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Evaluation of Electromyography Requests in a Tertiary Center

Üçüncü Basamak Bir Merkezde Elektromiyografi İstemlerinin Değerlendirilmesi

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ÖZET

Amaç: Elektrodiagnostik çalışmalar, sinir iletim çalışmaları ve iğne elektromiyografiyi kapsar. Artan sağlık maliyetleriyle birlikte, kliniklerden gelen ön tanı ve tanı uyumları önemli ölçüde ilgi çekmiş ve çalışmalara konu olmuştur. Çalışmamızın amacı, kliniğimizde sinir iletim çalışmaları ve iğne elektromiyografi istem nedenleri ile bu istemlerin sonuçlarının tutarlılığının karşılaştırılması ve bulguların elektromiyografi istem nedenlerini değerlendiren eski çalışmalarla karşılaştırılmasıdır.

Hastalar ve Yöntem: Bu çalışmada, laboratuvarımızda 2 yıllık süre içinde elektrodiagnostik incelemeler yapılan 590 kadın ve 549 erkekten oluşan toplam 1136 hasta verisi çalışmaya dahil edildi. Bu veriler geriye dönük incelenip bulgular demografik özellikler, istem nedenleri, sonuçlar, gönderen klinikler ve tanısal uyumları açısından sorgulanmıştır.

Bulgular: Elektromiyografik incelemeler ile yapılan istemlerin yaklaşık %60'ında patolojik sonuçlara ulaşıldığı görülmektedir. En çok istenen ön tanılar sırasıyla polinöropati ve tuzak nöropatilerdir. Tuzak nöropati istemlerinin çoğu Ortopedi kliniği (%60), polinöropati istemlerinin çoğu Nöroloji ve İç Hastalıkları klinikleri tarafından yapılmıştır. Olguların yarısından fazlasında sonuçlar patolojik raporlanmıştır. İstem nedenleri ve son tanı uyumu %44.8 olarak saptanmıştır. Ön tanı ve tanı uyumluluğuna bakıldığında, tuzak nöropati ön tanısıyla yapılan istemlerde Fizik Tedavi ve Rehabilitasyon kliniğinde bu uyum en yüksek olup, %42 oranında ön tanı-tanı uyumu izlenmiştir. İstem nedeni ve tanı uyumsuzluğu çoklu ön tanılarda önemli ölçüde yüksek bulunmuştur.

Sonuç: Elektromiyografinin teşhis ve tedavideki yararı, istenen ön tanı ve istem yapan klinikle yakından ilişkilidir. Elektromiyografi istem nedenleri ve son tanı uyumları öngörülebilir.

Anahtar Kelimeler: Nörolojik tanısal teknik, sinir iletim çalışması, elektromiyografi, üçüncü basamak merkez

ABSTRACT

Objective: Electrodiagnostic studies encompass nerve conduction studies and needle electromyography. The rationale behind the requests and diagnostic concordance according to referring clinic, coupled with escalating healthcare expenditures, have garnered considerable scholarly attention and been the focus of studies. Our study aims to compare the consistency of referred cases according to clinic and the interpretation of nerve conduction studies and needle electromyography studies, comparing the findings with previous studies evaluating electromyography requests.

Patients and Methods: In this study, data were included from 1136 patients, consisting of 590 women and 549 men who underwent electrodiagnostic examinations in our laboratory over a period of two years. These data were retrospectively analyzed, and the findings were evaluated in terms of demographic characteristics, reasons for referral, results, referring clinics, and diagnostic concordance.

Results: Electromyographic investigations were found to have a general pathology detection rate of approximately 60%. The preliminary diagnoses most requested were polyneuropathy and entrapment neuropathy, respectively. Most entrapment neuropathy referrals were from Orthopedics (60%), while the majority of polyneuropathy requests came from Neurology and Internal Medicine. Tests were reported as pathological in more than half of the cases. The overall concordance rate was found to be 44.8%. When examining the concordance between the referral diagnosis and the final diagnosis for entrapment neuropathies, the Physical Medicine and Rehabilitation clinic exhibited the highest rate at 42%. The rate of discrepancy between referral and outcome was significantly high in referrals with multiple indications.

