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ORIGINAL ARTICLE

THE EXPERIENCE OF A TERTIARY CENTER: DISTRIBUTION AND CONSISTENCY OF THE ELECTRONEUROMYOGRAPHY REQUESTS AND THE FINAL NEUROPHYSIOLOGICAL DIAGNOSIS IN OLDER AGE

Abstract

Introduction: Electroneuromyography is a test to evaluate peripheral nervous system disorders in a laboratory setting. Considering accompanying comorbidities, the geriatric age group constitutes a naive and unique segment of society. This study aimed to determine the ratio of electroneuromyography requests in individuals over 70 to all electroneuromyography requests and the compatibility of the requests and preliminary diagnoses with the results, applied procedures, and the departments making the requests.

Materials and Method: We retrospectively reviewed the electroneuromyography reports of individuals over 70 who applied to our electroneuromyography laboratory between 2018 and 2023.

Results: After a five-year query, 1,056 records, 11.4% of all electroneuromyography requests, were detected. A combination of nerve conduction studies and needle electromyography was performed in 68.2% of the patients. Polyneuropathy was the most requested electroneuromyography test protocol (n = 490, 42.7%). The most frequent electrophysiological diagnosis was polyneuropathy (n = 336), followed by lumbosacral radiculopathy (n = 297) and median nerve entrapment neuropathy in the wrist segment (n = 258). The primary diagnosis and electrophysiological findings were consistent in 55.2% of the cases. Most physicians referring patients to our electroneuromyography unit were neurologists. There were no significant differences among the departments in terms of the compatibility between the clinical preliminary and electrophysiological diagnoses (p = 0.15).

Conclusion: Polyneuropathy was the most common peripheral nervous system disorder in our study's geriatric population. The combination of nerve conduction studies and needle electromyography was determined to be the most applied procedure. When we compared the departments' requests, there was no significant difference in compatibility.

Keywords: Aged; Electromyography; Geriatrics; Neuromuscular Diseases.

INTRODUCTION

Electroneuromyography (EMG) is one of the most important diagnostic tools in diagnosing neuromuscular diseases (1). It is considered a crucial part of the neurological examination and is directly linked to the appropriate referral preliminary diagnosis (2). It can be applied to any age group but is of particular significance in the geriatric population due to comorbidities that can obscure the clinical presentation; thus, making an accurate diagnosis is challenging. EMG not only distinguishes objectively complex diagnoses and helps to confirm the diagnosis but also prevents unnecessary additional and costly examinations and treatments.

The number of elderly individuals is increasing daily, and this demographic shift is significantly impacting the distribution of neuromuscular diseases. According to Turkish Statistical Institute data, the population aged 65 and over increased from 8.8% in 2018 to 10.2% in 2023. With the increase in the number of elderly individuals, the World Health Organization redefined the 0–17 age group as adolescents, the 18–65 age group as young people, the 66–79 age group as middle age, and age 80 and over as elderly individuals in 2017 (3). The rise in comorbidities among older individuals is leading to a shift in the distribution of neuromuscular diseases, making the study of EMG evaluation in the elderly a matter of increasing importance (4). Our aim in this study is to identify the common peripheral nerve diseases in elderly patients referred to our EMG laboratory, assess the compatibility between clinical preliminary diagnosis and final electrodiagnosis, and contribute to the electrophysiological knowledge belonging to this population.

MATERIALS AND METHOD

The individuals over 70 referred to our EMG unit from various departments between November 2018 and November 2023 were retrospectively screened. The physicians referring patients to our EMG unit were often neurologists, physical therapy and rehabilitation specialists, orthopedists, and internal medicine specialists. The departments from which the patients were sent were noted. Electrodiagnostic (EDX) tests were performed utilizing Keypoint.Net (Medtronic A/S, Copenhagen, Denmark) EMG machines. As per the requested protocol, motor and sensory nerve conduction studies (NCSs), F wave recordings, needle electromyography (nEMG), evoked potentials, single fiber EMG, repetitive nerve stimulation, tremor recording, autonomic nerve tests, and reflex studies were performed separately or in combination. Requested protocols, performed procedures, and final electrophysiological diagnoses were documented.

The examinations were conducted by the same three technicians, each with at least 10 years of experience, and were reviewed by the same two physicians, each with at least 20 years of EMG experience.

