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Pattern of Disease Profile Based on Electrophysiological Study in a Tertiary Care Hospital

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ABSTRACT

Background: Electrodiagnostic evaluation consists of Nerve Conduction Studies (NCSs) and needle Electromyography (EMG), is an essential component of clinical practice. It provides both valuable quantitative and qualitative insight into neuromuscular function which aid to diagnosis. Sometimes it differentiate between closely mimic disease which cannot be ensured by clinical signs and traditional investigations. Though it is an important tool but very few studies is noticed which revealed the pattern of disease based on NCS and EMG.Therefore, the current study aimed to evaluate the pattern of disease profile based on electrophysiological study in an electro-diagnostic lab in a tertiary care hospital.

Methods: This hospital based descriptive cross-sectional study was conducted at the Electro-diagnostic Lab in the department of Neurology in Dhaka Medical College Hospital, for six months period following approval of this protocol. People who were attending in electro-diagnostic lab for performing electrophysiological studies due to any reason were approached for inclusion of the study. Informed written consent were taken from each patients. Detailed history and clinical examination were taken from each participants. Moreover, the findings of neurophysiological reports were included into the data collection form. After collection, data were edited manually and prepared for data entry and analysis weredone by using SPSS 23.

Results: Among 100 patients, 55% were males and 45% were females. Mean age was 44.97±13.39 years and prevalent (34%) age group 41-50 years. About 42% lived in urban areas and 58% were in rural area.Among all, 31% had their disease for 2-6 months, 18% had for 7-12 months, another 18% had <1month and 15% participants had disease for >1year. About 63% were diagnosed as peripheral neuropathy, 8% had muscle disease, 12% had other diseases and 17% patients had normal neurophysiologic study.NCS findings revealed that 26% cases had Peripheral nerve entrapment and 28% cases had Polyneuropathy. Among the Peripheral nerve entrapment, Carpal tunnel syndrome was the most common diagnosis (20%), and GBS is the most common among polyneuropathy cases. During EMG, total 8 patients were found to have muscle disease. Six patients had muscle disease and 2 patients had neuromuscular junction disorder.

Conclusion: This finding provides a pattern of diagnosis of an electro diagnostic lab. However, larger study is needed to get the actual prevalence of disease.

KEYWORDS- *ELECTROPHYSIOLOGY, NERVE CONDUCTION STUDY (NCS), ELECTROMYOGRAM (EMG), PERIPHERAL NEUROPATHY, MONONUROPTHAY, BANGLADESH, MOTORNEURON DISEASE, ENTRAPMENT NEUROPATHY*

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CHAPTER: ONE
INTRODUCTION

Background

The use of electrophysiological assessment of nerve function in the diagnosis of various neuropathies and defect in neuromuscular junction are well established. Usually there are two kind of test done in this evaluation process termed as nerve conduction study (NCS) and electromyography (EMG) which are collectively termed as 'clinical neurophysiology'. Irrespective of the nominal nomenclature, it helps to find signs that cannot be diagnosed with clinical examination alone and aids in diagnosis and management.[1-3] Moreover, these studies are adjunct to neurological examination and clinical history.[1] Several studies suggest that, it has an important role to obscure different cranial nerve lesions and peripheral neuromuscular disease. Even it can aid in diagnosis of some spinal cord lesions.[1,3,4]

The electrodes are placed on the skin overlying peripheral nerves to record compound action potentials during Nerve conduction study (NCS).The action potentials are recorded following the stimulation of nerves. It is classified to motor and sensory study, where skeletal muscle and peripheral nerve are the target respectively.Therefore,the result can reveal depolarization of sensory ,motor and mixed elements of the nerve.[4,5]The electrical difference is recorded and amplified to get expected results.[2,4]

Electromyography (EMG) is the recording of compound motor action potentials (CMAPs) of muscles after stimulating the motor nerve. To record the potentials from individual motor units concentric fine needle electrodes are inserted into the belly of muscle.[5] Surface or needle electrodes are used for the recording of electrical activity , the latter is used mostly in the clinical setting, and is assessed during the insertion of needle, during periods of rest to detect spontaneous activity, and during periods of voluntary contraction of the muscle.[6,7]

Electrophysiological studies are used in the evaluation of patients with loss of sensations and weakness in the limbs as well as those who presented with the complaints of numbness, tingling, pain.The use of electrophysiology helps to localize the level of the pathology as well as determines if the lesion involves the peripheral nerve (as in leprosy), neuromuscular junction, plexus, nerve root or anterior horn cells and also identifies the pathophysiology to diferentiate axonal loss from demyelination.[8-10] The study diagnoses mononeuropathies (eg. common nerve entrapments such as carpal tunnel syndrome,[9] ulnar neuropathy at the elbow and peroneal palsy) and extensive processes (eg. generalised peripheral neuropathy due to diabetes or inflammatory process such as Guillain-Barré syndrome).[11] In addition, neurophysiology specifically NCS are also used to monitor the function of nerve over time to detect progression of the disease, complications of treatment (eg. chemotherapy) and observing the course (acute/subacute/chronic) of disease.[1,2,9]

Neurological disorders consists of more than 6% of the overall burden of diseases and slight male predilection is evidenced.[3] Apart from these one of the predictor which is associated with increased suffering of neurological disorders is chronological age.[2] MacDonald et al. reported that the age and sex adjusted incidence (per 100,000/ year) and life time prevalence (per 1000 population) of different polyneuropathy (excluding diabetics and alcoholics), compressive mononeuropathy (except CTS) in the community were 15, 49 and 1, 2 respectively.[12-14]Electrophysiological studies are operator dependent.It can provide huge impact in the diagnosis or elimination of neuropathies if done by skilled personel.[7] As there were a limited studies available regarding this topics, the study was designed to assess the spectrum of disease profile with electrophysiological study done in an electro-diagnostic lab.

Rationale of the study

Electrophysiology is regarded as the clinical evaluation to ‘‘probe’’ nerves and muscles. These procedures has been performed Neurologist or clinicians who has Physical and rehabilitative medicine (PM&R) expertise. It a procedure which can detect the disease earlier and more precisely.However, studies to date concerning pattern of disease based on Electrodiagnostic test were limited. In Bangladesh data regarding this topics are often scare and not readily available. Therefore, this study was planned with the objective of to evaluate the pattern of disease profile based on electrophysiological study in an electro-diagnostic lab.

Research Question

What is the pattern of disease profile based on electrophysiological study in an electro-diagnostic lab in a tertiary care hospital?

General Objective

- To determine the disease profile dependent on electrophysiological study in an electro-diagnostic lab.

Specific Objectives

- Diagnose the disease according to the findings of NCS.
- To identify the disease according to the findings of EMG.
- To evaluate the demographic patterns of the respondents.