Conclusion: The usefulness of electromyography for diagnosis and treatment is closely associated with pre-diagnostic considerations and the department responsible for the request. The concordance between referrals and outcomes can be predicted.

Keywords: Neurological diagnostic technique, nerve conduction study, electromyography, tertiary referral center

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INTRODUCTION

Nerve conduction studies (NCS) and electromyography (EMG) are important diagnostic tools for the evaluation of neuromuscular disorders, even with the advances in neuroradiology and imaging techniques. The reasons for requesting these tests and diagnostic concordance according to clinic, together with increasing health costs, have attracted attention and been the subject of many studies (1-3). The aim is to standardize clinical neurophysiology laboratories with the accumulation of experience that is increasing through the years. NCS and EMG allow objective assessments of neuromuscular physiology. While sensory and motor components of peripheral nerves are evaluated with nerve conduction studies, spontaneous and voluntary motor unit action potentials are analyzed with electromyography (4). Thus, the location of the pathology in the peripheral nerve or muscle, the type of injury and duration can be interpreted. Electromyography is a neurophysiological technique that requires expertise. It is a flexible procedure that is tailored to the individual patient.

Recent reports in the literature emphasized pathophysiology, evaluation, and natural history of radiculopathy, with a focus on the timing and efficacy of EMG (5). Recent articles emphasized that laboratory tests for neuropathies should be based on history, clinical presentation, and electrophysiological findings to target the suspected neuropathy type, avoiding unnecessary tests and expenses while considering the sensitivity and specificity of the tests applied (6). This study was deemed necessary for these reasons. We aimed to evaluate the appropriateness of EMG requests in a tertiary center, while also determining the areas of use of EMG, and to compare the reason for referrals and final diagnoses, taking into account previous studies.

PATIENTS AND METHODS

Patients admitted to the Electromyography Laboratory of Necmettin Erbakan University Medical Faculty, Department of Neurology and Clinical Neurophysiology were enrolled. Between 2018 and 2020, data from 1136 patients aged between 1 and 91 years, who were referred from external centers and departments within our hospital, were retrospectively reviewed. In this study, 1136 patients who underwent electrodiagnosis (EDX) testing in our laboratory between 2018 and 2020 were examined. A total of 1136 patients, consisting of 590 females and 546 males, were included in the study after excluding 64 patients due to repetitive requests. The findings were analyzed according to the demographic characteristics of the patients, consistency of referral reasons, and referring clinics after examining NCS and EMG according to standardized protocols. The study followed the Declaration of Helsinki, and ethical approval was obtained from the Necmettin Erbakan University Medical Faculty Ethics Committee on January 22, 2021 (Decision number 2021/3054). Electrodiagnostic tests were carried out in our laboratory using a Nihon Kohden Neuropack MEM-4104 K model device.

After gathering brief information about the patients, the referring clinic and the reason for referrals were obtained. A brief anamnesis was taken, neurological examination was performed, and the appropriate electrophysiological examination was initiated. If needed, the extremities were warmed up and appropriate conditions were provided beforehand. The procedures consisted of the appropriate protocol (nerve conduction studies and needle EMG) covering the extremities, facial muscles, and anal sphincter for the requested protocol, or repetitive nerve stimulation tests evaluating the neuromuscular junction. Anal sphincter EMG was performed transdermally in patients with fecal incontinence based on MUP analysis with needle EMG in four quadrants. As stated in the studies, MUP activity was evaluated subcutaneously in patients at the 3, 6, 9, and 12 o'clock positions and at an angle of 30-50 degrees on the anal canal axis, at the line level on the mucocutaneous junction, and anal orifice line (7).

All requests for radiculopathy, plexopathy, and unilateral entrapment neuropathy were studied by comparing them with the contralateral extremity. Three extremity nerve conduction studies were performed for polyneuropathy protocols, and needle EMG was performed in at least one muscle to exclude differential diagnoses. In the case of the detection of pathology with needle EMG, the study area was expanded to confirm the diagnosis. In the myopathy protocol, after motor and sensory nerve conduction study in the upper and lower extremities, needle EMG was performed to evaluate the proximal and distal muscles. Repetitive nerve stimulation (RNS) tests, such as 2, 3.5 Hz low-frequency, and 50 Hz high-frequency RNS, were performed when necessary for the evaluation of neuromuscular disorders. All of the examinations were performed by clinical neurophysiologists and were simultaneously reported and interpreted.

