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Original Research Article

A Study on Nerve Conduction Velocity of Common Peroneal Nerve in Patient with Sub-Acute Guillain-Barre Syndrome - An Observational Study

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ABSTRACT

Introduction: Guillain-Barre´ Syndrome (GBS) is an acute immune mediated de-mylelinating poly-neuropathy. Worldwide, the incidence of GBS is 0.6-4.0 per 100,000. The disease is very variable in severity that recovers within weeks, due to widespread paralysis of muscles and loss of sensation. Weakness is prominent in leg muscles as compared to arms. In Guillain-Barré syndrome (GBS), foot drop may be seen within the first few days of the illness and may persist for months which are evaluated using Electrodiagnostic method.
Objectives: objective of this study was to find out the Nerve Conduction Velocity of common peroneal nerve of the affected lower extremities in participants with Guillain Barre Syndrome.
Methods: Thirty participants between the ages of 25- 50 years with the clinical diagnosis of Guillain Barre Syndrome with 1- 3month duration. Nerve Conduction Velocity of the Common Peroneal Nerve was studied in participant's right and left lower limbs. Outcome measures used in this study was distal latency, Motor NCV, Sensory NCV, CMAP and SNAP amplitude.
Results: The result of the study suggests that there is symmetrical involvement in both lower limbs in Sub- Acute Guillain Barre Syndrome. This study showed that there was prolonged latency, reduced amplitude & reduced motor nerve conduction velocity and reduced latency, increased amplitude & reduced Sensory Nerve Conduction Velocity of common peroneal nerve in both lower limbs
Conclusion: The present study concluded that there is symmetrical involvement and both sensory as well as motor nerve conduction velocity are affected in sub-acute stage of Guillain Barre Syndrome.

Keywords: Guillain Barre Syndrome, Electrodiagnostic, Distal latency, CMAP amplitude, NCV

INTRODUCTION

Guillain Barre Syndrome (GBS) is an acute immune mediated de-mylelinating poly-neuropathy. [1] The Worldwide, incidence of GBS is 0.6-4.0 per 100,000. Men are 1.5 times more likely to be affected. In the West, incidence increases with age, but in China the incidence of all forms across age groups is more uniform. [2-4]

The term GBS is often considered to be synonymous with Acute Inflammatory Demyelinating Polyradiculoneuropathy (AIDP), but with the increasing recognition over the past few decades of variants, the number of diseases that fall under the rubric GBS has grown to include axonal variants and more restricted variants such as Miller Fisher syndrome (MFS). [5,6]

Clinical features include progressive, symmetrical ascending muscle weakness of more than two limbs, are flexia with or without sensory, autonomic and brainstem abnormalities. Weakness is prominent in leg

muscles as compared to arms; usually presents with numbness and tingling in the feet with absence of fever at the onset of neural symptoms. Cranial nerve involvement may lead to bulbar weakness, oropharyngeal dysphagia and respiratory difficulties. [7,8] The disease is very variable in severity that recovers within weeks, widespread paralysis of muscles and loss of sensation requiring emergency medical attention. [9] The usual manifestations are loss of vasomotor control with wide fluctuation in blood pressure, postural hypotension and cardiac arrhythmias. Respiratory failure occurred and ventilatory assistance required in 30% cases. [10,11]

The main feature of GBS involves segmental demyelination mainly involving the proximal roots close to the dorsal root ganglia. It also involves the distal portions of the motor and sensory fibers in addition to the autonomic nervous system. Depending upon the site of damage and type of nerve fiber involved, the clinical course and clinical expression of GBS varies from individual to individual. Because of the anatomy of the nerves in the lower limbs; foot drop can result from several conditions including GBS. [12]

Electrophysiology represents the most important laboratory study to confirm the diagnosis of GBS in all its forms. [13] Patients with Guillain-Barre Syndrome (GBS) commonly develop a reduction in motor nerve fiber conduction velocity which helps to differentiate the condition from other types of neuromuscular disease. Electrophysiological testing must be done as early as possible after presentation and should be repeated on a weekly basis to further confirm diagnosis and for prognostic purposes. Nerve conduction usually distinguishes between demyelination and primary axonal degeneration, but the timing of nerve conduction studies is important - indices may be normal in the very early stages and when the illness is very advanced the nerves may be unexcitable. [14]

