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Correlation of conduction studies of tibial and superficial peroneal nerves with structural abnormalities diagnosed on magnetic resonance imaging in lumbar canal stenosis

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Abstract

Background: Lumber Spinal Stenosis can give rise to several clinical syndromes depending upon the severity of compression resulting from spinal stenosis. LSS diagnosis is made through a complete assessment that combines history, physical examination, neurophysiology and imaging. EMG and NCS play important role in the evaluation of LSR. Present study was planned to see the extent of functional loss (EPE) by conduction studies associated with the structural abnormality (MRI) of lumber spinal stenosis.

Methodology: Longitudinal study was conducted in GMCH for four months. MRI was done of the probable patients of LLS followed by neurophysiological examination. Then correlation of nerve conduction of lower limb nerve was made with the finding of MRI.

Results: Almost equal male & female were there in study & 70% participants belongs to less than 60 years of age group. maximum (57%) participants had severe stenosis & 21% had minimal stenosis.Maximum participants (90%) had lateral left & right compression and only 20% had central compression. Almost 43% participants had compression at L2-L3 level, 70% had at L3-L4 level, 94% had at L4-L5 level & 63% had compression at L5-S1 level.

Conclusion: The early detection of functional loss by the neurophysiological examination may provide useful information to the clinician in planning the effective management for the patient's favourable outcome.

Introduction

Lumbar canal stenosis (LCS) is a clinical condition in which the patient presents with chronic low back pain and claudication of lower limbs due to narrowing of the spinal canal, secondary to degenerative changes including bulging discs, osteophytes from the arthritic facet joints and thickened flavum ligament (FL). All these changes lead to compression of nerve roots arising from the lumbar spinal segments.

The diagnosis of LCS depends upon clinical signs and symptoms which are usually confirmed by the Magnetic Resonance Imaging (MRI), which clearly defines the structural abnormalities in lumbar canal area in terms of canal diameter (both central and lateral), severity of compression and level of lesion. However, the functional status of these nerves and roots is not usually assessed before planning the surgical management of such patients.

(Egli*et al*. 2007)[1] in his paper quoted Katz *et al*. [2]in 1996, that in the United states during 1994 more than 30,000 surgical procedures were performed for Lumber spinal stenosis

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(LSS). Reasons quoted for fast growth in surgical rates include improved diagnostic imaging, improved surgical techniques and the ageing of population.

Methodology

The study was planned with the aims of to find out correlation between the indices of functional neurophysiological deficit through NCS with the severity of lumbar canal stenosis as evident from the MRI findings. Longitudinal study design was found most suitable to achieve the stated objectives. Study participants were patients of lumbar spinal stenosis, who have visited the in-outpatient Dept. of Orthopaedics, Government Medical College & Hospital (GMCH) of Udaipur during study period of four months. The provisional diagnosis of LSS was confirmed by MRI study in the dept. of Radiodiagnosis. We assessed the neurophysiological profile of lower limbs with the MRI findings along with the clinical presentation of the patient.

EMG/nerve conduction studies (NCS) are extension of the neurologic clinical evaluation focusing on the peripheral nervous system, and recognizing that lesions do not occur in electrodiagnostic isolation, but are to be taken in coordination with a thorough neurologic examination and imaging studies to assess the patient's clinical picture.

Study participants were evaluated for NCS profile in the Department of Physiology of above-mentioned Medical College. Symptomatic patients with MRI findings suggestive of spinal canal stenosis in the lumbar region were included in the study. Patients with Neuropathy/Myelopathy from other systemic diseases or other causes Alcohol abuse, use of certain neurologic medications, such as muscle relaxants, opioidsor psychotropic medications, Diabetes, Hypothyroidism, Systemic diseases, individual having a pacemaker were excluded from study. NCS of Tibial Nerve & Superficial Peroneal nerve was performed. Motor Nerve Conduction Velocity, Sensory Nerve Conduction Velocity & Delayed responses were taken.

Threshold stimulus. Onset Latency, Distal Latency, Amplitude, Nerve conduction velocity parameters recorded in motor & Sensory Nerve Conduction Velocity while in F wave were recorded in delayed response. Software Statistical Package for the Social Sciences (IBM SPSS) version 20 was used for data analysis.

Results & Observations

Table 1: Gender & age wise distribution of study participants

Variable	Category	Frequency (percentage)
Gender	Female	25(49.02)
	Male	26(50.98)
Total		
Age	<60 year	36(70.6)
	≥60 year	15(29.4)
Total		

Table 1 shows almost equal male (50.98%)& female(49.02%) were there in study & 70%participants belongs to less than 60 years of age group and 30% were in above 60 years of age group.

Table 2: Severity of Lumber stenosis

Severity Status	Frequency	Percentage
Mild	13	25.49
Moderate	9	17.65
Severe	29	56.86
Grand Total	51	100.00

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Table 2 shows maximum (57%) participants had severe stenosis & 21% had minimal stenosis while around 18% had moderate grade of lumber stenosis.

