Original Article

The Value of Electrodiagnostic Studies in Diagnosis and Management of Neuromuscular Disorders: A Retrospective Study from a Tertiary-Care Hospital in Thailand

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ABSTRACT

Objectives: To evaluate the value of electrodiagnostic studies (EDx) in diagnosis and management of neuromuscular disorders.

Study design: Retrospective study.

Setting: Maharat Nakhon Ratchasima Hospital, Nakhon Ratchasima, Thailand.

Subjects: New patients who were referred to EDx laboratory, Maharat Nakhon Ratchasima Hospital between January 1, 2019 and December 31, 2020.

Methods: General demographics, referring physician specialty, referral diagnosis, diagnosis after EDx, impact of EDx on diagnosis and management were reviewed retrospectively. The impact of EDx was classified into confirmed, changed, and no added value. Management by referring specialists after receiving EDx reports including investigation, consultation and treatment were recorded. The association between variables and change in diagnosis and management after EDx, were analyzed using multivariable analysis.

Results: Of 856 patients, the diagnosis was changed and confirmed after EDx in 28.4% and 69.3% respectively. EDx results led to a change in management for 29%. Referral diagnosis of radiculopathy, no referral diagnosis, female patient and neurologists' referral were major contributing factors to a change in diagnosis with odds ratios (95% CI) of 3.67 (1.52, 8.85), 2.61 (1.44, 4.73), 1.79 (1.23, 2.56) and 1.79 (1.20, 2.67) respectively. While referral diagnosis of neuromuscular junction (NMJ) disease, motor neuron disease (MND) and referred by orthopedic surgeons were the top three variables correlated with a change in management with odds ratios (95% CI) of 3.81 (1.8, 8.08), 2.85 (1.11, 7.37) and 2.24 (1.2, 4.2) respectively.

Conclusions: EDx is a valuable investigation that confirms (69.3%) or changes (28.4%) the diagnosis and guides the appropriate management (29%) in patients with neuromuscular disorders.

Keywords: electrodiagnosis, electromyography, neuromuscular diseases

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Introduction

Electrodiagnostic studies (EDx) are commonly requested to evaluate patients with neuromuscular disorders and have been used for many decades. Such studies help to confirm the clinical diagnoses and provide information to guide subsequent investigation and management. Many previous studies have shown that EDx was useful in patients with suspected neuromuscular disorders such as polyneuropathy,[1] carpal tunnel syndrome,[2] upper extremity complaint,[3] tarsal tunnel syndrome,[4] peroneal neuropathy[5] and radiculopathy.[6] Many studies have confirmed the usefulness of EDx, such as those from the USA,[7-10] Canada[11] and Italy[12,13] that confirmed the value of the EDx study in patients with suspected neuromuscular disorders.

In Thailand, EDx is performed by a physiatrist in the Department of Rehabilitation Medicine or by a neurologist in the Department of Medicine, depending on the policy of each hospital. There is no Thai Board of Electrodiagnostic Medicine. The electromyographers perform EDx for each patient according to their clinical decision making rather than any strict guidelines. Maharat Nakhon Ratchasima Hospital is a tertiary referral hospital that has had an EDx laboratory in the Department of Rehabilitation Medicine since 2006. Patients with suspected neuromuscular disorders have been referred from orthopedic surgeons, neurologists, rheumatologists, general surgeons and other specialists for both outpatients and inpatients averaging 500 cases per year. No study of the value or usefulness of EDx has been conducted in Thailand before.

The objective of this study was to evaluate the value of EDx in diagnosis (confirmed, changed or no added value) and management (in terms of further investigation, injection or surgery) in patients with neuromuscular disorders.

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Methods

All patients who received an electrodiagnostic study (ICD 9: 9308) between January 1, 2019 and December 31, 2020 had their data collected from the Hospital database. The author reviewed electronic medical records of each patient. Only new consultations with a referral from other physicians were included in the present study. Sample size was calculated from power of 0.8, confidence level of 0.95, with an assumed relative risk of 1.5, therefore only 110 cases were required. However, all new patients in two calendar years were recruited in this study. EDx was performed for each patient by certified electromyographers who are physiatrists with a Diploma of the Thai Board of Rehabilitation Medicine or rehabilitation medicine in-training residents under close supervision of the staff. Six physiatrists worked as electromyographers in the period of this study. Patients were referred to EDx unit from specialists in Maharat Nakhon Ratchasima Hospital and other hospitals in Nakhon Ratchasima province. For patients referred from other hospitals, the specialties of referring physicians were unknown. Therefore, only "referred from other hospitals" was recorded. Patients who were firstly diagnosed and later received EDx by the same physiatrist were excluded to decrease potential bias.

