JPSIM Journal of Pakistan Society of Internal Medicine

Original Article

Frequency of Ulnar Neuropathy, Etiologies and Electro-Diagnostic Correlation with Clinical Severity

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Abstract

Objective: To determine frequency of ulnar neuropathy, etiology. Electro-diagnostic correlation with clinical severity.

Methods: This cross-sectional study was conducted in Neurology, King Edward Medical University Lahore. 95 patients, clinically diagnosed with ulnar neuropathy, were included, from July 2022 to Dec 2022. Patients with polyneuropathy, radiculopathy and plexopathy were excluded from study. Nerve conduction studies were performed by conventional methods. Electro-diagnostic findings were noted in predesigned proforma along with history and demographic variables.

Results: Out of total 95 patients, 72 patients were male and 23 were females. Most prevalent age group was 15–30 years old (mean age 32.0 + 12.7 years). 86.3% of the cases (64 males and 18 females) were traumatic (52 at the elbow, 26 at forearm, 04 at wrist). Trauma was more than entrapment or any other etiology. Frequent site of injury was elbow (58.9%) of all cases. A moderate positive correlation was noted between EDX and clinical severity. (r = 0.58)

Conclusion: Ulnar neuropathy is commonly seen at elbow after this forearm, wrist with high rate of traumatic nerve injuries. Young population was affected with male predominance. A detail clinical evaluation along with electro-diagnostics is valuable to determine the ulnar neuropathic pattern and its localization. Clinical and electro-diagnostic severity correlation is valuable in predicting prognosis.

Keywords: Ulnar neuropathy, Electro-diagnostics, Intramuscular, non-traumatic injury

How to cite this:

Batool M, Bano S, Shamim F, Numan A. Frequency of Ulnar Neuropathy, Etiologies and Electro-diagnostic Correlation with Clinical Severity. J Pak Soc Intern Med. 2023;4(2): 130-134

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Introduction

Ulnar nerve injury is becoming more prevalent mono-neuropathy in upper extremity next to carpal tunnel syndrome, in clinical as well as electro-diagnostic settings.[1] Ulnar nerve travels long root along its course in the upper limb, it becomes at risk to lesions, either traumatic or compressive. All these etiologies can damage ulnar nerve up to different proportions and can interfere with daily functioning of affected limb.[2,3] Symptoms usually include paresthesia or sensory disturbance in the little and ring fingers with weakness of ulnar innervated muscles. Usually, diagnosis is usually clinical which are further correlated with abnormal electrophysiology.[2] Electro-diagnostic studies(EDX), including NCS/EMG, are required for diagnosis of ulnar neuropathy when used along with physical examination.[1]

Common abnormal findings are noted in NCS is abnormal or absent CMAP amplitude, or conduction block across the elbow.[4] EMG may revealed neurogenic patterns in the ulnar innervated muscles.[5,6] FCU muscle might not be involved in many cases of ulnar neuropathy at the elbow, because nerve supply of this muscle arises proximal to the medial epicondyle.[3,6] Many factors that can explain this finding for example, nerve fibers supplying the FCU muscle have medical location, so better protected from trauma; while nerve fibers innervating intrinsic hand muscles and sensory fibers are lateral location .thus are at high risk of any external injury.[4,7,9] Another justification is abnormal axoplasmic flow. This theory states that external pressure hampered axoplasmic flow which results in a dying–back phenomena especially in the longest fibers.[4,6]

Some studies showed electro-diagnostics of FDP muscle is more sensitive than testing of FCU muscle in assessing ulnar neuropathy at elbow.[7] Likewise some studies suggests most affected muscle as Abductor Digiti Minimi than First Dorsal Interossei[4]. Another study shows FDI as the most affected muscle than ADM[6]. Addressing

these controversies, we aimed to conduct study to determine pattern of muscle affected in ulnar neuropathy at various sites by needle examination, its frequency and demographics of ulnar nerve injury, common etiologies and determining association of clinical and electrophysiological severity.

Methods

After taking approval from ethical committee of King Edward Medical University Lahore, 95 patients who were clinically diagnosed with ulnar neuropathy were identified from consecutive referrals presented to our neurophysiology laboratory, from July 2022 to Dec 2022.