Literature review

The use of electrophysiological study in for the evaluation and management of neuropathies and defect in neuromuscular junction are well established. It provides information regarding neuromuscular function which aid to diagnosis. Sometimes it differentiates between closely mimic disease which cannot be ensured by clinical signs and traditional investigations. Usually there are two kind of test done in this evaluation process termed as nerve conduction study (NCS) and electromyography (EMG). In some centers collectively denoted as ‘clinical neurophysiology’. Irrespective of the nominal nomenclature, it enables the physician to confirm diagnosis that cannot be done by clinical evaluation alone and can aid in treatment decisions.[15-17] Electrophysiological studies (NCS & EMG) are commonly used in the assessment of patients with numbness, tingling, pain, loss of sensations and weakness in the limbs. It helps in localizing the site or level of the lesion, determining if the pathology involves the peripheral nerve (as in leprosy), neuromuscular junction, plexus, nerve root or anterior horn cells and also identifies the pathophysiology, particularly distinguishing axonal loss from demyelination.[18-20] It also diagnoses mononeuropathies (eg. common nerve entrapments such as carpal tunnel syndrome,[19] ulnar neuropathy at the elbow and peroneal palsy) and more diffuse processes (eg. generalised peripheral neuropathy due to diabetes or inflammatory neuropathy such as Guillain-Barré syndrome).[21] The electrodiagnostic evaluations are the Nerve Conduction Study and Electromyography.

Nerve conduction studies (NCS): In nerve conduction study, the speed of action potential along the number of nerve fibres are tested with a measurements which is done on the skin. A small metal disk or sticker is used as a device to record, which is usually kept on the fingers or foot. An electrical impulse is sent by the stimulator which created specific images on the computer screen and by observing the pattern characteristic diagnosis is postulated.[22]Different pre-determined parts in limb are stimulated to record the electrical impulses. To deliver and detect the electrical impulses usually surface electrodes are used. It is a harmless test and patient rarely develop complications, only mentioned about slight discomfort as a ‘tingling’ or ‘tapping’ sensation.[19] Nerve conduction studies are commonly done by neurophysiologist in an outdoor setting for both inpatient and outpatient cases. It doesn’t take more than a hour, however time span may differ if clinical condition is complicated All types of nerves including sensory, motor and mixed can

be studied. one electrode is for initiation of the impulse and the second one is reserved to track down the response along the total length of nerve (proximally along sensory nerves or distally within the innervated muscle for motor nerves). In motor nerves, to generate a compound muscle action potential (CMAP) a depolarizing square wave current usually transferred through the peripheral nerve to calculate the summation result in the activated muscle fibres. A propagated sensory nerve action potential (SNAP) is used for sensory nerves. The parameters obtained and used for interpretation include: a) amplitude– from baseline to peak (reflects the number of conducting fibres and is reduced in axonal loss), b) latency (ms) – from stimulus to onset of evoked response, c) duration of response (ms), d) conduction velocity (m/s) – calculated from the distance between stimulation and recording points, divided by latency (reflects integrity of the myelin sheath important for impulse conduction, and is reduced in demyelinating processes).[19]

Electromyography (EMG): Electromyography (EMG) forms one of the cornerstones of the assessment of patients with neuromuscular disease. Needle EMG gives insight into the firing pattern and anatomical arrangement of individual muscle fibres and entire motor units. Characteristic changes in these variables occur in a range of neuromuscular disorders. The resulting changes in the EMG signal allow the underlying pathophysiology to be determined. EMG records the electrical activity arising within muscles. You can record this activity with surface electrodes, known as surface EMG. This samples a large region of the muscle, and while it gives a good indication of which muscle groups are active in for example tremor or dystonia, it gives little information as to the fine structure of those muscles. For this, you need needle EMG, which allows recording from within the muscle.[23] Electromyography is typically undertaken in conjunction with NCS when more specific information is required. Electromyography is most commonly used to investigate weakness and helps distinguish myopathic from neurogenic causes. Fine needles are inserted into muscle fibres and then the patient is asked to contract these muscles. Electromyography enables assessment of the morphology of single motor units (neuron, axon and innervated muscle fibres) and the recruitment pattern of these units. Changes in EMG morphology reflect changes in the number and size of muscle fibres innervated by single motor axons. Neurogenic lesions typically demonstrate polyphasic large motor units with a reduced recruitment pattern, while myopathic motor units are small and polyphasic with early recruitment. Electromyography also enables the pattern of abnormality to be determined to assist in diagnosis and localisation of a lesion. The stage of the neurogenic lesion (acute, subacute or chronic) as well as its recovery may also be assessed. Common indications that may necessitate EMG include: to diagnose myopathies, to differentiate between radiculopathy and peripheral nerve lesions, to localise the level of peripheral nerve or root lesions, and to detect widespread denervation that would be present in motor neuronopathies such as motor neuron disease.[24]

Mechanism: In Nerve conduction studies (NCS) electrodes are placed on the skin overlying peripheral nerves and records compound action potentials (the sum of all the individual nerves action potentials). As the impulse travels down to the nerve, the action potentials are measured following nerve stimulation. NCSs may generally be divided into motor studies (where skeletal muscle is the recording target) and sensory studies (where peripheral nerve is the recording target). Recordings from the nerve can reflect depolarization of sensory elements alone or of both sensory and motor (mixed) elements of the nerve.[25,26] The signals are recorded using a differential amplifier, which means that the difference between electrical potentials, picked up by two electrodes, is recorded. Filtering and amplification of signals is necessary to obtain optimal results.[27,25] On the other hand, Electromyography (EMG) involves recording compound motor action potentials (CMAPs) over muscles in response to motor nerve stimulation either individually and collectively. Here, fine concentric needle electrodes are inserted into muscle belly and the potentials from individual motor units recorded.[26] This electrical activity can be recorded via surface or needle electrodes, the latter being used far more commonly in the clinical setting, and is evaluated during needle insertion, during periods of rest (spontaneous activity), and during periods of voluntary muscle contraction.[28.29]

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Importance/ Benefits: Nerve conduction studies (NCS) and needle electromyography (EMG) are collectively termed 'clinical neurophysiology'. They enable the clinician to detect signs that cannot be confirmed by neurological examination alone and can guide diagnosis and treatment. Clinical neurophysiology aids diagnosis of disorders of the peripheral nervous system Testing helps to: a) localize the site or level of the lesion; determining if the pathology involves the peripheral nerve, neuromuscular junction, plexus, nerve root or anterior horn cells b) identify the pathophysiology, in particular distinguishing axonal loss from demyelination c) diagnose mononeuropathies (eg. Common nerve entrapments such as carpal tunnel syndrome, ulnar neuropathy at the elbow and peroneal palsy) d) diagnose more diffuse processes (eg. generalised peripheral neuropathy due to diabetes or inflammatory neuropathy such as Guillain-Barré syndrome). Nerve conduction studies are also used to monitor nerve function over time to determine disease progression, to assess the complications of treatment (eg. chemotherapy), as well as identifying the disease course (acute/subacute/ chronic).[24] Nerve conduction studies as part of the peripheral neurological examination are an extension of the clinical history and examination and are important in the management of cranial and peripheral neuromuscular disease as well as contributing to diagnosis of spinal cord lesions. NCS can be extremely useful both in localizing the lesions and determining the pathological processes responsible.[27]

