

H-REFLEX IN THE DIAGNOSIS OF LUMBO-SACRAL RADICULOPATHY

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KEY WORDS: *H-REFLEX, LUMBO-SACRAL RADICULOPATHY*

ABSTRACT

Material: *This work comprised fifteen patients suspected of having unilateral fifth lumbar root (L₅) and/or first sacral root (S₁) radiculopathy secondary to spinal nerve compression. Ten healthy subjects matched in age, sex and height served as controls. Diagnosis was confirmed clinically and with radiographic assessment.*

Method: *H-reflex was done bilaterally to both symptomatic and asymptomatic sides from both soleus and gastrocnemius muscles according to Shahani (1986). Peak to peak amplitude and latency was recorded.*

Results: *On the symptomatic side a significant prolongation was found in the latency of the H-reflex as elicited from both soleus and gastrocnemius muscles on the symptomatic side of patients versus the asymptomatic side or the control group $p < 0.05$. There was a highly significant reduction $p < 0.001$ of the amplitude of the motor evoked response from both muscles as well. However, abnormal H-reflex was also encountered in the non-symptomatic side. The H-reflex recorded from the soleus was more sensitive than from the gastrocnemius muscle. All patients with neurological deficit showed prolonged latency and reduced amplitude.*

Conclusion: *Both techniques, measuring H-reflex from soleus or gastrocnemius are complementary to each other and the positive results of any of them could be enough for the diagnosis of radiculopathy.*

INTRODUCTION

Back pain is one of the commonest and most troublesome of complaints. It is commonly associated with lumbosacral radiculopathy secondary to spinal nerve compression. Radiological investigations demonstrate anatomic abnormalities and not neurophysiological dysfunction, besides their hazards (*Aminoff, 1987*).

Electrodiagnosis has an important role in documenting lumbosacral radiculopathy secondary to spinal nerve involvement for making an accurate diagnosis, proper treatment plan and a good evaluation of the prognosis (*Chang and Lien, 1990*).

The H-reflex is a monosynaptic reflex in which the afferent and efferent arcs consist of a group of Ia afferent fibers from muscle spindles and the alpha-motor axons respectively (*Shahani, 1991*). It provides a way to assess conduction in the proximal segments of both motor end sensory axons as well as an assessment of the excitability of the anterior horn cell pool (*Sethi and Thompson, 1989*).

Aim of Work:

The aim of this work was to evaluate the neurophysiologic involvement of the parameter of H-reflex (latency and amplitude from both soleus and gastrocnemius muscles "GC") and to correlate it with the clinical involvement, in an attempt to use it as an electrodiagnostic test for lumbosacral radiculopathy.

PATIENTS & METHODS

This work comprised fifteen patients suspected of having unilateral L5 and/or S₁ radiculopathy secondary to spinal nerve compression. Ten normal subjects matched in age, sex and height with the patients served as controls.

The diagnosis was based on the following:

- ❖ Clinical features: Low back pain (acute or chronic), sciatica, positive straight leg raising test.
- ❖ Neurological deficit (s) as: dermatomal sensory impairment, decreased deep tendon reflex (s), motor impairment.

Patients with other neurological diseases as peripheral neuropathy or non-compressive lumbosacral radiculopathy as diabetic, infective or inflammatory radiculopathy diagnosed clinically were excluded.

All patients were subjected to:

- ❖ Full medical history taking.
- ❖ Thorough clinical examination including back examination and neurological examination.
- ❖ Plain X-ray for lumbo-sacral region.
- ❖ H-reflex neurophysiologic study. H-reflex technique was done bilaterally to the symptomatic and non-symptomatic sides and from both soleus and gastrocnemius muscles. It was done according to *Shahani (1981)* using a Dantec Key point apparatus.

The recording surface electrodes were placed over the medial gastrocnemius midway between the motor points of the posterior tibial nerve at the popliteal crease and medial malleolus. In case of the soleus muscle, they were placed just medial to the tibia equidistant between the stimulation point and the medial malleolus. Peak to peak amplitudes of the motor responses or maximum H response were measured in microvolts (μV). The latencies recorded were measured in milliseconds (msec). Latencies were considered abnormal when the difference between the two sides was more than 1.5 msec and the amplitude $\leq 50\%$.

RESULTS

The fifteen patients included in this study were eight males and seven females. Their age ranged from 35 to 57 years (43.3 ± 7.1) and the disease duration 23.3 ± 11.5 months.

The ten normal subjects were five males and five females with a mean age of 40.9 ± 8.2 .

Clinical back examination revealed:

- Tenderness at lumbosacral region in thirteen patients.
- Painful back movement in thirteen patients.
- Limited back movement in three patients.
- Straight leg raising was positive in four patients.

Neurological examination revealed:

- Myotomal muscle weakness in two patients.
- Decreased deep tendon reflex in six patients.
- Dermatomal sensory impairment in seven patients.

Radiological examination revealed:

- Lumbar spondylosis in five patients.

- Intervertebral disc lesion at L5-S1 in four patients.
- Lumbar spondylolisthesis in two patients.

H-Reflex Findings:

- The correlation matrix revealed significant +ve correlation between the H-reflex from the soleus and gastrocnemius on the same side (latency = 0.98, amplitude = 0.91 respectively, critical value was 0.55).
- Also, a +ve correlation was found between the symptomatic and the non-symptomatic side (latency = 0.82 and amplitude = 0.69).
- A +ve correlation was observed between age and the H-reflex (amplitude = 0.7).

