

**RELIABILITY AND BENEFITS OF CLINICAL EXAMINATION
FOR DETERMINING THE AFFECTED LEVEL
IN CERVICAL COMPRESSIVE MYELOPATHIC PATIENT:
A PROSPECTIVE STUDY OF 44 CASES**

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Abstract

A prospective comparative study was done to evaluate the accuracy of the neurological examination in reaching a correct diagnosis of the affected spinal level for compressive cervical myelopathy.

Forty four (44) patients who had been suffering from single level compressive cervical myelopathy by disc herniation or spondylosis and under went decompressive surgery were included in the study. Among 44 patients, 34 were male and 10 were female. Neurological examinations were: grading of muscle weakness, deep tendon reflex, pin prick sensation and numbness in upper limb only. With the knowledge that the patient is suffering from compressive cervical myelopathy, using clinical examination the neurological level of the affected level was determined. Patient's sign due to single level compression was elicited and MRI finding is correlated. Agreement between MRI and neurological level diagnosis was achieved. Analyzing the neurological examination finding revealed that patient perceived location of numbness in the upper limb was the most useful in diagnostic value for determining the affected level. But muscle weakness shows least value and with other test their rate is lower than 50% and shows unreliability of each individual test in determining the affected level. The result of the prospective study shows that neurological examination in patient with compressive cervical myelopathy (CCM) in

determining the neurological level of disease is moderately reliable and beneficial.

Key words : neurological examination; compressive myelopathy; MRI; myelomere; myelomelacia

Introduction

The advances of various modern radiological modalities can not undermine the usefulness of clinical examination to achieve proper diagnosis especially in neurological arena like cervical compressive myelopathy. It is indispensable to locate pathology properly and for it, to determine the spinal level which is responsible for neurological deficit. Though there are numerous text books present details neurological level of diagnosis for radiculopathy, there are very few reports regarding the determination of responsible neurological level for cervical compressive myelopathy.¹

The surgeon's ability to efficiently obtain the responsible level if CCM face great challenges due to discrepancy between the obtained neurological level of spinal segment and affected intervertebral level. There is another problem also that patient often complains of symptoms referable to both the cervical and thoracic spine.² It can be mentioned here that as an example, a herniated disc at C4 - C5 level, when laterally located, usually compress the C5 nerve root but it does not always compress the same segmental level of spinal cord when it is medially located.

This discrepancy may be due to developmental as there is lag between spinal cord segments and spinal vertebrae during growth and also be due to pathological as oedema that spreads to upper and lower levels from the site of spinal cord compression^{3,4}.

Their is a classic opinion that myelomere associated with motor function is shifted one segment cranially and that associated with sensory function is shifted 1.5 to 2 segments cranially with respective intervertebral level⁵. For better understanding, if we think motor myelomere at C5 and sensory

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myelomere at C5 or C6 are primarily disturbed by a compressive lesion at C3 - C4.

Hirabayashi, et al.⁵ proposed various indicators of the of the responsible level based on the pattern of changes in the following; reflexes, sensory function, muscle strength and extent of numbness in the hand. By presenting these indicators, they develop very important and essential neuro anatomical basis for the diagnosis of responsible spinal level. All of the reports regarding these except the reports of Morio Mutsumoto, et al.³ are retrospective.

By using the above indicators, the present study was done prospectively. Comparison between neurological examinations findings with the MR imaging finding in patient of CCM have done. In this way we tried to find out the reliability and benefit of determining the affected level based on clinical findings.

Materials & methods

Population: the populations of the study were surgically treated due to CCM from January 2001 to July 2008. Indication of the surgery was due to single level cervical disc herniation or cervical spondylosis. Operative procedures were done at Neurosurgery Department of Bangabandhu Sheikh Mujib Medical University, Dhaka and Neurosurgery Department of Dhaka Medical College Hospital, Dhaka. Diagnosis was done based on neurological findings like presence of hyper reflex including positive Hoffman's sign, sensory disturbances at upper and/or lower limbs and MRI documented cervical spinal cord compression. Patient who receive surgical treatment before and unwilling patient to include were excluded from the study. The pre-operative diagnosis was disc herniation including 18 patients who also have spondylotic myelopathy .Out of 44 patients of study 10 patients were female and 34 patients were male, mean age is 47 years (range 29 to 62 year).

