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Ulnar neuropathy at the elbow-laterality, disability, and associated conditions

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Abstract

Ulnar Neuropathy of the Elbow (UNE) is the second most common entrapment neuropathy. In this study, we aimed to determine the factors that may guide diagnosis and treatment by examining the electrodiagnostic (EDX), demographic data and upper extremity-related disability levels of patients with UNE. Demographic characteristics, symptom duration, EDX data and any other accompanying entrapment neuropathy, and the shortened Disabilities of the Arm, Shoulder, and Hand Injuries Questionnaire (Quick-DASH) scores were noted. The laterality, localization, factors associated with the severity of UNE, and the impact of the presence of Carpal Tunnel Syndrome (CTS) on disability have been studied in detail. 92 arms of 73 patients were included. The mean age of the patients was 47.71±13.99 years. 41 (56.2%) were male and 32 (43.8%) were female. 29 (39.7%) patients had at least one comorbid disease. Of the patients, 30 (41%) had left-sided UNE, 24 (33%) had right-sided UNE and 19 (26%) had bilateral UNE. The median symptom duration was 3 (1-12) months. 28 (38.4%) patients had also CTS. The median Quick-DASH score was 28 (9-80). There was also no significant association between UNE side and age or gender (p=0.439 and p=0.216, respectively). In 62 (67.4%) patients, the site of compression was 2 cm proximal to the medial epicondyle (ME). Symptom duration was statistically significantly longer in the moderate group than in the mild group, and in the severe group than in the mild UNE group (p<0.001 and p=0.035 respectively). When the association of compression neuropathy severity with gender and comorbidities was analyzed, no significant association was found (p=976 and p=330, respectively). In conclusion, UNE was more common in men, on the left side and 2 cm proximal to the ME. Controlled studies with more participants are needed to uncover factors that may guide the diagnosis and treatment of UNE.

Keywords: Laterality, ulnar nerve, ulnar neuropathy at the elbow

Introduction

Ulnar Neuropathy of the Elbow (UNE) is the second most common entrapment neuropathy with an incidence of 17.2-32.7 per 100000 cases [1,2]. It may be idiopathic or may be caused by certain systemic diseases, fractures around the elbow, cubitus valgus deformity, elbow osteoarthritis, prolonged immobilization in the elbow flexion position, occupations involving repetitive elbow movements, or activities that require the elbow to rest on something [3].

Despite causing various difficulties in activities of daily living, UNE has not been investigated as much as Carpal Tunnel Syndrome (CTS). Few epidemiologic studies on the risk factors of UNE have been published and show heterogeneity due to reasons such as selection of cases, or sample size [4]. While laterality is indicated in CTS, the same is not true for UNE. Various studies have shown different results with more right, left, or bilateral involvement [5-8]. These emphasize the need for further investigation of associated factors for success in diagnosis and treatment.

In this study, considering the gaps in the literature, we aimed to examine in detail the laterality, electrodiagnostic (EDX) and demographic data and upper extremity-related disability levels of patients with UNE and to reveal the factors that may guide diagnosis and treatment.

Material and Methods

Patients

Between 01.06.2022 and 31.12.2023, the files of patients admitted to our Electromyography (EMG) Laboratory were retrospectively analyzed. Before the study, the protocol was approved by Ankara Etlik City Hospital Local Ethics Committee (date:20.12.2023, number: AEŞH-EK1-2023-799), and the study

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complied with the principles of the Declaration of Helsinki.

Patients aged 18-85 years with a diagnosis of UNE by EDX were included in this study. Exclusion criteria included incomplete file data, severe neurological disorder, upper extremity trauma or fracture, a history of surgery for UNE, a known injury of the ulnar nerve, C8 T1 radiculopathy, brachial plexus damage, Guyon's Canal Syndrome, Thoracic Outlet Syndrome, and the presence of polyneuropathy.

Age, gender, comorbid diseases, education level, occupation, dominant hand, symptom duration, EDX data and any other accompanying entrapment neuropathy were noted.