The general demographic data including gender, age, diabetes mellitus (DM), type of patient (inpatient vs. outpatient), type of health coverage scheme, referring physician specialty, referral diagnosis, details of EDx, diagnosis after EDx, impact of EDx on diagnosis and management were recorded. Diagnoses were classified into carpal tunnel syndrome (CTS), other mononeuropathies, polyneuropathy, plexopathy, radiculopathy, myopathy, neuromuscular junction (NMJ) disease, motor neuron disease (MND), and others.[11] No referral diagnosis was stated if there was no referral diagnosis or there were only symptoms noted in the medical records. Normal EDx, inconclusive results or upper motor neuron lesion (UMNL) were recorded if the electromyographers concluded those in EDx reports. Details of EDx including numbers of motor and sensory nerve conduction studies (NCS), needle electromyography (EMG), repetitive nerve stimulation studies (RNS), late response and electromyographer's name were recorded. If there was no referral diagnosis, the physiatrist's diagnosis on the day of clinical evaluation before the date of EDx was also recorded.

The impact of EDx was evaluated and classified into confirmed, changed, and no added value. The diagnosis was "confirmed" when EDx supported the referral diagnosis or diagnosis documented by the physiatrists for patients without any referral diagnosis. The diagnosis was regarded as "changed" when the diagnosis from EDx differed from the referral diagnosis or if there was no referral diagnosis and no physiatrist diagnosis then EDx provides a diagnosis. If EDx neither altered nor confirmed the referral diagnosis, "no added value" was identified. Inconclusive EDx study results or incidental diagnosis that do not correlate with the patient's clinical and referral diagnosis were classified as no added value. Management by referring physicians after receiving EDx results within 3 visits or 3 months are considered associated with EDx results. Further investigation, other than blood work, such as imaging, lumbar puncture and biopsy, consultation with other specialists, referral to another hospital and treatment, such as injection or surgery, were recorded. Orthosis or rehabilitation management were not included as management after EDx. In a changed diagnosis group, the medical records of referring physicians on the next visit after EDx performed were studied to evaluate whether referring physicians recorded EDx results or not. If there was no medical record of an EDx report, it was assumed that the referring physicians would not see EDx results. Change in management was recorded if there was at least one change in management after referring physicians had seen EDx results. Management of patients referred from other hospitals could not be evaluated. Ethics approval was obtained from the Maharat Nakhon Ratchasima Hospital Institutional Review Board (058/2021).

Statistical analysis was studied using descriptive statistics, Student's t-test and chi-square test. Association between variables and change in diagnosis and management after EDx was analyzed using logistic regression analysis. *P*-value less than 0.05 was considered to indicate significance. The odds ratio shows the magnitude of association between variables and change in diagnosis and management after EDx.

Results

One thousand and eight patients had EDx studies within the two- year study period in the EDx laboratory. One hundred and fifty-two cases were excluded: 120 cases had EDx at a physiatrist's request (no referring physician), 21 cases were follow-up/repeat EDx, and 11 cases had incorrect ICD-9 coding. Therefore, 856 patients were included in this study. The clinical characteristics of the studied patients are shown in Table 1. The mean age was 47.5 years (range, 0-87). Half were females. Almost all patients (96%) were outpatients. Four percent were children. Eighty-six percent live in Nakhon Ratchasima province. The universal coverage scheme was used by two-thirds of the patients. Most referring specialists were orthopedic surgeons (65%), followed by neurologists (19%) and internal medicine physicians (6.5%). About 6% of the patients were referred from other hospitals. The most common referral diagnoses were other mononeuropathies (26%), CTS (22%) and plexopathy (16%). Almost 7% of the patients had more than one referral diagnosis.

