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Original Article

Prediction of Motor Myelopathic Severity in Patients with Cervical Spondylotic Myelopathy: How to Approach?

Zahan KFI[1], Alam MJU[2], Rahman MA[3], Hasan MM[4], Mahmud R[5], Hossain M[6], Hossain MA[7]

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Manuscript Preparation: Dr. Kanij Fatema Ishrat Zahan, Dr. Mohammad Jahangir Ul Alam

Data Collection:, Dr. Rashed Mahmud, Dr. Md. Asifur Rahman

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Abstract

Background: *Cervical spondylotic myelopathy (CSM) is a challenging thing to diagnose as it has subtle symptoms and insidious onset. But, there is a relationship between signal intensity change of the spinal cord on MRI and cervical spondylotic myelopathy through which motor myelopathic severity in these patients can be predicted.*

Objective: *The purpose of this study was to predict the motor myelopathic severity in patients with CSM with the help of magnetic resonance imaging (MRI).*

Methodology: *This cross-sectional study was carried out in the Department of Neurosurgery at Banghabandhu Sheikh Mujib Medical University (BSMMU), Dhaka from October, 2011 to March, 2013 for a period of one and half year. All patients who presented with cervical spondylotic myelopathy were included in this study. MRI of cervical spine was performed to all patients.*

Results: *A total number of 36 patients with cervical spondylotic myelopathy were included in this study. Among the 36 study patients, all had normal intensity in the spinal cord on sagittal T1WI of MRI; however, there was variable intensity on sagittal T2WI of MRI. Low Nurick score was found in 24 (66.6%) patients who had type 0signal intensity on (T2WI) MRI. High Nurick score was found in 3 (8.3%) patients who had type 0 signal intensity on (T2WI) MRI. Low Nurick score was found in 2 (5.5%) patients who had type 1 signal intensity on (T2WI) MRI. High Nurick score was found in 6 (16.6%) patients who had type 1 signal intensity on (T2WI) MRI. Only 1 patient (2.7%) having high Nurick score (3- 5) had type-2 signal intensity on (T2WI) MRI ($p<0.001$).*

Conclusion: *Prediction of motor myelopathic severity in patients with cervical spondylotic myelopathy can be done perfectly with the help of signal intensity change of the spinal cord on MRI which is very much helpful in patients' management.*

Keywords: *Motor myelopathic severity; Spinal cord; MRI; cervical spondylotic myelopathy*

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Introduction

Dorsomedial herniation of a disc and the development of transverse bony bars or posterior osteophytes may cause pressure on the spinal cord or the anterior spinal artery which supplies the anterior two-thirds of the cord is called cervical spondylotic myelopathy[1]. Cervical spondylotic myelopathy (CSM) represents a spectrum of pathologies that start with progressive

1. Dr. Kanij Fatema Ishrat Zahan, Associate Professor, Department of Neurosurgery, Dhaka Medical College & Hospital, Dhaka.
2. Dr. Mohammad Jahangir Ul Alam, Assistant Professor, Department of Medicine, Sir Salimullah Medical College & Mitford Hospital, Dhaka.
3. Dr. Md. Asifur Rahman, Associate Professor, Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University, Dhaka.
4. Dr. Md Motasimul Hasan, Associate Professor, Department of Endovascular & Stroke Surgery, Dhaka Medical College, Dhaka
5. Dr. Rashed Mahmud, Assistant Professor, Department of Neurosurgery, Dhaka Medical College & Hospital, Dhaka.
6. Prof. Mohammad Hossain, Professor & Dean, Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University, Dhaka.
7. Dr. Mohammed Afzal Hossian, Professor & Ex- Head, Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University, Dhaka.

Address of Correspondence: Dr. Kanij Fatema Ishrat Zahan, Assistant Professor, Department of Neurosurgery, Dhaka Medical College and Hospital, Dhaka-1200, Bangladesh; Email: kfizrifat@gmail.com; Cell no.: +8801781400183

degeneration of the disc, leading to instability at the posterior joints and spur formation and are associated with hypertrophy of the ligamentum flavum, resulting in stenosis of the cervical canal circumferentially2.