Clinical symptoms include sensory disturbances in the little and ring fingers with weakness or not, difficulty in gripping, wasting of ulnar-innervated muscles in hand, positive froment's, wartenberg's signs and typical ulnar claw hand. Patients with plexopathy or C8-T1 radiculopathy on the basis of clinical and electrodiagnostics were excluded. Patients with bleeding disorders history and edema were excluded. Nerve conduction studies along with electromyography was performed in every patient. The procedures followed at our institution were in accordance with the research principals and were all part of the routine procedures as mentioned in book "Electromyography and Neuromuscular Disorders[15] Preston & Shapiro 4th Edition", for investigation of ulnar neuropathy. Severity was assessed on clinical and electrophysiological scales (Bartels et al., 1998; McGowan, 1950). A single neurophysiologist performed NCS/EMG using the Nihon Kohden (Neuropack® X1 MEB-2300 EMG/NCV/EP) Measuring Desktop System. NCS was conducted with surface stimulation with electro-diagnostics protocols. Ulnar orthodromic SNAP was noted from wrist with stimulation at little finger. Ulnar CMAP was noted from abductor digiti minimi (ADM) with stimulation at the medial wrist and at elbow.

Data analysis was done by using SPSS, version 20. Categorical data like gender, clinical and electrophysiological severity were represented as frequency/percentages. Quantitative data like age was represented as mean / standard deviation. Pearson's correlation was used for analyzing correlation between EDX and clinical severity.

Results

95 patients (mean age 32.0 + 12.7 years), Demographic features, clinical characteristics, temporal course of ulnar neuropathy of the patients are presented in Table 1, 2.

Highest prevalence rate of the disease was observed in the 15–30 years old age group. Predominance of males (75.8%) was substantially high rather than females. On the basis of etiology, rate of traumatic ulnar nerve injury was highest (86.3%), (64 males and 18 females) (52 at elbow, 26 at forearm, 04 at wrist), idiopathic UN (8.4%), post-operative UN (4.2%) and IM injection induced UN (1.1%) as shown in table 3.

Site of lesion depicted in Table 3 revealed ulnar neuropathy across elbow as highest comprising 58.9% of all presented cases. Among them 92.8% traumatic and 7.1% were non-traumatic. 28.4% of total referrals were UN below elbow (in the forearm). 5.3% were UN at wrist while only 4.2% were non-localizing. In ulnar neuropathy across elbow n=56, FCU was involved in 47(83%) and FDP muscles 42(75%) in ulnar neuropathy. Regarding severity, severe cases were highest in percentage (53.7%) among electrophysiological severity while

Table 1: *Characteristics of Study Subjects*

Characteristics		Number of patients (n)	Percentage (%)
Gender	Male	72	75.8
	Female	23	24.2
Age	Mean (SD) = 32 ±12.8		
Difficulty in gripping	Yes	94	98.9
	No	01	1.1
Paresthesia	Yes	92	96.8
	No	03	3.2
Muscle atrophy	Yes	81	85.3
	No	14	13.7
Symptomatic hand	Right	54 (M=40, F=14)	56.8
	Left	41 (M=32, F=09)	43.2
Clawing	Yes	62	65.3
	Mild clawing	21	22.1
	No	12	12.6
Difficulty in gripping	Yes	94	98.9
	No	01	1.1
Clinical sensation loss	Yes	92	96.8
	No	03	3.2
Muscle atrophy	Yes	81	85.3
	No	14	13.7
Froments sign	Positive	84	88.4
	Negative	11	11.6
Wartenberg sign	Positive	82	86.3
	Negative	13	13.7

Table 2: *Signs versus Temporal Course*

Signs of Denervation or Re-innervation	Temporal Course				Total
	Acute	Sub-acute	Subacute-chronic	Chronic	
Denervation	0	2	31	1	34
Re-innervation	0	1	7	24	32
Both	0	1	5	2	8
None	1	1	8	11	21
Total	1	5	51	38	95

Table 3: *Electrophysiology versus Cause of Injury*

Electrophysiological severity	Cause of injury				Total
	Trauma	IM Injection	Post-operative	Idiopathic	
Mild	3	0	0	4	7
Moderate	32	1	1	3	37
Severe	47	0	3	1	51
Total	82	1	4	8	95

Table 4: *Clinical, electrophysiological severity and their correlation*

Clinical Severity Scale	Electrophysiological Severity			Total	r
	Mild	Moderate	Severe		
Mild	6	11	2	19	
Moderate	1	23	25	49	r=0.58
Severe	0	3	24	27	
Total	7	37	51	95	

clinically, moderate cases were highest in percentage (51.5%), Correlation between clinical and electrophysiological severity is as shown in Table 4.

