PREVALENCE OF SUBCLINICAL S1 RADICULOPATHY AND ITS ASSOCIATION WITH AGE AND GENDER IN CHRONIC LOW BACK PAIN PATIENTS WITHOUT RADICULITIS IN CENTRAL GUJARAT POPULATION: A HOSPITAL BASED CROSS SECTIONAL STUDY.

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Abstract:

Background: Soleus H reflex study is important diagnostic tool for S1 radiculopathy assessment in spinal canal stenosis, spondylolisthesis, lumbosacral radiculopathy patients. Significant differences were observed in soleus H reflex study variables when compared between normal and chronic low back pain cases with and without clinical radiculitis. Prevalence of subclinical S1 radiculopathy in chronic low back pain is less explored domain. **Aims and objectives**: To study prevalence, predictors and influence of age and gender on subclinical S1 radiculopathy in chronic low back pain without radiculitis patients. **Material and methods**: We selected 71 (47 male and 24 female) chronic low back pain cases without clinical radiculitis. All underwent soleus H reflex study. Cut off values were obtained from soleus H reflex study conducted on 50 controls. **Results:** Soleus H reflex study diagnosed 55 cases as S1 radiculopathy (77.46%) out of 71 cases using new criteria. With previous criteria prevalence was 35.2%. There was no association of age and gender on occurrence of S1 radiculopathy in these cases (p value<0.05). Diagnostic sensitivity, specificity, positive predictive value and negative predictive value of Soleus H reflex study was 77.46%, 94.00%, 94.83% and 74.6% respectively. H wave amplitude and H/M ratio were most frequently abnormal variable of soleus H reflex study in these cases.

Conclusion: Prevalence of subclinical S1radiculopathy among low back pain patients without radiculitis is 77.46%. Occurrence is not affected by age and gender. H amplitude and H/M ratio are better predictors of radiculopathy than other H reflex study parameters.

Key words: H reflex study, Low back pain, radiculopathy, Nerve conduction velocity.

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Introduction:

Although EMG and MRI are complimentary investigations for diagnosis of lumbosacral radiculopathy (LSR), role of these investigations in diagnosis of S1 radiculopathy in low back pain patients without radiculitis is limited. It may be attributed to the fact that there is no motor root involvement in these cases.[1, 2] Routine nerve conduction studies (NCS) of lower limb is more likely to be preserved except for severe LSR with axonal degeneration. Late responses (F and H waves) show prolonged latencies in L5S1 radiculopathy. F waves are less affected as compared to soleus H-reflex study.[3] Soleus H-reflex study is considered as sensitive test for detection of S1 sensory root dysfunction. In a study by Ghugare B et al, where low back pain patients without radiculitis were evaluated, significant difference were observed only in soleus H reflex study variables.[4] H latency is either prolonged or response is completely absent in S1 radiculopathy.[5] Thus, MRI gives evidence of structural root lesions, EMG gives evidence of motor root dysfunction and soleus H reflex study gives evidence of early sensory root dysfunction in LBP. Soleus H reflex study provides earliest evidence about S1 radiculopathy in LBP without radiculitis cases. Different parameters of soleus H reflex study have been used for diagnosis of S1 radiculopathy. Often, H latency and side to side latency difference is used. Role of H amplitude and H/M Ratio has also been evaluated for L5S1 radiculopathy diagnosis in low back pain patients with radiological evidence of L5S1 nerve root compression. These variables have increased the sensitivity of H reflex study for diagnosis of S1 radiculopathy.[6] Present study aims at estimating prevalence of subclinical S1 radiculopathy in low back pain patients without clinical evidence of radiculitis or neurodeficit with specific objectives to see effect of age and gender on occurrence of S1 radiculopathy. An attempt is also made to explore the best and worst predictors

of subclinical S1 radiculopathy from soleus H reflex study.

Material and methods

Study was conducted during June 2012 to January 2018 in clinical neurophysiology laboratory, physiology department at a tertiary care institute in central Gujarat. Patients were screened properly by consultant orthopaedic surgeon and radiologist using inclusion and exclusion criteria for study group.

