondylar groove, the humeroulnar aponeurotic arcade, and the exit point from the flexor carpi ulnaris muscle. The term "cell phone elbow" refers to cubital tunnel syndrome (CuTS), which is associated with symptoms such as pain, burning sensations, aching, numbness, and tingling along the medial aspect of the forearm and hand. [5, 6]

Cubital tunnel syndrome (CuTS), or ulnar nerve compression about the elbow, is a common peripheral entrapment neuropathy caused by compression, traction, or friction of the ulnar nerve. It is the second most prevalent peripheral entrapment neuropathy in the elbow, with delayed diagnosis leading to chronic symptoms and muscle weakness. [7, 4, 16, 17, 10, 6]

Cubital tunnel symptoms can start insidiously or acutely, with the latter more common with trauma. These symptoms are related to the mixed sensory and motor neural fibers of the ulnar nerve, causing mild intermittent numbness and pain. The cubital tunnel has up to 2.2 cm excursion and a maximal strain of 15%. As the elbow flexes, the cross-sectional area shrinks, and intraneural pressure increases. Compression neuropathy, a pathophysiologic concept, involves swelling, edema, and vasocongestion, leading to textural changes of the nerve.

Neural tension tests (ULTT) are clinical tools used to assess and treat neurogenic pain syndromes. ULTT 4 stresses the ulnar nerve using elbow flexion. Nerve conduction velocity (NCV) tests determine the velocity of electrical signals along a peripheral nerve, distinguishing between myelin sheath and nerve axon injuries. Motor and sensory nerve conduction studies involve stimulation of peripheral nerves.

The study on cubital tunnel syndrome, involving prolonged mobile phone use, aims to determine if there is a correlation between the nerve conduction velocity study and cubital tunnel syndrome, providing substantial literature support for clinical tests and its correlation with electrophysiological studies.

**2. Aim And Objectives:**

- **Aim:**
  A study to find out prevalence and electrophysiological evaluation of cubital tunnel syndrome among prolonged mobile phone users collegiate of Uka Tarsadiya University.

- **Objectives:**

  1. To find out the prevalence of cubital tunnel syndrome among collegiate.

  2. To determine the correlation of prolonged mobile phone users and cubital tunnel syndrome by ULTT-4 as clinical assessment of cubital tunnel syndrome among collegiate.

  3. To check whether Nerve conduction velocity can be used as a diagnostic tool for Cubital tunnel syndrome among collegiate.

3. **Methodology**

**Study Design**

This is the observational study to find out the prevalence and co-relation between clinical & electrophysiological evaluation of cubital tunnel syndrome among prolonged mobile phone users of collegiate.

**Participants**

Consist of students of 18 to 25 years of age of group, prolonged mobile phone users of collegiate of Uka Tarsadia University. Source of data Was Uka Tarsadiya University, Bardoli. A total of 58 students who were be found falling in the inclusion criteria were be selected in present study for analysis. Convenient sampling method was used for subject selection from 2023 to 2024.

- **Inclusion Criteria:**

  - Patient's age group: 18-25 years.
  - Both genders.
  - History of paresthesia and/or numbness and motor symptoms at the fourth and fifth digits following prolonged elbow flexion.
  - Mobile phone users more than 15 min.
  - Patients with complaint of tingling and numbness in upper extremity in the past 1 week.

- **Exclusion Criteria:**

- Addition of endoscopic cubital tunnel release or medial epicondylectomy in place of open simple decompression.
- Any history of fracture of ulna in past 6 months.
- Previous decompression surgery for ulnar neuropathy at elbow (UNE) in past 6 months.
- Any other hand deformity.
- Any individual suffering from upper limb myopathy.
- Clinical or neurophysiological signs of polyneuropathy.
- Any psychological problems.

**Outcome Measures**

1. Patient-rated ulnar nerve evaluation,

2. Nerve conduction studies,

3. Motor nerve conduction latency 1, latency 2 and amplitude of ulnar nerve.

**Procedure**

58 students were included, and they were given detailed instructions and signed a consent form. Clinical tests, such as the PRUNE questionnaire and ULTT-4 test, were performed to assess nerve conduction velocity and nerve conduction study for the ulnar nerve in a quiet, ventilated room.

**ULTT-4 –**

The Upper Limb Tension Test 4 (ULTT4) is designed to assess the ulnar nerve. This test involves a specific movement where the patient's shoulders are lowered and rotated inward to an angle of 10 degrees apart. During the procedure, the elbows are extended, the forearms are supported, and the wrists are flexed, tilting them toward the left side, while the fingers are also flexed.[28]

Detailed process of ULTT-4 –

1. Starting position- left patient’s elbow rests on the therapist’s hip
2. Wrist and finger extension, ensure 4$^{th}$ and 5$^{th}$ fingers are extended
3. Pronation
4. Shoulder lateral rotation, ensuring wrist position is maintain
5. Elbow flexion
6. Block shoulder girdle elevation by pushing first into the table

**Prune -**

The PRUNE is a 20-item assessment tool designed to evaluate pain, sensory and motor symptoms, as well as

functional disability in individuals diagnosed with UNE. This scale comprises six items related to pain, four items addressing symptoms, six items focused on specific activities, and four items concerning usual activities. The scoring system allows for a total range of 0 to 100 points, with an equal emphasis placed on both the symptoms and functional components in the overall score.