The referral diagnosis from each referring specialist is shown in Table 2. Most referrals from orthopedic surgeons were other mononeuropathies (32.7%), CTS (30.5%) and plexopathy (21%) respectively. While polyneuropathy (31.6%), NMJ disease (27.5%) and myopathy (13.5%) were common referral diagnoses from neurologists. Most referrals from other hospitals were other mononeuropathies (48.2%), CTS

Table 1. Clinical characteristics of the studied patients (n = 856)

Characteristics	Number (%)
Gender: female	427 (49.9)
Inpatient	33 (3.9)
Pediatric (age < 15)	33 (3.9)
Diabetes mellitus	80 (9.4)
Live in Nakhon Ratchasima province	735 (85.9)
Type of health coverage scheme	
Universal coverage scheme	543 (63.4)
Social security scheme	150 (17.5)
Government officer scheme	127 (14.8)
Other (cash, private insurance, veteran)	36 (4.2)
Referring specialist	
Orthopedic surgeon	560 (65.4)
Neurologist	162 (18.9)
Internist	56 (6.5)
Rheumatologist	14 (1.6)
Surgeon (general and plastic)	9 (1.1)
Otolaryngologist	2 (0.2)
Specialty not specified from other hospitals	53 (6.2)
More than one referral diagnoses	57 (6.7)

(17.9%) and polyneuropathy (12.5%). Considering 65 cases with no referral diagnosis, the percentage referred from orthopedic surgeons, neurologists, other specialists, and unspecified specialty from other hospitals were 74, 6, 15 and 5 respectively. Two cases were referred with myelitis and spinal cord lesion and were recorded as other referral diagnosis.

EDx includes motor and sensory NCS, EMG, RNS and late response. In Table 3, the mean numbers of EDx tests for each referral diagnosis are demonstrated. Almost all patients received NCS and EMG while RNS and late response were rarely used except RNS in NMJ disease. Patients with referral diagnosis of MND, myopathy, polyneuropathy and other diagnoses had more than 10 EDx tests.

CTS (26%), and other mononeuropathies (25%) were the most common diagnosis after Edx followed by polyneuropathy (14%) and plexopathy (12%). Normal or negative EDx results were noted in 114 cases (12%). Five cases (0.5%) with UMNL and 16 cases (1.7%) with inconclusive results were found. After EDx tests were performed, the diagnoses were changed in 243 cases (28.4%), confirmed in 593 cases (69.3%) and given no added value in 20 cases (2.3%).

A flow diagram showing patients with changed diagnosis after EDx is presented in Figure 1. From 243 cases with a change in diagnosis, there were 213 cases (88%) with a referral diagnosis and 30 cases (12%) with no referral diagnosis. In patients with a referral diagnosis that was changed after EDx, 43% had normal EDx results while 30% of results were normal in patients with no referral diagnosis. There was a decrease in the percentage of EDx diagnosis if the referral diagnosis was other mononeuropathies, plexopathy, NMJ disease, myopathy or MND. While CTS, polyneuropathy and radiculopathy showed similar proportions of referral and EDx diagnosis. Surprisingly, in patients with a change in diagnosis after EDx, there were 45 cases (19%) for which the medical records of the referring physicians mentioned nothing about the EDx results and the diagnosis was the same as the referral diagnosis. The referring physicians did not change the diagnosis after they had seen EDx reports in 8 patients. In some patients that had conflicting diagnosis between clinical opinion and EDx, discussion in medical records was noted.

The multivariable analysis of variables associated with change in diagnosis is shown in Table 4. Six variables that correlated with a change in diagnosis were: referral diagnosis of radiculopathy, no referral diagnosis, female patient, referred by neurologist, patient with DM and referral diagnosis of CTS with odds ratios (95% CI) of 3.67 (1.52, 8.85), 2.61 (1.44, 4.73), 1.79 (1.23, 2.56), 1.79 (1.20, 2.67), 0.52 (0.27, 0.99) and 0.48 (0.29, 0.77) respectively.

After the referring physicians received the EDx reports, the management changes related to EDx were studied. Two hundred and fifty patients (29%) had at least one change in management. From 434 managements, surgery was the most common form of management found in 35.7% of the patients. Carpal tunnel release in CTS (18.2%), nerve transfer or neurotization in brachial plexus injury (6.9%), and ulnar nerve transposition in ulnar neuropathy at the elbow (4.6%)

Table 2. Frequency of referral diagnosis from each referring specialist (n = 901)