The EDX protocols were as follows: entrapment neuropathy (median, ulnar, peroneal), radiculopathy (cervical and lumbosacral), plexopathy (brachial and lumbosacral), cranial neuropathy, sciatic nerve injury, myasthenia gravis, myopathy, motor neuron disease, evoked potentials (such as visual evoked potential, somatosensory evoked potential [SEP], motor evoked potential, and brainstem auditory evoked potential [BAEP]), reflex studies, movement disorders, autonomic tests (heart rate variability analysis and sympathetic skin responses), and anal EMG.

The level of compatibility between the clinical preliminary diagnosis and the electrophysiological diagnosis was categorized as "yes," "no," "requiring further evaluation," or "no comment." The protocols in which compatibility could not be determined were evoked potentials, autonomic tests, anal EMG, and reflex studies. These tests are usually requested for a specific initial diagnosis and used for monitoring the disease prognosis. Our institution's local ethics committee approved this study with approval number SBA 23/396.

The data were analyzed using the IBM Statistical Package for Social Sciences (SPSS) program version 27.0 (Armonk, NY: IBM Corp.). A significance level of $p < 0.05$ was used/established for all analyses. Data were presented as numbers with percentages or mean with standard deviation or range. The chi-square test was employed for intergroup comparisons. However, Fisher's exact test was used if more than 25% of cells had a count lower than expected.

Since we used data from performed examinations, informed consent was not required.

RESULTS

A retrospective scan using the data collection system for the past five years revealed that 1,056 (11.4%) of 9,184 records were of individuals over 70 years. Approximately 211 electrophysiological examinations were performed on individuals over 70 annually. However, during 2020–2021, this number decreased to 116 due to the COVID-19 pandemic (Figure 1).

Of the 1,014 patients from the screened records, 556 (54.8%) were female, 458 (45.2%) were male, and the mean age was 76.6 ± 5.4.

Figure 1. Distribution of electrodiagnostic studies by years (≥70 and other age groups)

