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Effect of H-Reflex on Patients of Lumbosacral Radiculities/Radiculopathy

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Abstract **Original Research Article**

An impingement in the lower back or lumbar-sacral spine can be manifested with symptoms and pain followed by radiation in a dermatomal pattern in the foot known as Lumbosacral radiculopathy. The purpose of present study was to assess diagnostic utility of H-reflex in patients of Lumbosacral radiculopathy. A randomized paired-study design was utilized to evaluate H-reflex elicited with tibial nerve stimulation. Thirty five patients with unilateral Lumbar radiculopathy, confirmed by clinical and magnetic resonance imaging (MRI) evidences were studied. Selected patients were divided in two groups GROUP A- Asymptomatic side in subject clinically diagnosed with radiculitis/radiculopathy is used as control group. GROUP B- Symptomatic side in same subjects clinically diagnosed with radiculitis/radiculopathy used as case group. A high-voltage electrical stimulator was used to elicit H-reflex bilaterally at the popliteal fossa for the diagnosis of first Lumbosacral (LS1) nerve-root radiculopathy. The variation in side to side H- latency and H/H-amplitude ratio by non-invasive technique brings awareness to clinicians about the Lumbosacral radiculopathy and this report may also be useful to clinician for early diagnosis of Lumbosacral radiculopathy.

Keywords: Hoffmann Reflex (H-Reflex), First Lumbosacral nerve-root radiculopathy (LS1).

INTRODUCTION

An impingement in the lower back or lumbar-sacral spine can be manifested with symptoms and pain followed by radiation in a dermatomal pattern in the foot known as Lumbosacral radiculopathy [1].

The majority of radiculopathies result from nerve root compression, either from disc herniation or as a consequence of spondylitis arthropathy; inflammatory and immunological lesions most commonly involved roots are L5 and S1. Clinical symptoms include radicular pain and weakness presenting in a myotomal distribution depending on affected spinal root(s) [2].

H reflex is a monosynaptic reflex in which the afferent and efferent arcs consist of group la afferent fibers from muscle spindles and the alpha-motor axons respectively**.** H-reflexes are useful in the evaluation of radiculopathy because they assess both motor and sensory pathways involving the nerve root; however, standard studies evaluate only the lumbosacral root level [3].

The H reflex was first described in 1910 and 1918 by Paul Hoffmann (hence the name), its basis was investigated in a series of papers by Magladery and colleagues [14, 15], and it was introduced into motor control studies by Paillard in 1955. It has been the subject of numerous reviews since then [16-22].

H-reflex latency is the most useful parameter to measure ipsilateral prolongation (>2 ms longer than the contralateral, uninvolved side) or absence of the H-reflex is observed in unilateral lumbosacral radiculopathy. In bilateral lesions, the reflexes may be prolonged or absent bilaterally. Recently, H-reflex amplitude asymmetry was observed as earlier indicator of S1 nerve root involvement as compared to H- wave latency [4].

MATERIALS AND METHODS

This study was conducted on the Patients of J.L.N. Medical College and Hospital those were referred from OPDs during May 2018 – October 2018 from various departments to neurophysiology laboratory, the 35 patients were selected for lumbar radiculopathy in the middle age group of 35-55 years.

STUDY GROUP

The patients were grouped as:

(i)Group A- Asymptomatic side in subject clinically diagnosed with radiculitis/radiculopathy is used as control group.

(ii)**Group B**- Symptomatic side in same subjects clinically diagnosed with radiculitis/radiculopathy used as case group.

A randomized paired-study design was utilized to evaluate H-reflex by a high-voltage electrical stimulator which was used bilaterally at the popliteal fossa. Patients with unilateral lumbosacral radiculopathy, confirmed by clinical and magnetic resonance imaging (MRI) evidences were studied. Subjects with Diabetes mellitus, with clinical or electrophysiological evidence of polyneuropathy as well as subjects with symptoms of less than 3 weeks duration, having spinal surgery done within the preceding 15 years and Patient who were equally affected in both the sides were excluded. Institutional Ethics Committee's approval was obtained and study was conducted at fixed room temperature of 30^{o}-34^{0}C.