Referral diagnosis	Total, n (%)	Referring specialists, n (%)			
		Orthopedic surgeon	Neurologist	Other specialist	Not specified
None (symptom)	65 (7.2)	48 (8.1)	4 (2.3)	10 (11.9)	3 (5.4)
CTS	200 (22.2)	180 (30.5)	4 (2.3)	6 (7.1)	10 (17.9)
Other mononeuropathies	237 (26.3)	193 (32.7)	7 (4.1)	10 (11.9)	27 (48.2)
Polyneuropathy	105 (11.7)	22 (3.7)	54 (31.6)	22 (26.2)	7 (12.5)
Plexopathy	143 (15.9)	124 (21.0)	10 (5.8)	5 (6.0)	4 (7.1)
Radiculopathy	25 (2.8)	20 (3.4)	2 (1.2)	2 (2.4)	1 (1.8)
Myopathy	36 (4.0)	0 (0.0)	23 (13.5)	13 (15.5)	0 (0.0)
NMJ disease	57 (6.3)	0 (0.0)	47 (27.5)	10 (11.9)	0 (0.0)
MND	31 (3.4)	1 (0.2)	20 (11.7)	6 (7.1)	4 (7.1)
Others (such as myelitis)	2 (0.2)	2 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)
Total	901 (100.0)	590 (100.0)	171 (100.0)	84 (100.0)	56 (100.0)

CTS, carpal tunnel syndrome; MND, motor neuron disease; NMJ, neuromuscular junction

Table 3. Number of EDx tests for each referral diagnosis

Referral diagnosis	Motor NCS[1]	Sensory NCS[1]	Needle EMG[1]	RNS[1]	Late response[1]	Total tests[1]
None (symptom)	1.6 (1.65)	1.1 (1.29)	2.1 (1.45)	0 (0.0)	0 (0.0)	4.8 (2.10)
CTS	3.55 (1.17)	3.78 (1.48)	0.8 (1.32)	0 (0.0)	0.04 (0.28)	8.18 (2.87)
Other mononeuropathies	2.23 (1.93)	1.84 (1.87)	3.08 (2.10)	0 (0.0)	0.03 (0.35)	7.19 (3.92)
Polyneuropathy	5.15 (1.85)	4.36 (1.91)	1.74 (2.02)	0.01 (0.1)	0.35 (0.87)	11.62 (4.11)
Plexopathy	0.99 (1.96)	1.31 (1.84)	6.34 (2.56)	0 (0.0)	0.07 (0.45)	8.72 (3.95)
Radiculopathy	2.72 (2.21)	2.28 (1.74)	3.96 (3.16)	0 (0.0)	0.16 (0.8	9.12 (5.27)
Myopathy	4.61 (2.49)	3.41 (2.03)	2.5 (1.78)	0.28 (0.7)	0.19 (0.52)	11 (4.85)
NMJ disease	1.95 (1.59)	1.14 (1.37)	0.30 (0.83)	1.68 (0.71)	0.04(0.19)	5.11(3.19)
MND	4.9 (1.70)	3.25 (1.61)	4.65 (1.74)	0 (0.0)	0.26 (0.63)	12.45 (4.01)
Others	5.5 (2.12)	2.5 (0.71)	2.5 (3.54)	0 (0.0)	0 (0.0)	10.5 (2.12)
More than 1 referral diagnosis	3.39 (2.22)	3.09 (2.07)	2.78 (2.8)	0.12 (0.47)	0.05 (0.23)	9.44 (4.48)

CTS, carpal tunnel syndrome; EDx, electrodiagnostic study; EMG, electromyography; MND, motor neuron disease; NMJ, neuromuscular junction; RNS, repetitve nerve stimulation study

[1]Mean (SD)