Ethical issues: Permission from Institutional Human ethics committee (IHEC) was sought before start of study. Written Informed consent was taken from each participant before participating in the study

Selection of participants: Patients with low back pain radiating below buttocks with or without any systemic illness prone to cause neuropathies in future were excluded from the study. Low back pain patients less than three months duration or acute trauma, patients with neuromuscular disorders were also excluded. Hence selected patients were having only low back pain not radiating below buttocks of more than 3 months duration without any general or systemic or neurologic illness. Radiological assessment was done to rule out lumbosacral spine abnormality. Total 71 patients with history of chronic low back pain without clinical evidence of radiculitis and no evidence of lumbosacral spine abnormality on spine radiograph were selected for study. All underwent brief electrophysiological study to assess objective evidence of neuropathy if any. With no preliminary findings of neuropathy in any of these cases, they were subjected to soleus H reflex study for further evaluation. Similarly 50 controls without low back pain were selected after thorough clinical and electrophysiological screening. Cut off values for different H reflex study parameters were obtained from 100 nerves in these 50 controls.

Electrophysiological study in brief: Soleus H reflex study (Fig 1) was performed in cases and controls. H reflex is electrophysiological correlate of ankle jerk. Subject lies in prone position. Active electrode was placed at soleus muscle belly and reference at tendo-achilles. Grounding was done by placing an indifferent electrode between active and stimulating site. Tibial nerve was stimulated in popliteal fossa. Settings were kept at duration 1ms, sweep speed 10ms/D, sensitivity 500uV/D, and single stimuli with 0.5Hz frequency. Initially, low strength stimuli starting with 1mA were passed and then increased till H wave appeared and then disappeared. Graphs were obtained as mentioned in fig 1. H wave and M wave latencies and amplitudes were marked, data stored for further analysis.

Criteria for S1 radiculopathy diagnosis: Soleus H reflex study was done in cases and controls. Numerical values for different variables of H reflex study were obtained and stored for further analysis. To find prevalence of subclinical S1 radiculopathy, cut off values obtained from controls were used. Established criteria for diagnosis of S1 radiculopathy based on soleus H reflex study are either absent H wave or present with prolonged latencies and/or inter-side latency difference more than 1.3ms. But these values are mostly from western population hence we firstly obtained cut off values of H reflex variables in our laboratory. These values are: H wave latency 30.17ms (upper limit), H wave amplitude 2.22mV (lower limit), H/M ratio 13.42% and inter-leg H wave latency difference 0.861ms (upper limit). Apart from three established variables used for diagnosis we also added H amplitude and H/M ratio because in one such study on radiologically confirmed L5S1 neural foramina compression cases, these variables were significantly affected. [6]

Statistical analysis: H wave abnormalities were studied in entire study population including controls using these cut off values. Cases were further stratified based on gender and age to look for any association between these physiological variables and S1 radiculopathy. Fisher exact test was applied to assess level of significance. For all purposes, p value <0.05 was considered statistically significant. Lastly, we also explored the predictors of radiculopathy in these cases and overall diagnostic sensitivity and specificity of Soleus H reflex study. Graph Pad prism online statistical tool was used for analysis.

Results

Total 71 participants (47 male and 24 female) in the age range 25 to 50 years with average age 39±13 were evaluated using H reflex test. Using set criteria's for S1 radiculopathy, it was observed that H reflex test was abnormal in 55 participants (77.46%). Out of these fifty five S1 radiculopathy

cases, 37 were male (78.72%) and 18 were female (75%). Gender wise distribution and comparison of S1 radiculopathy cases is shown in table no 1. Gender was not associated with occurrence of S1 radiculopathy in low back pain patients.

In table no 2 prevalence of S1 radiculopathy is mentioned based on its age, less than 40 years and more than 40 years. 28 out of 38 cases with age less than 40 years (73.68%) and 27 out of 33 cases with age more than 40 years (81.81%) were diagnosed as S1 radiculopathy. Although trend suggests rise in prevalence as age advances, statistically this association is not significant (p value >0.05).