Onset of cervical spondylosis is insidious, but a slow deterioration occurs in 20% of patients, 5.0% remain static and 75.0% develop new symptoms and signs3. Males around age 50 with a history of chronic occupational neck trauma are thought to be commonly afflicted. Initial complaints such as difficulty in buttoning a shirt, tying a necktie, or fastening the clasp of a bra are common. Associated symptoms include tingling, numbness and weakness in the hands4. Numbness and tingling can follow a root pattern: thumb for C6, middle finger for C7 and little finger for C_8 3. Motor myelopathic signs are defined as the presence of hyperreflexia (Reflex e"grade 3) or provocative signs which specifically includes Hoffmann's sign, inverted brachioradialis reflex (IBR), sustained clonus (more than 3 beats) and Babinski sign. Reflexes are graded ona 0 to 4 scale like 0 means absent, 1 means hypoactive,2 means normal,3means hyperactive without clonus, 4 means very hyperactive, often with clonus5.

The delineation of cervical spondylotic myelopathy as a clinical entity has improved with the development of high-quality cross-sectional neuroradiologic imaging7. Among the various imaging modalities used in clinical practice, MRI pathophysiologic specificity and potential for repeat studies without adverse effects on the health of subjects, is often the method of choice8. Sagittal views clearly demonstrate cord compression at the level of the disc space. Any hyperintensity within the cord on T2 weighted image reflects cord damage and may correlate with the severity of the myelopathy and outcome9.

Increased signal intensity (ISI) within the cervical cord on T2-weighted MR images obtained in patients with CSM was initially noted. More recently, 3 types of ISI

changes have been identified on sagittal T2-weighted MR images which are based on ISI characteristics as no change (Type 0), faint, fuzzy changes (Type 1) and intense, sharp changes (Type 2).This categorization of changes on sagittal T2- weighted images is based on the sharpness of the margins and the degree of hyperintensity of the intramedullary changes.

Intramedullary signal changes that are dull or light and have an unclear margin are termed "fuzzy" changes or Type 1 changes and those that are brilliant or intense and are clearly defined are termed "sharp" or Type 2 changes10. The objective of this present study was to predict the motor myelopathic severity in patients with CSM with the help of magnetic resonance imaging (MRI).

Methodology

The cross-sectional study was conducted in the Department of Neurosurgery at Bangabandhu Sheikh Mujib Medical University (BSMMU) Hospital, Dhaka, Bangladesh from October 2011 to March 2013 for a period of one and half year. Patients who were diagnosed as a case of CSM both clinically and on MRI of cervical spine who were admitted in the department of Neurosurgery, BSMMU were included as study population. All the relevant data were recorded in a predesigned data sheet. Data were collected purposively and analyzed by using the computer-based software Statistical Package for Social Sciences, (SPSS, version 16.0). Chi square test was applied to assess the relationship between signal intensity change of the spinal cord on MRI and motor myelopathic signs in the respondents. Statistical significance was set at p value <0.05.

Results

A total number of 36 patients with cervical spondylotic myelopathy were recruited for this study after fulfilling the inclusion and exclusion criteria.

Table-I

Distribution of the Respondents by Presenting Complaints (multiple responses)

Complaints	Frequency	Percentage
Neck pain	9	25.0
Numbness & tingling sensation	18	50.0
Weakness in upper limbs	34	94.4
Gait dysfunction	11	30.5
Difficulty in buttoning	9	25.0

The patients have multiple responses like if one patient had weakness in upper limbs, he or she might have neck pain or numbness & tingling sensation. Among the total respondents, presentation with weakness in upper limbs was found in 34(94.4%) patients followed by numbness & tingling sensation was in 18 (50.0%) patients and gait dysfunction was in 11 (30.5%) patients. Neck pain & difficulty in buttoning were in 9 (25.0%) patients (Table I).

Table-II

Distribution of the Respondents by Presence of Motor Myelopathic Signs (multiple responses)

Motor myelopathic signs	Frequency	Percentage
Hyperreflexia	36	100.0
IBR	1	2.7
Hoffmann's sign	27	75.0
Ankle clonus	9	25.0
Babinski sign	34	94.4

The respondents have multiple responses like if one patient had hyperreflexia, he or she might have Hoffmann's sign or any other motor myelopathic signs. Among the total respondents, 36(100.0 %) patients had hyperreflexia followed by 34(94.4%) patients had Babinski sign, 27(75.0%) patients had Hoffmann's sign, 9(25.0%) patients had Ankle clonus and 1(2.7%)patient had IBR (Table 2).