Relevant studies: The overall global burden of neurologic disease is approximately 20%, the majority being shared by the developing countries[30]. The incidence of neurologic disorder in UK is 0.6% with an overall 6% lifetime prevalence rate.[31] MacDonald et al reported[32] that the age and sex adjusted incidence (per 100,000/ year) and life time prevalence (per 1000 population) of different polyneuropathy (excluding diabetics and alcoholics), compressive mononeuropathy (except CTS) in the community were 15, 49 and 1, 2 respectively. Neurophysiological studies performed in best hands, gives enormous facts in the diagnosis or elimination of PN existence. EMG, NCS may act as the sheet anchor of diagnosis[33-35] According to a study conducted in Bangladesh at a tertiary level hospital the Majority of the patients (67.6%) presented after forty with a mean age at presentation of 48.11±17.3 years. The male patients (55.2%) predominated. Carpal tunnel syndrome (CTS) was the most common condition (19.2%) observed, followed by different form of polyneuropathy namely Guillain Barre Syndrome (GBS) (6.04% with 50% being Acute inflammatory demyelinating polyneuropathy (AIDP), chronic inflammatory demyelinating polyneuropathy (CIDP) (3.27%), sensory motor polyneuropathy 3.13% and multifocal acquired motor axonopathy (MAMA) 2.55%. Though plexopathy and radiculopathy were rare (1.09 and 0.94% respectively), anterior horn cell disease was not that uncommon (8.73%). Disorders of muscle and neuromuscular junction (myasthenia gravis) were seen in 5.1% and 1.89% patient. Other various conditions (e.g. stroke, cerebral palsy, myelopathy) were observed in 10.05%. NCS and EMG were found to be normal in 270 patients (19.6%).[27]

Carpal tunnel syndrome (CTS): Carpal tunnel syndrome (CTS) is a clinical syndrome of numbness, tingling, burning, and/or pain associated with localized compression of the median nerve at the wrist. It is the most commonly reported nerve compression syndrome, accounting for 0.2% of all U.S. ambulatory care visits in 2006[36] and over 500,000 carpal tunnel releases in 2006.[37] The impairment of the median nerve within the carpal tunnel is secondary to compression of the median nerve, resulting in mechanical compression and/or local ischemia. However, the symptoms associated with CTS are frequently reported in areas outside the distribution of the median nerve. Clinical CTS can be confirmed using electrodiagnostic (EDX) techniques that document abnormalities of the median nerve fibers within the carpal tunnel. Numerous studies have reported that comparison of sensory nerve responses is more effective than the use of an absolute median nerve latency in documenting the median nerve abnormalities consistent with CTS.[38] Sensory fibers have a larger proportion of large myelinated fibers, which have a higher energy requirement, and thus are more susceptible to ischemic damage.[39] Focal compression results in both ischemia and mechanical damage to the nerve fibers due to dysfunction of the myelin and disruption at the nodes of Ranvier.[39,40] Together this results in slowed conduction velocity, which allows the EDX physician to confirm a focal abnormality of the median nerve within the carpal tunnel. The comparison of median sensory latency to the radial, ulnar, or median (segments outside the carpal tunnel) sensory latencies allows

the greatest accuracy for confirming the clinical diagnosis.[38] Use of a comparison latency, as opposed to an absolute latency, controls for confounding factors of age, temperature, disease state (i.e., diabetes), gender, and hand size.[41]

Guillain Barre Syndrome (GBS): The Guillain-Barre syndrome is an acute polyneuropathy with relatively symmetrical paresis and a wide range of severity. Guillain-Barre syndrome is a heterogeneous disorder which encompasses clinical subtypes.[42,43] Onset of weakness of the bulbar muscles instead of weakness starting in the legs is the most remarkable indication that the syndrome encompasses different entities. However, within the 'classical forms' of the disease, clinical variations are also evident.[44] Muscle weakness of the limbs may be distributed diffusely or there may be a predominance of proximal or distal muscle weakness. The sensory system may be severely involved or completely spared. Variability in the clinical spectrum may be the result of different pathogenic mechanisms and this may also indicate variability in response to treatment. According to a study in Rotterdam, The Netherlands, Electromyographic data of the motor Guillain-Barre syndrome patients revealed little or no evidence for demyelination. Abundant denervation activity was present in half of the patients. The response to immune globulin treatment was good but with plasma exchange significantly fewer motor Guillain-Barre syndrome patients reached the stage of independent locomotion after a follow-up period of 6 months especially if the acute motor neuropathy occurred after a C. jejuni infection. The distinctive clinical, electrophysiological and laboratory features of motor Guillain-Barre syndrome patients show that the acute motor neuropathy represents a specific subgroup within the Guillain-Barre syndrome and recognizing these patients may have consequences for the choice of therapy.[45]

Electrodianostic study is very essential to diagnose neurological disorder accurately. This test has historically been performed by physicians with neurology or physical and rehabilitative medicine (PM&R) training. It is a procedure which can detect the disease earlier and more precisely. Developed countries have many studies regarding electrophysiological study. However, Study to explore the pattern of disease profile by electrophysiological studies is very few in south Asian region and in Bangladesh as well. So, this study could enrich the knowledge and better understanding about electrophysiological study in Bangladesh.

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CHAPTER: TWO
METHODS AND MATERIALS

2.1 Study Design:
Descriptive study(Cross Sectional)

2.2 Place of Study:
Electro-diagnostic Lab in the Neurology Department of Dhaka Medical College and Hospital , Dhaka,Bangladesh

2.3 Period of study:
Six months after approval of the protocol.

2.4 Study population:
Adult of either sex who are referred to the Electrophysiological lab for any Electro-diagnostic investigation.

2.5 Sampling Method:
Purposive convenient sampling.

2.6 Sample size:
In Bangladesh, no such relevant study is available to get the required prevalence. Considering 50% prevalence for this study (as prevalence is unknown), sample size estimation will be done by following statistical formula.

$$n = \frac{Z^2 pq}{d^2}$$

For this study, sample size was calculated with 95 % confidence interval and 5% error.

Here, for 95% confidence level Z = 1.96, for 50 % prevalence P=0.5, q= (1-P) and for 5% error (d) = .05

$$n=\frac{(1.96)^2 x\ 0.5x\ (1-0.5)}{(0.05)^2}$$

n = 384

Due to time and resource constraints, total 100-study population were included for the study.