Nerve Conduction Velocity study is a test commonly used to evaluate the ability of electrical conduction of the motor and sensory nerves of the human body. [15] NCV studies assess the peripheral motor and sensory functions by recording the evoked response to stimulation of peripheral nerve. It has an important role in evaluation of peripheral and entrapment neuropathies by confirming the clinical suspicion of neuropathy. It helps in identifying the predominant pathophysiology such as conduction block, demyelination, axonal degeneration and temporal course of disease i.e. acute, sub-acute and chronic. [16] The NCV study provides an objective and qualitative measure of nerve function and also helps in predicting the prognosis of neuropathy. [17] Dependence of nerve conduction parameters on intrinsic factors like age, gender and extrinsic factors like temperature is well known. Reduction in NCV has been found in older age groups as compared to young individuals. [18]

Nerve conduction studies are also used to monitor nerve function over time to determine disease progression, to assess the complications of treatment. [19] Among the various diagnostic tools, Nerve conduction studies are a Gold Standard technique which aid in the early diagnosis of GBS.

Nerve conduction abnormalities become more prominent during the initial weeks of the disease even if patient's clinical status is improving. [20,21] Early nerve conduction findings include abnormal or absent F waves with low CMAP's, an abnormal upper extremity sensory nerve action potential combined with normal sural response and multiple indirect discharges. [22] Electrodiagnostic testing features of acquired demyelination are particularly helpful because these findings are characteristic of immune-mediated demyelinating neuropathies. [23]

The objective of this study is to find out the motor and sensory nerve conduction velocity of common peroneal nerve in patient with sub-acute Guillain Barre` Syndrome.

MATERIALS AND METHODS

The research design used for the study was observational study. Participants included in the study were both male and female individuals with clinical diagnosis of Guillain Barre Syndrome who were referred to Neurophysiotherapy department and who were willing to participate in the study. The sample size included in the study was 30 with convenient sampling.

Equipment: The equipment was used for assessing the motor Nerve Conduction Velocity. For this purpose, RMSEMGEP MARK II was used.

Selection Criteria: The inclusion criteria for the study were: Both male and female participants, Age between 25-50 yrs, Participants with GBS duration more than 1 month and less than 3months. The exclusion criteria for the study were: Diabetes Mellitus duration more than 25 years Alcoholism [chronic], Orthopedic condition- lower limb fracture & trauma, Other neurological condition

Outcome measures:

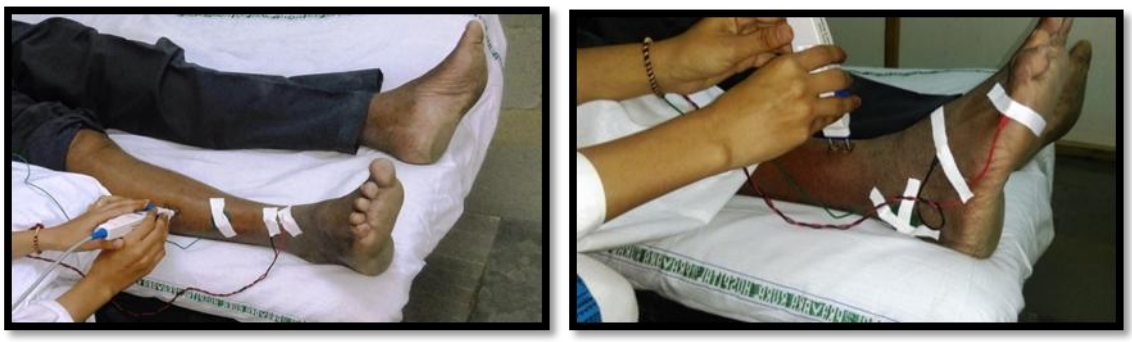
Distal Latency: Latencies are the time interval between nerve stimulation (shock artifact) and the onset of CMAP. CMAP amplitude: CMAP amplitude is usually measured from baseline to negative peak and is expressed in millivolt (mv).

