ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

"The Role of NCS and MRI in Assessment of Patients with Chronic Low Back Pain"

Nabiel Abdel Hakeem Metwally[1a], Hassan Ahmed Hashem Soliman[1b]

1a. Professor and head of Neurology department, Al-Azhar faculty of medicine, Assiut branch, Egypt.
1b. lecturer of neurology, Al-Azhar faculty of medicine, Asyut branch, Egypt.

Manuscript Info

Manuscript History:

Received: 15 September 2015
Final Accepted: 22 October 2015
Published Online: November 2015

Key words:

NCS, low back pain,Lumbosacral MRI

Corresponding Author

Nabiel Abdel Hakeem Metwally

Abstract

Background: The role of neurophysiology in the assessment of peripheral nerve disorders is long standing well known, we need to evaluate the role of specific tests in the assessment of proximal nerve segments in comparison to a well-established diagnostic tests as MRI. The purpose of this study is to assess the role of nerve conduction study (NCS) in evaluation of patients with chronic low back pain in comparison with clinical and radiological findings. methods: A fifty patient was enrolled in this study including ten patients without root pain (group I) and forty patients with root pain (group II) and fifty healthy volunteers, including (24) males and (26) females as control (group III), matched for age and sex with patient group, both case and control groups were subjected to clinical examination, laboratory studies, NCS and lumbosacral MRI. Results: The most radiological finding in lumbosacral region at CLBP is the disc bulge and disc herniation of intervertebral discs, the tibial MUP amplitude is the most sensitive test in diagnosing local CLBP without neurological deficit, the motor nerve conduction study of tibial and peroneal nerves are more important in diagnosing the CLBP with neurodefecit at lower limbs. Conclusion: MRI with motor and sensory NCS increases the sensitivity of diagnosing radiculopathy in CLBP to 82%.

INTRODUCTION

The role of neurophysiology studies in the assessment of patients with LBP and radiculopathy is well known decades ago.

Chronic Low back pain (CLBP) is termed when the pain lasts for more than 3 months[1].Low back pain is a disabling musculoskeletal disorder with an overall lifetime prevalence of 60% to 90%. Almost 95% of low back pain complaints resolve after 3 months [2]. The diagnostic evaluation of CLBP is difficult as its primary causes are different, affecting intervertebral discs, ligaments, facet joints, muscles etc. Also clinical signs and symptoms, radiological and electrophysiological evaluation can't exactly provide the source of pain responsible for patient's symptoms in most cases [3]. MRI is useful in diagnosing the etiology of both acute radicular low back pain and some causes of chronic low back pain[4].Overweight has a significant association with the lumbosacral radicular pain[5]. The results of certain case-control studies have revealed a positive association between increased (body mass index) BMI and lumbar disc herniation among men and women[6].Lumbar disc herniation is an important cause of low back pain and lumbosacral radicular pain [7] . Fortunately, in as many as 90 percent of patients, acute low back pain resolves within six weeks regardless of treatment methods and only 5 to 10 percent of cases requiring surgery [8].

METHODS:

1. Participants:

This is a case study that performed at period from March 2013 to august 2014. Patients were selected with conventional method from patients referred to the electrodiagnostic unit, neurology department, faculty of medicine, AL Azhar University Hospital, Assiut branch, Egypt. This study was carried out on fifty patients with history of back pain more than 3 months from both sex (24men, and 26 women) participated in this study with an age range of 20-53 years, including 10 patients with no history of root pain and 40 patients with history of root pain and fifty healthy volunteers. All participants were informed about the tests, and the study was approved by faculty of medicine, AL Azhar University Hospital. exclusion criteria were; those with acute onset back pain or manifested with low back pain below 3 months duration, significant trauma or surgical operation at lumbosacral region, those presented with neuropathy due to metabolic cause or history of drug abuse.

2. Method:

All participants were underwent a complete medical history, clinical examination and Laboratory investigations including: CBC, ESR, CRP, Serum Ca, Random blood sugar, Serum Albumin, bilirubin, ALT, AST, alkaline phosphates, Serum createnine, Blood urea, Complete urine analysis and MRI lumbosacral spine was done.

2.1. Neurophysiological studies: These studies include:

2.1.1. Motor nerve conduction studies of common peroneal and posterior tibial nerves conduction studies for all patients;

2.1.2. F wave response study in tibial and common peroneal nerves; Mean F wave latency: Mean of latencies of 10 consecutive F response.