2.7 Selection criteria:

Inclusion criteria:
- Age: > 18 years
- Sex : Both sex
- Patients referred to the Electrophysiological lab for any Electro-diagnostic investigation.
- Willing to participate

Exclusion criteria:
- Severely ill patients
- Not willing to participate in the study
- Not interested in Electrophysiology

2.8 Operational definitions:

Disease pattern of Electrophysiological study: defines the followings:

1. Peripheral nerve entrapment: includes carpal tunnel syndrome, mononeuropathy
2. Polyneuropathy: includes axonal, demyelinating, mixed, Sensory Motor Polyneuropathy, Sensory Neuropathy, Mononeuritis multiplex, Hereditary Neuropathy, HMSN-1, HMSN-2, Traumatic Neuropathy etc.
3. Plexopathy
4. Radiculopathy
5. Motor neuron disease
6. Neuromuscular Junction disorder: Myasthenia Gravis
7. Muscle Disease: Noninflammatory myopathy, Inflammatory myopathy, Myotonic dystrophy etc.

2.10 Study procedure

The Ethical Review Committee (ERC) of Dhaka Medical college hospital approved the ethical clearance to conduct the study. Before data collection, a questionnaire is formed and were tested. The patients attending in the Electro diagnostic lab were approached for inclusion of the study. before final selection, all of them were reviewed according to selected criteria. Prior to interview, all of the study population were counselled regarding the study aim, objectives, and usefulness of the research and informed written consent was recieved. Measures were taken cautiously to maintain ethics thoroughout the study. The researcher conducted the interview with an aid of an questionnaire. The questionnaire includes basic demographic information (age, gender, marital status, occupation, residence and educational level). Moreover, information regarding the findings of NCS and final diagnosis were also included into the case record form. Total 100 consecutive people were interviewed. Following verifying the consistency of the data, it will be analyzed by SPSS 23.

2.11 Informed consent:

Written informed consent was taken from every patient

2.12 Ethical issues

The researcher was concerned about the ethical issues and the following criteria will be followed to ensure maintaining the ethical values.

A. The Ethical Review Committee (ERC) of Dhaka Medical college hospital approved the ethical clearance to conduct the study.
B. Confidentiality is strictly maintained throughout the study.
C. Written Informed consent is taken from the subject by explaining the followings:-
   i. The purpose of the study.
   ii. Explanation in details regarding NCS and EMG
   iii. Explained adequately that they had the right to withdraw themselves from the study.
D. The subjects didn't gain any economic advantage from this research.

2.14 Data Processing and Analysis:

Data was collected and then proof reading was done .Later tabulation was done in SPSS/PC software. 95% confidence level at 5% acceptable error level was set as statistical significance.Percentages or mean ± standard deviation are used to describe the patients' characteristics. Variables were in continuous in nature while in categorical variables were expressed as frequency and percentage. Differences in $p< 0.05$ level was agreed as significant at the outset.The SPSS 23 Windows version was used to formulate data as well as to express them in graph & chart.

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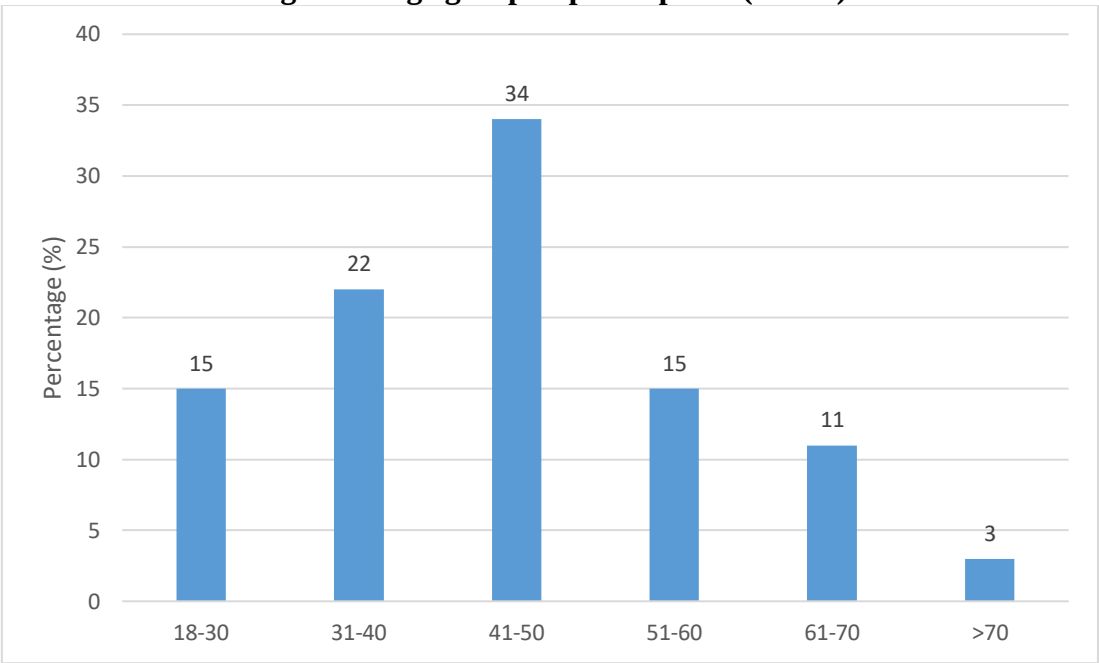
CHAPTER: THREE
RESULTS

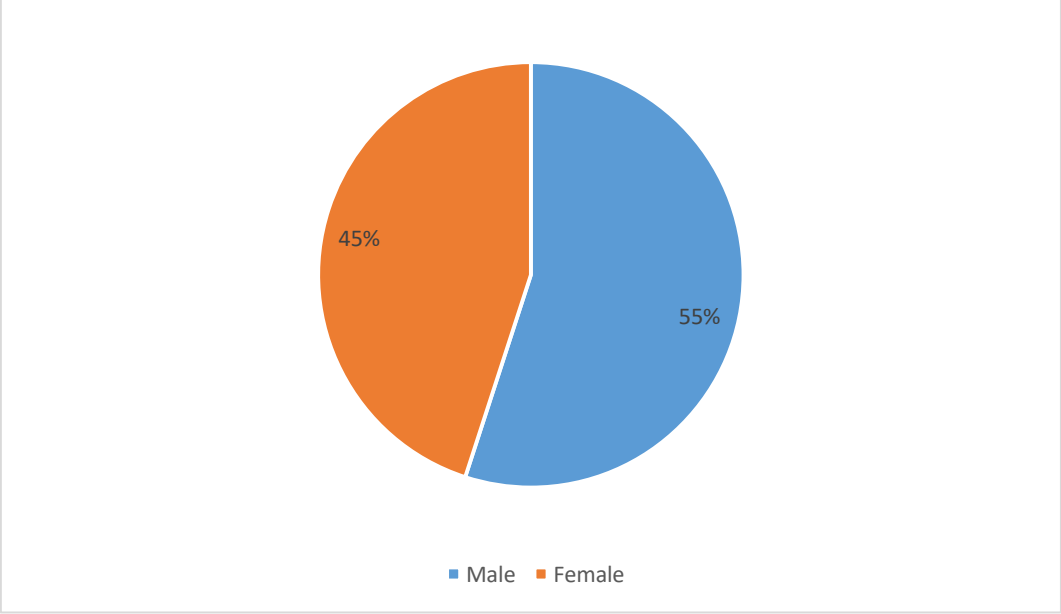
CHAPTER 3.0

Figure 1. Age group of participants (n=100)



This bar diagram shows that maximum age was 74 years and minimum age 18 years. Age group 41 – 50 years (34%) was the most observed data. Mean age was 44.97±13.39 years.