Table 3: Site of cord compression

Site	Compression	Frequency	Percentage
Central cord	No	41	80.39
	Yes	10	19.61
Lateral (right)	No	5	9.80
	Yes	46	90.20
Lateral (left)	No	5	9.80
	Yes	46	90.20

Table 3 shows site of compression maximum participants (90%) had lateral left (90.20%) & right compression (90.20%) and only 20% participants had central cord compression.

Table 4: Level of compression

Level	Compression	Frequency	Percentage
L2-L3	No	29	56.86
	Yes	22	43.14
L3-L4	No	15	29.41
	Yes	36	70.59
L4-L5	No	3	5.88
	Yes	48	94.12
L5-S1	No	19	37.25
	Yes	32	62.75

Table 4 shows 43% participants had compression at L2-L3 level, 70% participants had lumber compression atL3-L4 level, 94% participants had compression at L4-L5 level & 63% participants had compression at L5-S1 level.

Discussion

Objectives of the current study was to correlate the of conduction studies of selected lower limb nerve (Tibial and Superficial Peroneal Nerves) with findings of on Magnetic Resonance Imaging in Lumbar Canal Stenosis. The main results of the studywerealmost equal male & female were there in study & 70% participants belongs to less than 60 years of age group. maximum (57%) participants had severe stenosis & 21% had minimal stenosis. site of compression maximum participants (90%) had lateral left & right compression and only 20% had central compression43% participants had compression at L2-L3 level, 70% had at L3-L4 level, 94% had at L4-L5 level & 63% had compression at L5-S1 level.

Egli O *et al.* [1]concluded that the applied electrophysiological recordings, especially SSEP, can confirm a neurogenic claudication due to cauda equina involvement and help to differentiate neurogenic from vascular claudication or Musculoskeletal disorders of the lower limbs. Yousif S *et al.*[3]concluded that There was a statistically significant correlation between abnormal physical findings and nerve root compression in MRI.Singh R[4]*et al.* Concluded that Mean conduction velocity was mildly decreased in tibial and sural nerves in all the patients either with normal MRI or disc involvement on MRI. In disc involvement conduction velocity, decrease was more as compared to normal MRI. Ziegler MS [5]concluded that Electromyography confirmed high frequency of radiculopathy, particularly multi-radiculopathy. L5 and S1 roots were the most susceptible to injuries. We also found a higher prevalence of L4 radiculopathy. Adamova B[6]*et al.* conducted a study and the aim was to evaluate the appearance of significant transient electrophysiological abnormalities after walking exercise in patients with LSS and to establish the contribution of dynamic electrophysiological examination in the differential diagnostics of patients with LSS.

Johnsson K[7]*et al*. concluded that in spinal stenosis with total occlusion, bilateral neurogenic changes were registered in 87.5%, without total occlusion in 81%and in spinal claudication with a myelogram of normal width in 29%. The corresponding frequencies of multi-segmental EMG abnormalities were 94%, 75%and 21%, respectively. H. Matsui *et al*. [8]also conducted a study to see the electrophysiological findings in cases of compressed lumbar nerve roots. S.C. Cho *et al*. [9]and Marciniak C[10]*et al*. by their study have proven the utility of electrodiagnostic testing in management of lumber stenosis.Nafissi S *et al*. [11]conducted a study and found that patients under study had the mean age of 46.4 ± 13.1 years (mean ± standard deviation). There were positive MRI findings in 64% of the patients. In 43% L5 root and in 40% S1 root was involved. Abnormal electrophysiological findings were recorded in 82% of the patients. They concluded that 82% positive findings in electrophysiological studies in the diagnosis of lumbosacral radiculopathy make it an efficacious tool in the evaluation of the patients suffering from lumbosacral radiculopathy. T.D. Lauder[12] by his study concluded that having at least one abnormal physical examination finding makes the probability of having an abnormal electrodiagnostic study more likely than if the results of the physical examination are normal. E.E. İnal*et al*. [13]evaluated the relationship between clinic and electroneuromyographic (ENMG) findings in patients with suspected radiculopathies. They have not taken MRI finding in consideration. DillinghamTR *et al*.[14, 15]evaluated Electrodiagnostic assessment and its implications for treatment and outcomesand concluded that an EMG confirmed lumbosacral radiculopathy is associated with better clinical outcomes. Arslan Y*et al*. [16]investigated the correlation and classification of EMG and magnetic resonance imaging (MRI) findings in the diagnosis of suspected radiculopathy. They found that the mean age of the patients was 51.58±11.53 years. In total, 41 (55.4%) patients were women and 33 (44.6%) were men; 48.8% (n=36) showed cervical radiculopathy and 51.2% (n=38) exhibited lumbosacral radiculopathy. The most common MRI finding was protrusion (37.8%)and the most common EMG finding was re-innervation (59.5%). The correlation of MRI and EMG findings was significant in lumbar radiculopathy (p=0.007), but not in the cervical radiculopathy results (p=0.976). Conclusion: EMG and MRI findings were compatible for lumbar radiculopathy, but not for cervical radiculopathy in mild to moderate grades.

Conclusion

Electrophysiological studies can play an important role in the determination of appropriate treatments for patients, prevention of unnecessary interventions and detection of treatable alternatives or complementary diagnose as the test cannot be used in isolation.

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