2.1.3. Sensory nerve conduction studies of dorsal sural nerves.

NCS was performed with Nihon Kohden corporation Model: MEB2003k, Serial no 00051, Japan 2012.

2.1.4. Machine settings: Sensitivity—2–5 μV/division, Low frequency filter—20 Hz, High frequency filter—2 kHz, Sweep speed—1 msec/division.

2.1.5. Position: This study is performed in the prone position.

2.1.6. Analysis of the response:

- **Distal motor latency**. Measured from stimulus to initial deflection of the motor response and expressed in milliseconds (msec).
- **Conduction velocity**. Calculated by measuring the distance in millimeters (mm) between tow stimulation sites and dividing by the difference in latency (msec)from the proximal and distal stimuli.
- **Amplitude**. Measured from peak to peak of elicited motor response and expressed in millivolts (mv).
- **Duration**. Measured from the onset to the last positive peak and expressed in milliseconds(msec).

2.2. Neuroradiological studies

MRI of lumbosacral spines (Axial, Sagital) views to identify site of root compression and identify cause of compression and exclusion of neoplasm at site

3. Statistical analysis:

Data were expressed as means ± SD (range) unless otherwise stated, Calculations were done with the statistical package of SPSS for windows, version 17.0 (SPSS inc., Chicago, IL, USA). $P \leq 0.05$ was set as significant, $p<0.001$ was set as highly significant, $p>0.05$ was set as non-significant. R value that was between 0.1– 0.3 indicate mild correlation 0.3- 0.5 indicate moderate correlation, More than 0.5 indicate high correlation and -Ve result mean negative correlation.

4. Ethical consideration

1- Risk-benefit assessment: There is no risk during application of the research.
2- Confidentiality was maintained during the research.
3- Informed oral consent was taken from patients and controls or their close relatives for their approval to participate in this study.

RESULTS

The characteristics of patients:

This study including fifty patients with chronic back pain, subdivided into 10 patients without root pain (group I), including 4 males and 6 females, with age rang 29-55 year, Mean ± SD of weight 92±16.16, height 171.2±7.829 and BMI 31,03±4.753 and 40 patients with root pain (group II) including 20 males and 20 females, with age rang 21-67 year, Mean ± SD of weight 84.95±16.63, height 170.67±6.228 and BMI 29.331±5.974 and 50 healthy as control (group III) including 24 male and 26 female with age range 21-67 year, Mean ± SD of weight 84.12±11.222, height 172.2±6.794 and BMI 28.44±4.315.

Clinical findings in patients with CLBP:

Clinical examination of patients showed 10 with tender back, one with back deformity (scoliosis), 4 with foot deformity, 27 with weakness (21 for ankle, 4 for knee and 2 for hip), 4 with wasting, one with fasciculation, 36 with reflex abnormalities (27 for ankle and 9 for knee), 24 with dermatomal sensory defect and 26 with positive raised straight leg test.

NCS abnormalities in case and control groups:

Motor NCS was abnormal in 52% in patients compared to 16% in control group and sensory NCS was abnormal in 30% in patients compared to 4% in control group, with statistically high significant results (P= 0.001).

NCS in relation to ankle weakness: showed, statistically significant results for, reduced SUAP amplitude (P=0.020) and prolonged DL (P=0.005) of Sural nerve, reduced CV (P=0.003) and reduced MUAP amplitude (P=0.001) of Peroneal nerve and prolonged DL (P=0.001) of Tibial nerve.

Relation of ankle reflex to NCS: showed, statistically significant results for, reduced sural SUAP amplitude (P=0.007), prolonged F-latency (P=0.039), reduced CV (P=0.004), reduced MUAP amplitude (P=0.001) and prolonged DL (P=0.004)of Peroneal nerve, prolonged F–latency (P=0.004) and reduced MUAP amplitude (P=0.009) of Tibial nerve.

Relation of straight leg rising test to NCS: showed, statistically significant results for, prolonged DL of sural nerve (P=0.032), reduced CV (P=0.006), reduced MUAP amplitude (P=0.001) of Peroneal nerve and prolonged F–latency (P=0.001) and prolonged DL (P=0.001) of Tibial nerve.

MRI findings in the study group (patients with CLBP):

MRI of patients showed, 19 with disc bulge, 8 with disc herniation, 2 with Disc prolapsed, 7 with Degenerative process without root compression, one with Spinal stenosis, 2 with Annular tears and 11 with Normal MRI findings.

