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Ulnar/Sural Amplitude Sensory Ratio in The Diagnosis of Guillian Barre Syndrome

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Abstract

Introduction: sural sparing pattern is believed to be important early neurophysiologic changes of Guillain Barre syndrome (GBS), but there is no agreed unified definition of it. This study aims to define sural sparing as the ratio of sensory amplitude of ulnar to sural nerves which has higher sensitivity in the detection of GBS.

Method: The study involves 20 patients presented with classical features of GBS. Then the diagnosis was confirmed using serial electrodiagnostic testing and CSF examination. Then they undergo full neurological and neurophysiological assessment by nerve conduction study and electromyography. Sural sparing is defined as decrease in the ratio of sensory amplitude between ulnar and sural nerves compared to age and sex matched control.

Results: The study found that ulnar/sural amplitude sensory ratio is a sensitive (75%) and specific (95%) finding in GBS.

Conclusion: We conclude that ulnar/sural amplitude sensory ratio is useful marker for diagnosis of GBS and can be used as agreed definition of sural sparing pattern.

Key words: Guillian Barre syndrome, flaccid paralysis, sural sparing pattern.

Introduction

Guillain–Barré syndrome (GBS) is an "acute, immune-mediated disorder of the peripheral nerves". It is the most common reason of post-infectious paralysis worldwide. The epidemiology of the disease is variable between different countries and range from 0.6 to 4 cases per 100,000 [1].

Various types of Guillain-Barré syndrome (axonal and demyelinating) exist depending on clinical features, electrodiagnostic, serological and pathological criteria [2].

Early diagnosis of (GBS) is important to help in early start of treatment and then to retard the disease progression and improve the prognosis. So early electrodiagnostic tests is shown to be useful in early diagnosis[3]. However the electrophysiologic findings in the early stages is nonspecific and can't define the neuropathic nature of the disease. Albert and his study group studied the electrodiagnostic findings in patients with acute paralysis within 4 days of onset of symptoms and found that 15 (83%) of them showed nonspecific features of demyelination (like prolonged distal motor latency, abnormal late responses…) but no one had shown conduction block or temporal dispersion which are features needed for supporting diagnosis of acute immune mediated demyelination [4].

The goal of electrodiagnostic examination is to be sure that peripheral nerve dysfunction is the cause of acute weakness which is suspected on clinical ground, to elucidate findings of new onset acquired demyelination like increase temporal dispersion, prolonged distal motor and sensory latencies and F-wave latencies, conduction block, non-uniform slowing of conduction velocities[5]. Also electrodiagnostic study help to exclude other causes of weakness like myopathy, motor neuron disease, chronic neuropathy and others. In addition to that, electrodiagnostic characteristics help to predict the prognosis of the disease[6].

Although sensory nerve conduction study is routinely performed with identifiable changes, they are rarely included in the electrodiagnostic criteria[7]. One of the most important finding is the "sural-sparing" pattern; which mean, the finding of a normal or relatively preserved sural sensory potential in the presence of abnormal upper limbs sensory nerve action potential (e.g., ulnar, radial or median sensory responses). The importance of sural sparing come from the fact that, it is common finding (seen in approximately 50-70% of patients suspected to have GBS examined early within 7 days of onset of disease) and is very unusual for neuropathies other than GBS[8]. So sural sparing pattern is considered to be highly specific marker of GBS[7].

The diagnostic utility of this abnormality has been demonstrated in various studies ([9];[10];[11]; [12]).

Old researches that examines the validity of sural sparing in the diagnosis of GBS lacked an agreed definition for sural sparing and in many cases treatment had started already which has potential confounding factors[13].

Our recent study aims to define sural sparing pattern as the ratio of amplitudes of ulnar sensory response to sural sensory response and to find the sensitivity and specificity of this ratio in diagnosing GBS.

Materials and methods

This case control study involves 20 patients studies at the period between 2010and 2017. They has age between 1-65 years and gender distribution of 11 females and 9 males. All the patients presented with features suggestive of acute flaccid paralysis like weakness and paresthesia of distal lower limbs with gradual progression toward proximal parts and upper limbs. Detailed nerve conduction study was done for those patients using Nihon Kohden machine 2010. The duration of symptoms ranges from 5-14 days. The final diagnosis of GBS was obtained depending on serial nerve conduction studies done after 5-7 days which show progressive demyelination or axonal degeneration compared to old study or examination of cerebrospinal fluid which show increase albumin and sugar with low cellular count.

Nerve conduction study was done using supramaximal stimulation and standard surface electrodes. Latency, amplitude and conduction velocity was tested both motor and sensory fibers of median, ulnar, peroneal, tibial and sural nerves with F-waves and H-reflex testing. The ratio of amplitude of ulnar sensory to sural sensory responses was assessed and compared between patients and control group. Skin temperature was maintained throughout the study.

20 normal healthy controls also involved in the study. They has the same age and gender characteristics of patient group and also undergo detailed NCS testing.

Statistical analysis was done using SPSS program version 20 . Mean and standard deviation of the variables was compared between patients and control with ROC curve for finding of cut off value and sensitivity and specificity of the test was done also.