Electro Diagnostic Procedure

H- reflex was performed in all patients clinically diagnosed with lumbosacral radiculopathy on EMG NCV EP Machine, model RMS SALUS 4C. It was a monosynaptic spinal reflex in which the muscle response was recorded using surface bar electrodes and a fixed distance was used between the stimulation and recording electrodes throughout the testing experiment (from popliteal fossa for stimulation to the recording electrodes at 3 cm distal to the bifurcation of the gastrocnemii). Filters were set at 20 Hz to 5 kHz and sweep speed was being at 10 ms per division with Duration of 100 µs for H-reflex. The SNS (sacral nerve stimulator) for M-wave was at 5mv and SNS for H-wave was at 500µv. The stimulation intensity for H-maximum was maintained by verifying the constant amplitude of the minimal M-wave. H reflexes are inhibited as the stimulus intensity is increased from submaximal to that required for eliciting a maximal direct (M) response. This relationship has been explained by "collision" of orthodromic impulses with impulses conducted antidromically in motor axons. In fact, this mechanism has little or no role in the inhibition of H reflexes that occurs with increasing stimulus intensity.

Parameters like latency, its amplitude and side to side amplitude (H/H) ratio were obtained from H-wave. To control for the excitability of the motor neurons, patients was instructed to relax. This procedure was reduced the reflex amplitude variability to the minimum. Seven to ten traces was elicited and recorded for each participant and the largest five traces was included in the analysis. Then, recorded parameters were compared with previously generated normal values and similar responses from the asymptomatic side.

STATISTICAL ANALYSIS

After performing H-reflex on patients with radiculitis/radiculopathy, the collected data was analyzed by using two tailed paired statistical student's t-test to calculate mean value, standard deviation, t-sat. value and p-value. In the Implication all the different parameters obtained by H-reflex on symptomatic side of the patients were compared with asymptomatic side of the same patient. The significance would be defined as $p \leq 0.05$ with standardized test statistics value (t-sat. value) for 34 degree of freedom was 2.03. The diagnostic efficacy was calculated by using Microsoft excel in windows 10.

OBSERVATION & RESULTS

Age and gender wise distribution of all the study subjects is depicted in [Table-1]. Age groups were not statistically different between male and females in study subjects. The mean, standard deviation, test statistics and p-value for median and ulnar nerve is shown in [Table/Fig-2/1]

Table-1: Characteristics of present study in subject of unilaterally affected with Lumbosacral radiculopathy

Parameters	Male	Female	P-vale
Number(n)	14	12	-
Age(years)	47.21±5.63	45.62±5.84	<0.43

Table-2: Comparison of mean, t. Sat. and p-vale of H-reflex in group –A and group-B

Parameter	Group-A (Asymptomatic Side) (Mean Value ± SD)	Group-B (Symptomatic Side)(Mean Value ± SD)	Student t- test (two-tailed) radiculopathy t stat. value	Student t- test (two-tailed) radiculopathy p value
H-Latency(msec)	7.8±2.03	8.12±2.03	4.83	< 0.0001
H/H-Amplitude(mv)	6.23±2.36	2.65±1.11	13.43	< 0.0001

The p-value in all the parameters of H-reflex were statistically significant (P<0.0001) in both Group A (asymptomatic side) and Group B (symptomatic side).The t-value for H-reflex were above 2.03 which was significant in present study, but the difference of t value in H/H- Amplitude from normal standardized t-value was higher than t value of other parameters it shows that the variation in H/H- Amplitude was highly significant for the patients of lumbosacral radiculopathy.