Relation of MRI abnormality with neurology deficit in CLBP:

All patients with knee weakness (4), hip weakness (2), wasting (4), fasciculation (1) and sensory deficit (24) showed abnormal MRI findings while 17 of 21 with ankle weakness, 22 of 27 with abnormal ankle reflex, 7 0f 9 with abnormal knee reflex and 23 of 26 with positive SRL were with abnormal MRI and the only those with sensory defect showed statistically (p=0.003) significant results.

Tables:

Table (1):Correlation between group I and II:

	main ± SD	Group I	Group II	P value
	DL	3.825 ± 0.187	3.962 ± 0.246	0.203
Sural N.	CV	**43.596±1.696**	44.692 ± 1.532	0.39
	Amplitude	**6.431± 0.959**	6.144 ± 1.333	0.687
	F-latency	47.708 ± 1.763	46.941 ± 4.081	0.885
Peroneal N.	DL	4.047 ± 0.193	4.244 ± 0.382	0.567
	CV	49.285 ± 3.218	44.361± 5.368	0.025
	Amplitude	6.025 ± 0.780	3.728 ± 1.642	0.001
	F-latency	50.427 ± 3.345	46.994 ± 2.441	0.001
Tibial N.	DL	4.098 ± 0.229	4.370 ± 0.335	0.002
	CV	47.095 ± 5.561	46.905 ± 5.283	0.999
	Amplitude	5.885 ± 0.540	5.666 ± 1.431	0.852

Table (2): Correlation between group I and III:

	main ± SD	Group I	Group III	P value
Sural N.	DL	3.825 ± 0.187	3.936 ± 0.260	0.266
	CV	**43.596±1.696**	45.410 ± 0.923	0.008
	Amplitude	**6.431± 0.959**	7.369 ± 0.701	0.043
	F-latency	47.708 ± 1.763	45.031 ± 1.308	0.217
Peroneal N.	DL	4.047 ± 0.193	4.230 ± 0.374	0.327
	CV	49.285 ± 3.218	45.372± 1.657	0.229
	Amplitude	6.025 ± 0.780	5.494 ± 0.403	0.040
	F-latency	50.427 ± 3.345	48.341 ± 1.790	0.530
Tibial N.	DL	4.098 ± 0.229	4.058 ± 0.186	0.98
	CV	47.095 ± 5.561	49.291 ± 2.113	0.292
	Amplitude	5.885 ± 0.540	7.974 ± 0.756	0.001

Table (3): Correlation between group II &III:

	main ± SD	Group II	Group III	P value
Sural N.	DL	3.962 ± 0.246	3.936 ± 0.260	0.948
	CV	44.692 ± 1.532	45.410 ± 0.923	0.019
	Amplitude	6.144 ± 1.333	7.369 ± 0.701	0.001
	F-latency	46.941 ± 4.081	45.031 ± 1.308	0.001
Peroneal N.	DL	4.244 ± 0.382	4.230 ± 0.374	0.997
	CV	44.361± 5.368	45.372± 1.657	0.197
	Amplitude	3.728 ± 1.642	5.494 ± 0.403	0.001
	F-latency	46.994 ± 2.441	48.341 ± 1.790	0.001
Tibial N.	DL	4.370 ± 0.335	4.058 ± 0.186	0.001
	CV	46.905 ± 5.283	49.291 ± 2.113	0.033

Table (4): Correlation between demographic characteristics (Age, Weight, Height, BMI and Duration of disease) and neurophysiological parameters in study group:

		Sural			peroneal				Tibial			
NCS		CV	Amp	DL	FL	CV	Amp	DA	FL	CV	Amp	DL
Age	r	0.042	-0.078	0.063	0.061	0.004	-0.109	0.044	0.051	-0.123	0.053	0.069
	P	0.553	0.273	0.380	0.394	0.950	0.129	0.539	0.472	0.084	0.454	0.331
Weight	r	-0.024	0.026	0.080	-0.151	-0.059	-0.078	0.116	0.186	0.017	-0.164	0.053
	P	0.735	0.717	0.264	0.033	0.406	0.278	0.101	0.008	0.809	0.020	0.457
Height	r	-0.006	0.099	0.072	0.034	-0.010	0.035	-0.211	0.060	-0.080	0.097	-0.018
	P	0.934	0.164	0.313	0.636	0.886	0.629	0.003	0.401	0.260	0.173	0.797
BMI	r	0.001	-0.013	0.136	-0.163	-0.070	-0.136	0.173	0.151	0.039	-0.170	0.076
	P	0.985	0.852	0.056	0.021	0.327	0.057	0.014	0.032	0.587	0.016	0.282
Duration	R	0.137	0.127	-0.181	-0.054	0.034	0.041	-0.040	0.084	-0.068	-0.047	0.065
	P	0.176	0.207	0.075	0.595	0.743	0.692	0.696	0.407	0.501	0.641	0.521