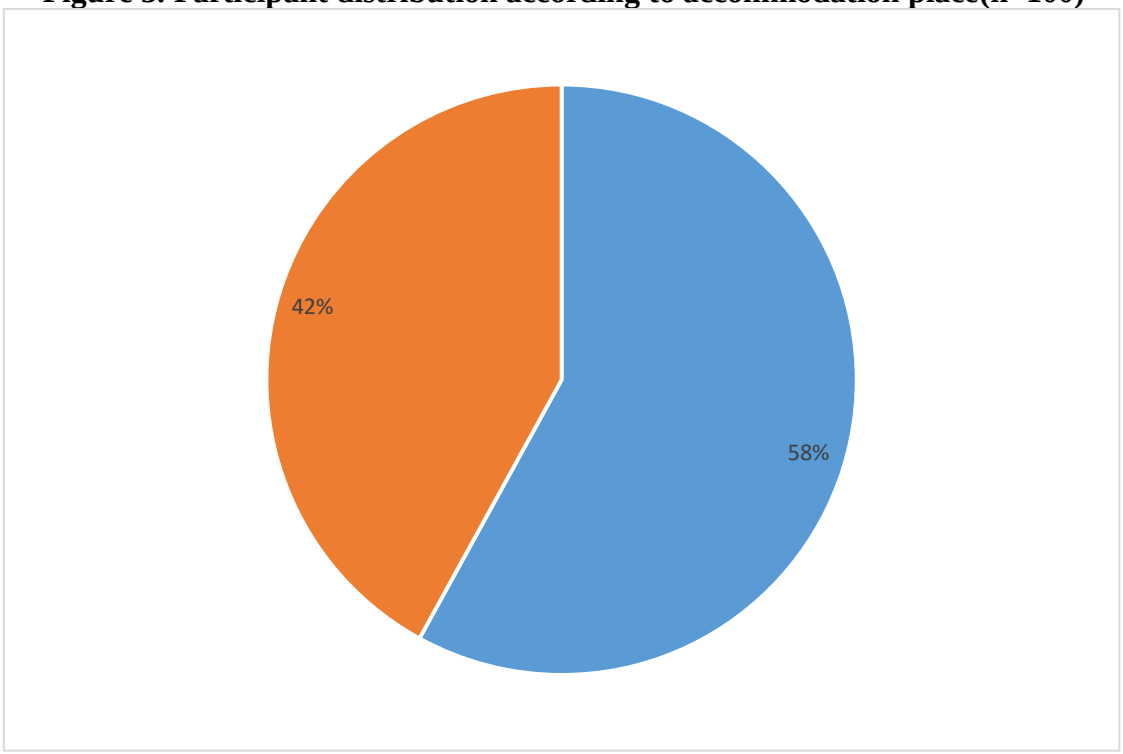
Figure 2. Sex distribution of participants (n=100)



This pie chart shows that majority participants were male (55%) and rest (45%) were female.

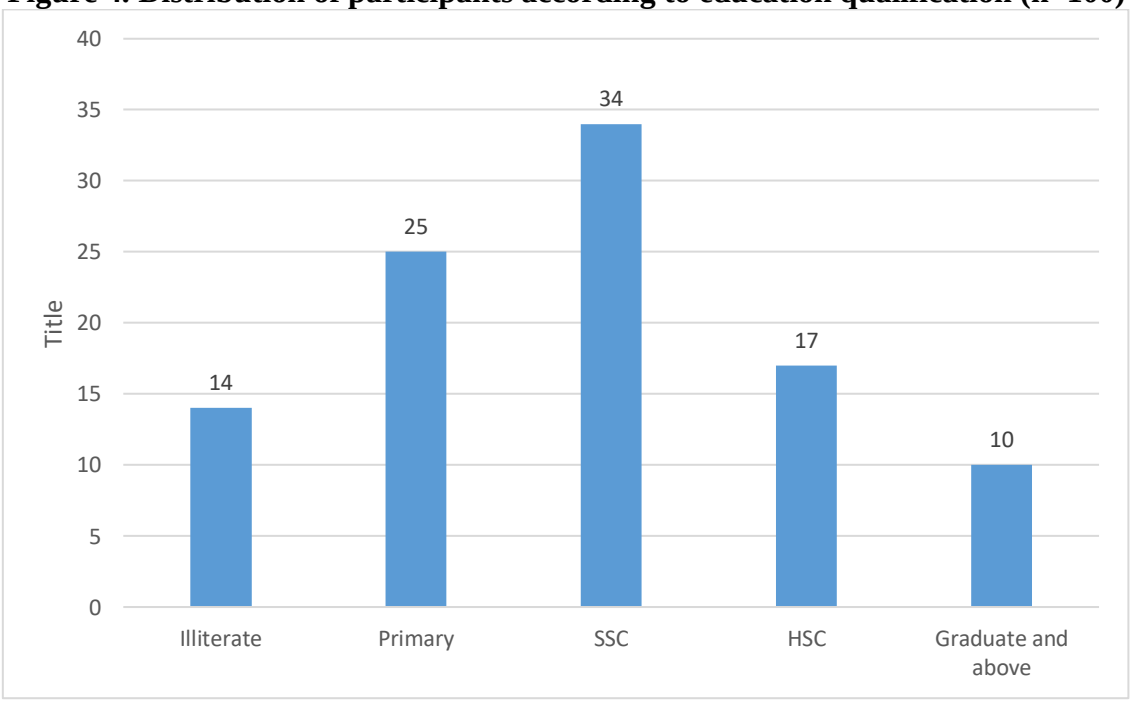
ISSN No:-2456-2165

Figure 3. Participant distribution according to accommodation place(n=100)



This pie chart shows that fifty-eight percent participants came from rural(blue) area and 42% participants came from urban(orange) area.

Figure 4. Distribution of participants according to education qualification (n=100)



This bar diagram shows that among 100 participants, 34% completed SSC, 25% completed primary, 17% completed HSC and 10% completed graduation and above. Fourteen percent participants were illiterate.