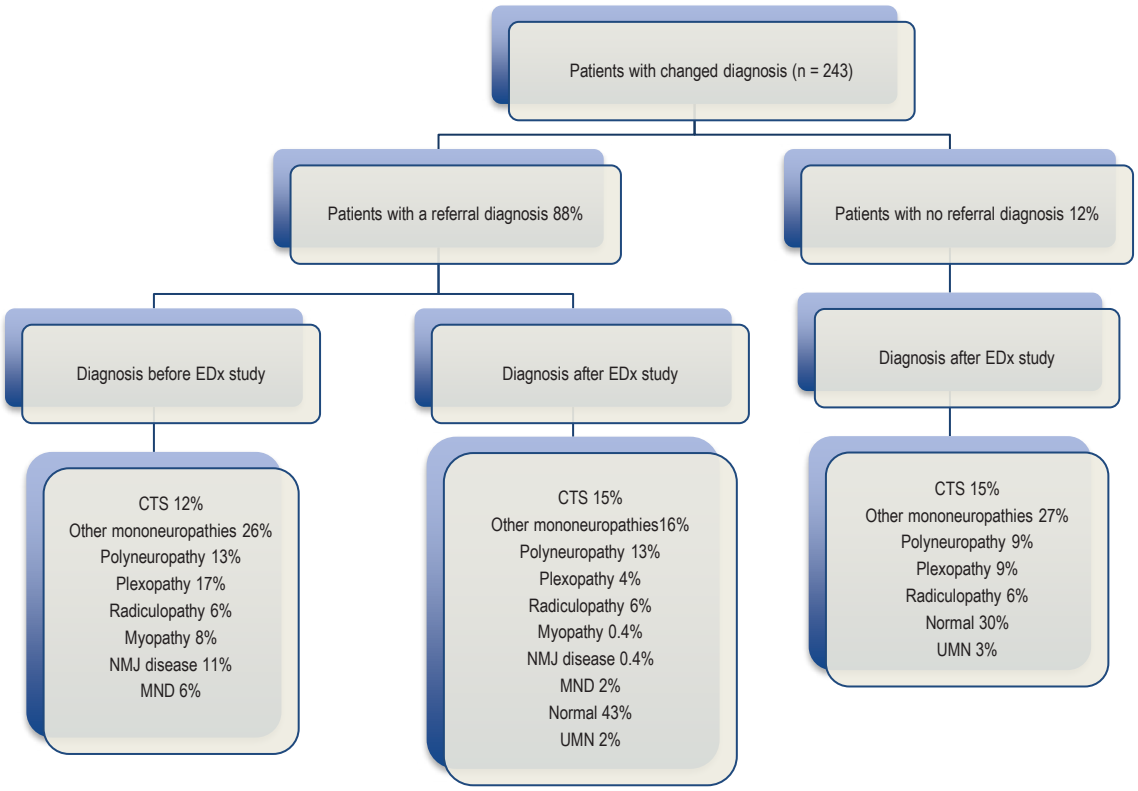

Figure 1. Flow diagram of patients with changed diagnosis after EDx

CTS, carpal tunnel syndrome; EDx, electrodiagnostic study; MND, motor neuron disease; NMJ, neuromuscular junction; UMN, upper motor neuron lesion

were the most common operations performed on patients. Tendon transfer in wrist and foot drop (1.6%), discectomy in radiculopathy (1.2%), thymectomy in NMJ disease (0.9%), rotator cuff repair in negative EDx of brachial plexopathy (0.7%), tendon lengthening in equinus deformity that ruled out peripheral neuropathy and tarsal tunnel release in tarsal tunnel syndrome were also informed by EDx studies (1.4%). Interestingly, EDx results indicating UMN led to subsequent imaging and two patients being diagnosed with brain tumor metastasis and hydrocephalus. Electromyographers were the first persons to note these suspicions in medical records and the EDx reports. EDx also affected the consultation, referral to other hospitals and discharge in 31%, investigation in 25% and injection in 8% of the patients. Two patients were treated with medication as appropriate to the EDx diagnosis: however the referring physicians disagree with the EDx diagnosis.

The association of variables and change in management were analyzed using multivariable analysis (Table 5). There were 8 variables that correlated with a change in management. Referral diagnosis of NMJ disease, MND, orthopedic surgeons' referral, total number of the EDx tests ≥ 15, referral diagnosis of CTS, female, referral diagnosis of other mononeuropathies and patients with DM were correlated

Table 4. Multivariable analysis of variables associated with change in diagnosis

Factors	Odds ratio (95% CI)	*p*-value
Patient's characteristics		
Age	1.0009 (0.99, 1.01)	0.849
Female	1.79 (1.23, 2.56)	0.002*
DM	0.52 (0.27, 0.99)	0.047*
Inpatient	0.94 (0.39, 2.26)	0.89
Referring specialists: neurologist vs. orthopedic surgeon	1.79 (1.20, 2.67)	0.005*
Referral diagnosis		
No referral diagnosis	2.61 (1.44, 4.73)	0.002*
CTS	0.48 (0.29, 0.77)	0.002*
Radiculopathy	3.67 (1.52, 8.85)	0.004*
Total number of EDx tests ≥ 15	2.01 (1.13, 3.60)	0.18

CTS, carpal tunnel syndrome; DM, diabetes mellitus; EDx, electrodiagnostic study

Table 5. Multivariable analysis of variables associated with change in management