Figures:

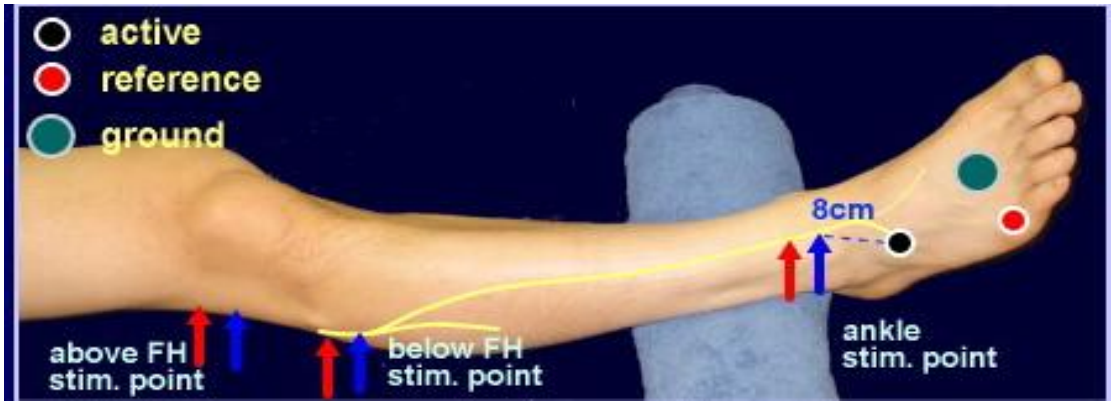

Fig. (1) Common peroneal nerve. [9,10].

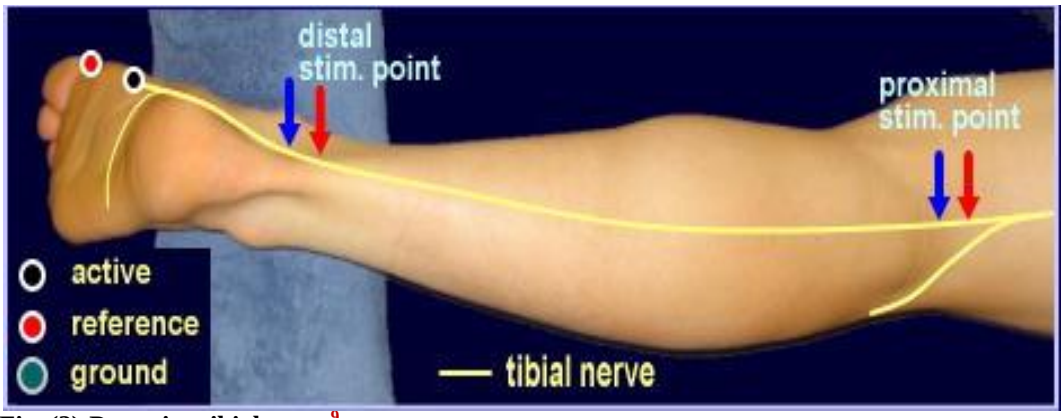

Fig. (2):Posterior tibial nerve[9].