Results

Table 1 show the demographic data of patients and control

VARIABLE	AGE (YEARS)	SEX NUMBER (MALE\FEMALE)
Patient	30±20	9\11
Control	29±22	9\11

The results of motor nerve conduction study of patients and control is summarized in table 2. It outline clearly that there is statistically significant differences between patients and control regarding the tested parameters (latency, amplitude and conduction velocity). These findings are seen for both upper & lower limb motor nerves.

	VARIABLE	PATIENT	CONTROL	P VALUE
Ulnar	DML (ms) amplitude (mv) CV (m\s) F-wave latency (MS)	4.2±2.6 4.3±2.9 40±13 28±13	2.2±0.3 14.8±4 52±3 21±11	0.001 0.00 0.00 0.05
Peroneal	DML (ms) amplitude (mv) CV (m\s)	6.3±4 1.6±1.5 34±11	3.6±1 3.8±1 43±3	0.01 0.00 0.003
Tibial	DML (ms) amplitude (mv) CV (m\s) F-wave latency (MS)	5.4±3 3.5±3.8 33±14 47±21	3.6±0.6 14±4 47±3 48±5	0.01 0.00 0.006 0.08

The results of sensory nerve conduction study is demonstrated in table 3. It shows statistically significant differences between patients and control group in tested parameters like latency and amplitude. These changes are seen mainly in median and ulnar nerves. While in sural nerve, the results are not significant.

Table 3: shows the findings of sensory NCS of studied nerves

	VARIABLE	PATIENT	CONTROL	P VALUE
Median	DSL (ms) Amplitude (μv)	3.2±2 16.6±18.8	2±1 37±13	0.00 0.00
Ulnar	DSL (ms) Amplitude (μv)	2.9±1.8 13±15	1.8±1 23±7	0.008 0.008
Sural	DSL (ms) Amplitude (μv)	2.8±1.7 12.5±12	2±1 11.5±2	0.7 0.9

The value of ulnar/sural amplitude ratio is shown in table 4. It show obviously highly significant difference between patients and control. The ratio is decreased in GBS patients due to the ulnar affection and relative sural sparing.

Table 4: shows the value of ulnar/sural amplitude sensory ratio.

GROUP	PATIENT	CONTROL	P VALUE
Ulnar/sural amplitude (μv)	0.6±0.9	2.1±0.5	0.000

Sensitivity and specificity of ulnar/sural amplitude sensory ratio is shown in table 5. It shows high sensitivity and very good specificity in the diagnosis of GBS at cut off point of 1.

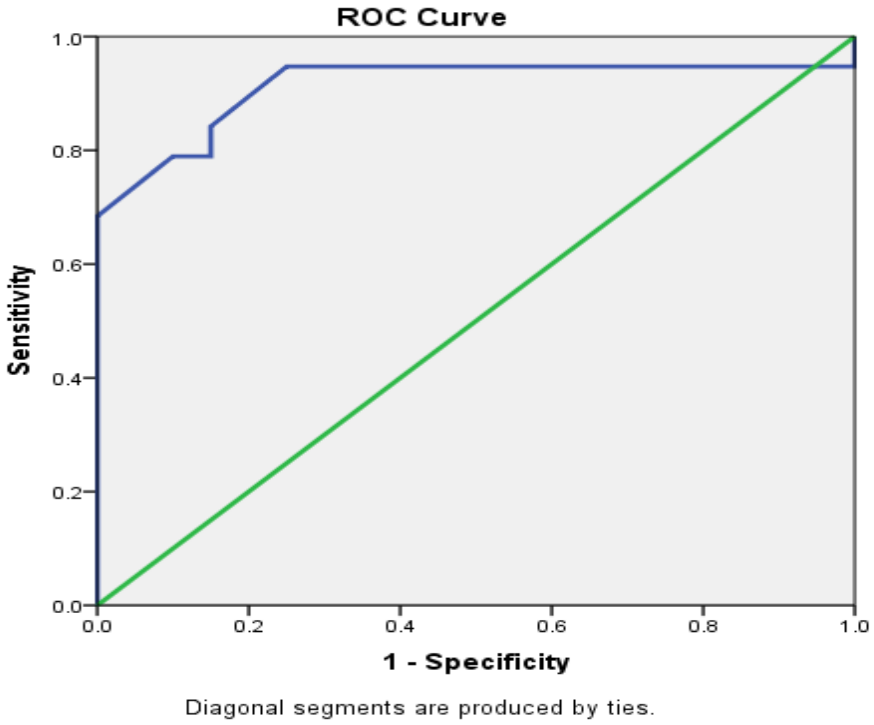

Figure 1: shows ROC curve of the study

Table 5 show the cutoff point with sensitivity and specificity of the procedure

Area	Cut Off Point	Sensitivity	Specificity	P Value	95% Confidence Interval	
					Lower Bound	Upper Bound
0.91	1	75%	95%	0.124	0.806	1

Discussion

Many previous researches [14], [15], [10], [11], [4] studied the sensitivity and of sural sparing pattern and found that the sensitivity range from 19-67% while the specificity range from 90-100%. From careful review of these literatures we found that this discrepancy seems to be due to lack of well-known definition of sural sparing and from variation in the timing of performing NCS. So we suggest the use of the ratio of sensory amplitude between ulnar to the sural nerve and call it ulnar/sural amplitude sensory ratio. We choose ulnar nerve in the comparison because it is less likely to be affected by entrapment like median nerve, while radial sensory to sural nerve ratio could be seen more commonly in other types of neuropathy (diabetic neuropathy) [11].