Patients with neurological deficit had abnormal H-reflex (Prolonged latency and diminished amplitude). H-reflex abnormalities were observed from the soleus muscle in ten symptomatic and two asymptomatic sides, while from the gastrocnemius muscle in nine symptomatic and ten asymptomatic sides.

On the symptomatic side a significant prolongation in latency of H reflex elicited from both soleus and gastrocnemius muscles versus control group and the asymptomatic side was found $p < 0.05$ and highly significant reduction $p < 0.001$ for the amplitude of the motor evoked response from both muscles. These results are shown in tables (1) and (2).

Table (1): Statistical comparison of H-reflex data between control and symptomatic side.

	Symptomatic side (No.=15)	Control (No.=10)	t	p	Sig.
Soleus latency (msec)	34.5±5.1	29.9±2.1	3	<0.05	S
Gastrocnemius latency	28.9±4.4	27.1±2.2	2.8	<0.05	S
Soleus amplitude (µv)	122.1±24	321.8±38.4	11.8	<0.001	HS
Gastrocnemius amplitude	127.6±26.7	262±10.1	8.5	<0.001	HS

Table (2): Statistical analysis and comparison of H-reflex results between both sides of the patients.

	Symptomatic side (No.=15)	Asymptomatic side (No.=10)	t	p	Sig.
Soleus latency (msec)	34.5±5.1	30.8±3	2.7	<0.05	S
Gastrocnemius latency	28.9±4.4	27.6±3.9	2.2	<0.05	S
Soleus amplitude (µv)	122.1±24	294.6±61.9	11.3	<0.001	HS
Gastrocnemius amplitude	127.6±26.7	241±48.6	7.3	<0.001	HS

DISCUSSION

H-reflex is the result of a distally initiated nerve action potential through sensory axon that travels proximally, initiating a motor neuron action potential at the level of the spinal cord, which in turn is conducted distally and recorded through the muscle response (*Ball, 1993*). So, it provides information related to conduction velocity and differs from standard nerve conduction studies in that it involves the proximal portions of the plexuses and roots that are difficult to study directly (*Kimura, 1989*). H-reflex studies have proven to be a useful method for documenting S1 radiculopathies (*Wilbourn and Aminoff, 1988*).

In the current study, the latency of H-reflex from both soleus and gastrocnemius muscles were significantly higher on the symptomatic affected side than the non-symptomatic side and controls. However, it was also higher in the controls than in the asymptomatic side, and this may be due to subclinical affection of the other side. This is supported by the observation of abnormal H-reflex in two of our patients in the non-symptomatic side. A bilateral root involvement in disc lesions is commonly encountered. Controls for our patients with different age and height would serve better than the asymptomatic side. This can be explained by the fact that H-reflex is mediated partially by Ia afferents which are amongst the largest diameter nerve fibers and therefore the most vulnerable to compression (*Eiser, 1991*). So, standard controls for our patients with same age and height would serve better than the asymptomatic side.

In our study the diminished amplitude was observed more on the symptomatic side. This observation disagrees with *Johson (1989)* who stated that the amplitude of H-reflex is not a reliable parameter because it is influenced by many variables. But *Shahani (1991)* stated that both changes in latency and amplitude should be taken into consideration.

All our patients with diminished ankle reflex had H-reflex abnormality in latency and/or amplitude. This agrees with the study of *Ball (1993)* who observed that prolongation or absence of H-reflex correlates well with a diminished or absence of ankle reflex in radicular disease.

We found that recording the H-reflex from the soleus muscle is more sensitive than from the gastrocnemius. However, H-reflex recording from both soleus and that from gastrocnemius showed significant correlation. So, we can consider both techniques as complementary for each other and the positive result of any of them could be enough for the diagnosis of radiculopathy.

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الانعكاس (هـ) في تشخيص حالات إصابة الجذور العصبية القطنية و العجزية

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تضمن هذا البحث خمسة عشر مريضا مشتبه في معاناتهم بإصابة في جذر العصب الخامس القطني و جذر العصب العجزى الأول نتيجة للضغط على العصب الفقاري. المجموعة الضابطة تكونت من عشرة أشخاص أصحاء. تم تأكيد التشخيص بالكشف الإكلينيكي و الأشعة. ثم عمل الانعكاس (هـ) للطرف الذي به الشكوى و الناحية الأخرى أيضا. و تم تسجيل الانعكاس من العضلتين السوليس و الجاستروكنيميس على طريقة شاهانيي (1986)، تم تسجيل ارتفاع الانعكاس و مدة ظهوره. و وجدت علاقة ذات دلالة إحصائية بين مدة الظهور في العضلتين في الناحية المصابة مقارنة بالمجموعة الضابطة و أيضا بالناحية التي ليست بها شكوى. و ظهر أيضا نقص في ارتفاع الانعكاس ذو دلالة إحصائية عالية.

و وجد أيضا في بعض من الحالات في الناحية التي لا تظهر بها شكوى قياسات غير طبيعية للانعكاس (هـ).

رغم أن عضلة السوليس أظهرت حساسية أكثر من ناحية الانعكاس (هـ) لكن العضلتان أظهرتا قياسات للانعكاس (هـ) في طول مدته و نقصان ارتفاعه ذات دلالة إحصائية في حالات المرضى ذو إصابة عصبية.

يمكن في النهاية أن نستخلص أن قياس الانعكاس (هـ) من العضلتين مكمل لبعضه و النتائج الإيجابية من أي منهما كافية لتشخيص الإصابة العصبية.