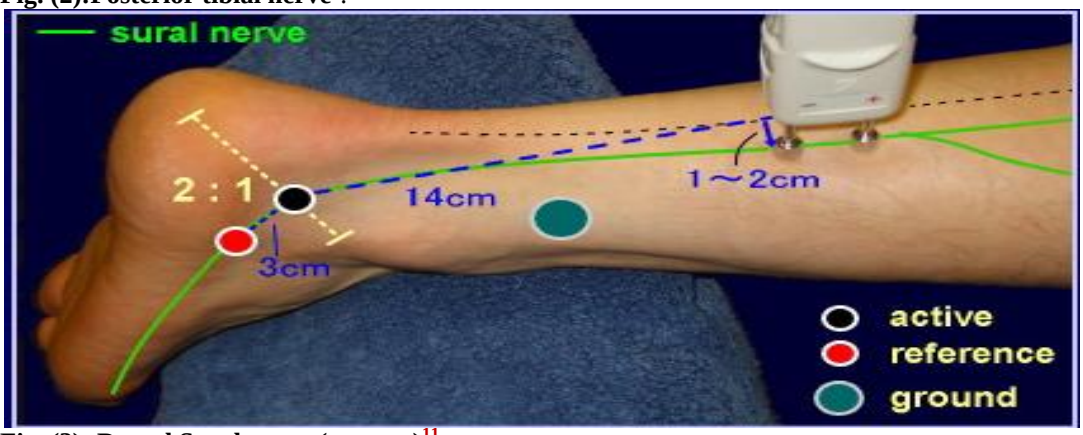

Fig. (3): Dorsal Sural nerve (sensory)[11].

DISCUSSION

Low back pain is a disabling musculoskeletal disorder with an overall lifetime prevalence of 60% to 90%. Almost 95% of low back pain complaints resolve after 3 months, leaving 5% with persistence of symptoms developing into CLBP [12]. Risk factors for the onset of back pain include smoking, obesity, older age, female gender, physically strenuous work, sedentary work and low educational attainment [13]**.** The diagnostic evaluation of CLBP is difficult as its primary causes are different, affecting inter vertebral discs, ligaments, facet joints, muscles… etc. Also clinical signs and symptoms, radiological and electrophysiological evaluation can't exactly provide the source of pain responsible for patient's symptoms in most cases[14]**.**

In this study, neurophysiological findings were abnormal in 16.6 %, for MNCS in patient with CLBP without neurodefecit (group I) and 61% in patients with CLBP with neurodefecit (group 2), as regard SNCS, 50% in group 1 and 45% in group 2 were abnormal, while abnormal F wave was found in 30%, these results partially agree with[2], who found that, the abnormality in MNCS were 64% , SNCS were 46% , while abnormal F wave in 40%, that difference may be explained by patient difference in age, sex and BMI, our study results again partially agree with[15], they found that, motor nerve conduction abnormalities were 35.5% and abnormal F wave response was 42.5%. also our results partially agree with[16] who found that, abnormal MNCS in 36%.

In the present study NCS in group 1 shows significant diminished MUAP of tibial and peroneal nerves with significant diminished amplitude and slow CV of sural nerve, these results partially agree with[2] who found that, significant decrease of MUAP and CV of peroneal nerve.

In the present study, NCS in group 2 shows significant (prolonged DL of the peroneal nerve, diminished MUAP amplitude of tibial, peroneal and SUAP of sural nerves with significantly slow CV of tibial and sural nerves and F- wave latencies of tibial and peroneal nerves were longer), while in the previous study [17], the MUAP amplitude of tibial and peroneal nerves are lower in patients than control patients, in addition F- wave latencies of tibial nerve were longer and tibial and peroneal CV were slower in patient group.

In this study there is significant relationship between gender with MUAP amplitude and F- wave latency, while in the previous study [17], there is no significant relationship between the gender and neurophysiology.

In this study there is no significant relationship of patient's age with DL, MUPA amplitude, CV and F- wave latency of tibial, peroneal and sural nerves and this agree with[19] , they found the same results.

In this study there is no observed correlation between age of patients and sural SNAP and CV ,this partially agree with [2] , who found that, there is low negative correlation between sural SNAP and patient age and no correlation with sural CV. These results also was agree with [20, 21]they found that, there was no correlation between age of patient and sensory sural CV.

In this study height show low negative correlation with SNCV and SNAP amplitude of sural nerve and this was in agreement with [2, 18, 22, 23] they found same results.

In this study there is no significant correlation were observed between weight and BMI with SNCV, SNAP amplitude of sural nerve and this agree with [2]and in partial agreement with [11] who found that, there was significant negative correlation between BMI and sensory sural amplitude with (20-40)% reduced mean value in obese compared to thin it may due to attenuation by thicker Sub- Coetaneous tissue in person with higher BMI with no correlation between CV of sural nerve and BMI.

In this study there is no significant relationship of patient height with peroneal and tibial MNCS and F- response except negative correlation with peroneal DL and this disagree with [24]who found moderate correlation.