Motor Nerve Conduction Velocity (MNCV): Conduction Velocities is computed measurement of the speed of conduction and is expressed in meter per second.

Sensory nerve conduction Velocity (SNCV): Sensory nerve conduction velocity represents the speed of the fastest, myelinated cutaneous sensory fibres of the nerve.

PROCEDURE

The study received ethical approval from the institutional ethical committee of PIMS, Loni (Ref. no. PIMS/CPT/IEC/2016/16555). The participants were screened and after finding their suitability according to the inclusion and exclusion criteria, they were requested to participate in the study. An informed written consent form was obtained from the participants. The demographic data was obtained and detailed assessment was done. The study variables like Distal latency, CMAP amplitude, Motor Nerve Conduction Velocity, sensory nerve conduction velocity of the Common Peroneal Nerve were assessed. All participants were allocated in a single group. The Distal latency, CMAP amplitude and Motor Nerve Conduction Velocity SNAP, sensory nerve conduction velocity of the Common Peroneal Nerve of the affected lower limbs were obtained from the same participants. The study was performed using NCV as a diagnostic tool.



Placement of the Electrode for Sensory & Motor nerve conduction velocity

DATA ANALYSIS AND RESULTS

The mean age of participants was 38 ± 7.57years. The average age of females was 37.69 ± 7.07 years and for males was 38.64 ± 8.18 years. The gender ratio was 17:13 (17 males and 13 females).

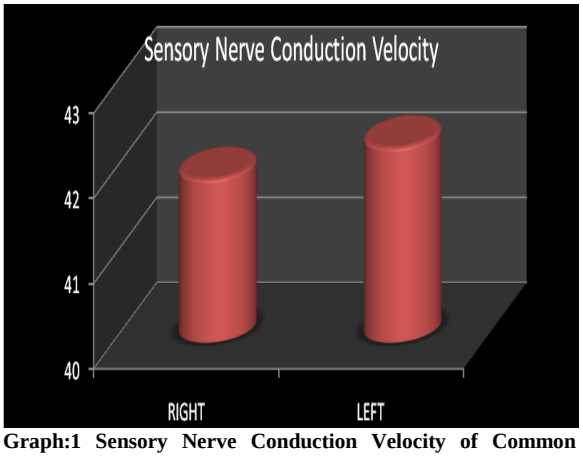
Latency & Amplitude of Sensory Nerve Conduction Velocity: The mean value of latency of the right lower limb was

2.48±0.10ms. & the mean value of latency of the left lower limb was 2.51± 0.13ms. On comparing the latency of the right and left lower limbs of the GBS participants, it was observed that this difference was not significant. (p >0.05 (0.38), t = 0.87 with df = 58). Amplitude of the Common Peroneal Nerve of the participants was measured. The mean value of amplitude of the right lower limb was 10.96± 1.23ms. & the mean value of amplitude of the left lower limb was 11.01± 1.29ms. On comparing the amplitude of the right and left lower limbs of the GBS participants, it was observed that this difference was not significant. (p >0.05 (0.87), t = 0.15 with df = 58).

Table: 1 Latency & Amplitude of Sensory Nerve Conduction Velocity of Common Peroneal Nerve for Both Sides.

	Right (Mean± SD)	Left(Mean± SD)	t value	p value
Latency	2.48±0.10	2.51± 0.13	0.87	0.38 , Not Significant
Amplitude	10.96± 1.23	11.01± 1.29	0.15	0.87, Not Significant

Sensory nerve conduction velocity (SNCV): The SNCV of the Common Peroneal Nerve of the right limb was 41.92±2.40m/s. & SNCV of the Common Peroneal Nerve of the left lower limb was 42.29± 2.09m/s. On comparing the Sensory Nerve Conduction Velocity of the right and the left lower limbs, it was observed that this difference was not significant. (p = 0.519, t = 0.64 with df = 58).



Graph:1 Sensory Nerve Conduction Velocity of Common Peroneal Nerve for Both Side.

Table : 2 Sensory Nerve Conduction Velocity of Common Peroneal Nerve for Both Side.

Right (Mean± SD)	Left (Mean± SD)	t value	p value
41.92±2.40	42.29± 2.09	0.64	0.519, Not Significant

Latency & Amplitude of Motor Nerve Conduction Velocity of Common Peroneal Nerve for Both Sides.

