

**Aetiological and demographic profile of patients who had undergone electro diagnostic studies**

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Abstract**Background**

Electrodiagnostic (EDX) studies are an important diagnostic modality in the evaluation of patients with neuromuscular disorders. It is an extension of clinical examination and hence to be performed by a physician with in depth knowledge of electro and neurophysiology. EDX studies utilize principles of electrophysiology to delineate neuro physiological disorders for diagnostic confirmation, prognostication and for assessment of efficacy of management. Though this modality is extensively used by the department of Physical Medicine and Rehabilitation; an analysis on profile of patients who underwent the procedure is lacking; hence in this study an attempt was done to delineate the aetiological and demographic profile of such patients; so that the results can be utilized for the betterment of services for patients with neuromuscular disorders.

Materials and Methods

It is a descriptive study based on secondary data of hospital records of 500 patients who have had EDX studies in the electrophysiology laboratory which is functioning at the Physical Medicine and Rehabilitation centre of a tertiary care hospital for a period of two years from June 2015 to May 2017.

Results

Out of 500 cases studied 337 were females (67.4%), 163 males (32.6%) with F: M = 2:1. Age ranges from 2 years to 81 years with a mean age of 40.5. Majority belongs to 30 to 60 years age group (75.6%). Most commonly performed EDX study is nerve conduction study (93.8%); which was done for the evaluation of carpal tunnel syndrome (61.4%), peripheral nerve injury (32.6%), Hansen's disease (6.4%) and Guillain Barre Syndrome, motor neuron disease etc(6.2%). CTS was more among females (86%) but peripheral nerve injury was more among males (64.6%).

Conclusion

Most commonly done EDX investigation was Nerve conduction study. Carpal tunnel syndrome was the most common indication for EDX. CTS was more common in females and post traumatic peripheral nerve injury among males.

Keywords: Electrodiagnostic studies, Carpal Tunnel Syndrome, Peripheral Nerve Injuries, Hansen's disease.

1. Background

Electrodiagnosis is the field of study that, by employing the science of electrophysiology, uses electrical technology to study human neurophysiology. Neurodiagnostics (NDS), Electromyography (EMG), and Evoked potentials (EPs) are aspects of electrodiagnosis. Information needed to answer any questions regarding nerve / muscle injuries, muscle disease, localization, and

prognosis can be obtained through electrodiagnostic testing. This information should help to focus treatment on the exact site of injury¹.

It is one of the important diagnostic modalities used by the department of Physical Medicine and Rehabilitation for diagnostic and prognostic work up of neuromuscular disorders. Interestingly, the information provided by electrodiagnosis is functional and not static, telling the practitioner how the nerve and muscle are functioning. In contrast, a magnetic resonance imaging (MRI) study is a static test that simply provides a picture of anatomy. A relatively benign appearing MRI scan can be obtained from a patient with significant pain. Conversely, MRI scans may reveal disk protrusions and herniations in many people who are asymptomatic. Therefore, electrodiagnostic testing can be an important adjunct in clinical diagnosis^{2,3,4}.

Though this diagnostic modality is routinely used by the department of Physical Medicine and Rehabilitation for diagnostic and prognostic work up of neuromuscular disorders; there are not many studies to illustrate aetiological and demographic profile of patients who have had such studies; hence here we try earnestly to undertake such an effort. This is a descriptive study based on secondary data from hospital records of electrodiagnostic laboratory attached to the department of Physical Medicine and Rehabilitation of a tertiary care teaching hospital in Kerala.

Objectives

1. To delineate the etiological profile of patients who underwent electrodiagnostic studies in our department.
2. To describe their demographic profile.

Electro diagnostic (EDX) studies and CTS

CTS is one of the important indications for EDX studies; it's equally important for diagnostic confirmation, risk

stratification, exclusion of differential diagnosis and also to assess the response to treatment. Carpal tunnel syndrome (CTS) is a clinical syndrome of numbness, tingling, burning, and/or pain associated with localized compression of the median nerve at wrist⁵. It is the most commonly reported nerve compression syndrome, accounting for 0.2% of all U.S. ambulatory care visits in 2006⁶ and over 5,00,000 carpal tunnel releases in 2006⁷. 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 absolute median nerve latency in documenting the median nerve abnormalities consistent with CTS⁸. Sensory fibers have a larger proportion of large myelinated fibers, which have a higher energy requirement, and thus are more susceptible to ischemic damage⁹. 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^{9, 10}. 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 diagnosis⁸. 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 size¹¹. Wrist index and metacarpal index

are two significant anthropometric factors associated with CTS¹². CTS occurs more among females^{13, 14, 15}. Many studies suggest that reason for this gender difference was due to: 1) The carpal tunnel cross sectional area relative to the size of the hand is constitutionally smaller in women than in men¹⁶. 2) The less compliance of carpal tunnel against indentation force among females than men¹⁷.

