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Diagnosis Confirmation Rates of Desired Electroneuromyography Results with Pre-Diagnosis of Upper Extremity Entrapment Neuropathy

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Abstract: Electroneuromyography (ENMG) is an examination used by clinicians to confirm the diagnosis of patients with suspicion of entrapment neuropathy. The correlation between the ENMG results and requests increases when the clinical examination and anamnesis are well evaluated. This study aims to determine the compatibility of the electroneurophysiological examinations made due to the prediagnosis of entrapment neuropathy at the ENMG Laboratory in the Neurology Clinic and determine whether there is a difference between the clinics that made the requests. The study complied with the examinations made in Çanakkale Onsekiz Mart University neurology clinic ENMG laboratory between 01/07/2019 and 21/07/2020, and these examinations were retrospectively scanned.In total, 1464 results were scanned and those who underwent ENMG examination on the entrapment neuropathy protocol (SUT code 703220) were included in the study. Patients for whom requests were made lower extremity entrapment neuropathy and those who were younger than 18 were not included. Information regarding 445 (313 women, 132 men) patients with upper extremity entrapment neuropathy were obtained. The mean age of the patients was 49.5±14.2 (18-89). The study found that among electroneurophysiological examinations made due to the prediagnosis of entrapment neuropathy, 155 (34.8%) were diagnosed with carpal tunnel syndrome, 18 (4.0%) were diagnosed with ulnar nerve entrapment neuropathy, 3 (0.7%) were diagnosed with radial nerve entrapment neuropathy and 253 (56.9%) had normal results. But there were no significant differences between the rates of normal results in terms of clinics that made the requests. While normal results were obtained on the majority of the electroneurophysiological requests due to the pre-diagnosis of upper extremity entrapment neuropathy, there were no significant differences between the clinics.

Keywords: Electroneuromyography, Upper Extremity Entrapment Neuropathy, Clinical Compatibility.

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1. Introduction

Entrapment neuropathies (compression neuropathies) are a type of mononeuropathy characterized with sensory, motor and autonomous symptoms that occur as a result of entrapment of peripheral nerves at certain points during their course for different reasons. While entrapment neuropathies are commonly observed between the ages of 25-40 due to professional reasons, it can be observed between the ages of 40-60 due to metabolic and hormonal reasons (1-2).

Although entrapment neuropathies can be observed both in lower and upper extremities, it is more common in upper extremities.

Upper extremity entrapment neuropathies include cervical rib syndrome, thoracic outlet syndrome, carpal tunnel syndrome (CTS), anterior interosseous syndrome, pronator teres syndrome, cubital tunnel syndrome, guyon canal syndrome, posterior interosseous nerve (PIN) syndrome, and superficial cutaneous radial nerve entrapment (keralgia paresthetica- wartenberg syndrome), and entrapment of the radial nerve in the axillary area. The most common upper extremity entrapment neuropathy is carpal tunnel syndrome. Carpal tunnel syndrome develops due to the compression of the median nerve in the carpal tunnel. Clinically, numbness, pain and tingling are observed in the first three fingers of the hand. The patients complain of numbness that increases at night (3).

Anterior interosseous syndrome is based on the compression of the anterior interosseous which is the motor branch of the median nerve while PIS is the compression of the median nerve between two ends of the pronator teres muscle. Cubital tunnel syndrome develops due to the entrapment of the ulnar nerve in elbow while guyon canal syndrome develops due to the entrapment of the ulnar nerve inside the guyon canal. PIN is induced by the entrapment of radial nerve due to various reasons such as radius head fractures at the level of radial head, tumors, etc. Superficial cutaneous radial nerve entrapment (keralgia paresthetica-wartenberg syndrome) develops when the superficial sensory branch of the radial nerve is exposed to compression during its course in the forearm. Clinical symptoms are pain and numbness on the dorsum of the hand and radial region. Compression of the radial nerve on the axillary region may develop due to using crutches, tumor or trauma. Clinically, weakness in triceps and distal muscle with radial nerve innervation are observed (4). Diagnosis is based on anamnesis and clinically in entrapment neuropathy and confirmed with ENMG. Nerve conduction is checked in electroneurophysiological studies and needle electromyography is performed. It can be detected whether the affected nerve is affected demyelination or axonal (5).

