

The Utility of the Cervical Par Spinal Muscles Needle EMG in the Diagnosis of Cervical Radiculopathy

Zina S. Fakhrymbchb; Mscnajeab H. Mohammed Mbchb; Msc; Dm; Phd

Corresponding Author: Zina S. Fakhrymbchb

Summary:

Background: Cervical radiculopathy is a common cause of morbidity. Its management often requires clinical, electrodiagnostic and radiological evaluation, and its treatment may include surgery.

Objectives: assess the importance of the cervical paraspinal muscles in the diagnosis of cervical radiculopathy.

Subjects and methods: Ninety five (95) patients with cervical radiculopathy with a mean age of (48.4±11) years and twenty six (26) healthy control subjects with a mean age of (45.2±10.1) years involved in the study. Needle EMG of the cervical paraspinal muscles in addition to six upper limbs muscles were performed.

Results: The percentage, sensitivity, specificity, PPV and NPV of each level of cervical radiculopathy was increased by the combination of the needle EMG abnormalities of the cervical paraspinal muscles with that of the upper limbs muscles.

Conclusion: Paraspinal muscles EMG is mandatory in the cervical radiculopathy work up, in review of the high diagnostic yields of the procedure.

Keywords: Electrodiagnostic (EDX), electromyography EMG, paraspinalmuscles (PSM), upper limb (UL).

Date of Submission: 01-08-2018

Date of acceptance: 16-08-2018

I. Introduction

Cervical radiculopathy is a clinical syndrome manifested by compression of a spinal nerve in the neck. This syndrome is typically characterized by upper extremity pain and, occasionally, sensorimotor deficits in the area supplied by the affected nerve. Patients who suffer from this disease are

often debilitated, losing time from work and social obligations. It is essential for clinicians to rapidly diagnose and appropriately treat these patients (1).

Cervical radiculopathy is a common cause of morbidity. Its management often requires clinical, electrodiagnostic and radiological evaluation, and its treatment may include surgery (2).

Electrodiagnostic (EDX) examination for patient with cervical radiculopathy serves to confirm the presence of radiculopathy, establish the involved root (roots), determine if axon loss or conduction block is present, grade the severity of the process, estimate the age of the radiculopathy and exclude other peripheral nerve diseases that mimic radiculopathy (3). Various types of electrodiagnostic studies may be considered when evaluating a patient for cervical radiculopathy in the electrodiagnostic laboratory. Potential tests include EMG, motor and sensory nerve conduction studies, late responses, and somatosensory evoked potentials(2).

Compression of the ventral (motor) root may cause demyelination or axon loss, or both. These yield different EDX findings:

- When the compression causing axon loss, Wallerian degeneration will occur. One of the electrical manifestations of this process when it involves the extrafusal motor fibers is SA in an appropriate myotomal distribution. With some chronic root lesions in which SA are lacking, MUAP changes indicate that both motor axon degeneration and subsequent regeneration have occurred. However, if the axon loss severe enough, low-amplitude CMAPs with decreases conduction velocity of the peripheral nerve that derived from the affected root.

- Pure demyelination: with many radiculopathies, even acute ones studied within a few weeks of onset, no evidence of motor axon loss is detectable. This suggests that another pathophysiologic process, focal demyelination, is operative. At times, such demyelination is severe enough to produce conduction block. Lesser degrees of focal demyelination may result in conduction slowing at the injury site.

The slowing may affect all axons to the same degree (synchronized slowing) or alter the speed of conduction along different axons to different degrees (desynchronized or differential slowing). Both focal slowing and conduction block; cannot be evaluated well because roots are not accessible to conduction studies. Thus, apart from reduced MUAP recruitment, the needle EMG studies might be otherwise normal (3,4).

Paraspinal muscle involvement should always be sought, as it adds important support for the diagnosis of an intraspinal lesion, and rules out plexopathy and peripheral mononeuropathy as the cause of extremity muscle involvement (5).

Statistical analysis:

Two software programs were used to summarize, present and to analyze the data; SPSS (Statistical Package for Social Sciences, version 18) and Microsoft Office Excel 2007. Numeric variables were presented as mean +SD (standard deviation). Nominal variables were presented as frequency and percent. Data of the patients and control group were compared using independent sample (t) test. The number and percentage of abnormalities were calculated with Chi-square test. The level of statistical significance was defined as (P) value < 0.05. Chi-square test was used to compare frequencies. The level of $P < 0.05$ was considered to be significant. Descriptive statistics for all data of each set were expressed as mean + SD and the percentage of abnormal values in any test were calculated as exceeding the mean + 3SD of the normal values of the matched control group. The validity of neurophysiological tests were also applied (sensitivity, specificity, positive predictive value and negative predictive value). Statistical significance was considered whenever the P value was less than 0.05.