Peripheral nerve injuries and EDX studies

Electrodiagnostic tests are essential in the evaluation of nerve injuries¹⁸. They are helpful in localizing the site of injury, such as differentiating lower cervical root, lower trunk of brachial plexus injury, or ulnar neuropathy¹⁸. They allow distinction of conduction block (neurapraxia) from axonal degeneration. They also provide important prognostic information for guiding patient management. Electro physiologic testing, like the clinical examination or arthroscopy, is dependent on the skills of the examiner. In an individual patient, the approach is designed to extend the physical examination and must be redirected during the course of the study by the initial electrodiagnostic findings. Therefore, these studies are best performed by physicians trained in EMG and neuromuscular disorders¹⁸. An understanding of nerve response to injury determines the optimum time for these studies to be performed. Timing examinations appropriately reduces the chances of obtaining inconclusive results. There are few situations in which immediate examination after nerve injury is useful. The most informative results will be obtained after 10–14 days. Subsequent examinations are useful to document ongoing recovery, especially when other therapeutic procedures are under consideration. Intra operative studies may be invaluable in identifying the appropriate circumstance for nerve grafting¹⁸. NCS and needle EMG, by providing details of the physiologic features of the

nerve injury, are extremely useful adjuncts to the clinical neurologic examination and provide important information to help guide therapeutic management¹⁸. Peripheral injuries occur more among males. This may be due to the type of vocational/avocational activities in which males are more engaged which makes them prone for orthopedic and hence neurological trauma¹⁸. Studies by Kouyoumdjian JA, Graca CR, Ferreria VF¹⁹, Morell RC, Prielipp RC, Horwood TN et al²⁰ and Soheil Saadat, Vahid Eslami, Vafa Rahimi et al²¹ have also substantiated that males are more prone for peripheral nerve injuries than females.

EDX studies and Hansen's disease

EMG and NCV studies give support to the notion that segmental demyelination with axonal preservation is the initial form of nerve involvement in leprosy²². However, small unmyelinated and myelinated fibers are involved early in the disease. There is extensive involvement of peripheral nerves in leprosy, but statistically some specific nerves and sites predominate. The view that more superficial and therefore cooler nerve paths are preferentially involved in leprosy is challenged by a recent report of involvement of the phrenic nerve²². Both EMG and NCV are more sensitive than clinical examination and EMG may be even better than muscle biopsy in the detection of muscle denervation in leprosy. There is not a consensus as to whether EMG or NCS is the most sensitive technique in the detection of early neural involvement in leprosy. Serial EMG and NCS studies are useful for assessing the effects of medical therapy and for surgical indications in neural leprosy²².

EDX studies and Guillain Barre Syndrome

Electrodiagnostic studies diagnostic in >95% cases in early GBS²³. Nature and severity of physiologic findings dependent on timing of study, number of nerves studied, and whether proximal nerve segments investigated; there

is multifocal demyelination affecting proximal and distal nerve segments. Typically abnormal or absent F waves may be initial sole abnormality and in the present study F-wave unrecordable was seen in about 40-60% of cases studied. In 41.86% H reflex were unrecordable and 23.26% showed prolonged latencies¹⁴. Also markedly reduced CMAP amplitudes were seen in high percentage (40-70%) of participants in almost all the nerves. Conduction block was seen in about 57.14% of cases; with conduction slowing and temporal dispersion reflect demyelination. Evidence of SNAP or CV abnormality seen in about 34.69% of cases; 03 patients that showed unexcitable nerves early²³. Weak to moderate correlation between the degrees of weakness was seen in the hand with CMAPs of median & ulnar nerves²³.

EDX and Myopathies

The muscular dystrophies are a group of hereditary, progressive muscle disorders characterized by necrosis of muscle tissue and replacement by connective and fatty tissue²⁴. The best known muscular dystrophies are the dystrophinopathies (Duchenne muscular dystrophy [DMD] and Becker muscular dystrophy [BMD]), which are caused by mutations in the gene encoding the muscle protein dystrophin²⁵. EDX testing is of limited utility in the dystrophinopathies, particularly when there is a positive family history. Definitive diagnosis requires genetic testing and, at times, muscle biopsy. EDX testing may be helpful, however, in sporadic cases of DMD and in BMD, which may have a more benign phenotype and a broader differential diagnosis. If needle EMG is performed in a patient with a dystrophinopathy, it typically reveals increased insertional and spontaneous activity in the form of fibrillation potentials and PSWs, along with brief, small, polyphasic MUAPs with early recruitment. In the end stages of the disease, however, when muscle is replaced by connective and fatty tissue,