Epineural blood stream decreases in acute period after the entrapment of the nerve, and as a result, malfunctions occur in axonal transport. The severity of the pressure increases, and intraneural blood stream is affected in time and fibrosis starts. This period is the mid phase and edema starts both as epineural and intrafascicular. If the pressure continues, endoneural edema and fibrosis develop in addition to edema. Lastly, segmental demyelinating and Wallerian degeneration occur (2-6). Remyelination and demyelination develop due to chronic pressure on the nerve. No axon loss is observed for a long time. Axon loss and muscle atrophy occur in the last phases of the chronic period (7). Diabetes, obesity, thyroid diseases, excessive alcohol intake, pregnancy, systemic inflammatory diseases, chronic renal failure and diseases that cause edema in the body are reasons that catalyze the occurrence of entrapment neuropathy. The frequency of entrapment neuropathy is also increased in professions with excessive repetitive movements such as playing a musical instrument. Patients with entrapment neuropathy consult to many branch clinics. ENGM examination is requested in polyclinics to confirm the prediagnosis without making sufficient physical examination and requesting radiological imaging. Thus, there is overcrowding in laboratories and patients have to wait for a long time (9-10).

The aim of this study was to determine how compatible the patients are with their pre-diagnosis by reviewing the electroneurophysiological results of the patients who were directed to ENGM unit of our hospital with the prediagnosis of upper extremity entrapment neuropathy and whether there is a difference in terms of compatibility between the clinics that make the request.

2. Material and Methods

The patients who consulted to Çanakkale Onsekiz Mart University neurology clinic ENMG laboratory between 01/07/2019-21/07/2020 and whose examinations were made were retrospectively scanned.

In total, 1464 patients were scanned and those on whom ENMG examination was made on the entrapment neuropathy protocol (SUT code 703220) were included in the study. Patients for whom requests were made lower extremity entrapment neuropathy and those who were younger than 18 were not included. Information regarding 445 (313 women, 132 men) patients who consulted with the prediagnosis of upper extremity entrapment neuropathy were obtained. The mean age of the patients was 49-50 (18-89). The compatibility between the prediagnosis of entrapment neuropathy and electroneurophysiological diagnosis was retrospectively investigated. All ENMGs were performed using the NihonKohden ENGM device in the ENMG unit of the Neurology clinic. ENMG results were categorized as normal, carpal tunnel syndrome (CTS), ulnar entrapment neuropathy, radial nerve entrapment neuropathy, radiculopathy and polyneuropathy (PNP).

Data were transferred to digital environment and were controlled. Frequency and percentage were calculated and presented for discrete variables while mean and standard deviation were calculated and presented for continuous variables. A very small number of departments that made the requests were combined as the "other" group (Infection Diseases and Clinical Microbiology: 1, Internal Diseases: 3, Cardiology: 1, Plastic, Reconstructive and Aesthetic Surgery: 1, Medical Oncology: 1). Analyses between the departments that made the requests and ENMG results were carried out by calculating with Exact test in a multi-mesh table. Test constant and absolute p value were given for the analysis, and the general significance limit was accepted as $p<0.05$.

3. Results

Demographic characteristics of the participants were evaluated as age and sex. Of 445 patients included in the study, 313 (70.3%) were female and 132 (29.7%) were male (Figure 1). The mean age of the patients was 49.5±14.2 (youngest 18-eldest 89).

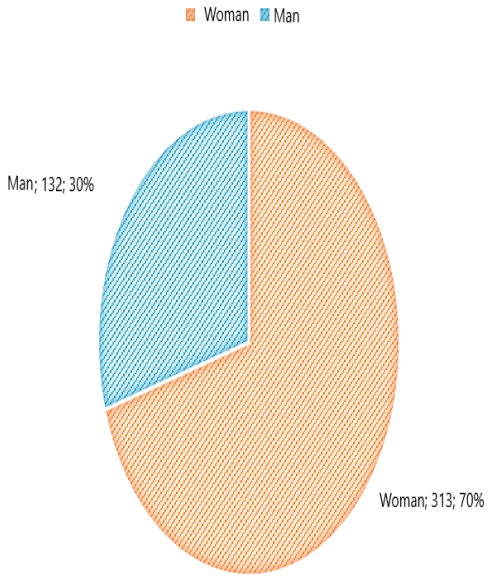

Figure 1: Gender ratio of the patients included in the study.

Considering the ENMG results, the highest number of requests were made from the neurology polyclinic (200, 44.9%).

The departments that made requests for electroneurophysiological examination and the number of requests are as follows; Neurology Clinic: 200, Orthopedics: 90, Physical Treatment and Rehabilitation (PTR) Clinic: 80, Neurosurgery Clinic: 68, other: 7 (Infection Diseases and Clinical Microbiology: 1, Internal Diseases: 3, Cardiology: 1, Plastic, Reconstructive and Aesthetic Surgery: 1, Medical Oncology: 1).