Measurements

Medelec Synergy 10-channel (Oxford, England) EMG device was used for all electrophysiologic examinations. Nerve conduction was studied when the elbow was flexed between 70 and 90◦. For the diagnosis of UNE, the American Association of Neuromuscular and EDX Medicine (AANEM) guidelines were used. According to these guidelines, UNE is diagnosed in the presence of at least two of these four criteria: (1) ulnar motor nerve conduction study (MCV) <50 m/s from above the elbow to below the elbow; (2) deceleration of MCV by 10 m/s or more from above the elbow to below the elbow; (3) >20% decrease in the compound motor action potential (CMAP) from above the elbow to below the elbow; (4) a signicifant change in CMAP configuration from above the elbow to below the elbow and/or axonopathy needle EMG changes in the ulnar nerve. [5].

In nerve conduction studies, ulnar nerve SCV from the wrist segment of the fifth finger, and ulnar MCV recorded from the adductor digit minimi (ADM) muscle were recorded. The results of the inching MCV test along the elbow (2 cm short segment MCV) and needle EMG findings of ADM, first dorsal interosseos (FDI), and flexor carpi ulnaris (FCU) muscles were also noted.

The results of the shortened Disabilities of the Arm, Shoulder, and Hand Injuries Questionnaire (Quick-DASH), which was completed to assess upper extremity problems at the time of presentation to the EMG Laboratory, were noted. Quick-DASH is an 11-question scale that evaluates function and disability in upper extremity problems by questioning the person's difficulties during life activities and whose Turkish validity and reliability study has also been conducted [9,10]. The scale is scored between 0-100, with higher scores indicating more impairment.

The laterality, localization, factors associated with the severity of UNE, and the impact of the presence of CTS on disability have been studied in detail.

Statistical Analysis

All statistical analysis was performed using the Statistical Package for Social Science (SPSS) version 20.0 software (IBM Corporation, Chicago, IL). The Shapiro-Wilks test was used for data distribution analysis. Data are expressed as frequency (%) for nominal and categorical variables, median (min-max) for non-normally distributed variables and mean±standard deviation (SD) for normally distributed variables. A p-value of less than 0.05 was found to be statistically significant. The Kruskal-Wallis test and Pearson Chi-Square test made comparisons among groups according to the severity of compression neuropathy. Post hoc analysis with Bonferroni correction was used for pairwise comparison. A p-value of less than 0.05 was found to be statistically significant.

Results

The study included 92 arms of 73 patients who met the criteria. The mean age of the patients was 47.71±13.99 years. Of the participants, 41 (56.2%) were male and 32 (43.8%) were female. 39 (53.4%) patients were actively employed. 29 (39.7%) patients had at least one comorbid disease. The right hand was dominant in 66 (90.4%) of the patients. Of the patients, 30 (41%) had left-sided UNE, 24 (33%) had right-sided UNE and 19 (26%) had bilateral UNE. The median symptom duration was 3 (1-12) months. 28 (38.4%) patients had also CTS. The median Quick-DASH score was 28 (9-80). Demographic and clinical characteristics of the patients are shown in Table 1.

Table 1. Demographic and clinical characteristics of the patients

Variables			Total (n=73)
Age (years), mean±SD			47.71±13.99
Gender, n (%)	**Female**		32 (43.8)
	Male		41 (56.2)
Educational level, n (%)	**Unschooled**		4 (5.5)
	Primary school		23 (31.5)
	High school		34 (46.6)
	University		12 (16.4)
Occupation, n (%)	**Housewife**		30 (41.1)
	Blue collar		26 (35.6)
	White collar		13 (17.7)
	Student		6 (8.2)
	Retired		4 (5.5)
Comorbidities*, n (%)	**Yes**		29 (39.7)
	No		44 (60.3)
Hand dominancy, n (%)	**Right**		66 (90.4)
	Left		7 (9.6)
Compression side, n (%)	**Right**		24 (33)
	Left		30 (41)
	Bilateral		19 (26)
Symptom duration (months), med (min-max)			3 (1-12)
Q-DASH, med (min-max)			28 (9-80)
Accompanying CTS, n (%)	**Yes**	**Mild**	14 (19.2)
		Moderate	12 (16.4)
		Severe	2 (2.8)
	No		45 (61.6)

*Hypertension, diabetes mellitus, rheumatoid arthritis, hypothyroidism, Q-DASH: Quick- Disabilities of the Arm, Shoulder, and Hand Injuries Questionnaire, CTS: carpal tunnel syndrome

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There was also no significant association between UNE side and age or gender (p=0.439 and p=0.216, respectively).