Factors	Odds ratio (95% CI)	*p*-value
Patient's characteristics		
Age	1.004 (0.994, 1.014)	0.46
Female	1.61 (1.15, 2.27)	0.01*
DM	0.47 (0.25, 0.88)	0.02*
Inpatient	0.91 (0.34, 2.43)	0.85
Referring specialists:		
Orthopedic surgeon	2.24 (1.2, 4.2)	0.011*
Neurologist	0.64 (0.32, 1.29)	0.21
Other specialists (reference)	1	
Referral diagnosis		
CTS	2.07 (1.37, 3.29)	0.001*
Other mononeuropathies	0.5 (0.32, 0.78)	0.002*
NMJ disease	3.81 (1.8, 8.08)	< 0.001*
MND	2.85 (1.11, 7.37)	0.03*
Total number of EDx tests ≥ 15	2.08 (1.16, 3.73)	0.01*

CTS, carpal tunnel syndrome; DM, diabetes mellitus; EDx, electrodiagnostic study

with a change in management with odds ratios (95% CI) of 3.81 (1.8, 8.08), 2.85 (1.11, 7.37), 2.24 (1.2, 4.2), 2.08 (1.16, 3.73), 2.07 (1.37, 3.29), 1.61 (1.15, 2.27), 0.5 (0.32, 0.78) and 0.47 (0.25, 0.88) respectively.

Discussion

The present study showed 97.7% of the patients with neuromuscular disorders had their diagnoses either altered or confirmed after EDx. Consistent with the previous studies of Kothari et al,[7] and Lindstrom et al,[11] that demonstrated that EDx had been helpful in confirming and changing to new clinically relevant diagnoses in almost all cases. Nardin et al,[9] studied the diagnostic accuracy of EDx in the evaluation of weakness. They showed an overall diagnostic accuracy of 91%. The percentage of confirmation and change in diagnosis in this study was 69.3% and 28.4%. As in other research, the diagnoses were confirmed in 40-63% of cases[7,8,10-12] and were changed in 12.6-59.5% of cases.[7,8,10-12]

Confirmation of the diagnosis was around 70% in this study which is more than in the other studies. The proportion of the referring specialists may explain these findings. In this study, most referring specialists were orthopedic surgeons (65%) who had mostly diagnosed entrapment or focal nerve injury rather than complex ones. The very low percentage of general practitioners (GP) who referred patients for EDx in this study may be another reason. GP referrals from other hospitals accounted for only 6%. This contrasts with Mondelli et al,[13] Lindstrom et al,[11] and Cocito et al,[12] who reported GP referrals of 66%, 54% and 25% respectively. Neurologists and internal medicine physicians could not be easily differentiated because of the consultation and residency training system in the hospital. If these two specialties were summarized into the same group and called neurologists, they would account for 25% of referrals, which is still less than in the other studies. Most of the previous studies that investigated the usefulness of EDx showed that neurologists were the specialists with the most referral for EDx: 76% in Nardin et al,[9] and 31% in Cocito et al,[12] Multivariable analysis of variables associated with change in diagnosis could confirm this hypothesis. For those patients referred by a neurologist, the diagnosis was more than 80% more likely to be changed.

Twenty-eight percent of the patients had their diagnosis changed after EDx. A referral diagnosis of radiculopathy led

to a 3.7-fold greater likelihood of being changed. But if the referral diagnosis was CTS, it was not likely to be changed (Table 4). Not surprisingly, no referral diagnosis was a potent predictor for change in diagnosis after EDx, which was 2.6-times more likely to be changed. Female patients were 1.8-times more likely to have their diagnosis changed after EDx studies. It may arise from complex complaints or pain with negative physical examination findings that made the clinicians state no referral diagnosis or radiculopathy, which these two factors were the potent predictors for change in diagnosis. This was the opposite for patients with DM, whose diagnosis was unlikely to be changed. We did not find that being an inpatient or age of the patients were associated with change in diagnosis as found in the previous study of Lindstrom et al,[11] The very small proportion of inpatients may be a reason for the lack of statistical significance in this study.