Subjects and methods: This study has been conducted at the department of neurophysiology at al Kafeelsuperspeciality hospital during the period from January 2016 to October 2017. Ninety five (95) patients with cervical radiculopathy with a mean age of (48.4±11) years and twenty six (26) healthy control subjects with a mean age of (45.2±10.1) years involved in the study. All the patients were diagnosed and referred by neurosurgeons and neurologists. MRI of the cervical spine was performed for all patients to detect cervical nerve root compression if present.

Procedures: five muscles per each upper limb in addition to the cervical paraspinal (PSM) are examined for each subject using concentric needle electrodes. The upper limbs (UL) muscles to be tested were include rhomboids muscles for C4, C5 roots (mainly for C5 root), deltoid muscle for C5, C6 roots (mainly for C5 root), biceps for C5, C6 roots (mainly for C6 root), triceps muscle for C6, C7 roots (mainly for C7 root), extensor indicis muscle for C7, C8 roots and first dorsal interosseus muscle for C8 root). Needle EMG of the cervical PSM can be done with standard EMG equipment. It is performed by placing needles in the PSM in carefully selected different locations. Examination of eight levels of PSM (four on the right and four on the left) was considered. The needle electrode was inserted between the spinous processes of the corresponding and the upper vertebrae 2.5 cm to 3 cm lateral to the midline for the C5, C6, C7 roots and between the spinous processes of the C8, T1 vertebrae for the C8 root. In the current study, the EMG of the PSM was designated as abnormal through finding of abnormal spontaneous activity (SA) in the form of fibrillation potentials and/ or positive sharp waves (FPSW). During the examination of the PSM, the patient was lay sideways on the opposite shoulder, with his/her back against the examiner and the side to be tested uppermost. A pillow was placed under the head to prevent lateral flexion of the neck. The patient was also asked to flex the neck towards the chest to insure total relaxation of the paraspinal muscles on the However, the UL EMG part of the current study was designated as abnormal through finding of abnormal spontaneous activity (SA) and /or characteristics of MUAP morphology (polyphasia and /or increase duration) in addition to reduce recruitment pattern in a specific myotomal distribution. In which the EMG test was considered positive when the abnormalities found in at least two UL muscles innervated by the same myotome and different peripheral nerves.

II. Results

Figure (1) illustrate the percentages of each level of cervical radiculopathy diagnosed by the upper limbs needle EMG, while figure (2) illustrate the percentages of each level of cervical radiculopathy diagnosed by the combination of upper limbs and the cervical PSM needle EMG, and as it is clear from figure (2), the percentage of each level of cervical radiculopathy was increased by the examination of the cervical PSM, for example the Rt side C5 radiculopathy 37.9% by using upper limb EMG and increased to 39% by the combination of the cervical PSM and upper limbs abnormalities.

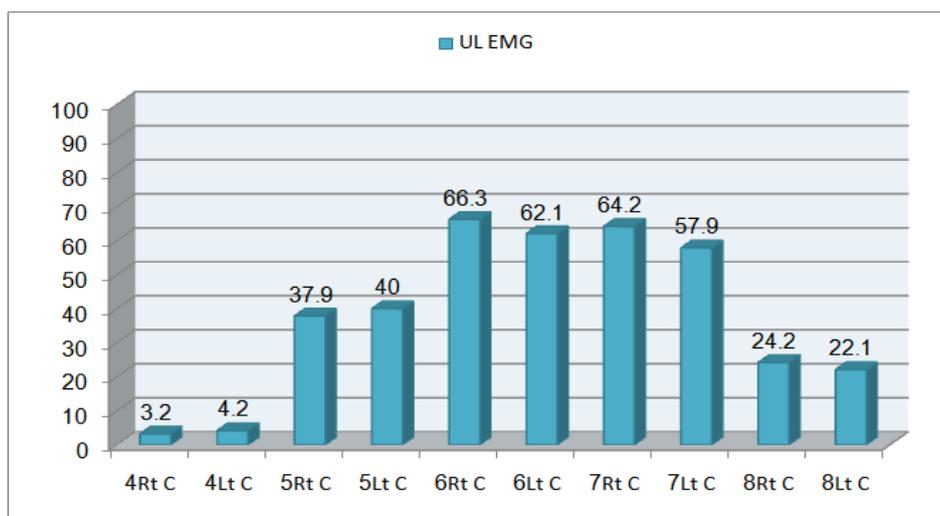


Figure (1): Bar chart shows the percentages of cervical radiculopathy diagnosed by the EMG of the upper limbs muscles.