Accordingly, we found higher sensitivity and specificity (75% & 95% respectively) than other studies

Al-Shekhlee and his study group found that sural-sparing is useful in older patients too; 2 out of our 5 patients above 70 years displayed the pattern[16].

On the other hand, sural sparing pattern is more commonly seen acute than chronic demyelination. Bromberg and his study group found that this abnormality occurred in (39%) of GBS patients compared with (28%) CIDP patients and (14%) of diabetic neuropathy sufferers [10].

As shown recently [15], it can help in the differentiation of GBS from its clinical mimics.

The development of sural-sparing has largely been referred to the demyelinating insult of GBS and so it is well documented finding only in the demyelinating form of the disease (AIDP) ([9]; [10]; [11]). [12]

Hiew and his study group explained that sural sparing defined by absent median/present sural patterns is of low sensitivity (20-30%) , it is specific of AIDP (100%). While in axonal types of GBS (AMAN & AMSAN) has low specificity.[14]

On the other hand Umapathia and his co-workers found that sural sparing pattern occur in both demyelinating and axonal types of GBS and it reflect a pathological process common to axonal and demyelinating GBS-subtypes alike[12].

Although abnormality in sensory nerves was detected in 85 % of patients with demyelinating GBS in median and ulnar nerves and 37% of patients in sural nerves, but sensory nerves testing are does not considered in the electrodiagnostic criteria of GBS. These abnormal findings confirm that sensory conduction studies of the distal nerve segments, is impaired in almost all patients with AIDP and that a relatively normal sural response, in the presence of the suggestive clinical setting, is characteristic of AIDP ([17]; [1]).

From histopathological point of view and in spite of widespread infiltration of macrophage, sural nerve was relatively preserved, a fact responsible for normal sural nerve potential.

The explanation of sural preservation in GBS is that the sural nerve recording is done behind the lateral malleolus, some distance proximal to its terminal end while upper limb sensory nerves recorded at its most terminal end and it is well known that GBS affects the most distal segments of the nerves early in the course of the disease [12].

On the other hand, this phenomenon can be demonstrated as GBS has a predilection to affect entrapment sites and points where the blood nerve barrier is susceptible (for example the median nerve at the wrist and the ulnar nerve at the elbow). Many

authors[18] demonstrated diffuse inflammatory demyelination with or without axonal degeneration involves mainly the spinal nerves which are obviously the most proximal portions of the nerves, and so far they are severely affected. This supports the assumption that disruption of blood nerve barrier (either at nerve roots or at entrapment sites) as a more reasonable explanation for the sural-sparing in GBS[19].

Conclusion

Ulnar\sural sensory amplitude ratio is useful marker for the early diagnosis of GBS and may substitute or can be agreed definition of sural sparing pattern.

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الخلاصة

يعتقد ان استثناء العصب الربلي من العلامات الفسلجية العصبي المبكرة المهمة لاعتلال الاعصاب المحيطية الحاد. ولكن لا يوجد تعريف موحد و متفق عليه لهذه العلامة. تهدف هذه الدراسة الى تعريف استثناء العصب الربلي انه النسبة بين السعه الحسية للعصب الزندي الى السعه الحسه للعصب الربلي. وتملك هذه المعادلة حساسية عالية لتشخيص اعتلال الاعصاب المحيطية الحاد.

تشتمل هذه الدراسة عشرون مريضا يعانون من العلامات التقليدية لمرض اعتلال الاعصاب المحيطية الحاد. وقد تم التأكد من هذا التشخيص اعتمادا على اجراء تشخيص كهربائي متسلسل او اعتمادا على نتائج فحص السائل النخاعي. بعد ذلك خضع المرضى الى تقييم عصبي وفسلجي عصبي كامل اعتمادا على فحص تخطيط الاعصاب وتخطيط العضلات الكهربائي. وقد تم تعريف استثناء العصب الربلي بانخفاض نسبة السعة الحسة للعصب الزندي الى العصب الربلي بالمقارنة مع مجموعة سيطرة مطابقة من حيث الجنس والعمر.

وجدت الدراسة ان النسبة بين السعة الحسية للعصبين الزندي والربلي تملك حساسية تصل الى 75% وخصوصية تصل الى 95%.

استنتجت الدراسة ان السعة الحسية للعصبين الزندي والربلي علامة مفيدة لتشخيص اعتلال الاعصاب المحيطية الحاد. ويمكن ان يستخدم كتعريف لاستثناء العصب الربلي.

الكلمات المفتاحية: اعتلال الاعصاب المحيطية الحاد المزيل للنخاعين، الشلل الرخو، استثناء العصب الربلي.*