Referrals were categorized into referral reasons, including the most and least common suspected diagnoses. Reports were categorized as pathological or normal regarding the proportion of individual diagnoses. According to the referring physician's specialty, the frequency of referrals and final diagnoses, and the concordance and agreement of the referral diagnoses were reported. In conclusion, the data were analyzed in detail, including demographic characteristics such as age and sex, referral diagnoses, and their compatibility with final diagnoses after conducting the EDX tests, and the characteristics of the referral diagnoses and referring clinics.

Statistical Analysis

Descriptive statistics utilized mean and standard deviation for continuous numerical variables, and numbers, percentages, and rates for categorical variables and their relationships. Descriptive statistics were employed in this study. A significance level of $p<0.05$ was adopted for all comparisons. Research data were analyzed using IBM SPSS Statistics, version 24.0 (IBM Corp, Armonk, N.Y., USA).

Necmettin Erbakan University Medical Faculty, Neurology Department, Clinical Neurophysiology Electromyography Laboratory has been active since 1990. Readings are conducted by faculty members. Since 2012, subspecialists in Clinical

Table 1. Demographic characteristics of patients

	Female		Male	
	n	%	N	%
Under 18 years old	46	7.8	44	8.1
Ages 18-65	434	73.6	393	72.0
Over 65 years old	110	18.6	109	20.0
Total	590		546	

Neurophysiology have been trained in the department.

RESULTS

A total of 1136 patients, including 590 females and 546 males, had a mean age of 47.01 ± 18.95 years. Of the patients, 7.9% were under the age of 18, 72.8% were between the ages of 18-65, and 19.3% were over the age of 65. The demographic features of the patients are shown in Table 1. The findings were analyzed under three different headings: the referral request, findings, and characteristics of the referring clinics.

EMG Referrals

The most requested preliminary diagnoses were polyneuropathy (28%) and entrapment neuropathy (22%). Referrals for EMG requests and overall results are shown in Table 2. Entrapment neuropathy was requested mostly by the Orthopedic department (60%). Neurology and Internal Medicine clinics made the majority of referrals for polyneuropathy. Entrapment neuropathy is a commonly requested diagnosis by the Rheumatology department, which falls under the subspecialty of Internal Medicine. The most frequently requests by Neurology were for polyneuropathy and entrapment neuropathy. EMG requests referred by the Neurology clinic are shown in Table 2. The results revealed that the highest levels of concordance were observed for polyneuropathy, entrapment neuropathy, myopathy, and motor neuron disease within the requested referrals. A cohort of cases (5.4%) underwent EMG as "general screening" without any specific clinical indication, as demonstrated in Table 3.

EMG Findings

According to the data presented in Table 2, 40% of the requests resulted in normal findings. It was observed that 43% of the cases referred for a "general scan" were reported as normal. Less than 5% of the total cases were diagnosed with myopathy, neuromuscular junction disease, or motor neuron disease. Polyneuropathy and entrapment neuropathy were the most frequently detected pathological results, accounting for 16% and 13% of the cases, respectively. As shown in Table 4, the correlation between the initial and final diagnoses was influenced by the requesting clinic and protocol. The overall

Table 2. Distribution of EMG requests from the Neurology Clinic and all departments according to protocols and distribution of all results according to protocols

