

## AN ANALYSIS OF NERVE CONDUCTION STUDY: DEMOGRAPHIC AND ELECTROPHYSIOLOGICAL CHARACTERISTICS

\*Dilip Thakur<sup>1</sup>, Bishnu Hari Paudel<sup>1</sup>, Nirmala Limbu<sup>1</sup>

Department of Basic & Clinical Physiology; B. P. Koirala Institute of Health Sciences, Dharan

### ABSTRACT

Nerve conduction study (NCS) assesses peripheral nerve functions and is indicated in nerve or/and muscle disorders. This retrospective NCS done in Neurophysiology lab of BPKIHS, aimed to explore the pattern of neurological disorders, demographic and electrophysiological profile of patients' referred for NCS. Demographic profiles, provisional clinical and electrophysiological diagnoses of 475 patients' recorded from Nov 2006 to Aug 2010 were analyzed using descriptive statistics. Pearson's Chi-squared test was used to find correlation between clinical and electrophysiological diagnoses. Age of the patients' ranged from 2.5 to 88 (41.5±18.6) years. Middle age (36-60 years; n=203, 42.73%) group was the most commonly referred. Males (n=284, 59.8%) were referred more with tingling sensation (n=71, 17.88%) as the commonest complaint followed by weakness of extremities (n=64, 16.12%). Maximum cases were electro-diagnosed as neuropathy (n=314, 66.1%), chronic axonal type (n=169, 53.82%) being the most common followed by carpal tunnel syndrome. Mixed nerves (n=186, 60.8%) were most commonly involved followed by motor (n=74, 24.18%), and sensory nerves (n=46, 15.03%). A significant correlation (p<0.01) was seen between clinical and electrophysiological diagnoses. This study showed different pattern of neurological disorders and confirmed the correlation of electrophysiological diagnoses with provisional clinical diagnoses.

**Keywords:** electrophysiological diagnoses, nerve conduction study, neuropathy

### INTRODUCTION

Our Clinical Neurophysiology lab gets requisition referrals for nerve conduction studies (NCS) and needle electromyography (EMG). Majority of such

referrals expects electro diagnosis of nerve/muscle and/or NMJ disorder. The diagnosis reached at the end of these electro-diagnostic assessments are usually neuropathy or myopathy<sup>3</sup>. NCS and EMG being the major components of the electro-diagnostic assessment, enable the presence and extent of peripheral nerve pathology yielding a better diagnostic value<sup>1</sup>.

Motor and sensory NCS assess peripheral motor and sensory functions by recording the evoked response to stimulation of peripheral nerves<sup>2</sup>. Motor (CMAP: compound muscle action potential) and sensory (SNAP: sensory nerve action potential) nerve parameters includes latency, amplitude, duration, conduction velocity, F-waves. The nerve conduction study is an extension of clinical neurological examination. Some of the most common indications are focal or diffuse weakness, focal or diffuse numbness, muscle cramps etc and usually indicated in peripheral neuropathy of any origin.

Peripheral neuropathy is a common neurological disorder<sup>4</sup>. Many diagnostic tests and procedures have been developed and are used for the evaluation of patients with neuropathy<sup>5</sup>. Characterizing neuropathy is helpful in differential diagnosis of polyneuropathy. This study aimed to learn the demographic & electrophysiological profile of patients as well as the relation between electrophysiological and clinical diagnoses. In addition, it attempted to describe the pattern of neurological disorders.

### MATERIALS AND METHODS

A database including demographics, provisional clinical diagnosis, and electrodiagnosis of all the patients' is maintained at the Clinical Neurophysiology of BPKIHS, Dharan in a standardized fashion. We retrospectively analyzed these NCS that was done from Nov 2006 A.D to Aug

#### \*Corresponding author:

Email: dilip7bp@gmail.com;  
dilip.thakur@bпкиhs.edu

2010. The electrophysiological diagnoses made then, were based on NCS and/or EMG studies<sup>1</sup>.

Data including demographic profiles, provisional clinical diagnosis and electrophysiological diagnosis of the patients were tabulated. Then the electrophysiological findings were classified into normal or abnormal, if abnormal then categorized according to underlying pathology i.e. whether the neuropathy is of axonal or demyelinating or mixed type. The type of nerve fiber involved whether motor, sensory or both were tabulated. Lastly, the clinical and electrophysiological diagnosis was correlated. In this way, an overall profile of all cases was made by using descriptive statistics. Pearson's Chi-squared test was used to find the correlation between clinical diagnoses and electrophysiological diagnoses.

## RESULTS

The total number of referred patients to Neurophysiology laboratory of Department of Physiology, BPKIHS was 475 during November 2006 to August 2009.

Demographic profiles of patients referred for NCV

### Age and Sex

Age of the patients ranged from 2.5 years to 88 years with mean age of 41.5±18.6 years. 59.8% were males. The most common age group was 36-60 years in both the gender (see table 1 & 2).

### 1. Chief complaint of patient

Most common complain of patients was tingling sensation (n=71, 17.88%) followed by weakness of extremities (n=64, 16.12%), tingling sensation with numbness (n=26, 6.54%), tingling sensation as well as burning sensation (n=15, 3.78%), tingling sensation with weakness (n=14, 3.52%), loss of sensation (n=14, 3.52%), burning sensation (n=14, 3.52%), pain (n=11, 2.78%), and pain & tingling sensation (n=9, 2.26%).