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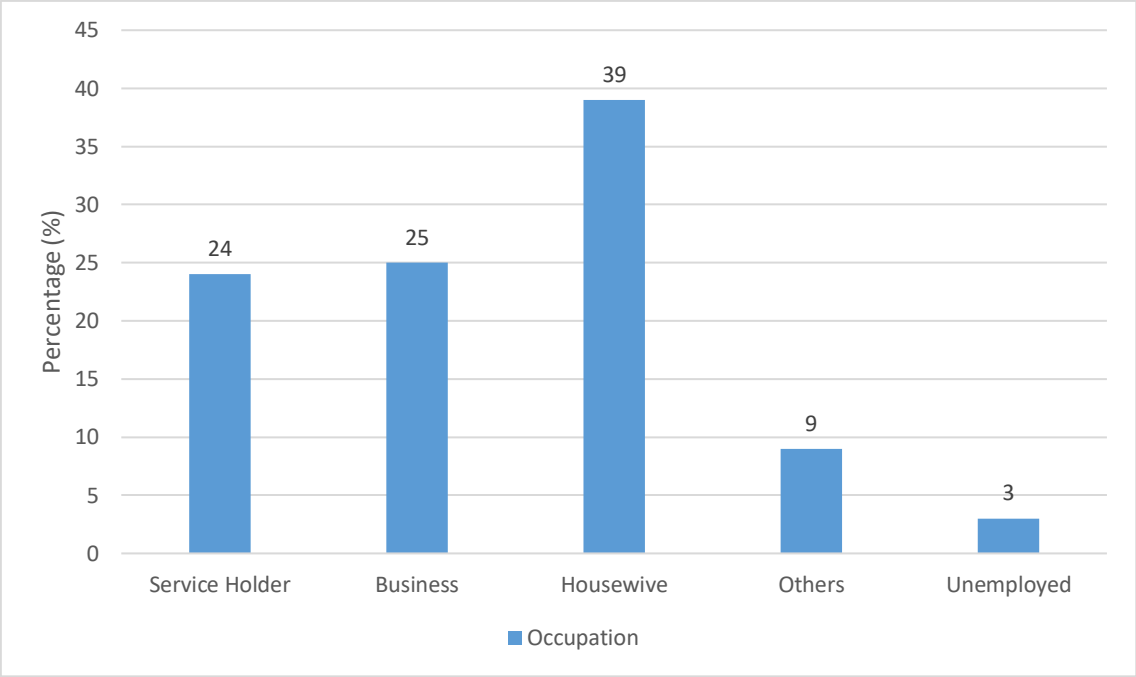
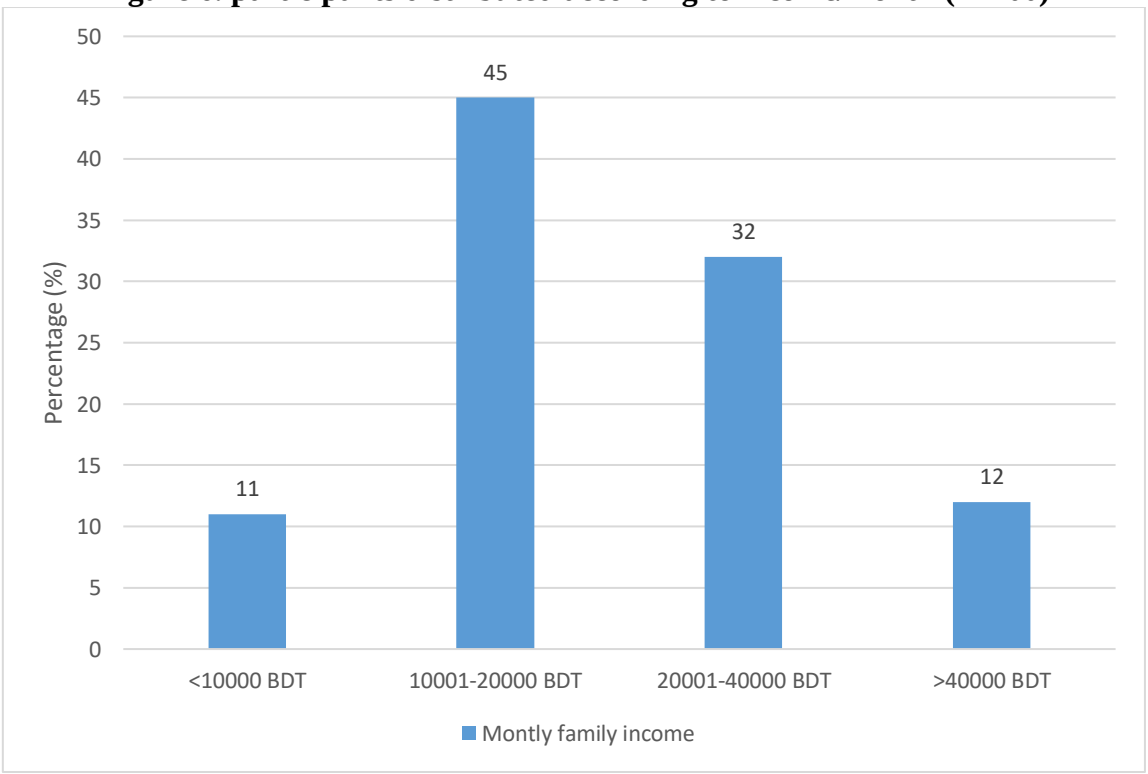
Figure 5. Distribution of participants according to occupation (n=100)



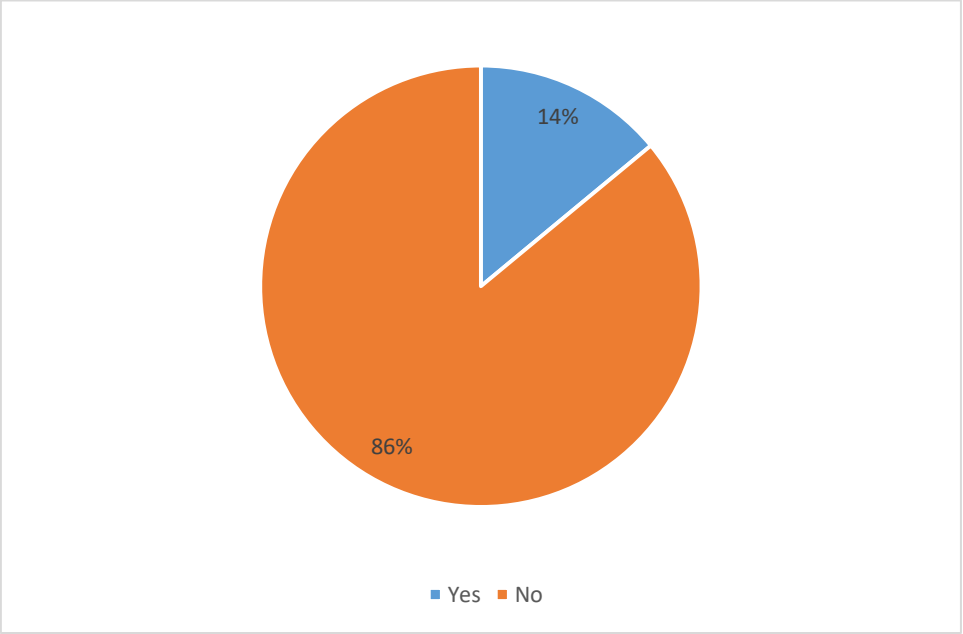
This bar diagram shows that majority of the participants were housewives (39%), followed in decreasing order by businessman (25%), service holder (24%), and others (9%). Other jobs included day labourer, rickshaw-puller and farmer. Three percent (3%) participants were unemployed.