Clinical Examination : we independently examined the patient clinically and determine the responsible level. None of us provided prior clinical information other than the diagnosis of myelopethy. For diagnosis, the neurological tests like muscle power, deep tendon reflexes, pin prick sensation and patient perceived area of numbness were used for diagnosis. Grading of strength of the key muscles innervated by cervical nerve roots were done by using

manual muscle testing (MMT). Deep tendon reflexes specially biceps and triceps tendon reflexes were rated exaggerated, normal or diminished. An exaggerated reflex indicates an upper motor neuron lesion indicating that a compressive lesion was located at the above the segment and a diminished reflex or absent reflex was a lower motor neuron lesion indicating that the compressive lesion was located at the segment associated with the reflex. In pin prick sensation, the upper most impaired level was accepted according to dermatome proposed by Nozaki.⁶ Hand numbness recorded according to patient's recognition of most strongly felt numbness. Neurological signs found in the most severe impaired side were used for diagnosis of spinal level. The diagnosis was made by using the indicators for level related diagnosis. (Table I)⁷. Actually these indicators used as reference but diagnosis was made by clinical judgment. The surgical management was done by anterior cervical discectomy in 26 patients and single level anterior fusion in 18 patients. All 44 patients enjoyed neurological improvement and felt comfort by relieving symptoms. So inference can be made that pre-operative diagnosis of CCM was correct.

Table I : Affected nerve roots in the cervical spine

Root	Motor weakness	Reflex diminution	Sensory impariment
C ₆	Biceps & Brachioradialis	Biceps, Supinator & Triceps	Lateral forearm, thumb and index finger
C ₇	Triceps, forearm extensor	Triceps	Strip posteriorly along forearm, dorsum of middle and one other finger
C ₈	Thumb & finger extensor	None	Ulnar border of forearm, ring and little finger

As diagnostic imaging, MRI of cervical spine in all patients and in few cases Plain X-ray of cervical spine were done. Al-Mefty⁸ described two type of MRI changes in CCM. First type is localized changes at the level of compression indicating myelomelacia (high intensity signal on T2 WI) and second type indicate necrosis or secondary syrinx noted locally or extending longitudinally.⁸ However MRI is extremely sensitive and may overestimate the extent of surgical pathology. A recent study has documented a significant incidence of abnormal MRI finding in asymptomatic patient.⁹

As a result it is important to remember that an abnormal MRI is not necessarily an indication for surgery. The maximally compressed level on MRI is recognized as responsible level. Other presence or absence of pathology like foraminal stenosis at the responsible level was also taken in account. The MRI images were evaluated and findings were correlated with neuro-radiologist who was not provided any information of the patient. Disagreement of finding of MRI documented level in a patient was excluded from study. Only agreement between MRI and Neurological examination based diagnosis were taken for analysis.

Result

The MRI documented and neurologically determined responsible levels were C3 –C4 in 6.82% patients, C4 –C5 in 50% patients, C5 –C6 in 40.91% patients, and C6 –C7 in 2.8% patient.

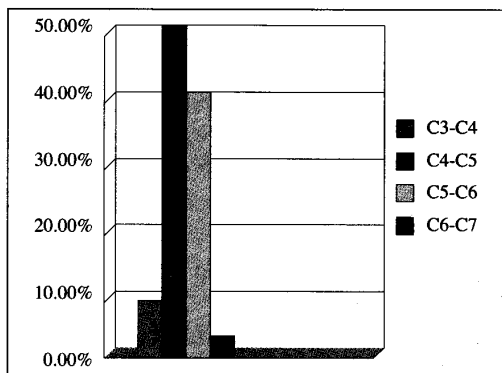


Fig 1: Bar diagram showing the frequency of neurologically determined responsible levels of spine.