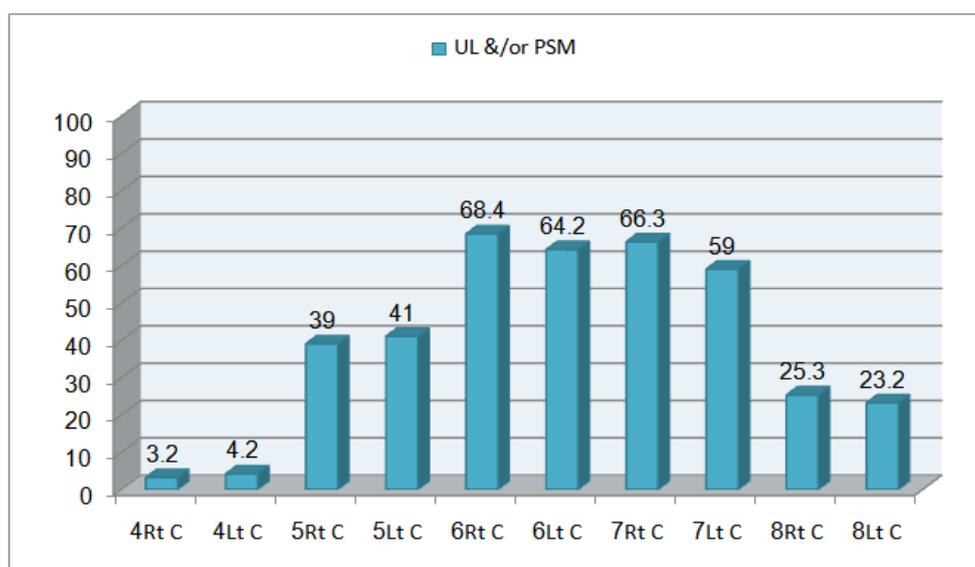


Figure (2): Bar chart shows the percentages of cervical radiculopathy by the combination of the needle EMG abnormalities of the paraspinal muscles and that of the upper limbs muscles.

In addition to, using the MRI as a gold standard and comparing the needle EMG to it the, validity was increased by the combination of needle EMG abnormalities of the cervical paraspinal muscles and the upper limbs muscles as it is clear by comparing the results illustrated in table 2 with that in table 1; for example the sensitivity, specificity, PPV and NPV for Rt side C5 radiculopathy was 81%, 89.7%, 83.3%, 88.1% respectively by using the needle EMG abnormalities of the upper limbs muscles (table 1) and it increased to 83.8%, 89.7%, 83.8%, 89.7% by the combination of the abnormalities of the paraspinal muscles with that of the upper limb muscles (table 2).

Table (1): Validity of upper limbs EMG with corresponding MRI as gold standard

Level of radiculopathy	Sensitivity	Specificity	PPV	NPV
Rt C5 radiculopathy	81	89.7	83.3	88.1
Lt C5 radiculopathy	84.6	91.1	86.8	89.5
Rt C6 radiculopathy	85.3	81.5	92.1	68.8
Lt C6 radiculopathy	89.8	83.3	89.8	83.3
Rt C7 radiculopathy	82.4	81.5	91.8	64.7
Lt C7 radiculopathy	82	85.3	90.9	72.5
Rt C8 radiculopathy	81	91.9	73.9	94.4
Lt C8 radiculopathy	80	93.3	76.2	94.6

Table (2): Validity of EMG of UL and PSM with corresponding MRI as gold standard.