the insertional activity is reduced and a mixed population of short and long duration MUAPs might be appreciated, reflecting the chronicity of the disease process^{26, 27}. EDX testing is more helpful in the other muscular dystrophies, in which CK levels may be only mildly elevated and the differential diagnosis is broader. EDX findings again include abnormal spontaneous activity (fibrillation potentials and PSWs) and short, small, polyphasic MUAPs with early recruitment. The pattern of muscle involvement, such as limb girdle versus distal, depends on the specific disease process²⁴.

2. Materials and Methods

This study entitled “Aetiological and demographic profile of patients who had undergone electro diagnostic studies” is a hospital-based study carried out in the Department of Physical Medicine and Rehabilitation, Government TD Medical College, Alappuzha, for a period of two years from June 2015 to May 2017 to evaluate the etiological and demographic profile of persons who were investigated in the electrodiagnostic (EDX) laboratory which is functioning in the department. This was a descriptive study on secondary data of hospital records conducted by evaluating the records of the EDX lab.

Statistical Analysis

A total of 500 patients who were evaluated in the electrophysiology lab during the study period were included in the study. All the data were entered in Microsoft excel sheet, rechecked and analysed with SPSS16 statistical software. For statistical analysis of categorical variables Spearman’s Rho test and for continuous variables descriptive statistics were used.

3. Results

Total number of cases studied was 500. Age of patients ranged between 2 years to 81 years; with a mean age of 44.6. 75.6 % belonged to the 30 to 60 year age group. 337

of them were females (67.4%) and 163 were males (32.6%) with a female: male ratio 2:1.

The most common type of EDX investigation conducted at this department was NCS (Nerve Conduction Study) (93.8 %). EMG (Electro Myography) was done in 31 persons (6.2%).

The most common indication for doing nerve conduction study was Carpal Tunnel Syndrome (61.4%). In 130 (26%), it was done for those with a history of post traumatic peripheral nerve injury and in another 32 (6.4%) for peripheral nerve injury due to Hansen’s disease. Few cases of Guillain Barre Syndrome, Spinal muscular atrophy and Muscular dystrophy were also seen.

CTS was more commonly seen among females. 86% of those with CTS were females. But post traumatic peripheral nerve injuries were more among males (65% Vs 35%).

4. Discussion

Electrodiagnosis is routinely used by the department of Physical Medicine and Rehabilitation for diagnostic and prognostic work up of neuromuscular disorders; but unfortunately there are not many studies from this specialty to illustrate aetiological and demographic profile of patients who have had such studies. Hence we conducted this study at the electrodiagnostic lab of the department of Physical Medicine and Rehabilitation at TD Medical College, Alappuzha.

In this series out of the 500 cases studied; 307 patients belongs to CTS group (61.4%). Among them; 264 were females and only 43 males. Hence in this series also; CTS was seen more among females and was fully agreeing with the literature ^{13, 14,15,16,17.}

Post traumatic peripheral nerve injuries formed the second biggest group; 130 cases which comprised of 26% of study population. Out of 130 cases of peripheral nerve injuries; 84 were males and only 46 females. The male

predominance among post traumatic peripheral nerve injury among males was also in accordance with the literature^{18, 19, 20,21}.

36 persons were suffering from nerve involvement due to Hansen’s disease. A higher number of cases of peripheral nerve injury due to this single disease might be due to the fact that the majority of HD cases in the World being reported from India²⁸.

5. Charts and Figures

Age group	Number	Percentage
<10 years	9	1.8 %
11-20 years	19	3.8 %
21-30 years	49	9.8 %
31-40 years	109	21.8 %
41-50 years	175	35 %
51-60 years	94	18.8 %
60+ years	45	9 %