The mean value of latency of the right lower limb was 7.75± 2.59ms. & the mean value of latency of the left lower limb was 6.96± 2.27ms. On comparing the latency of the right and left lower limbs of the GBS participants, it was observed that this difference was not significant. (p >0.05 (0.217), t = 1.248 with df = 58).Amplitude of the Common Peroneal Nerve in the participants was measured. The mean value of amplitude of the right lower limb was 0.93± 0.65 ms.& the mean value of amplitude of the left lower limb was 1.17± 1.15 ms. On comparing the amplitude of the right and left lower limbs of the GBS participants, it was observed that this difference was not significant. (p >0.05 (0.32), t = 0.99 with df = 58).

Table: 3 Latency & Amplitude of Motor Nerve Conduction Velocity of Common Peroneal Nerve for Both Side

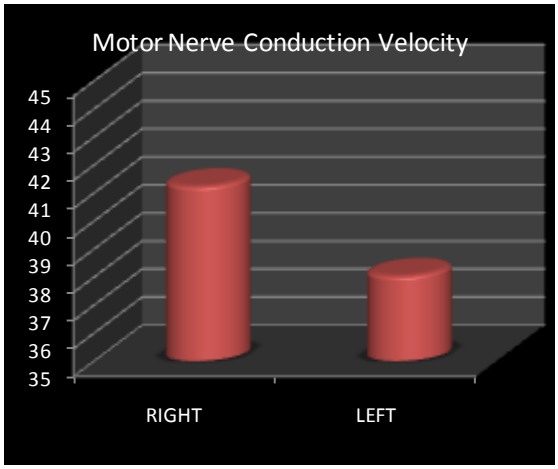
	Right (Mean± SD)	Left (Mean± SD)	t value	p value
Latency	7.75± 2.59	6.96± 2.27	1.248	0.217, Not Significant
Amplitude	0.93± 0.65	1.17± 1.15	0.99	0.32 , Not Significant

Motor Nerve Conduction Velocity of Common Peroneal Nerve: The MNCV of the Common Peroneal Nerve of the right limb was 41.23± 8.98 m/s. & the MNCV of the Common Peroneal Nerve of the left lower limb was 38.03± 7.87 m/s. On comparing the Sensory Nerve Conduction Velocity of the right and the left lower limbs, it was observed that this difference

was not significant. (p = 1.14, t = 1.46 with df = 58).

Table 4. Motor Nerve Conduction Velocity of Common Peroneal Nerve for Both side.

Right (Mean± SD)	Left (Mean± SD)	t value	p value
41.23± 8.98	38.03± 7.87	1.46	1.14, Not Significant



Graph: 2. Motor Nerve Conduction Velocity of Common Peroneal Nerve for Both side.

DISCUSSION

The result Obtained from this study indicated that there was symmetrical involvement of both lower limbs, and there was changes in the distal latency, CMAP, SNAP amplitude, Motor and Sensory Nerve Conduction Velocity of the common peroneal nerve in sub-acute GBS participants. It means that both sensory as well as motor nerve conduction velocity are affected in sub-acute stage of Guillain Barre Syndrome.

Motor nerve conduction velocity:

On observing the motor latency of the Right and Left lower limbs of the GBS participants, the difference was not significant. On observation the CMAP amplitudes of the Right and Left lower limb of sub-acute GBS patients, the difference was not significant. On observation the Motor Nerve Conduction Velocity of the Right and Left lower limb, the difference was not significant.

The present study suggests that there is symmetrical involvement and prolonged latency, reduced amplitude &reduced motor nerve conduction velocity in sub-acute stage of Guillain Barre Syndrome in both lower limbs.