Level of R. by EMG of UL and/or PSM	Sensitivity	Specificity	PPV	NPV
Rt C5 radiculopathy	83.8	89.7	83.8	89.7
Lt C5 radiculopathy	87.2	91.1	87.2	91.1
Rt C6 radiculopathy	88.3	81.5	92.3	73.3
Lt C6 radiculopathy	93.2	83.3	90.2	88.3
Rt C7 radiculopathy	85.3	81.5	92.1	68.8
Lt C7 radiculopathy	83.6	85.3	91.1	74.4
Rt C8 radiculopathy	85.7	91.9	75	95.8
Lt C8 radiculopathy	85	93.3	77.3	95.9

III. Discussion

Hence the needle electrode examination (NEE) assesses the motor component of radiculopathy, it is the most specific and sensitive test for the identification of axon loss radiculopathy. In many cases, the NEE provides information about the root level of involvement, the degree of axon loss present, the degree of ongoing motor axon loss, and the chronicity (5). Consequently, comparing the mentioned UL abnormalities of each cervical root level to the corresponding MRI level (as a gold standard), giving a high value of sensitivities for all the cervical levels (tables1, 2).

Similarly, the sensitivity was thoroughly reviewed in 1999 by the American Association of Neuromuscular and Electrodiagnostic Medicine (ANEM), and published as a practice parameter. The 9 studies they cited in their final review revealed overall sensitivity of needle EMG in the diagnosis of cervical radiculopathy to be between 50% and 71%, which they described as having moderate diagnostic sensitivity. Hence, the results of the current study were slightly higher than the results of these studies. Also, the results of the current study is higher than the results of studies done by (Zahra, Simin and Behrooz, 2014) and (Nardin, et al., 1999)(6,7) who give a total agreement of 59.6% and 60% respectively. However, the combination of the PSM abnormalities with that of the ULneedle EMG abnormalities there is an increase in the sensitivity of the needle EMG (tables 3 and 4).

The results of the present study are in agreement with study of Dillingham, 2002(8) who found that testing PSM adds significant sensitivity to the needle examination for cervical radiculopathy.

Also, it support the study of Samiha, et., al., 2014 (9) who mentioned that, the examination of the paraspinal muscles in cervical the radiculopathy work - up is of extreme importance, with regard to the high diagnostic yield of this technique.

IV. Conclusion

Asignificant percentages of cervical radiculopathy will missed if the examination of the cervical paraspinal muscles is not part of the electrodiagnostic evaluation of cervical radiculopathy ;without the examination of the PSM muscles the screen of cervical radiculopathy misses much of its sensitivity.

References

- [1]. John, M. C., Matthias, P., Alexander, P. H (2011): cervical radiculopathy: a reviewarticle. HSSJ7:265–272.
- [2]. American Association of Electrodiagnostic Medicine ANEM (1999): practice parameter for needle electromyographic evaluation of patients with suspected cervical radiculopathy: summary statement. Muscle Nerve 22: Supplement 8: S209-S211.
- [3]. Aminoff, M. J (1998): Clinical electromyography, in Aminoff MJ (ed): Electrodiagnosis in Clinical Neurology, 5th ed. New York, ChurchillLivingstone, pp. 233-259.
- [4]. Katirji, B (2007): Electromyography in clinical practice: a case study approach. 2nd ed. Mosbey Elsevier. Chapter 2, Routine Clinical Electromyography; P.13-49, case 2; P.81-97.
- [5]. Kerry, H. Levin (2002): Electrodiagnostic approach to the patient with suspected radiculopathy. NeurolClin N Am, 20: 397-421.
- [6]. Zahra, R. S. and Simin S. B. (2014) : A comparison of magnetic resonance imaging with electrodiagnostic findings in the evaluation of clinical radiculopathy: a cross-sectional studyTavana. Eur Spine J 23: 916–921 DOI 10.1007/s00586-013-3164-z.
- [7]. Nardin, R. A., Patel, M. R., Gudas, T. F., Rutkove, S. B., Raynor, E. M., et. Al., (1999): Electromyography and magnetic resonance imaging in the evaluation of radiculopathy. Muscle Nerve 22:151–155.
- [8]. Timothy, R. Dillingham (2002): Electrodiagnostic approach to patients with suspected radiculopathy. Phys Med RehabilClin N Am 13: 567-588.
- [9]. Semiha, k., Gulnihal,k., Yasemin, B. (2004): Diagnostic sensitivity of paraspinal needle EMG in cervical radiculopathy. Gazi medical journal.15: 19-22.

IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS) is UGC approved Journal with Sl. No. 5012, Journal no. 49063.

A S. Fakhrymbchb "The Utility of the Cervical Par Spinal Muscles Needle EMG in the Diagnosis of Cervical Radiculopathy." IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS) 13.4 (2018): 25-28.