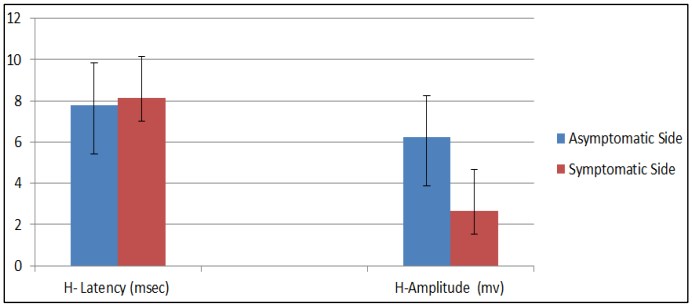

Fig-1: Comparison of mean value ± SD of in all parameters of H- reflex in group –A and group-B

The sensitivity, specificity, positive and negative predictive values of H- latency and H/H Amplitude is shown in [Table–3]. Among them the diagnostic efficacy for H-latency and amplitude was obtained to be more sensitive with high positive predicative value and sensitivity of H/H amplitude was highly significant.

Table-3: Diagnostic efficacy of H- Reflex in nerve conduction Parameter in group -B:

Nerve Parameters	Parameters	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value(%)
H-Reflex	H-Latency(msec)	91%	67%	97%	40%
	H/H-Amplitude(mv)	94%	75%	97%	60%

DISSCUSSION

H- Reflex abnormalities in 91% subjects in due to H latency prolongation and absent H- responses. Other criteria, H/H amplitude ratio when added to former two, abnormality was evident in 97% subjects. This was statistically verified by applying student's t-test among both the groups (p< 0.0001) and calculating diagnostic sensitivity (97% as against former criteria with only 91%) as shown in table 3. H/H amplitude ratio provides an easy estimate of motor neuron pool activation especially those fast conducting neurons, and therefore excitability of axons was observed by Delwaide PJ in 1984 [5].

Among enlisted electrophysiological predictors of LSR, H/H ratio was most frequently abnormal (94%) although the used lowest cut off ratio of H/H amplitude was 0.29 which was less than 0.4 indicated S1 neural involvements. Observation was corroborative with the findings by Dhand UK et al. determine that the use of H/H amplitude ratio manifest increased sensitivity of H-reflex study in the diagnosis of S1 radiculopathy among low back pain patients with or without neuro-deficit corresponding to S1 radical [9-13], [7], [6].

Ward R. Jankus, *et al*. [8] mention that a side-to-side amplitude ratio smaller than 0.4 (mean - 2 SD) in the face of a normal side-to-side latency difference is probably abnormal, the amplitude on the side of the smaller response was expressed as a ratio of the contralateral amplitude; this mean value ±SD was 0.74 ± 0.17 [7]. Hesham N Alrowayeh *et al.* [4] reported that the H-reflex amplitude asymmetry is an earlier sign/parameter of nerve root involvement in patients with radiculopathy compared with latency [8].

H-reflex latency prolongation and side-to-side differences in patients with radiculopathy probably because of neural demyelination with significant damage of large diameter nerve axons Conversely, absent or reduced amplitude on the affected side was probably because of nerve conduction block in extensive demyelination, it was widely used for detection cervical and lumbosacral radiculopathy.

SUMMARY AND CONCLUSION

The present study observed that the variations in side to side H-latency were more than 1.9msec and H/H- amplitude ratio was ≤ 0.4 or H-reflex was absent on symptomatic side. These variations in H- reflex amplitude and latency parameters were found during pathologic processes (demyelination) of nerve root axonal compression.

The nerve conduction changes in H/H amplitude ratio and H-latency is utilized in order to determine an excellent electrodiagnostic tool to establish lumbosacral radiculopathy with evidence support of H/H amplitude ratio is an earlier sign of nerve root involvement than latency.