In 90.91% patients, there were high signal intensity area of spinal cord on T2 weighted sagittal MR image but in 9.09% patients two level high intensity lesions were documented. In these 90.9% patients, the level of the high intensity areas corresponds to the levels where the spinal cord maximally compressed. In 9.09% patients with two level high intensity lesion, the responsible level was determined by taking the severity of spinal cord compression on MRI. Foraminal stenosis were present in 18.18% patients, responsible level were determined by radiology.

Our clinical examination revealed muscle weakness in 22.73% patients, deep tendon reflexes in 34.09% patients pin prick sensation in 43.19% patients and numbness in 70.45% patients.

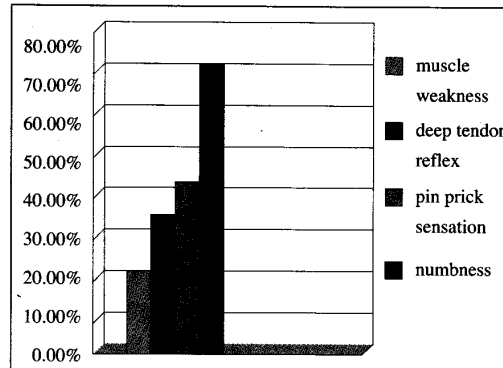


Fig 2 : Bar diagram showing the frequency of clinical findings

Discussion

The primary goal of this prospective study was to evaluate the usefulness of the neurological examination to determine the responsible intervertebral level in compressive cervical myelopathic patients. There have been numerous reports; a frequently expressed opinion is that a particular spinal level was deemed the responsible level if ipsilateral anterior decompression resulted in alleviation of symptoms.³ This successful surgical outcome served as gold standard for diagnosis of the responsible level. More recently for single level compression many neurosurgeons recommended posterior approach especially if there is association of developmental spinal canal stenosis. In this prospective study 40.91% patient underwent anterior fusion.

Though the determination of the level to be decompressed in cervical compressive myelopathic patient is usually done by MRI, in recent years we think clinical evaluation of the patient is invaluable and correlation of available findings should be done judiciously. We analyzed the presence or absence of high signal intensity of the spinal cord and foraminal stenosis on MRI. It is found that high signal intensity lesion was present in most of the patients and the presence of these high signal intensity were strongly co-related with symptoms. But presence of foraminal stenosis did not show any impact on the diagnosis established by neurological examination.

In our series, it is found by analyzing neurological signs are that the value of numbness of upper limb is the highest and muscle weakness is the lowest. The value of abnormal reflexes and sensory disturbances were present in less than 50% cases. These results of our prospective study indicate that the pattern of

reduced muscle power, abnormal deep tendon reflexes, and sensory disturbance are not useful individually as indicator to determine the responsible level. These observations make inference that it mandatory to do general evaluation of all neurological signs obtained with the highest importance to upper limb numbness. It is not yet known why upper limb numbness bears most diagnostic value. Hirabayashi, et al.⁵ speculated that numbness in upper limb may reflect damage of the spinal segment and long tract. The low rate of muscle weakness can be due to multiple innervations of tested muscles.

In this study, highest compression was determined at C4-C5 level with very closely followed by C5-C6. It is contradictory to donely Matsumoto et al. 3 prospective study and in their study the rate was highest at the C3-C4 level.

In the recent years, for decompressing the compressive myelopathy, many surgeons are now advocating posterior approach minimally invasive surgery.^{10,11} Therefore; conduction of pre-operative neurological examination to determine the affected level will enjoy a time honoured diagnostic procedure.

Conclusion

In this prospective study the consistency of the clinical examination and MRI for determining the affected level of cervical compressive myelopathy has been analyzed. The analyzed result shows that neurological examination is reliable pre-operative diagnosis of the affected level in patients of cervical compressive myelopathy and more accurately at C4-C5 level.

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