Figure 6. participants distributed according to income/month (n=100)



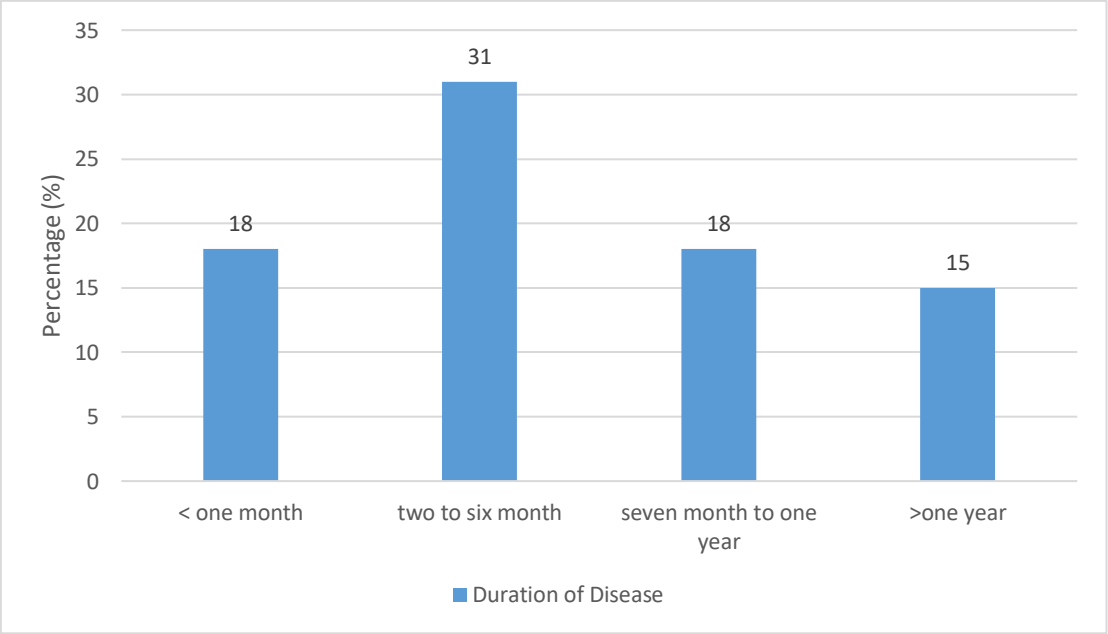
This bar diagram shows that majority of the participants had income between 10001- 20000 BDT (45%).

Figure 7. participants distributed according to family history of neuromuscular disease (n=100).



This pie chart shows that among all 14% participants had family history of the corresponding neuromuscular disease.

Figure 8. Distribution of participants according to duration of disease (n=100).



This bar diagram showed among all 31% had their disease for two to six months, 18% had for seven month to one year, another 18% had less than one month and 15% participants had disease for more than one year.

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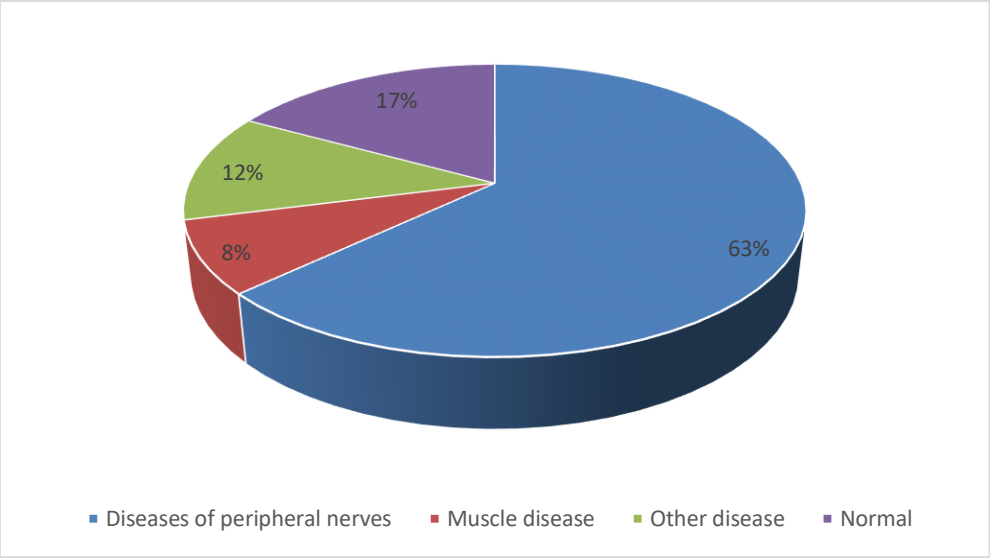
Figure 9. Distribution patients according overall diagnosis (n=100).



This pie chart shows that among all participants in the study, 63% were diagnosed as having disease of peripheral nerves, 8% had muscle disease, 12% had other diseases and 17% patients had normal neurophysiologic study.

At NCS carpal tunnel syndrome was the most common diagnosis (n=20). Polyneuropathy was the most common disease of peripheral nerves (28%) and among them GBS was the most common diagnosis (10%). Peripheral nerve entrapments was the second common diagnosis (26%) which mainly consisted of carpal tunnel syndrome (20%). Rest of the distribution is given in table 1.

Table 1. Diseases diagnosed at nerve conduction studies (NCS) (n=63)

Diagnosed disease	Percentage (%)
Peripheral nerve entrapment	**26**
Carpal tunnel syndrome	20
Mononeuorpathy	6
Ulnar nerve	3
Peroneal nerve	2
Lateral cutaneous nerve	1
Polyneuropathy	**28**
GBS	10
AMAN	2
AIDP	3
AMSAN	2
MFS	1
CIDP	6
Mononeuritis Multiplex	2
Hereditary Neuropathy	2
Truamatic Neuropathy	2
Plexopathy	**1**
Radiculopathy	**1**
Disease involving motor neurons	**7**
Motor neuron disease	5
Anterior Horn Cell	2

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GBS: Gullein Barre Syndrome; AMAN: Acute motor axonal neuropathy; AIDP: Acute inflammatory demyelinating polyneuropathy; AMSAN: Acute motor sensory axonal neuropathy: MFS: Miller Fisher Syndrome; CIDP: Chronic inflammatory demyelinating polyneuropathy

Table 2. Diseases diagnosed at Electromyography (EMG) (n=8)

Diagnosed disease	Percentage (%)
Muscle disease	**6**
Noninflammatory myopathy	4
Inflammatory myopathy	1
Myotonic dystrophy	1
Neuromuscular Junction Disorder	**2**
Myasthenia Gravis	2

Table 2 shows that total eight patients were found to have muscle disease. Six patients had muscle disease and 2 patients had neuromuscular junction disorder.