	Neurology Clinic EMG requests		All EMG requests		All EMG results	
Diagnosis	n	%	n	%	n	%
Polyneuropathy	215	43.9	318	28.0	178	15.7
Entrapment neuropathy	68	13.9	247	21.7	150	13.2
Radiculopathy/plexopathy	43	8.8	93	8.2	57	5.0
Myopathy	22	4.5	31	2.7	10	.9
Myasthenia gravis	19	3.9	21	1.8	4	.4
Motor neuron disease	21	4.3	27	2.4	13	1.1
M. sphincter ani denervation	2	0.4	147	12.9	128	11.3
Cranial neuropathy	9	1.8	87	7.7	69	6.1
Mononeuropathy/peripheral nerve injury	4	0.8	10	0.9	24	2.1
General scan	34	6.9	61	5.4	-	-
Normal	-	-	-	-	453	39.9
Polyneuropathy + entrapment neuropathy	18	3.7	24	2.1	35	3.1
Polyneuropathy + radiculopathy/plexopathy	10	2.0	18	1.6	4	0.4
Polyneuropathy + myopathy	3	0.6	17	1.5	1	0.1
Polyneuropathy + myasthenia gravis	1	0.2	1	0.1	0	0
Polyneuropathy + motor neuron disease	3	0.6	3	0.3	3	0.3
Entrapment neuropathy + radiculopathy/plexopathy	15	3.1	25	2.2	3	0.3
Entrapment neuropathy + motor neuron disease	1	0.2	1	0.1	1	0.1
Radiculopathy/plexopathy + myopathy	-	-	1	0.1	1	0.1
Radiculopathy/plexopathy + myasthenia gravis	-	-	1	0.1	0	0
Myopathy + motor neuron disease	2	0.4	3	0.3	0	0
Polyneuropathy + peripheral nerve injury	-	-	-	-	3	0.3
Radiculopathy + peripheral nerve injury	-	-	-	-	1	0.1
Tremor	-	-	-	-	1	0.1
Total	490	100.0	1136	100.0	1136	100.0

Table 3. Final diagnosis of cases with unclear referral diagnosis

Diagnosis	n	%
Polyneuropathy	9	14.8
Entrapment neuropathy	12	19.7
Radiculopathy/plexopathy	5	8.2
Myopathy	1	1.6
Normal	26	42.6
Mononeuropathy/peripheral nerve injury	4	6.6
Polyneuropathy + entrapment neuropathy	3	4.9
Total	61	100

Table 4. Concordance between electromyography referrals and outcomes (number of requests compatible with the final diagnosis/number of requests made in the relevant protocol)

	Neurology	Orthopedics	General Surgery	ENT	PMR	Neurosurgery	Pediatrics	IM	Oncology	Rh
Polyneuropathy	(92/215) 43%	(1/15) 7%	(1/1) 100%	(0/1) 0%	(10/21) 48%	(5/9) 56%	(5/26) 19%	(10/15) 67%	(4/4) 100%	(0/3) 0%
Entrapment neuropathy	(21/68) 31%	(30/86) 35%	-	-	(25/51) 49%	(12/30) 40%	-	(0/3) 0%	-	(2/7) 29%
Radiculopathy/ Plexopathy	(11/43) 26%	(1/13) 8%	-	-	(5/12) 42%	(4/8) 50%	(6/9) 67%	(1/2) 50%	-	(1/1) 100%
Myopathy	(7/22) 32%	(0/1) 0%	-	-	(0/1) 0%	-	(0/3) 0%	(1/1) 100%	-	(0/2) 0%
Myasthenia gravis	(3/19) 16%	(/)%	-	-	(3/4) 75%	-	(1/2) 50%	-	-	-
Motor neuron disease	(9/21) 43%	(0/4) 0%	-	-	-	-	(0/1) 0%	-	-	-
M. sphincter ani denervation	(1/2) 50%	(/)%	(124/145) 86%	-	-	-	-	-	-	-
Cranial neuropathy	(4/9) 44%	(0/1) 0%	-	(61/75) 81%	-	-	-	-	-	-
Mononeuropathy/ peripheral nerve injury	(2/4) 50%	(2/2) 100%	-	-	-	-	-	-	-	-
Polyneuropathy + ET	(4/18) 22%	(1/3) 33%	-	-	(0/1) 0%	(0/2) 0%	-	-	-	-
Polyneuropathy + radiculopathy/ Plexopathy	(1/10) 10%	(0/2) 0%	-	-	(0/3) 0%	(0/2) 0%	-	(1/1) 100%	-	-
Polyneuropathy + myopathy	(0/3) 0%	-	-	-	-	-	(0/14) 0%	-	-	-
ET + radiculopathy/ Plexopathy	(0/15) 0%	(0/2) 0%	-	-	(1/4) 25%	(0/3) 0%	-	-	-	(0/1) 0%
Concordance Rate	34%	27.1%	85.6%	80.3%	45.4%	38.9%	21.4%	54.2%	100%	21.4%