Study conducted by Sunil et al. on motor nerve conduction of common peroneal nerve in young adult. This study obtained the normal value of distal latency, amplitude and motor nerve conduction velocity of common peroneal nerve. The study gave distal latency of 4.09 ms, amplitude of 6.58 mv and motor nerve conduction velocity of 52.31m/sec. For proposing normative value, these measurements are an adequate way for Electrophysiological evaluation. [24]

The results of present study are supported by a study conducted by Taly AB et al.in 1995 in which the motor nerve conduction study showed a significantly prolonged latency for both the upper and lower limb nerves. Similarly, the conduction velocities of right and left peroneal and tibial nerves were significantly reduced when compared to their mean standardized laboratories values. Hence, in GBS patients, the motor conduction velocities and latencies are affected to a greater extent as shown by previous studies. [25]

Another study conducted by Suganthi. B et al. on various electrophysiological changes in the motor conduction, sensory conduction and F wave latencies of acute Guillain-Barre Syndrome patients. The mean values obtained for the various nerve conduction parameters were compared against the corresponding standardized values using Student's t-test. The results of this study showed that, the motor nerve conduction velocity was significantly lower and the motor nerve conduction latency was significantly prolonged. .

In a study done by Ropper et al. on 41 patients of GBS who underwent electro-diagnostic studies within a week of onset of symptoms, 16 patients had abnormalities of compound muscle action potentials including dispersion, delayed latency, low amplitude, conduction velocity slowing, conduction block or abnormal F-waves. [26]

Most large GBS studies suggest that electrophysiological abnormalities may not be randomly distributed but rather are greater in terminal and most proximal segments of the peripheral nervous system and across common sites of entrapment. The reason for this distribution may be relative deficiency in the blood-nerve barrier in these regions. [27]

The study conducted by Arthur K. Asbury reported in the literature saw motor fibers clinically involved more than sensory fibers. In one study, 90% of GBS patients had motor nerve conduction abnormalities, this is common in the first two weeks of illness and this figure rises to 96% by the third week of illness. [28]

Sensory Nerve Conduction Velocity:

On observing the Sensory latency of the Right and Left lower limbs of the GBS participants, the difference was not significant. On observation the SNAP amplitudes of the Right and Left lower limb of sub-acute GBS patients, the difference was not significant .In this study the sensory nerve conduction velocity of the common peroneal nerve in the right and lef lower limb of the sub-acute GBS patients were recorded. The Sensory nerve conduction velocity of the Right lower limb was 41.92±2.40 m/s and of the Left lower limbs was 42.29± 2.09 m/s. On observing the Sensory Nerve Conduction Velocity of the Right and Left lower limbs of the GBS participants, the difference was not significant

This study suggests that there is symmetrical involvement and reduced latency, increased amplitude & reduced sensory Nerve Conduction Velocity of common peroneal nerve in both lower limbs.

Study was conducted by J Kalita et al. on the sensory nerve conduction velocity in acute case of Guillain Barre syndrome and they conclude that the sensory nerve action potential amplitude of the superficial peroneal and sural nerves was normal in 84.37%, decreased in 3.12% and absent in 12.50% of the individuals. This finding also matches with previous study by Oh SJ et al. the mean conduction velocities of sensory nerve action potential of superficial peroneal and sural nerves were within the normal range of the mean standardized laboratory value. [29,30]

Similar study by Parmar LD et al. conducted on nerve conduction velocity in Guillian Barre syndrome and they concluded that 34.69% patient had sensory abnormalities. [31]

Another study by Shin J. et al. showed that, sensory neuropathy was sudden at onset and peaked to maximal deficit within 4 weeks. All of the patients had electrophysiologic evidence of demyelination in at least two nerves. Demyelination was demonstrated in motor nerve conduction in seven patients and in sensory nerve conduction in one. All patients had sensory nerve conduction abnormalities in at least one nerve. [32]

A study conducted by Arbind Kumar Choudhary et al concluded that Nerve Conduction Studies showed motor conduction studies (MNCV) and sensory conduction studies (SNCV) of the both the upper and lower extremities, revealed borderline- prolonged distal latencies, a reduced median and ulnar CMAP amplitude in upper limb ((right and left) along with reduced common peroneal posterior tibial in lower limb (right and left) and normal median, ulnar and sural SNAP amplitude recordings in both upper and lower limb. [33]

CONCLUSION

The present study concluded that there is symmetrical involvement and both sensory as well as motor nerve conduction velocity are affected in sub-acute stage of Guillain Barre Syndrome, hence it can be used for the recovery & management of Guillain-Barre syndrome.

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