When focusing on EDx diagnoses in the changed diagnosis group (Figure 1), 43% of studies were normal in patients with a referral diagnosis compared to 30% in the patients without referral diagnosis. Unlike the previous study by Lindstorm H et al,[11] that showed 65% vs. 12% in patients with and without a referral diagnosis, the percentage that may reflect different proportions of patients with and without a referral diagnosis. The present study had 88% vs. 12% whereas Lindstorm H et al,[11] had 56% vs. 44%. Almost all patients were referred from specialists (94%) in this study compared to 46% in Lindstorm et al,[11] The overall negative or normal EDx in this study was 12%, which did not differ from the previous studies, which had 2-37.5%.[7-,12,13]

About 1 out of 30 of referrals for NMJ disease actually had NMJ disease while about 1 out of 20 of referrals for myopathy in fact had myopathy. These findings may reflect the sensitivity and quality of EDx performed by the electromyographers. The number of EDx tests correlates with the confidence to detect abnormalities. The present study showed quite a small amount of EDx tests for each referral diagnosis (Table 3); because EDx is an operator dependent procedure, this problem made us aware of the need to improve the quality of EDx. Other techniques should be performed to improve the sensitivity of EDx especially in NMJ disease such as single fiber EMG.

The management of referred patients was changed in 29% of cases after EDx, which was similar to the previous studies of Perry et al,[8] and Shepherd MM[10] at 25% and 30% respectively. In contrast to the study of Lindstorm et al,[11] in which management was changed in 63.4% of the cases. The criteria to indicate change in management were the key reasons. In this study, rehabilitation, orthosis, conventional laboratory studies such as blood work or medication did not count as a change in management; therefore, referring neurologists were unlikely to change management. In contrast, orthopedic surgeons referral showed they were 2.2-times more likely to order further management, such as imaging, injection and surgery. The referral diagnoses of NMJ disease, MND and CTS were about 4, 3 and 2 times, respectively, more likely to lead to a change in management, whereas other mononeuropathies was unlikely to cause a change to management. A total of ≥ 15 EDx tests was associated with complex cases and was 2 times more likely to result in a change in management. Female patients were likely to have management changed by 60% while patients with DM were unlikely to have management changed. Female may correlate with CTS and NMJ disease (In this study, 68% of referral diagnoses of NMJ disease were female) that made these variables also correlated with a change in management.

For future improvement of the EDx laboratory, electromyographers should be trained and qualified especially in peripheral neurological disorders other than common nerve injury. Guidelines or protocols of EDx for each diagnosis should be developed. In the period of this study, there was one year in which we had residency training in the EDx laboratory, although the presence or otherwise of residency training was not the aim of this study. However, the author believe that residency training should affect the EDx quality in a positive way. If possible, the EDx laboratory should be audited for standard procedures and reports. The results from this study showed that only 4% of patients were pediatric compared with the previous studies, which had 16%.[11] EDx skills for pediatric patients should be improved. There are two good points in this study that should be addressed. Firstly, the low numbers of patients with no referral diagnosis (7%) when compared to 25% in Lindstrom et al,[11] and 35% in Mondelli et al,[13] Secondly, the EDx conclusion with inconclusive results was very low (1.7%) when compared to 16.5% in Perry et al,[8] A further important point, 45 cases were referred for EDx but the referring physicians did not read the EDx reports. The communication between electromyographers and the referring physicians should be improved.

There were some limitations of this study. Firstly, this study was a retrospective study based on medical record reviews in a tertiary hospital. Secondly, there was only one person who reviewed the medical record and who was also the electromyographer. Thirdly, there were no standard criteria for change in diagnosis or management. The definitions used in the present study were adapted from a previous study.[11] Fourthly, this study was performed in a tertiary hospital. Referrals to the EDx laboratory are different from community hospitals or large academic EDx laboratories. Lastly, as mentioned-above, electromyographers are not certified by a specific board of EDx. However, there were some strengths of this study including the large number of patients and the variety of the diagnoses. This EDx laboratory was a tertiary hospital in the ministry of public health. Half of the study was held without academic training intervention. It may be a good reflection of the situation of EDx service in tertiary hospitals in Thailand.

Conclusions

EDx is a valuable investigation that can confirm (69.3%) or change a diagnosis (28.4%), and guides the appropriate management (29%) in patients with neuromuscular disorders. Referral diagnosis (radiculopathy, CTS or no referral diagnosis), referring specialists (neurologist), female patient and DM are the variables associated with a change in diagnosis after EDx. While referral diagnosis (NMJ disease, MND, CTS or other mononeuropathies), referring specialists (orthopedic surgeons), total number of EDx tests ≥ 15, female patient and DM are associated with a change in management.

Disclosure

The author declares no conflict of interest.

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