In 62 (67.4%) patients, the site of compression was 2 cm proximal to the medial epicondyle (ME) (Figure 1). Compression severity was mild in 67 (72.8%) cases. In 20 (21.7%) cases, axon damage findings were detected. Table 2 shows the EDX findings of arms with UNE.

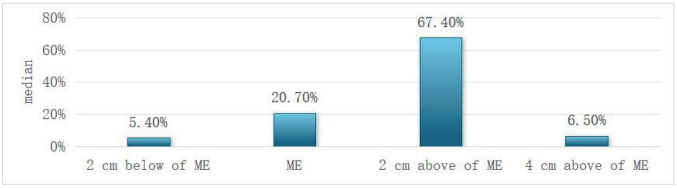

Figure 1. Localizations in Ulnar Neuropathy of Elbow, n (%); ME: Medial epiconyle

Table 2. Electrophysiological findings of arms with ulnar nerve compression neuropathies

Severity of compression neuropathy, n (%)	**Mild**		67 (72.8)
	Moderate		17 (18.5)
	Severe		8 (8.7)
Axonal degeneration, n (%)	**Yes**		20 (21.7)
	No		72 (78.3)
Nerve conduction study- Sensory Ulnar nerve (Digit V), med (mi-max)	**Velocity (m/s)**		42.1 (0-49.0)
	Latency (ms)		2.5 (0-5.31)
	Amplitude (mV)		13.2 (0-157.2)
Nerve conduction study- Motor Ulnar nerve (ADM), med (min-max)	**Velocity (m/s)**	**Forearm**	59.0 (0-92)
		Elbow	43.0 (0-64)
	Latency (ms)	**Below elbow**	6.09 (3.6-12.24)
		Wrist	2.29 (1.82-4.69)
		Above elbow	8.65 (4.8-14.58)
	Amplitude (mV)	**Below elbow**	7.4 (0-14.3)
		Wrist	8.0 (2.6-16.0)
		Above elbow	6.5 (1.1-13.8)
Motor inching, med (min-max)	**Latency difference (ms)**		1.15 (0.73-3.13)
	Amplitude difference (%)		5 (0-90)
Needle EMG, n (%)	**ADM**	**Active denervation**	8 (8.7)
		Chronic denervation	13 (14.1)
		Normal	3 (3.3)
	FDI	**Active denervation**	9 (9.8)
		Chronic denervation	7 (7.6)

EMG: electromyography, ADM: adductor digiti minimi muscle, FDI: first interosseos muscle

Table 3 shows the association between severity of compression neuropathy and upper extremity disability, age, symptom duration, and inching difference. Symptom duration was statistically significantly longer in the moderate group than in the mild group, and in the severe group than in the mild UNE group (p<0.001 and p=0.035 respectively). The difference in motor inching amplitude was statistically significant between mild and severe cases (p=0.001). Motor inching latency difference was statistically significantly different between mild and moderate cases (p=0.002).

When the association of compression neuropathy severity with gender and comorbidities was analyzed, no significant association was found (p=0.976 and p=0.330, respectively).