### 2. Provisional clinical diagnosis

Out of 475 total cases, surprisingly, provisional clinical diagnosis was not mentioned in the NCV requisition form in 102 (21.47%) cases. Peripheral neuropathy was provisionally diagnosed in 110 (29.34%) patients. 33 (8.4%) patients were referred for NCV as diabetic neuropathy. Carpal tunnel

syndrome, GB Syndrome, Hansens disease, and organophosphorus induced delayed neuropathy were diagnosed clinically in 24 (6.1%), 22 (5.6%), 14 (3.6%), and 9 (2.3%) patients respectively.

### 3. Electrophysiological diagnosis

Out of 475 cases studied, 161 (33.9%) patients showed no evidence of neuropathy and were electrophysiologically diagnosed as normal. Few cases were inconclusive and needed further investigation i.e. needle electromyography (EMG) to reach to electrophysiological diagnosis. In 314 (66.1%) patients diagnosed as neuropathy, the commonest was of chronic axonal type (n=169, 53.82%) followed by acute axonal (n=61, 19.42%), chronic mixed (n=32, 10.2%), acute mixed (n=12, 3.82%), chronic demyelinating (n=6, 1.91%), and acute demyelinating type (n=1, 0.31%). Apart from neuropathy, the more common electrodiagnosis was carpal tunnel syndrome (n=26, 8.28%).

**Table 1: Age group distribution**

Age group (yrs)	Number (n)	Percentage (%)
2.5-14	32	6.73
15-35	164	34.52
36-60	203	42.73
61-88	76	16

**Table 2: Gender distribution**

Gender	Age group	Number (n)	Percentage (%)
<b>Male 284 (59.8%)</b>	2.5-14	19	6.7
	15-35	97	34.15
	36-60	113	39.7
	61-88	55	19.36
<b>Female 191 (40.2%)</b>	2.5-14	13	6.8
	15-35	67	35.1
	36-60	90	47.12
<b>Total (475)</b>	61-88	21	11

### **Type of nerve fibers**

The most commonly involved nerve fibers were mixed nerves (n=186, 60.8%) followed by motor (n=74, 24.18%), and sensory nerves (n=46, 15.03%).

### **Referral Departments**

Maximum numbers of cases were referred from Internal medicine (n=320, 67.4%) department of BPKIHS followed by Orthopedics (n=83, 17.5%) and other departments. 11 (2.3%) cases were referred from the peripheral centers.

### **Correlation of provisional clinical diagnoses with electrophysiological diagnoses**

Out of 475 cases, provisional clinical diagnosis was not mentioned in 102 (21.47%) cases. 373 cases were selected to find the relation between provisional clinical diagnoses and electrophysiological diagnoses. The study showed a significant correlation ( $p < 0.01$ ) between clinical and electrophysiological diagnoses.

### **DISCUSSION**

This study was aimed to know the different pattern of neurological disorders and to understand the relationship between electro-diagnostic study and clinical diagnosis. The pattern of peripheral nerve disorders in this study cannot be taken as representative of actual population prevalence for several reasons such as the difficulties of referral over large distances, lack of familiarity with neurophysiological investigations by practitioners and economic hardships. All play a role in preventing referral. However, the pattern of peripheral nerve disorders found in this report appears to be similar to great extent with some dissimilarity as those observed in other countries. Most of the cases of peripheral neuropathy in our study belonged to fourth to fifth decade with men dominance<sup>6</sup>. The male predominance for neuropathy in our study was also supported by other studies<sup>5,7,8</sup>. This may be due the ignorance of the females about their problems in this part of world. The predominant symptom was tingling sensation followed by weakness of extremities. But, previous study reported weakness as the commonest symptom<sup>7</sup>. In our study, purely sensory manifestations were found in majority of cases followed by purely motor manifestations, and mixed (both sensory and motor) involvement. These findings were contradictory to those reported by

previous studies<sup>9, 10</sup>. In our study, diabetes mellitus was the most frequent cause of peripheral neuropathies<sup>6, 7, 9, 11-14</sup>. The most common clinical diagnoses were diabetic polyneuropathy followed by carpal tunnel syndrome whereas latter was more common in one of the previous study<sup>15</sup>. Some authors found compressive neuropathy as the most common neuropathy, with diabetes being the commonest with noncompressive etiology<sup>16</sup>. The most common form of neuropathy was of axonal type followed by mixed and demyelinating type<sup>5, 7, 17-19</sup>. Contrary to our finding, some authors found mixed type being the commonest followed by demyelinating and axonal type<sup>9</sup>. 33.9% patients with neurologic complaints were electrophysiologically diagnosed as normal as it showed no evidence of neuropathy. This may be due to small fiber neuropathy which is not detected by our machine. Approximately 20% patients with neuropathy remain undiagnosed<sup>20</sup>. Thus, this study showed many similarities and some dissimilarity with previous studies of similar type.

This NCS definitely has some limitations as we know it is difficult to get cooperation from small children while performing the tests. There is a need of addition of devices that can test small nerve fibers (tingling, change in temp. perception, burning feet etc) in our setting. A good cooperation among the referring and reporting doctors/faculties is required to make these electrodiagnostic tests as a more supportive diagnostic tool. It is neither desirable for the patient nor the neurophysiologist to investigate all the different peripheral nerves as well as muscles. Development of neurology super specialty center in our hospital and collaboration with it will definitely add to the quality of the test and the number of patients referred. This study showed the different pattern of neurological disorders: acute, chronic, axonal, demyelinating, mixed neuropathies etc. and confirmed the correlation of electrophysiological diagnoses with provisional clinical diagnoses.

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