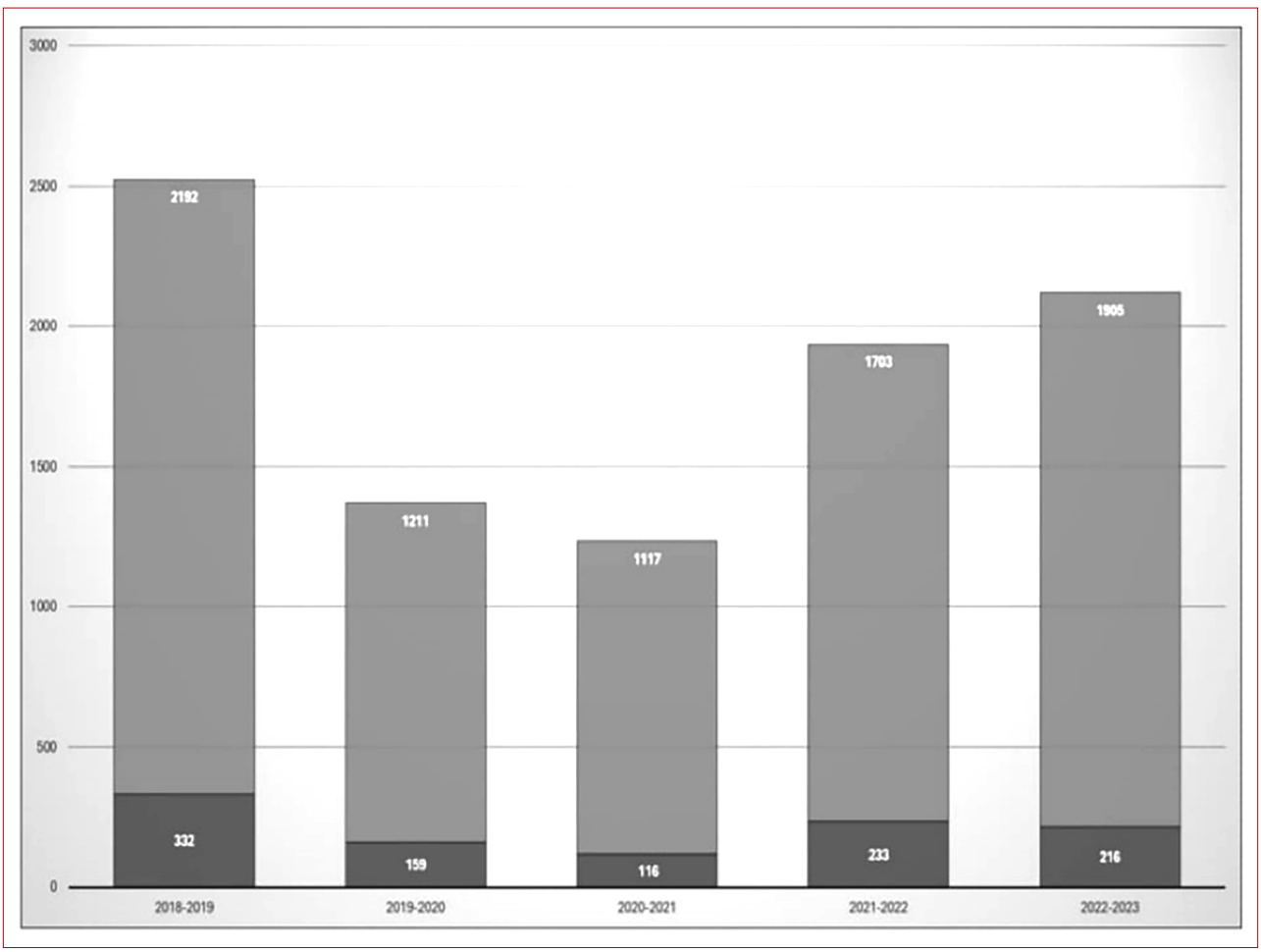
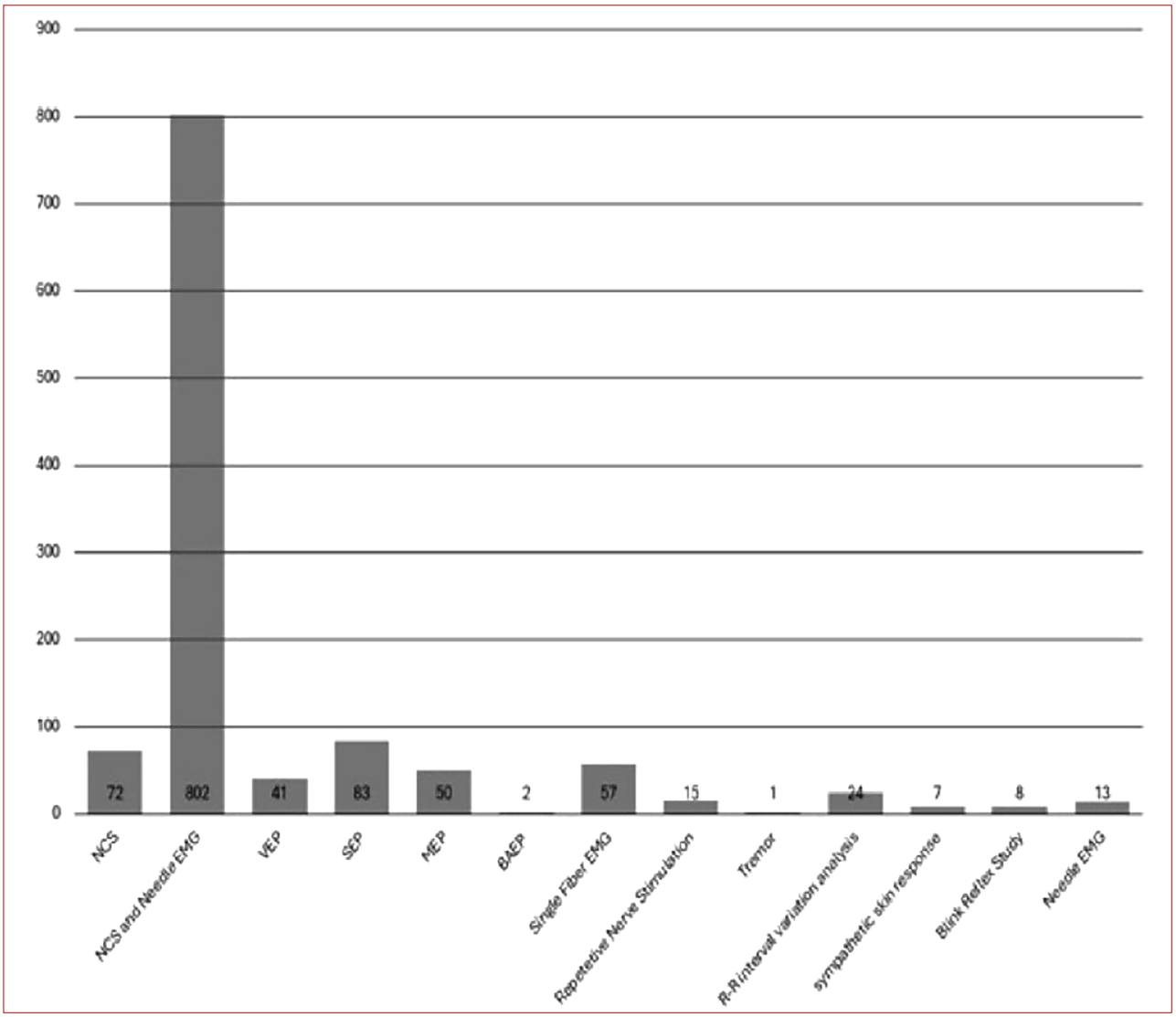