Table 3. The association with severity of compression neuropathy and upper extremity disability, age, symptom duration, and inching difference

	Mild neuropathy	Moderate neuropathy	Severe neuropathy	P1	P2	P3
Age	48.56±13.66	49.17±12.31	46.62±18.30	0.997	0.989	0.980
Symptom duration	3 (0-12)	6 (3-12)	6 (1-10)	**<0.001**	**0.035**	1.000
Q-DASH	28 (9-80)	24.6 (9-70)	42 (22-54.25)	1.000	0.210	0.132
Motor inching amplitude difference (%)	4 (0-71.2)	10 (1.2-40)	11 (0-90)	0.645	**0.001**	0.052
Motor inching latency difference	1.15 (0.73-2.29)	1.35 (0.94-3.02)	1.32 (0.99-3.13)	**0.002**	0.118	1.000

P1: mild-moderate, P2: mild-severe, P3: moderate-severe, Q-DASH: Quick- Disabilities of the Arm, Shoulder

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Discussion

In this study investigating laterality, level of disability and associated conditions, UNE was found to be more prevalent on the left than on the right and more prevalent in men than in women, regardless of hand dominance. Systemic diseases were present in a significant proportion of patients and when the severity of compression was analyzed, the majority were moderate. It was noteworthy that symptom duration was shorter in those with mild compression.

This study concluded that UNE was more common on the left side, regardless of hand dominance, similar to the limited literature [6,7]. Gowers WR emphasized that this may be related to the sleeping side [11]. While right-handed people use their right hand for a variety of tasks, such as using a computer, they often use their left arm to balance their body or lean on their left arm. From this perspective, it is understandable that UNE is more common on the non-dominant side, in contrast to CTS, which is more common in the dominant hand. Another study concluded that right-sided UNE is more common in elderly patients and those with concomitant CTS [6]. In the present study, no significant correlation was found between UNE laterality and either age or absence of CTS. These different results in the literature suggest that there may be etiologic factors associated with UNE that have not yet been elucidated.

It was found that the male gender was dominant in the patients with UNE. It was consistent with the literature [6,7,12]. In addition to the fact that men are more prone to traumatic elbow injuries, their thicker forearm muscle structure and greater grip strength, and greater pressure on the ulnar nerve during elbow movements are listed in the literature as the reasons why UNE is more common in men [7]. On the other hand, in a study conducted by Bartels and Verbeek, they found that gender was not an independent variable for UNE [13]. In addition to differences in patient numbers included in the studies, anthropometric measures of the elbow may be effective in obtaining different results. The effect of gender can be better examined in studies in which patients' jobs are described in more detail and their hobbies are questioned.

A case-control study examining the risk factors for UNE revealed that diabetes and hypertension are not independent risk factors for UNE [13]. On the other hand, Mondelli et al. revealed that diabetes is a risk factor for the development of UNE [4]. In another study, diabetes and chronic renal failure were associated with bilateral UNE [6]. In the present study, UNE side or degree was not associated with comorbidity. We think that the differences in the number of patients included in the studies may be effective in obtaining different results. In addition, the fact that the mean age of our patient group was younger than the literature may have caused the number of comorbidities to be lower and thus different results to be obtained.

It is noteworthy that one study reported that entrapments in the ME and proximal to it are more demyelinating, while entrapments distal to the ME usually cause axonal damage [14]. Although the relationship between the site of entrapment and the presence of axonal damage has not been examined, in our study, entrapment distal to the ME was found to be very rare and axonal damage was not detected in most of the cases.

When we analyzed the relationship between UNE severity and Q-DASH, no significant relationship was found. Moreover, even when CTS was present, disability scores did not change. To our knowledge, there is no other study in the literature examining the severity of UNE and Q-DASH. These results may be related to the small number of patients in the study and the fact that Q-DASH is a subjective scale based on patient expression.

Although our study has limitations such as being retrospective and having a small number of participants, it is valuable because it is a study in which EDX findings in UNE were analyzed in detail and their relationship with disability levels was examined.

Conclusion

In conclusion, although certain risk factors have been identified, there is a need for more controlled studies with more participants in which clinical, demographic, and electrophysiological characteristics for UNE as well as the association with disability levels are examined in detail, as this may lead to new strategies for earlier diagnosis and treatment.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
The study protocol was approved by Ankara Etlik City Hospital Local Ethics Committee (20.12.2023, AEŞH-EK1-2023-799).

Patient Informed Consent
The participants received oral and written information about the study and gave their written informed consent.

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