**Nerve Conduction Velocity -**

Nerve conduction velocity assessment for the ulnar nerve is conducted by applying small electrical impulses to superficial nerve sites. This procedure is considered safe and is generally well-accepted by patients, typically resulting in only minor discomfort and no lasting adverse effects. Individuals undergoing the test often report sensations akin to tingling or tapping. It is advisable to refrain from using topical creams prior to the test, as they can increase skin resistance. Additionally, in colder settings, it may be necessary to warm the limbs to ensure optimal conduction velocity.

The ulnar nerve conduction study requires a standard elbow position, with motor nerve conduction velocity measured by ADM and stimulating at the wrist, below, above, axilla, and Erb's point. The limb position during stimulation and distance measurement are crucial, with the patient in a comfortable position. Errors in nerve length measurement can result in fictitious slowing of nerve conduction velocity.

## 1. STATISTICAL ANALYSIS

This study aimed to investigate the prevalence of cubital tunnel syndrome in normal individuals using prolonged mobile phones and electrophysiological assessment in symptomatic and asymptomatic cases. A total of 58 subjects were included, with 11 having symptoms and 47 not. The study used descriptive statistics, Mann Whitney test, and SPSS software for data analysis. The results were considered significant if $p<0.05$.

## 2. RESULTS

Fifty-eight participants include in the study. Age of patients are 18-25.

| **Mean age of all the study participants (n=58)** | | | |
|---|---|---|---|
| **Variables** | **Mean** | **SD** | **N** |
| **Age** | **20.43** | **1.975** | **58** |

**Table 4.2.1: Above table mentioned mean and standard deviation (SD) of age of 58 individuals.**

| **Distribution of study participants based on their symptoms** | | |
|---|---|---|
| | **Frequency (n)** | **Percentage (%)** |
| **Symptomatic** | 11 | 18.96% |
| **Asymptomatic** | 47 | 81.03% |

| | | |
|---|---|---|
| **Total** | 58 | |

**Table 4.2.2**

1= Symptomatic 2 = Asymptomatic

Above the table mentioned frequency (n) and percentage (%) of symptomatic and asymptomatic group.

In chart 18.96% people were symptomatic and 81.03% people were positive or were symptomatic for CuTS.

| **Test of significance between the latency 1 of right wrist and right elbow** | | | | | | |
|---|---|---|---|---|---|---|
| | | Total | N | Mean rank | Sum of ranks | Sig. |
| Latency 1 of right wrist | Symptomatic | 58 | 11 | 51.73 | 569.00 | .000 |
| | Asymptomatic | | 47 | 24.30 | 1142.00 | |
| Latency 1 of right elbow | Symptomatic | 58 | 11 | 48.91 | 538.00 | .000 |
| | Asymptomatic | | 47 | 24.96 | 1173.00 | |

**Table 4.2.3: Motor Nerve Latency 1 for right wrist and right elbow**

- Mann Whitney U test for motor nerve latency – 1 for right wrist and right elbow and for both the group. Mean value for both group is given.
- It does show a difference between groups.
- Significance level is mentioned.

| **Test of significance between the latency 1 of left wrist and left elbow** | | | | | | |
|---|---|---|---|---|---|---|
| | | Total | N | Mean rank | Sum of ranks | Sig. |
| Latency 1 of left wrist | Symptomatic | 58 | 11 | 51.73 | 569.00 | .000 |
| | Asymptomatic | | 47 | 24.30 | 1142.00 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Latency 1 of left elbow | Symptomatic | 58 | 11 | 51.73 | 538.00 | .000 |
| | Asymptomatic | | 47 | 24.30 | 1173.00 | |

**Table 4.2.4: Motor Nerve Latency 1 for left wrist and left elbow**

- Mann Whitney U test for motor nerve latency – 1 for left wrist and left elbow and for both the group. Mean value for both group is given.
- It does show a difference between groups.
- Significance level is mentioned.

| **Test of significance between the latency 2 of right wrist and right elbow** | | | | | | |
|---|---|---|---|---|---|---|
| | | Total | N | Mean rank | Sum of ranks | Sig. |
| Latency 2 of right wrist | Symptomatic | 58 | 11 | 32.14 | 353.50 | .565 |
| | Asymptomatic | | 47 | 28.88 | 1357.50 | |
| Latency 2 of right elbow | Symptomatic | 58 | 11 | 31.23 | 343.50 | .706 |
| | Asymptomatic | | 47 | 29.10 | 1367.50 | |

**Table 4.2.5 Motor Nerve Latency 2 for right wrist and right elbow**

- Mann Whitney U test for motor nerve latency – 2 for right wrist and right elbow and for both the group.

