RESEARCH ARTICLE

THE STUDY OF H-REFLEX EFFICACY IN DIAGNOSIS OF LUMBOSACRAL RADICULOPATHY.

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Manuscript Info	*Abstract*
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Background: Electrophysiological studies are playing useful and valuable role in the diagnosis and prognosis of lumbosacral radiculopathies. The correct diagnosis of lumbosacral radiculopathy is very essential for administration of timely and appropriate treatment. H-reflex is one of the types of electrophysiologic studies helpful in diagnosis of lumbosacral radiculopathies. Hence,it is reasonable to evaluate the diagnostic efficacy of H-reflex study in lumbosacral radiculopathy.

Objectives: The present study was undertaken to evaluate the diagnostic efficacy of various parameters of H-reflex in lumbosacral radiculopathy

Methodology: In this cross- sectional study, a total of 283 subjects (168 males and 115 females) aged 40 years and above who were clinically diagnosed as having lumbosacral radiculopathy were enrolled after getting ethical approval and informed written consent. All the patients were subjected to electrophysiological evaluation using RMS EMG EP Mark –II machine in Clinical Neurophysiology unit, Department of Physiology through which their H-reflex study was conducted.

Result: No statistically significant difference was observed between right and left sided values for all the H-reflex parameters tested($P > 0.05$). All parameters were found to have reliable sensitivity, specificity and accuracy in diagnosing lumbosacral radiculopathy

Conclusion: H-reflex studies are useful supportive diagnostic tool for lumbosacral radiculopathy.

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Introduction:-

Radiculopathy is one of the most common causes for referral to the electromyography (EMG) laboratory. Studies have reported that lumbosacral radiculopathy affects 4-6% of the population at some point in their lives[1]and it has also been shown that L4-5 and L5-S1 are the most common level affected in lumbosacral radiculopathy. This disease is commonly caused by the compression of nerve root while coming out of the intervertebral foramen.

The diagnosis of lumbosacral radiculopathy is somewhat difficult which is usually done by employing radiological imaging techniques, electrophysiological evaluation involving nerve conduction studies and EMG, and rarely cerebrospinal fluid (CSF) examination.[2] Radiological imaging can usually recognize the presence of anatomical lesion compressing the nerve roots however,it is important to note that radiculopathy may occur without a structural

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lesion seen on radiological imaging. In such cases additional investigation like electrophysiological study is usually required.

Electrophysiological studies are playing useful and valuable role in the diagnosis and prognosis of lumbosacral radiculopathies. In cases with negative and aberrant radiological and clinical findings, electrophysiological studies are particularly useful; whereas in cases with positive radiological and clinical findings, it plays a complementary diagnostic role. The correct diagnosis of lumbosacral radiculopathy is very essential for administration of timely and appropriate treatment.

Late response study which is one of the type of electrophysiologic study allows assessment of the functional state of the proximal portions of the peripheral nerves, which are affected to a varying extent in the course of lumbosacral radiculopathy. H-reflex is one of the types of late response in electrodiagnosis which was first described by Hoffmann[3]in 1918. M-latency, H-latency, H-M latency, H-amplitude are the various parameters of H-reflex study that can be taken into account while analyzing it.

As the appropriate and correct diagnosis can minimize pain, discomfort, disability, and the direct and indirect costs of care due to this disease, it is reasonable to evaluate the diagnostic efficacy of H-reflex study in lumbosacral radiculopathy. Therefore, the present study is undertaken to study the usefulness of various H-reflex parameters to diagnose lumbosacral radiculopathy.