Table 1. Number of EMG requests of departments and rates of compatibility

Department	Number of Requests (n)	Compatibility with electrophysiological diagnosis (%)
Neurology	667	58.1
Internal Medicine	122	65.0
Physical Therapy and Rehabilitation	64	60.9

Figure 2. Distribution of the procedures performed



(NCS=Nerve conduction study, EMG=Electromyography, VEP=Visual evoked potential, SEP=Somatosensory evoked potential, BAEP=Brainstem evoked potential, MEP=Motor evoked potential)

When we screened the 1,056 procedures for age groups, 785, 243, and 28 belonged to the age groups 70–79, 80–89, and 90–99, respectively. We observed that compatibility was 54%, 56%, and 75%, respectively, for these age groups. It was noted that the percentage of compatibility increased with aging. However, no statistically significant difference was observed in compatibility between age groups (p=0.37).

EMG requests were for both outpatients and inpatients from many departments. The departments with the highest number of requests were neurology (n=667), internal medicine (n=122), and physical therapy and rehabilitation (n=64; Table 1). Requests were also received from many departments, such as orthopedy, neurosurgery, and intensive care. No significant difference was observed in the compatibility between the electrophysiological diagnoses and the clinical preliminary diagnoses among the departments (p=0.15).

More than one protocol could be requested in the same session (n=1,146). It was detected that the most requested procedure was the polyneuropathy protocol, with 490 requests (42.7%). It was followed by radiculopathy and entrapment neuropathy protocols.

More than one procedure could be performed in the same session (for example, polyneuropathy and SEP). The total number of examinations was 1,175. The most performed procedure was combined NCS and nEMG, constituting 68.2% (n=802) of all procedures (Figure 2). This was followed by SEP, 83

Table 2. Compatibility of electrophysiological diagnoses with requested protocols

Requested Protocol	Number of Requests (n)	Compatibility with electrophysiological diagnosis (%)
Entrapment Neuropathy	107	
Median nerve	103	82.6
Ulnar nerve	3	66.6
Peroneal nerve	1	100
Polyneuropathy	490	
GBS	16	56.2
Other axonal and demyelinating PNP	474	58.8
Radiculopathy	137	
Cervical	35	65.7
Lumbosacral	102	89.2
Brachial Plexopathy	8	75
Motor Neuron Disease	48	33.3
Cranial Neuropathy	9	
Facial nerve	5	83.3
Other cranial nerves	4	100
Myopathy	67	50.7
Myasthenia Gravis	65	33.8
Sciatic Nerve Injury	4	100
Radial Nerve Injury	3	66.6

*GBS=Guillain-Barre Syndrome; PNP=Polyneuropathy

(7%), and NCS, 72 (6%). Only one tremor record and two BAEP studies were noted as the least frequently performed examinations.

It was determined that polyneuropathy (*n*=336) was the most common electrophysiological diagnosis, followed by lumbosacral radiculopathy (*n*=297) and median nerve entrapment neuropathy in the wrist segment (*n*=258). Overall, 15.7% (*n*=166) of the examinations were reported electrophysiologically normal.

The preliminary and electrophysiological diagnoses were compatible in 55.2% (*n*=582) of the reports. However, this compatibility was not found in 32.4% (*n*=343) of the reports, and 1.8% (*n*=19) were in the follow-up decisions group. In 10.6% (*n*=112), no comment was made.

The requested protocols and electrophysiological diagnoses were evaluated separately, and the least compatibility was observed in the motor neuron disease (33%) and myasthenia gravis protocols (33%; Table 2).