Table 1: Distribution of age

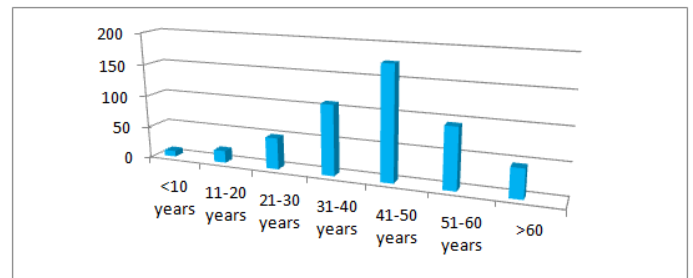


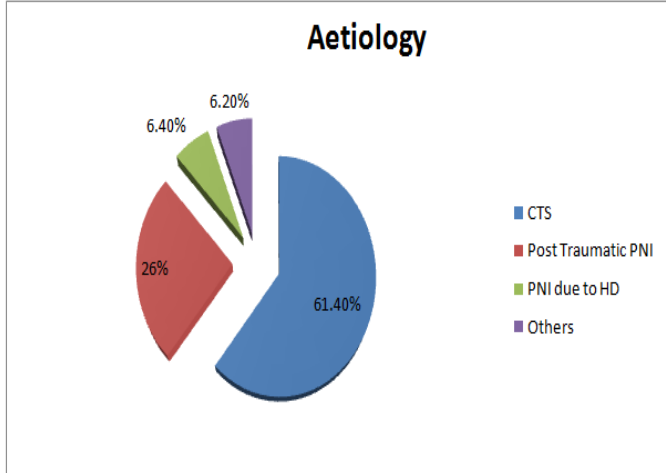
Figure 1: Distribution of age

Diagnosis	Number	Percentage
CTS	307	61.4%
Post traumatic Peripheral Nerve Injury	130	26%
Peripheral Nerve Injury due to HD	32	6.4%

Others	31	6.2%
Total	500	100%

CTS: Carpal tunnel syndrome; HD: Hansen’s disease

Table 2: Aetiology



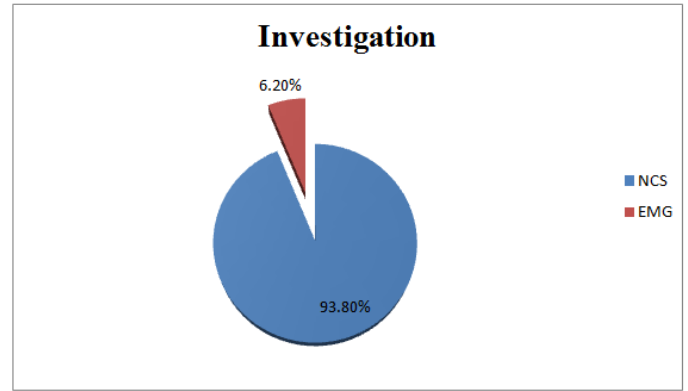
CTS: Carpal tunnel syndrome; Post traumatic PNI: Post traumatic Peripheral Nerve Injury; PNI due to HD: Peripheral Nerve Injury due to Hansen’s disease

Figure 2: Aetiology

Test	Number	Percentage
NCV	469	93.8%
EMG	31	6.2%
Total	500	100%

NCS: Nerve Conduction Studies; EMG: Electro Myo Graphy

Table 3: Distribution of intended Electrodiagnostic investigation



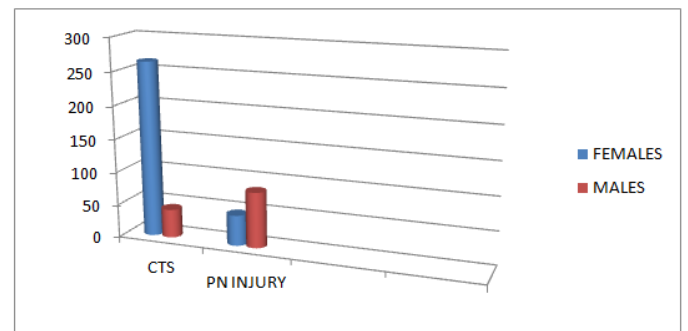
NCS: Nerve Conduction Studies; EMG: Electro Myo Graphy

Figure 3: Distribution of intended Electrodiagnostic investigation

Gender	CTS	PN INJURY
Female	264	46
Male	43	84
Total	307	130

CTS: carpal Tunnel Syndrome; PN injury: Peripheral Nerve Injury

Table 4: Gender Distribution of CTS and Peripheral Nerve Injury



CTS: carpal Tunnel Syndrome; PN injury: Peripheral Nerve Injury

Figure 4: Gender distribution of CTS and Peripheral Nerve Injury.

6. Conclusions

This hospital records based descriptive study could reveal the following points.

1. Most commonly done EDX investigation was Nerve conduction study (93.8 %).
2. EDX studies were more attended by females (67.4%) than males (32.6%).
3. Most common indication for doing Nerve conduction study was Carpal Tunnel Syndrome (61.4%).
4. Most common age group that underwent EDX study belongs to 30-60 years (75.6%).
5. CTS were more commonly seen among females (86% Vs 14%) but Peripheral nerve injuries were more among males (65% Vs 35%).

6. References

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