Materials and methods:-
The present cross sectional study was performed in a total of 283 subjects aged 40 years and above who were clinically diagnosed by the consultant orthopedic surgeon as having lumbosacral radiculopathy. We have excluded the subjects with diabetes mellitus, clinical or electrophysiological evidence of polyneuropathy, myopathy, myelopathy, neuromuscular transmission disorders, having symptoms of less than 3 weeks duration,in whom spinal surgery was performed within the preceding 15 years and the patients with local injuries/lesion that may interfere with the electrophysiological study. A total of 168 males and 115 females were recruited in the study after getting their written informed consent.Prior Ethics approval from the Institutional Ethics committee was obtained.After doing detailed clinical and neurological examination, the electrophysiological evaluation was performed using RMS EMG EP Mark –II machine in Clinical Neurophysiology unit, Department of Physiology through which their H-reflex study was conducted. All tests were performed under constant room temperature (30^0C) to shortlist the errors.
H reflexes were readily obtained using percutaneous stimulation and surfacerecording techniques. The stimulating cathode was placed proximally toavoid the theoretical possibility of anodal block. Stimulus pulses of long duration (1 ms) were used to preferentially activate large sensory fibers.The stimulus frequency was 1 per 3 seconds or less to allowfull recovery of the H reflex from a prior stimulus. By starting with submaximalstimuli and increasing to supramaximal stimulation, we determinedthat: (1) the ''late'' response should be larger than the preceding directmotor response, (2) the H reflex with the largest amplitude, and (3) theinhibition of the H reflex with increasing stimulus intensity. Latencies were measured to the onset ofthe responses. For calf H reflexes, the tibial nerve was stimulated in the popliteal fossa. Surface recordings were made from the soleus muscle. Active electrode was placed medial to the tibia at a point that was one half the distancebetween the stimulation site and the medial malleolus, with the indifferentelectrode placed on the Achilles' tendon. Setting were kept at sweep speed 10 ms/D, intensity 2 mV,frequency 2 Hz and stimulus strength duration was 1 ms. Stimulus intensities were amplified gradually in steps of 1-2 mA until the maximum H-wave amplitude was obtained and further by 2-5 mA until the maximum M-wave amplitude was obtained.Three stimuli were live averaged for single response. Downward deflection was marked as latencies of waveforms. Minimum stimulus intensity required obtaining an H-wave and M-wave of 0.4mV amplitude was considered H and M threshold respectively.[4,5]

Electrophysiological parameters evaluated were M-latency in milliseconds (ms), H-M latency in milliseconds (ms) and H-amplitude in milivolts (mV).

Structured format was used to record the observations. Statistical analysis was done by using descriptive and inferential statistics using Kappa Statistics, z-test for difference between two means and diagnostic accuracy. The study observations were analyzed to find the Specificity, Sensitivity, Positive Predictive Value and Negative Predictive Value. The software used in the analysis were SPSS 17.0 and Graph Pad Prism 5.0 and $p<0.05$ was considered as level of significance ($p<0.05$).

Results:-

The age and gender wise distribution of patients and physiological variable of study subjects are shown in table 1 and 2. Descriptive statistics of H-reflex study is shown in Table 3. No statistically significant difference was observed between right and left sided values for all the H-reflex parameters tested in posterior tibial nerves (P >0.05). The sensitivity, specificity, positive and negative predictive values of all the H-reflex parameters is shown in Table 4. H-reflex parameters were found to have reliable sensitivity and specificity in diagnosing lumbosacral radiculopathy. Accuracy of theseelectrophysiological parameter was also observed to be comparable to gold standard test and by using kappa statistics fair to slight agreement was found between H-reflex parameters and MRI. (Table 4).

Table 1: Age and gender wise distribution of patients

Age Group(Years)	Male (N)	Female(N)	Total(N)
40-49	75(26.50%)	45(15.90%)	120(42.40%)
50-59	47(16.61%)	33(11.66%)	80(28.27%)
60-69	32(11.31%)	31(10.95%)	63(22.26%)
70-79	12(4.24%)	5(1.77%)	17(6.01%)
≥80	2(0.71%)	1(0.35%)	3(1.06%)
Total	168(59.36%)	115(40.64%)	283(100%)

Table 2: Physiological variable in study population

Physiological Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age(years)	283	40	81	53.31	9.89
Height(cm)	283	145	180	161.42	7.19
Weight(kg)	283	40	95	62.37	7.96
BMI(kg/m^2)	283	17.54	33.76	23.91	2.48