ET: Entrapment neuropathy, ENT: Ear, nose, throat, IM: Internal medicine, PMR: Physical medicine and rehabilitation, Rh: Rheumatology

Table 5. Concordance of preliminary and final diagnosis in patients with multiple preliminary diagnoses

EMG Requests	Concordant	Discordant	Total
Polyneuropathy + entrapment neuropathy	5 (21%)	19 (79%)	24
Polyneuropathy + radiculopathy/plexopathy	2 (11%)	16 (89%)	18
Polyneuropathy + myopathy	2 (12%)	15 (88%)	17
Polyneuropathy + Myasthenia Gravis	0 (0%)	1 (100%)	1
Polyneuropathy + motor neuron disease	0 (0%)	3 (100%)	3
Entrapment neuropathy + radiculopathy/plexopathy	1 (4%)	24 (96%)	25
Entrapment neuropathy + motor neuron disease	0 (0%)	1 (100%)	1
Radiculopathy/plexopathy + myopathy	0 (0%)	1 (100%)	1
Radiculopathy/plexopathy + myasthenia gravis	0 (0%)	1 (100%)	1
Myopathy + motor neuron disease	0 (0%)	3 (100%)	3
Total	10 (11%)	84 (89%)	94

concordance rate between the preliminary and definitive diagnoses for all requests was 44.8%. Considering the clinics that requested EMG the most, the rate of concordance was 34% for neurology, 27.1% for orthopedics, and 85.6% for general surgery. The concordance rate for each clinic is given in Table 4. Referrals with specific symptoms related to a single nerve, such as sphincter dysfunction and cranial neuropathy, had higher concordance rates. The rate of discrepancy between referral and outcome was significantly high at 89% for diseases with multiple indications, such as polyneuropathy plus entrapment neuropathy, while the concordance rate was only 11% (Table 5).

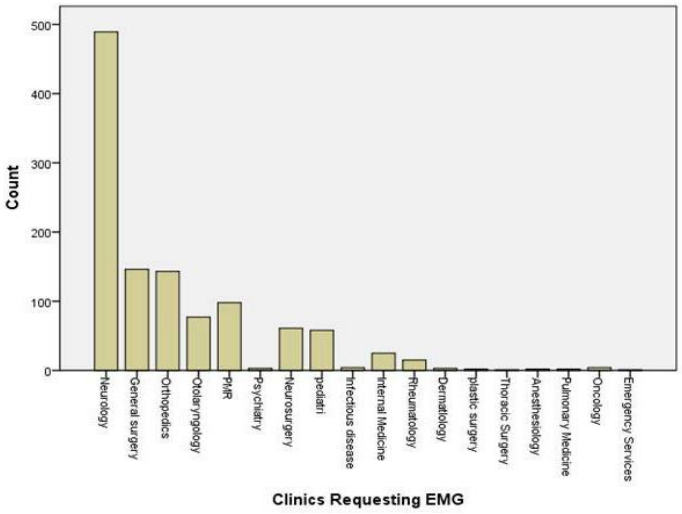

Figure 1. Referring Clinics for EMG
PMR: Physical medicine and rehabilitation, NCS: Nerve Conduction Studies, EMG: Electromyography, RNS: Repetitive Nerve Stimulation

Referring Clinics

EMG was mostly requested by Neurology (490), General Surgery (146), and Orthopedics (143) clinics, respectively. The clinics requesting EMG are summarized in Figure 1. When we examine the concordance between the referral diagnosis and the final diagnosis for entrapment neuropathies, physical medicine rehabilitation (PMR) had the highest rate at 42%. Entrapment neuropathies were confirmed by EMG at a rate of 40% when requested by Neurosurgery, 35% when requested by Orthopedic departments, and 31% when requested by Neurology. The highest diagnostic compatibility in the referrals made by Neurology was observed for polyneuropathies (43%). For polyneuropathies, this rate was 100% for requests by Oncology, and 56% for requests by Neurosurgery.

Polyneuropathy was the most common pre-diagnosis requested by Neurology, and 43% of these were confirmed by EMG. This rate was higher for Internal Medicine. Of all EMG requests, 40% were reported as "normal." Furthermore, the majority of requests from Orthopedics (58%) and Pediatrics (69%) were reported as "normal." The normal rate was significantly lower for more specifically requested cases by Ear, Nose, and Throat (ENT) (17%), Oncology (<1%), and General Surgery (12%) clinics. The general screening request was mostly used by Neurosurgery, with a rate of 12%. The compatibility of the diagnoses with the referral diagnosis according to the requesting clinics is shown in Table 4.