In this study there is no significant relationship between duration of CLBP and neurophysiology and this was in agreement with [25,26]they found that, patient with duration of CLBP more than one month had more EDX abnormality compared to shorter duration, and our results were in disagreement with[19]who found that there is significant relationship between the electrophysiological findings and duration of symptoms.

In this study there is highly significant relationship between ankle weakness and amplitude in common peroneal nerves, where there is only one of 27 patients with ankle weakness had normal CAMP amplitude of common peroneal nerve, this result was partially agree with [19] who found that, only 36.8% of patient with ankle weakness had normal common peroneal MUPA amplitude while 63.2% had abnormal or absent MUPA amplitude of common peroneal nerve.

In this study there is no significant relationship of ankle weakness and MUPA amplitude of tibial nerve and this was agree with [19].

In this study there is highly significant relation between diminished MUPA of common peroneal nerve and SLR where in 33 subject with positive SLR test 22 subject has abnormal diminished MUPA of common peroneal nerve represented 66.7% compared to 11 subject represented 33.3% had normal MUPA of common peroneal nerve and this agree with [19] who found that, in 47 subject with positive SLR test 13 subject had decrease MUPA of common peroneal nerve representing 27.6% compared to 2 of negative SLR.

In the study, there is high positive relationship between SLR test and evidence of disc bulge at radiological lumber MRI at patient complaining of CLBP, while no evidence of relationship of positive SLR test and other radiological finding in lumber region with inability to obtain relation between positive SLR test and spinal stenosis and annular tear at radiological MRI at lumber region at CLBP and this result was in disagreement with [27]who found that, there is positive relationship of positive SLR test with spinal stenosis at MRI, with no significant relation with other radiological finding at lumber region at CLBP patient.

In this study the MRI showed high sensitivity 82.50% in diagnosis of CLBP more than 3 months with high positive likelihood ratio 84.62 % and low negative likelihood ratio 36.35%, with low specificity 40 % which is closely agree

with [28] they found that, the MRI showed high sensitivity 89 % with positive likelihood ratio 58 % with low negative likelihood ratio 39.35% and very low specificity of 11 %.

REFERENCES:

1. **Dankaerts, W, O'Sullivan, P., Burnette and AF and M. Straker.** Difference in sitting postures are associated with nonspecific chronic low back pain disorders when sub-classified. *Spine,* **2006,** *31(6), 69-704.*
2. **Ghugare B, Das P, Ghate J, Patond K, Koranne M and Singh R,.** assessment of nerve conduction in evaluation of radiculopathy among chronic low back pain patients without clinical neuro deficit. *Indian J Physiology Pharmacol;* **2010,** *54(1).*
3. **Frymoyer JW.** Back pain and sciatica. New EnglJ Med; 318: 291–300. Assessment of nerve conduction in evalution of radiculopathy among chronic low back pain patients without clinical neuro deficit. *Indian J Physiologic Pharmacol;* **2010,** *54(1) : 63–68.*
4. **Davis, P.C., Wippold, F.J., Brunberg , J.A., Cornelius, R.S., De La Paz, R.L., and Dormont, D.,** ACR appropriateness criteria low back pain. Retrieved from http://guideline.gov/content.aspx?id=35145 Institute for Clinical Systems Improvement. (2012). Health care guideline: *adult acute and subacute low back pain (15th ed.).from* http://www.nice.org.uk/nicemedia/live/11887/44343/44343.pdf .
5. **Shiri R, Karppinen J, Leino-ArjasP, Solovieva S, Varonen H, Kalso E and et al,.** Cardiovascular and lifestyle risk factors in lumbar radicular pain or clinically defined sciatica: a systematic review. *Eur Spine J,* ***2007,*** *16: 2043-2054.*
6. **Zhang Y, Sun Z, Liu J and Guo X.,**Advances in susceptibility genetics of intervertebral degenerative disc disease. *Int J BiolSci, 2008, 4: 283-290.*
7. Chou R.**, Qaseem A., Owens D. and Shekelle P.,** Will this patient develop persistent disabling low back pain? *JAMA. 2010, 303:1295-1302.*
8. **CRAIG HUMPHREYS S., JASON C. ECK and SCOTT D. HODGES.,** Neuroimaging in Low Back Pain, *Am Fam Physician J. 2002, 1;65(11):2299-2307.*
9. **Buschbacher RM.** Tibial nerve motor conduction to the abductor hallucisbrevis. *Am J Phys Med Rehabil;1999, 78:S26–S31.*
10. **Lee HJ.** Compound nerve action potential of common peroneal nerverecorded at fibular neck: its clinical usefulness. *Am J Phys Med Rehabi; 2001, 80:108–112.*
11. **Buschbacher RM.** Sural and saphenous 14-cm antidromic sensory nerve conduction studies. *Am J Phys Med Rehabil; 2003, 82(6):421–426.*
12. **Daube JR and Rubin DI.** *Clinical neurophysiology, 3. ed. New York: Oxford University Press; 2009, 340.*
13. ***Katz JN.*** *Lumbar disc disorders and low-back pain: socioeconomic factors and consequences. J Bone Joint Surg Am; 2006, 88 Suppl 2:21..*
14. **Davis, P.C., Wippold, F.J., Brunberg J.A., Cornelius, R.S., De La Paz and Dormont, D,** ACR appropriateness criteria low back pain. Institute for Clinical Systems Improvement. *Health care guideline: adult acute and subacute low back pain, 2012, (15th ed.).*
15. **Sheki A.A and Hamadan B.F.**role of different neurophysiological test in differential diagnosis of diabetic axonal neuropathy and Lumbosacral radiculopathy *;from Neurosciences ;2009, vol . 14 (1).*
16. **Berger AR, Busis NA and Logigian EL.** Cervical root stimulation in the diagnosis of cervical radiculopathy. *Neurology;1999, 37:329–32.*
17. **Tilki E. H , Coskun M , Akdemir U.N and Incesu L.** Axon count and sympathetic skin response in lumbosacral radiculopathy, *2014, from* http://dx.doi.org/10.3988.10.1.10.
18. **Thakur D, Jha S, Pandey NK, Jha CB, Bajaj BK and Paudel BH.,**Influence of height on nerve conduction study parameters of the peripheral nerves. *Journal of clinical and diagnostic research ;2011, 5(2):260-263.*
19. **ShahriarNafissi**, **HosseinPakdaman, FarzadFatehi, MassoudNabavi, MajidGhafarpour, MansoorehTogha and et al.,** *Electrophysiological evaluation in lumbosacral radiculopathy , Iranian Journal of Neurology; 2012, 11(3).*
20. **Fuji MY, Kuwabara S, Sato Y, Isose S, Shibuya K and Sekiguchi Y.,** The effect of age, gender and body mass index on amplitude of sensory nerve action potentials: multivariate analysis. *Clinical Neurophysiol;* ***2009,*** *120(9):1683-86.*
21. **Huang CR, Chang WN, Chang HW, Tsai NW and Lu CH.,** Effect of age, gender, height, and weight on late responses and nerve conduction study parameters. *ActaNeurologicaTaiwanica;* ***2009,*** *18(4):242-49*

22. **Saeed S and Akram M.** Impact of anthropometric measures on sural nerve conduction in healthy subjects. *J Ayub Med Coll Abbottabad; **2008**, 20(4):112-14.*
23. **Stetson DS, Albers JW, Silverstein BA and Wolfe RA.** Effect of age, sex and anthropometric factors on nerve conduction measures. *Muscle Nerve;* **1992,** *15(10):1095-104.*
24. **DilipThakure .** influence of height on the nerve conduction parameters of limbs, *from journal of clinical and diagnostic research. 2011, VOL-5 (2): 260-263.*
25. **Haig AJ, Talley C and Grobler LJ.** Paraspinal mapping: quantified needle electromyography in lumbar radiculopathy. *Muscle Nerve.;* **1993,** *16(5): 477-84.*
26. **Scelsa SN, Berger AR and Herskovitz S.,**Electrophysiologic correlates of weaknesses L5/S1 radiculopathy. *ElectromyogrClinNeurophysiol.;* **2001,** *41(3): 145-51.*
27. **ZaroskyJ, Young R, Barbee J, MogonyeJ and Kirk M.,**Chart Review Study of Correlation Between Straight Leg Raise and MRI Findings chronic low back pain;**2010,** *from http:// www. J p s .com.*
28. **Hasankhani E.G and Kashani O. F.** magnetic resonance imaging versus electrophysiollogic tests in clinical diagnosis of lower extremity radipain,published b(Huang J.H , Knikou M), *ISRN neuroscience,* **2013***: article ID 952270, 4 pages from http://dx.*