REFERENCES

1. Tarulli AW, Raynor EM. Lumbosacral radiculopathy. Neurologic clinics. 2007 May 1;25(2):387-405.
2. Fisher MA. AAEM Minimonograph# 13: H reflexes and F waves: physiology and clinical indications. Muscle & Nerve: Official Journal of the American Association of Electrodiagnostic Medicine. 1992 Nov;15(11):1223-33.
3. Aminoff MJ. Aminoff's Electrodiagnosis in Clinical Neurology: Expert Consult-Online and Print. Elsevier Health Sciences; 2012 Mar 29.
4. Alrowayeh HN, Sabbahi MA. H-reflex amplitude asymmetry is an earlier sign of nerve root involvement than latency in patients with S1 radiculopathy. BMC research notes. 2011 Dec;4(1):102.
5. Delwaide PJ. Contribution of human reflex studies to the understanding and management of the pyramidal syndrome. InElectromyography in CNS Disorders 1984 Jan 1 (pp. 77-109). Butterworth-Heinemann..
6. Dhand UK, Das SK, Chopra JS. Patterns of H-reflex abnormality in patients with low back pain. Electromyography and clinical neurophysiology. 1991;31(4):209-13..
7. Schuchmann JA. H reflex latency in radiculopathy. Archives of physical medicine and rehabilitation. 1978 Apr;59(4):185-7.
8. Jankus WR, Robinson LR, Little JW. Normal limits of side-to-side H-reflex amplitude variability. Archives of physical medicine and rehabilitation. 1994 Jan 1;75(1):3-7.
9. Wilbourn AJ. The value and limitations of electromyographic examination in the diagnosis of lumbosacral radiculopathy. InLumbar disc disease 1982 (pp. 65-109). Raven Press, New York.
10. Wilbourn AJ, Aminoff MJ. Radiculopathies. InClinical electromyography 1993 (pp. 177-209). Butterworth-Heinemann, Boston.
11. White JC. The ubiquity of contraction enhanced H reflexes: normative data and use in the diagnosis of radiculopathies. Electroencephalography and Clinical Neurophysiology/Evoked Potentials Section. 1991 Dec 1;81(6):433-42.
12. Ellis SG, Roubin GS, King 3rd SB, Douglas Jr JS, Weintraub WS, Thomas RG, Cox WR. Angiographic and clinical predictors of acute closure after native vessel coronary angioplasty. Circulation. 1988 Feb;77(2):372-9.
13. De Visser BO, Schimsheimer RJ, Hart AA. The H-reflex of the flexor carpi radialis muscle; a study in controls and radiation-induced brachial plexus lesions. Journal of Neurology, Neurosurgery & Psychiatry. 1984 Oct 1;47(10):1098-101.
14. Magladery JW, McDougal Jr DB. Electrophysiological studies of nerve and reflex activity in normal man. I. Identification of certain reflexes in the electromyogram and the conduction velocity of peripheral nerve fibers. Bulletin of the Johns Hopkins Hospital. 1950 May;86(5):265.
15. Magladery JW, Teasdall RD, Park AM, Porter WE. Electrophysiological studies of nerve and reflex activity in normal man. V. Excitation and inhibition of two-neurone reflexes by afferent impulses in the same trunk. Bulletin of the Johns Hopkins Hospital. 1951 Jun;88(6):520-37.
16. Hugon M. Methodology of the Hoffmann reflex in man. InHuman reflexes, pathophysiology of motor systems, methodology of human reflexes 1973 (Vol. 3, pp. 277-293). Karger Publishers.
17. Schieppati M. The Hoffmann reflex: a means of assessing spinal reflex excitability and its descending control in man. Progress in neurobiology. 1987 Jan 1;28(4):345-76.
18. O'Leary DH, Polak JF, Kronmal RA, Manolio TA, Burke GL, Wolfson Jr SK. Carotid-artery intima and media thickness as a risk factor for myocardial infarction and stroke in older adults. New England Journal of Medicine. 1999 Jan 7;340(1):14-22.
19. Pierrot-Deseilligny E, Mazevet D. The monosynaptic reflex: a tool to investigate motor control in humans. Interest and limits. Neurophysiologie Clinique/Clinical Neurophysiology. 2000 Apr 1;30(2):67-80.
20. Zehr PE. Considerations for use of the Hoffmann reflex in exercise studies. European journal of applied physiology. 2002 Apr 1;86(6):455-68.
21. Knikou M. The H-reflex as a probe: pathways and pitfalls. Journal of neuroscience methods. 2008 Jun 15;171(1):1-2.
22. Pierrot-Deseilligny E, Burke D. The circuitry of the human spinal cord. Spinal and supraspinal control of movement.