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DISCUSSION

The standardization of EMG processes relies on fundamental information gleaned from data collected since the 1940s (8). In 1999, Bischoff et al. published the first guidelines by the International Federation of Clinical Neurophysiology, although few clinics had the requisite equipment and infrastructure at that time (9). A new standardization statement was released in 2020 by Tankisi et al., which reflects the need for the ever-increasing use of EMG with the development and innovations of technology (10). For reliability, this interdisciplinary field necessitates a common terminology and approach, as referrals are made by different clinics. Recent studies demonstrate an approximately 10% increase in the number of EMG requests (11).

Research has indicated that relying solely on diagnostic procedures to replace comprehensive medical history and physical examination can lead to unfavorable implications concerning time and expenses. Moreover, the effective and efficient utilization of electrophysiological assessments necessitates a clear identification of the clinical indication (3). Clarifying the diagnosis through electrophysiological procedures is crucial, as is the exclusion of differential diagnoses, which are equally important in making an accurate diagnosis. The electrophysiology laboratory protocols should be followed after obtaining a detailed medical history and performing a thorough examination, taking into account the reason for referral of the case. It is imperative to recognize that the vulnerabilities of nerves to injuries exhibit variations beyond the scope of the existing literature (12); therefore, the appropriate technique and analysis should be selected based on the findings obtained (13).

Our study revealed that the three clinics with the highest frequency of EDX testing requests were Neurology, General Surgery, and Orthopedics clinics, respectively. Polyneuropathies were found to be the most common referral diagnosis, which is consistent with previous studies in the literature that focused on expert requests (1,11). The increase in EMG requests observed in our study aligns with the findings of Ohmori et al., highlighting the impact of technological advancements and growing clinician awareness on diagnostic practices (14). The most commonly requested preliminary diagnoses were polyneuropathy (28%) and entrapment neuropathy (22%), whereas disorders of the muscle and neuromuscular transmission were the least frequently cited causes for referral, consistent with recent studies (15).

Additionally, our finding that polyneuropathies are the most frequently referred diagnosis indicates a broad acknowledgment of the critical role of electrophysiological assessments in diagnosing and treating polyneuropathies. Nevertheless, the absence of long-term prospective studies has constrained the assessment of the accuracy and reliability of new morphometric and neurophysiological methods (16). Of the patients, 61 were referred without a clear working pre-diagnosis and "general screening" was requested in 5.4% of cases. While 43% of these cases were reported as normal, entrapment neuropathy was the most common pathological finding. Considering the findings obtained in a center with only neurologists, and that this rate is 3%, our rate of specifying a preliminary diagnosis is quite high (11). In 2004, Podnar found that only 50% of requests had a pre-diagnosis in their

laboratory (3). From this, it can be concluded that the rate of indicating a preliminary diagnosis has increased over the years. In our lab, electrodiagnostic testing requests were most frequently made with the pre-diagnosis of polyneuropathy. Neurology mostly referred for polyneuropathy, while other branches referred for entrapment neuropathy. Polyneuropathy and entrapment are common referral diagnoses in our lab, and their co-occurrence as dual diagnoses was seen in 3% of cases. Definitive myopathy, radiculopathy, plexopathy, motor neuron disease, and peripheral neuropathy diagnoses are based on electromyographic findings. It is accepted that nerve conduction studies are often normal in radiculopathies; therefore, the diagnosis is based on electromyography. Innervation of a muscle from two different roots, and preservation of compound muscle action potentials (CMAP) unless there is a significant loss of axons exceeding 50% or a reinnervation process develops, are the mechanisms that explain normal EMG findings. Although rare, in the case of pure demyelinating conduction block, EMG studies and motor unit potential (MUP) configurations will remain normal, even if a clinical loss of strength is observed in the relevant root (17).