Discussion

Electro-diagnostic studies are still considered in standard practice for diagnostic evaluation of neuromuscular disorders. Majority of studies done in the past focuses more on ulnar neuropathy at elbow as it is common prevalent site of ulnar nerve injury. Contrary to the previous studies, we prospectively evaluated the localization of ulnar nerve injuries anywhere in the course of nerve. In our study, gender-based distribution showed that predominance of males was substantially high (75.8%) rather than females, consistent with the majority of previous studies.[2,6,16] Likewise, both traumatic and non-traumatic neuropathy were more frequently seen among males as compared to females.[9,10] This is in contrast to a study with no gender predilection in etiologies[4]. The reason for this difference could reflect less female labour force participation rates in South Asia than West. Hence, female encounter to road accidents and other hazards is less than males.

The most prevalent symptoms encountered were difficulty in gripping (98.9%) followed by paresthesia (96.8%) in medial aspect of hand and 5th finger, positive froments sign (88.4%), positive Wartenberg sign (86.3%) while 87.4% had either mild or proper ulnar claw hand. Atrophy of FDI and ADM were seen in 85.3% more or less alike to what has been presented in most of the previous studies.[12,20,21] Based on etiology, traumatic ulnar nerve injuries comprised the majority of cases (86.3%), in contrast to most of the studies where non-traumatic UN 4, 12 or idiopathic UN 6,7 were more common. Comparable to the study done by Yadav et al. Our study showed that right hand was predominantly affected (56.8%) than left one (43.2%).[12] This might be due to fact that many people are right-handed and use it more in work making it vulnerable to environmental hazards than left hand. However, it is contrary to another study which showed the involvement of left side more than right.[8]

In majority of cases (58.9%), electro-diagnostic studies localized ulnar neuropathy at elbow (54.7% traumatic UN and 4.2% non-traumatic UN), contrary to a study which suggested quarter of cases as non-localizing UN[11], more likely because our study encompasses the localization of ulnar nerve injuries anywhere in the course of nerve. Most of ulnar nerve injuries were of significant clinical severity (80% were either moderate or severe) corresponding to the electrophysiologic evidence (92.6% either moderate or severe UN) by considerable axonal pattern on nerve conduction studies and marked neurogenic changes or absent interference pattern on needle examination. Severe involvement was more prevalent in cases with traumatic injuries (57.3%) whereas in non-traumatic group, mild and moderate involvement was most predominant, just as what is indicated in previous studies.[4] This high rate of severity index might be because most of the cases presented to us were either subacute to chronic or chronic in phase making less chances of nerve to recover.

Out of 56 cases of ulnar neuropathy that occurred at elbow 25% had spared Flexor digitorum profundus while only 7% cases had spared Flexor carpi ulnaris muscle which signifies that FCU muscle has little bit more abnormal EMG than FDP muscle, in accordance to a study conducted by Eliaspour et al.[6] In our study, needle examination of the FDI, ADM muscles showed similar findings. A study done by D. Eliaspour et al., showed no difference in the sensitivity of these muscles for ulnar neuropathy diagnosis at the elbow.[6] Abnormal

findings of FDI in needle examination can only access if ulnar nerve is affected anywhere throughout its course and is considered a best muscle to be sampled for this purpose but it cannot localize the lesion since it is abnormal in all the cases irrespective of where the ulnar nerve is being injured.

Among uncommon ulnar nerve injuries concerning etiology and site we found some unusual cases. Based on etiology, 1 out of 95 cases (1.1%) was of IM injection presented as ulnar neuropathy across elbow. Injection-related UN seems to be quite rare but it still does present, relatively more common in lean patients who lack muscle mass making ulnar nerve superficial and vulnerable to damage.[17] Based on site, out of 4 patients of UN at wrist 2 were of deep palmar motor branch of ulnar nerve (2.1%); Guyon's canal type 2 lesion. One case was of pure sensory ulnar neuropathy (1.1%) Guyon's canal type 3 lesion.[18,19] Our study had some limitations, for example the sample size was small and could not determine the sensitivity of the test. Another limitation of our study is lack of follow ups. so we cannot comment on prognosis.

Conclusion

Study showed that most frequent site for ulnar neuropathy is elbow followed by forearm and wrist with considerably high rate of traumatic nerve injuries. Young population was affected the most with male gender predominance. Careful examination of ulnar NCS and needle examination of ulnar innervating muscles had valuable in diagnosing ulnar neuropathy. This study recommends that electromyography is helpful in assessing severity and in localization of lesion. Therefore, it is important to perform needle examination after nerve conduction studies for interpreting the degree of damage and determine prognosis before further damage ensues. This could be done by starting the proper treatment to avoid functional disability since it affects the most productive age group i.e., young population. Hence, considering the importance of electro-diagnostic studies and the value of knowledge it can give about the severity, site, and type of lesion, damage caused by traumatic nerve injuries can be minimized to a great extent.

Conflict of Interest: *None*

Funding Source: *None*

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