Table no 3 shows five predictors that were used for subclinical S1 radiculopathy diagnosis in study group. The order in which most to least frequent abnormal predictor appeared was reduced amplitude of H wave, H/M ratio, prolonged H wave latency, inter-leg H wave latency difference and lastly absent H response. If criteria for diagnosis follow only three parameters i.e. absent H wave, prolonged latency and inter-side difference; prevalence of S1 radiculopathy shrinks to 35.2%. With addition of remaining two parameters it is 77.46%.

Diagnostic efficacy of soleus H reflex study is shown in table no 4. It is observed that this test is highly specific in diagnosis of subclinical S1 radiculopathy in low back pain patients without radiculitis.

Discussion

Chronic pain in any lumbar structure i.e. ligaments, joints or muscles may influence the pathways sub serving the soleus muscle either through a common element in the central neuronal circuitry or following a motor pattern of trunk musculature . [7, 8] Soleus H reflex study has proved its role in diagnosis of S1 radiculopathy in canal stenosis, spondylolisthesis and radiologically diagnosed lumbosacral neural foramina compression cases.[5, 6] H-reflex study has contributed mainly in S1 sensory nerve root dysfunction, even in chronic low back pain subjects without clinical neurodeficit. [9, 10] As discussed earlier, sensitivity of H reflex study were increased when H wave amplitude and H/M ratio parameters were added while evaluating lumbosacral radiculopathy patients. [6]

In current study we evaluated 71 cases with low back pain without radiculitis. Soleus H reflex study was done and the prevalence of subclinical S1 radiculopathy observed in these cases was 77.46%. Without H amplitude and H/M ratio this prevalence reduced to 35.2%. This suggests that H amplitude and H/M ratio are highly sensitive parameters of H reflex study which when added in electrodiagnostic criteria for S1 Radiculopathy along with prolonged latencies, absent wave and inter leg latency difference, surprisingly doubles the prevalence of disease in the cohort under study. This is in agreement with few previous studies, although cohort was different. In these studies, study group were, sciatica patients, L5S1 neural foramina compression cases or S1 radiculopathy cases. [6, 11, 12]

Conclusion

Prevalence of subclinical S1-radiculopathy among low back pain patients without radiculitis is 77.46%. Occurrence is not affected by age and gender. H amplitude and H/M ratio are better predictors of subclinical S1-radiculopathy than other H reflex study parameters. Further studies with larger sample size may be done to extrapolate the results in general population.

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Table no 1: Gender wise distribution and comparison of S1 radiculopathy cases.

Participants gender	S1 radiculopathy		Total	Confidence interval	Fisher exact 2 tailed p value
	Present	Absent			
Male	37	10	47	0.6491-0.8820	p value = 0.768, i.e. >0.05; association is not statistically significant
Female	18	06	24	0.5479-0.8831	
Total	55	16	71		

Table no 2: Age wise distribution and comparison of S1 radiculopathy cases.

Participants age (Years)	S1 radiculopathy		Total	Confidence interval	Fisher exact 2-tailed p value
	Present	Absent			
≤ 40	28	10	38	0.6491-0.8820	p value = 0.5704, i.e. >0.05; association is not statistically significant
> 40	27	06	33	0.5479-0.8831	
Total	55	16	71		

Table no 3: Predictors of subclinical S1 radiculopathy in low back pain patients without radiculitis

Predictors of subclinical S1 radiculopathy	Number of cases in which abnormality was present out of 71 cases	Percentage of abnormality

Absent H wave	01	1.4%
prolonged H wave latency	24	33.8%
decreased amplitude	44	61.97%
decreased H/M ratio	30	42%
Interside- H wave latency difference	11	15.49%

Table no 4: Diagnostic specificity sensitivity positive predictive value and negative predictive value of soleus H reflex study

Test (H reflex study)	Low back pain without radiculitis		Total	Test specificity, sensitivity, PPV, NPV and likelihood ratio
	Present	Absent		
Positive	55	03	58	Sensitivity= 77.46%, Specificity= 94.00%, PPV=94.83%, NPV= 74.60, Likelihood ratio= 12.91 and 0.24
Negative	16	47	63	
Total	71	50	121	

Figure No. 1: Soleus H reflex study in Chronic low back pain patients without radiculopathy.