AANEM emphasized the necessity for needle EMG in patients with normal nerve conduction studies to avoid unnecessary tests and exclude differential diagnoses in a statement published in 2015 (18). Although radiculopathy/plexopathy protocol requests constituted 8% of all requests, they account for only 5% of EMG diagnoses, which is consistent with similar recent studies(19). Focal demyelination can result in normal conduction studies distal to the lesion (20). In our study, 40% of patients with EMG requests had normal results, consistent with the literature (11). Proximal and distal lesions present with similar clinical findings, and definitive differential diagnosis is achieved through EMG. Needle EMG is essential in diagnosing carpal tunnel syndrome (CTS) as differential diagnoses such as radiculopathy or peripheral neuropathy must be excluded. Double crush syndrome, a rare partial nerve fiber lesion where axonal transport is interrupted both proximally and distally (21), was the referral diagnosis in 2% of cases in our study, but was detected by EMG in less than 1% of cases.

Clinical findings may indicate peripheral neuropathy, but normal electrodiagnostic results can occur due to misdiagnosis or mild nerve damage. Electrodiagnostic assessment evaluates large diameter myelinated nerves, and may not detect mild conduction block or axon degeneration (20). Some patients sent to the EMG laboratory have completely normal examination and EMG findings. Radiculopathy and focal demyelination may present as normal EMG results. In a study of CTS patients, only one-third with clinical complaints had electrodiagnostic abnormalities (22). In Turkey, the high density of outpatient clinics and patient requests often lead to unnecessary EMG referrals. The diagnostic concordance for electrodiagnostic procedures can vary. RNS has a high diagnostic concordance of 76% for generalized myasthenia but a relatively low diagnostic concordance of 48% for ocular myasthenia (23). A study of 300 patients, which evaluated the sensitivity of diagnostic hypotheses, found that the symptoms and clinical signs in patients can increase the diagnostic concordance of electrodiagnostic studies for CTS (3).

In our study, PMR clinics had the highest compatibility with the final diagnosis for entrapment neuropathies, General Surgery clinics had highest concordance for anal sphincter dysfunction, and the ENT clinic had highest concordance for facial paralysis. This can be explained by the high diagnostic concordance of the referring diagnosis when isolated to a single nerve, the low diversity of differential diagnoses, and the ease of recognizing clinical findings. Studies showed that concordance significantly increases in patients presenting with limited neurological findings such as isolated weakness (24).

When requests were examined according to the referring clinics, the highest confirmation rate for referrals from Neurology was for polyneuropathy, with a consistency of 43%. The higher rate of confirmation for Internal Medicine clinics may be related to the predominant presence of comorbid diseases such as malignancy, diabetes, and chronic renal failure. The differential diagnosis of CTS, which is the most common entrapment neuropathy, includes joint arthritis, cervical radiculopathy, flexor carpi radialis tenosynovitis, Raynaud's phenomenon, and cubital tunnel syndrome (25). Since these differential diagnoses are related to PMR departments, their high diagnostic concordance for the diagnosis of entrapment neuropathy is not surprising. To further investigate this difference, entrapment neuropathies should be classified according to severity or stage.

CONCLUSION

The utility of EMG in diagnosis and treatment is closely linked to several factors, including pre-diagnostic considerations and the department responsible for the request. Electrodiagnostic assessments represent an essential component of the neurological approach when considering differential diagnoses for neurological conditions, alongside the patient's clinical history and neurologic examinations. Nevertheless, factors such as the time-consuming and invasive nature of EMG, economic considerations involved, and variables that affect the reflection of neuromuscular pathology on the results, highlight the importance of establishing a thorough preliminary diagnosis before ordering these examinations. EDX studies are never a screening method, but they reveal pathology with high accuracy when performed with appropriate pre-diagnosis. EDX tests are not universally abnormal in all neuromuscular disorders, but should be considered for patients with clinical suspicion. Multiple pre-diagnoses decrease the diagnostic concordance and result in delays.

Electromyographic investigations were found to have a general pathology detection rate of approximately 60%. The findings of this study suggest that the diagnostic concordance of EMG increases when preliminary diagnoses are narrowed down based on clinical findings. Future studies should focus on developing more specific guidelines and standards to improve the clinical effectiveness of EMG referrals. Furthermore,

multidisciplinary approaches should be encouraged to improve concordance rates of different clinical specialties.

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