Table 3. Distribution of other diseases diagnosed (n=12)

Other diseases	Percentage (%)
Stroke	1
Cerebral palsy	2
Myelopathy	3
Adhesive capsulitis	2
Fibromyalgia	1
Conversion disorder	3

Results shows that total 12 patients had such other problems. Among them 3 had myelopathy, 2 had cerebral palsy and 1 had stroke. Also another 3 had conversion disorder, 2 had adhesive capsulitis and 1 had fibromyalgia.

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CHAPTER: FOUR
DISCUSSION

Discussion

Nerve conduction study is a crucial addendum of the history and examination.It is crucial to evaluate cranial and peripheral neuromuscular disease. Spinal cord lesions can be diagnosed along with the localization of the lesion and determination of the exact pathological disease process can be identified. This study was done to audit the prevalence of different types of neurological and muscular disorders in patients who were referred for neurophysiologic study in the department of neurology of DMCH.

Total 100 participants were selected for inclusion. Mean age was 44.97±13.39 years and majority patients belonged to age group 41 – 50 years (34%). This is very similar to the findings of Chowdhury et al[46] who conducted a similar study in the National Institute of Neurological Disease in 2013. They reported a mean age of 48.11±17.3 years. They also found majority patients majority patients aged between 41 to 50 years (349 out 1372).

In the present study majority patients were male (55%) and rest (45%) were female. Studies conducted in Dhaka Medical College Hospital showed that the age and male sex related increase of neurological disorders are a common observed traits. Chowdhury and colleagues[46] in their study found 55.2% male which is same as that of this study.

Among all 58% patients were resident of rural area and 42% were from urban area. In Dhaka Medical College Hospital, Dhaka, Bangladesh, patients from all around the country comes for treatment, this represents national residence distribution of the country. According to a World Bank estimate in 2017, 64.14% patients lived in rural area of Bangladesh[49]. Arsenic toxicity is an important cause of toxic neuropathy which is strongly related with geographic distribution. As rural population are subject to use arsenic rick tube-well. A geographic link needs to be investigated.

Majority patients completed SSC (34%) and followed by 25% completing primary education. Fourteen percent patients were illiterate in this study. According to a survey conducted in 2012 published by UNICEF primary school completion rates were 66.2% in Bangladesh and secondary school attendance rate was 42.9% for female and 47% for male[50]. Therefore findings of the present study mimics current educational trend in the country and has no particular disease association.

Majority of the patients were housewives (39%) followed in decreasing order by 25% businessman, 24% service holders, 9% others and 3% were unemployed. In comparison Tegueu et al[51]found 31.8% service holders, 17.65% businessman, 17.54% housewives, and 9% retired along other occupation. This shows that neurological and muscular diseases were found across all categories of occupation and monthly family income.

Among all patients 14% had family history of respective neuromuscular diseases. Hereditary neuropathies[52],MND[53] and hereditary muscular dystrophy[54] patients are more likely to give positive family history of that disease alongside others.

Overall 17% patients had normal neurophysiologic study. Chowdhury et al found 19.1% subjects having normal NCS and EMG in their study.

At NCS the most common diagnosis (20%) among all patients was carpal tunnel syndrome. In the United States the most common focal mononeuropathy is carpal tunnel syndrome (CTS), which is a major cause of disability[55]. Thakur et al found CTS to be the second most common electrophysiologic diagnosis[56]. There is considerable controversy regarding the need for electrophysiology in carpal tunnel syndrome.

Electrophysiology has been proposed as the standard of care for diagnosing carpal tunnel syndrome with a recommendation that it should be performed before surgery in all cases[57]. This view has been supported by recent articles D'Arcy in JAMA[58] and the Bland in BMJ[59].

Among patients having nerve entrapment (26%), 6 patients had mononeuropathy. Among 6 patients, 3 had ulnar nerve entrapement, 2 had peroneal nerve entrapment, and 1 had lateral cutaneous nerve involvement. The most frequent focal neuropathy in lower extremity is peroneal neuropathy [60], while the second most common neuropathy in upper limb is ulnar neuropathy [61]. *In this study* ulnar neuropathy was more common. For evaluation of these neuropathies Electrodiagnosis can play a major role. The diagnosis of a mononeuropathy; to localize the lesion in the wrist, forearm, or elbow; and from differentiation of mononeuropathy from plexopathy, radiculopathy, polyneuropathy as well as from motor neuron disease. In adiition,EDS provides valuable prognostication. [62,63].

As a whole polyneuropathy was the most common diagnosis constituting 28% cases. Among them 10 cases were GBS. In Bangladesh the crude incidence rate of GBS ranges from 1.5-1.7/ 100,000/year[64]. AIDP was found in 3 patients (30% among GBS). In contrast Islam et al[65] et al found 56% AMAN cases and Ye et al[66] found 54% AMAN cases. But, similar to this study AIDP was found more frequently in the study by Chowdhury et al[46]. In this study patients from all age groups were taken. On the other hand,they had done the research in patients who are less than 15 years old. Studies in Variation in the results also observed in Indian research study considering that AIDP or demyelinating subtype being more common in this region[67].

Multifocal demyelination is a diagnostic hallmark of CIDP[68]. In this study CIDP was found in 6 patients. CIDP may occur secondary to other disease. Thakur et al. found chronic axonopathy to be the most common neuropathy in their series of nerve conduction study.[11] A North Indian study showed that Diabetes Mellitus (DM) was responsible as a cause of CIDP in 16 cases among 65 patients.[69]

Electrophysiology allows identification of Lower Motor Neuron (LMN) features of MND in both clinically affected and as yet clinically silent regions and thus helps to make an earlier working diagnosis. The present study found 5 cases of motor neuron disease. Common characteristics of MND in electrophysiology include evidence of active denervation (positive sharp waves, fibrillation potentials, fasciculation potentials) and chronic denervation evidenced by large motor unit potentials[70].

At EMG 2 cases of Myesthenia Gravis was found and 4 cases of noninflammatory myopathy was noted. Neurophysiologic methods are of great importance in order to recognize myasthenic patients among those with muscle fatigability and to follow the effect of different therapeutic measures[71]. Chowdhury et al found muscle disorder to be 0.3% of all neurological disorders[46].

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CHAPTER: FIVE
STUDY LIMITATIONS

- This study was conducted in single centre
- Small Sample size
- Purposive convenient sampling were taken
- Study design was cross-sectional

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CHAPTER: SIX
CONCLUSION

Electro-diagnostic labs often receive a wide array of neurological condition to perform the electrophysiological tests. If done by skilled person these investigations can play a pivotal role in management and prognosis. Peripheral neuropathy was found as the most frequent diagnosis in this study followed by muscle disease. Among entrapment, Carpal tunnel syndrome was the commonest and GBS was the common among polyneuropathy cases. However, further larger study is needed to validate the findings.

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RECOMMENDATIONS

Depending upon the study findings, following recommendations are suggested that

1. This findings could valuable for the physicians during diagnosis.
2. Electrophysiology should be popularize for evaluation of Neuro muscular disease
3. Electrophysiology Lab should be established in every Medical College Hospital

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