Table 3: Descriptive Statistics for H-Reflex study

Electrophysiological Parameters	Right Side		Left Side		z-value	p-value
	Mean	SD	Mean	SD		
M- latency(ms)	7.08	1.76	7.34	3.16	0.13	0.89
H-M latency(ms)	25.1	4.15	24.29	3.30	0.30	0.76
H-amplitude (mV)	3.85	2.29	3.39	2.23	0.20	0.84

Table 4: Diagnostic Accuracy of H-reflex parameters

Diagnostic Accuracy	M- latency	H-M latency	H-amplitude
	Percentage (%)	Percentage (%)	Percentage (%)
Sensitivity	50.44	61.84	49.12
Specificity	85.45	74.55	78.18
Positive Predictive Value	93.50	90.97	90.32
Negative Predictive Value	29.38	32.03	27.04
Accuracy	57.24	64.31	54.77
Likelihood Ratio	3.46	2.43	2.25
Kappa Statistics	0.20	0.24	0.15

Discussion:-

The H-reflex is considered the electrophysiologic equivalent of the Achilles' tendon muscle stretch reflex. It evaluates the physiological integrity of tibial or S1 sensory path even the intraspinal course of S1 root. H reflexes involve conduction in proximal fibres, and provide a valuable technique for defining proximal nerve injury and may be abnormal even when more distal studies are unremarkable [6].

Velazquez Perez L et al[7]concluded that H reflex was useful tools for evaluating patients with compressive radiculopathies. They found H-reflex abnormality in 77.5% of cases of S1 radiculopathy. This is in accordance with

our observation. Our findings coincides with the observations by Tsao BE et al[8] who reported absent H-reflex or low H-reflex amplitude in 82 % of surgically proven cases of S1 radiculopathy. H-reflex,a monosynaptic reflex can differentiate to some extent, L5 from S1 radiculopathy.Many researcher have found the its sensitivities and specificities with respect to lumbosacral radiculopathy ranging from 32% to 88%.[9,10,11,12,13] Similar observations are also reported by I-Hsuan Tsai and Hao-Hsuan Tsai[14]who narrated that abnormal H-reflex profile parameters which includes M-wave, H-wave, H/M ratio, H-amplitude etc. were associated with both current and chronic lumbosacral radiculopathy.

Our findings are identical with the observations by Marin R et al[15] who reported that H-reflex showing 50% sensitivity and 91% specificity in L5, S1 radiculopathy. Hesham N Alrowayeh and Mohamed A Sabbahi[16] studied the electrophysiological changes in H-reflex amplitude and latency in patients with radiculopathy and found that decrease in H-amplitude is earlier sign of nerve root involvement in patients with radiculopathy compared with latency. Our findings are comparable with these observations.R E Rico and E J Jonkman[17] reported that H-reflex was not of any value in diagnosing L5 radiculopathy. This is in contrast to our findings as we found it to be useful diagnostic tool in L5, S1 radiculopathy.

We observed a significant reduction of the amplitude of the soleus H-reflex. This might be because of loss of axons, obstruction to impulse conduction or dispersion of the afferent volley and well correlates with no elicitation of the Achilles reflex. If the H-reflex is not delayed, then it is noteworthy that changes in H-reflex threshold and amplitude occur before any slowing of conduction through the nerve.

The severity of the compression of nerve roots may explain H amplitude reduction and prolongation of H latency of Soleus H-reflex study[18]. Because of nerve root compression, there is insufficient microcirculation and ischemia present in lumbosacral radiculopathy, this may lead to membrane potential and ion channel changes in the nerve fiber as well as focal disturbance to myelin. Both these factors together may influence the temporal dispersal of the compound sensory afferent volley and/or axonal conduction block.[19]This might be the reason why did we get abnormality in all the H-reflex parameters tested in lumbosacral radiculopathy.

Conclusion:-
H-reflex studies are useful and valuable supportive diagnostic tool for lumbosacral radiculopathy. All the parameters of H-reflex study have reliable sensitive and specific in diagnosing lumbosacral radiculopathy.

Acknowledgement:-

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