  Mean value for both group is given.
- It does not show a difference between groups.
- Significance level is mentioned.

| **Test of significance between the latency 2 of left wrist and left elbow** | | | | | | |
|---|---|---|---|---|---|---|
| | | Total | N | Mean rank | Sum of ranks | Sig. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Latency 2 of left wrist | Symptomatic | 58 | 11 | 32.73 | 360.00 | .481 |
| | Asymptomatic | | 47 | 28.74 | 1351.00 | |
| Latency 2 of left elbow | Symptomatic | 58 | 11 | 32.14 | 353.50 | .565 |
| | Asymptomatic | | 47 | 28.88 | 1357.50 | |

**Table 4.2.6 Motor Nerve Latency 2 for left wrist and left elbow**

- Mann Whitney U test for motor nerve latency – 2 for left wrist and left elbow and for both the group. Mean value for both group is given.
- It does not show any difference between groups.
- Significance level is mentioned.

| **Test of significance between the amplitude of right wrist and right elbow** | | | | | | |
|---|---|---|---|---|---|---|
| | | Total | N | Mean rank | Sum of ranks | Sig. |
| Amplitude of right wrist | Symptomatic | 58 | 11 | 21.27 | 234.00 | .073 |
| | Asymptomatic | | 47 | 31.43 | 1477.00 | |
| Amplitude of right elbow | Symptomatic | 58 | 11 | 20.36 | 224.00 | .046 |
| | Asymptomatic | | 47 | 31.64 | 1487.00 | |

**Table 4.2.7: Amplitude for right wrist and right elbow**

- Mann Whitney U test for motor nerve amplitude for right wrist and right elbow and for both the group. Mean value for both group is given.
- It does not show any difference between groups in amplitude of right wrist.
- It does show a difference between groups in amplitude of right elbow.
- Significance level is mentioned.

| Test of significance between the amplitude of left wrist and left elbow | | | | | | |
|---|---|---|---|---|---|---|
| | | Total | N | Mean rank | Sum of ranks | Sig. |
| Amplitude of left wrist | Symptomatic | 58 | 11 | 21.27 | 234.00 | .073 |
| | Asymptomatic | | 47 | 31.43 | 1477.00 | |
| Amplitude of left elbow | Symptomatic | 58 | 11 | 21.27 | 234.00 | .073 |
| | Asymptomatic | | 47 | 31.43 | 1477.00 | |

**Table 4.2.8: Amplitude for left wrist and left elbow**

- Mann Whitney U test for motor nerve amplitude for left wrist and left elbow and for both the group. Mean value for both group is given.
- It does not show any difference between groups.
- Significance level is mentioned

## 7. Discussion

The study investigated the prevalence of cubital tunnel syndrome among prolonged mobile phone users and conducted electrophysiological assessments in symptomatic and asymptomatic cases. Out of 58 participants, 11 had symptoms, and 58 were suspected of having CuTS.

A study by Arooja Fatima et al. (2019) found that 19.8% of healthy subjects had symptoms of cubital tunnel syndrome (CTS) due to prolonged phone usage. The condition, which can be similar to other ulnar neuropathies, can lead to increased disability and dysfunction after 6 weeks. Wrestlers and more women are at risk. The study used questionnaire-based methods for diagnosis.

The study by Ukkirapandian et al. (2024) found that mobile phone usage significantly impacts ulnar nerve function, with prolonged latency and delayed conduction velocity. Electrodiagnostic studies like nerve conduction velocity studies and EMG are crucial for diagnosing ulnar neuropathy. Early screening for entrapment was lower than normative data.

Byl et al. found that prolonged use of a cell phone with 135° elbow flexion causes 2% ulnar nerve strain, increasing pressure within the cubital tunnel. Muhmoud et al. examined ulnar nerve conduction velocity from two forearm positions and found that supination and full extension had higher velocity than other positions.

A study found that ulnar nerve conduction velocity decreases at 45° elbow flexion due to forearm supination and pronation. A previous study found pressure-induced pain was more frequent in one-handed phone handling in asymptomatic women.

**8. Conclusion**

The purpose of the study was to study on prevalence of cubital tunnel syndrome and of correlation prolonged mobile phone users and CuTS, electrophysiological assessment in symptomatic and asymptomatic cases.

The result of this study shows a positive significant correlation between the prolonged mobile phone users and cubital tunnel syndrome so alternative hypothesis is retained.

Results of nerve conduction studies found so significant difference in NCS between symptomatic and asymptomatic group, so in that alternative hypothesis retained.

**9. Further Recommendations**

For future recommendation different neuropathy condition can take for nerve conduction studies. As the groups was formed based on symptomatic and its weakness and also use for different population.

**10. LIMITATIONS**

This study also had some potential weakness.

- In this study small numbers of prolong mobile phone users were included.
- A greater number of participants would be required to have sufficient power in calculations and decrease the probability of potential errors to allow for more conclusive results.
- Furthermore, study only included participant with age ranges between the 18 to 25 years; it can be done on elder age group participants, as the nerve conduction study is very sensitive measurement and can be affecting by the age of individual.

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