Most of the ENGMs (253, 56.9%) requested due to the prediagnosis of upper extremity entrapment neuropathy were observed to be normal. Abnormal results obtained from the ENMG results were as follows based on the frequency order; CTS (155, 34.8%), ulnar nerve entrapment neuropathy (18, 4.0%), polyneuropathy (15, 3.4%), radial nerve neuropathy (3, 0.7%) and radiculopathy (1, 0.2%).

According to the ENMG results in terms of gender, while the rates of normal results were similar between female (56.5%) and male (57.6%) patients, CTS diagnosis and other diagnoses were significantly higher in women (CTS: 37.4%, other: 13.6%) than men (CTS: 28.8%, other: 6.1%) ($X^2=8.377$; $p=0.015$).

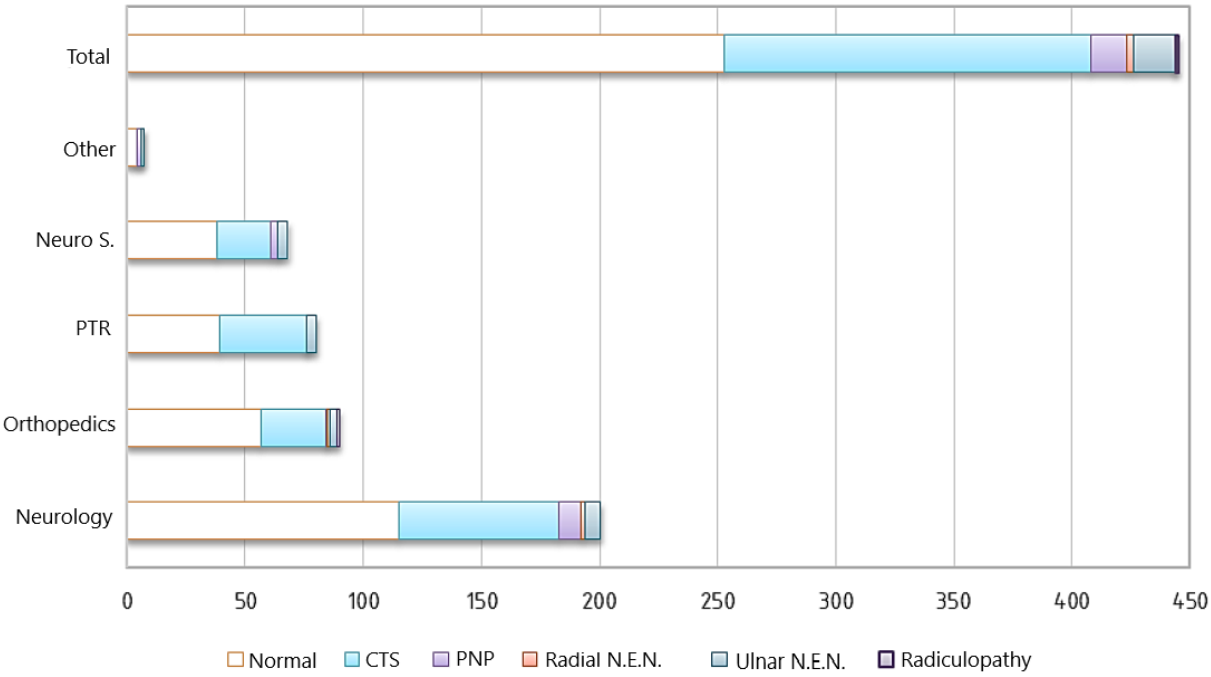

Figure 2: Distribution of diagnosis in terms of clinics.

Table 1: Distribution of diagnosis in terms of clinics (Exact X^2=32.206; p=0.023).

	Neurology	Orthopedics	PTR	Neurosurgery	Other	Total
Normal	115[a] (57.5%)	57[a] (63.3%)	39[a] (48.8%)	38[a] (55.9%)	4[a] (57.1%)	253
CTS	68 [a,b,c] (34.0%)	27[c] (30%)	37[b] (46.2%)	23 [a,b,c] (33.8%)	0 [a,c]	155
PNP	9[a] (4.5%)	1[a] (1.1%)	0[a]	3[a] (4.4%)	2[b] (28.6%)	15
Radial Nerve Entrapment Neuropathy	2 (1.0%)	1 (1.1%)	0	0	0	3
Ulnar Nerve Entrapment Neuropathy	6[a] (3%)	3[a] (3.3%)	4[a] (5%)	4[a] (5.9%)	1[a] (14.3%)	18
Radiculopathy	0[a]	1 [a] (1.1%)	0[a]	0[a]	0[a]	1
Total	200	90	80	68	7	445

*a,b,c: It defines the different subgroups that form in each row as a result of post-hoc analysis. Those who were included in more than one group were not significantly different from the groups they were included. ** Infection Diseases and Clinical Microbiology: 1, Internal Diseases: 3, Cardiology: 1, Plastic, Reconstructive and Aesthetic Surgery: 1, Medical Oncology: 1.