DISCUSSION

EDX procedures are an extension of the neurological examination used to diagnose neuromuscular diseases (1). EMG in older individuals has distinct characteristics, including differences in the obtained data compared to adults and potential technical challenges due to the comorbidities. Given the growing older population in society, this issue is significant. Thus, it has become increasingly important to identify neuromuscular diseases in this age group.

The requests for EMG can vary depending on the healthcare institution, the referring department, and the physician. Mondelli and coworkers claimed that the most common request is the entrapment neuropathy protocol, especially for carpal tunnel syndrome (5). However, in our study, we observed that the most requested protocol was for polyneuropathy. In a study conducted at a tertiary reference center, as in our research, it was reported that the most common request was the polyneuropathy protocol, followed by radiculopathy (6).

The relatively low number of carpal tunnel syndrome, ulnar nerve lesions, and other focal neuropathies observed in our study, despite their high prevalence in the general population, was thought to be influenced by the limited number of patients referred from the orthopedics and neurosurgery departments. Additionally, it was considered that the plastic surgery and hand surgery departments, in addition to these specialties, may have directed such patients presenting with neuropathic complaints to conservative interventions based on their history and physical examination findings without the need for EMG studies, which could also contribute to the low patient numbers.

The incidence of polyneuropathy increases with aging (7). It was reported that the rates of neuropathic complaints were 26% in people aged 65–74 and 54% in people aged 85 and over (8). In our study, consistent with previous data, it was determined that the requests for polyneuropathy protocol and EDX diagnosis took precedence. The diagnoses of lumbosacral radiculopathy and median nerve entrapment neuropathy in the wrist segment followed the diagnoses of polyneuropathy. The median age at diagnosis of lumbosacral radiculopathy was reported to be 70 years (9). It is known that median nerve entrapment neuropathy in the wrist segment has a bimodal age distribution. Its first peak is reported to occur between ages 50 and 54, and its second peak occurs between ages 75 and 84 (10). A multicenter study examining EDX studies showed that abnormal findings were identified at a rate of 65% (11). However, our study found this rate to be higher, at approximately 85%.

Numerous studies have examined the difference between clinical preliminary diagnosis and EDX diagnosis. Studies investigating the correlation

between preliminary diagnosis of upper extremity requests and EDX studies have reported that this rate varies between 37% and 49% (12,13). Our study found the percentage compatibility between the clinical preliminary and electrophysiological diagnoses to be 55.2% (*n*=582).

The higher compatibility rates between abnormal EDX studies and clinical preliminary diagnoses/electrophysiological diagnoses in our study compared to other studies can be attributed to several factors. First, our center is a referral center, which can be explained by the fact that our referrals are also experienced. Additionally, the EDX pathology detection rate increases due to the higher rate of comorbidities in elderly individuals.

When evaluating the requested protocols and electrophysiological diagnoses separately, compatibility was lowest for the motor neuron disease (33%) and myasthenia gravis protocols (33%). This was likely due to the lower incidence of motor neuron disease and myasthenia gravis in this age group. Motor neuron disease typically occurs between ages 51 and 66, while myasthenia gravis has a bimodal onset age of 30–50 (14). However, it was believed that medical professionals requested these protocols to rule out these severe diseases in patients experiencing symptoms such as widespread weakness and swallowing and breathing difficulties.

In agreement with other studies, our study found that the compatibility between the clinical preliminary diagnosis and the electrophysiological diagnosis increased as age increased (15).

The neurology department made the highest number of requests, and there was no significant difference between the clinical preliminary diagnosis and the electrophysiological diagnosis compatibility with other departments. We believe that the lack of compatibility differences between departments might be because the neurology department verified the EMG protocols requested by inpatient services. Furthermore, in our study, more EMG examinations were performed in females (54.8%) than in males (45.2%), which is consistent with previous studies (16,17).

In conclusion, considering the increasing elderly population in the country, the importance of evaluating this group separately comes to the fore. Our study is critical because it is the most comprehensive examination of the characteristics of EDX studies in the geriatric age group.

Limitations

Polyneuropathies were not classified based on etiology (e.g., diabetic, chemotherapy-induced, vitamin deficiency-related). This limits the specificity of our findings regarding the underlying causes of polyneuropathies in the geriatric population.

The study reflects data from a single tertiary center, and the patient population is limited to those referred for electrophysiological studies. This may result in referral bias, affecting the generalizability of the findings.

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Conflicts of Interests: The authors have no competing interests.

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