Table 2: Carpal tunnel syndrome results between clinics.

	Neurology	Orthopedics	PTR	Neurosurgery	Other	Total
Normal	115[a]	57[a]	39[a]	38[a]	4[a]	253
	57.5%	63.3%	48.8%	55.9%	57.1%	56.9%
CTS	68[a, b, c]	27[c]	37[b]	23[a, b, c]	0[a, c]	155
	34.0%	30.0%	46.2%	33.8%	0.0%	34.8%
Other	17[a]	6[a]	4[a]	7[a]	3[b]	37
	8.5%	6.7%	5.0%	10.3%	42.9%	8.3%
Total	200	90	80	68	7	445
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

*a,b,c: It defines the different subgroups that form in each row as a results of post-hoc analysis. Those who were included in more than one group were not significantly different from the groups they were included.

ENMG results in terms of clinics are presented in Table 1. There were significant differences between ENMG results in terms of clinics (Exact X^2=32.206; p=0.023). While the most frequently obtained normal results rates were not significantly different between the clinics, CTS diagnoses were higher in PTR clinic and there were significant differences in Orthopedics and Traumatology. Observed values regarding all diagnoses are presented in Table 1 and Figure 2. The clinic whose prediagnosis of entrapment neuropathy was confirmed with ENMG results the most (41, 51.3%) was PTR, and the clinic with highest number of normal results were Orthopedics and Traumatology (57, 63.3%). While 4 out of 7 examinations were normal in other clinics, obtained 3 results were CTS diagnosis.

4. Discussion

Electrophysiological examinations are useful for diagnosing entrapment neuropathies and deciding on the treatment. To confirm the clinical diagnosis, other possible problems must be excluded first. False negative results can be observed in the early period of entrapment neuropathies. Various studies have shown that the number of requests for ENMG examinations has increased in recent years. The most important reason for this increase is requesting an ENMG examination to confirm the prediagnosis of entrapment neuropathy without making detailed physical examination on patients who consulted to the polyclinics (9-11).

The workload of ENMG laboratories increases due to unnecessary requests; thus, the patients have to wait a long time for the examination (12). The normal result rates of the ENMG requests were reported between 16-38% in numerous studies. The most important reason that the results turn out normal was reported to be insufficiency of neurological examination. Nikolic et al. found that there are differences even among the neurologists in terms of the compatibility between the prediagnosis and electrodiagnostic diagnosis (13).

In this study, 56.8% of the ENMG results that were performed with the prediagnosis of entrapment neuropathy were normal. This result was found to have a higher rate of normal ENMG results compared with the studies in the literature. The study compared the examinations requested for carpal tunnel syndrome between clinics and found that the clinic with the highest compatibility between pre-diagnosis and ENMG results was PTR (46.2%) (Table 2).

All requests for ENMG examination were made by specialist physicians in this study. There were no significant differences between the clinics that made requests in terms of normal results. This shows that clinics that made requests have approximately the same knowledge and clinical experience about entrapment neuropathy. ENMG requests of general practitioners and specialist physicians were compared in numerous studies in the literature, and the electroneurophysiological diagnosis compatibility was lower among general practitioners. The compatibility rate in the requests made by general practitioners was 36.5% while this rate was higher among specialist physicians. The compatibility rate in the requests made by neurology specialists was 42% (14-16).

5. Conclusions

The fact that 56.8% of the ENMG results were normal in this study and it indicates that the requests for ENMG examinations are made without performing sufficient physical examination and taking anamnesis. The fact that the results of the requests are normal more than expected can be interpreted as that the number of unnecessary requests is high, and this situation may cause additional costs for the health system, patients undergo unnecessarily painful examinations and loss of workforce among medical staff. Therefore, physicians should spare more time while examining patients with the prediagnosis of entrapment neuropathy and should perform more detailed physical examination.

Conflict of interest statement
The authors declare no conflict of interest.
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