Table-III

Distribution of the Respondents according to Severity of Motor myelopathic Signs (n=36)

Severity determined by Nurick score	Severity determined by Nurick score	Percentage
Low score (0-2)	26	72.2
High score (3-5)	10	27.8
Total	36	100.0

Among the total respondents, 26 patients (72.2%) had low Nurick score (0-2) followed by 10 patients (27.8%) had high Nurick score (3-5) (Table 3).

Table-IV

Relationship between Signal Intensity in the Spinal Cord on (T2WI) MRI and Severity of Motor Myelopathic Signs in the Respondents

Signal intensity on (T2WI) MRI	Nurick Score		P value
	Low score (0-2)	High score (3-5)	
Type 0	24	3	
Type 1	2	6	
Type 2	0	1	<0.001
Total	26	10	

Low Nurick score was found in 24(66.6%) patients who had type 0 signal intensity on (T2WI) MRI. High Nurick score was found in 3(8.3%) patients who had type 0 signal intensity on (T2WI) MRI. Low Nurick score was found in 2(5.5%) patients who had type 1 signal intensity on (T2WI) MRI. High Nurick score was found in 6(16.6%) patients who had type 1 signal intensity on (T2WI) MRI. Only 1 patient (2.7%) havinghigh Nurick score (3-5) had type-2 signal intensity on(T2WI) MRI. The difference was statistically significant ($p<0.001$) (Table 4).

Discussion:

This study included only patients with cervical spondylotic myelopathy (CSM) diagnosed both clinically and on MRI of cervical spine done minimum at 1.5 Tesla MRI who were admitted in the Department of Neurosurgery at BSMMU, Dhaka. The signal intensity change of the spinal cord on MRI helped to predict the motor myelopathic severity in these patients.

CSM usually occurs in patients around 50 years. Chatley et al12 found that in their series of 67 patients with CSM the mean age was 47.1years with a range of22 to 65 years. In this study, the mean age was

53.11 years with SD of ±10.71 years. The range of age in this series of 36 patients was 30 to 72 years. Maximumnumbers of study patients (30.6%) were in between 40to 49 years followed by between 50 to 59 years whichwas 27.8% cases. In another study, the study population was composed of 67 patients whose mean age was 59.5 years with an age range of 30 to 79 years13.

In this study, sex distribution of the patients revealed male being 80.6% (29) and female 19.4% (7). Male tofemale ratio was 4.2:1. Similarly in the study of Chatley et al12 among 64 patients, 57 were male and 7 were female giving male to female ratio as 8.14:1. In another study, the study population was composed of 67 patients among whom 17 were female and 50 weremale13.

This study shows the presenting symptoms among therespondents in descending order as weakness in upper limbs (94.4%), numbness & tingling sensation (50.0%), gait dysfunction (30.5%), neck pain (25.0%)and difficulty in buttoning (25.0%). The respondents have multiple responses, like if one patient had weakness in upper limbs, the patient may also have had neck pain or numbness & tingling sensation.

Chatley et al12 shows the presenting complaints in theirstudy as gait dysfunction (86.0%), limb weakness (78.1%), numbness & tingling (51.6%) and neck pain (39.1%). In this present study, there were 5 motor myelopathic signs being present in the respondents named hyperreflexia, Hoffmann's sign, IBR

(Inverted brachioradialis reflex), ankle clonus and Babinski sign. All the study patients (n=36) had hyper reflexia (100%). Babinski sign was present in 27(94.4%) number of study patients. positive Hoffmann's sign was present in 27 (75%) patients followed by 9 (25%) patients had ankle clonus. IBR was found in 2.7% patients only. The respondents have multiple responses, i.e. if one patient had hyperreflexia, the patient might have Hoffmann's sign or any other motormyelopathic signs. In another study, hyperreflexia waspresent in 85.19% cases, Hoffmann's sign was 83.33%cases and Babinski sign was in 44.44% cases14. Chikuda et al15 also found in their study as hyperreflexia being 96%, Hoffmann,s sign 80%, Babinski sign 52% and ankle clonus 28%. In another study, there were Hoffmann's sign was in 59% cases, hyperreflexia was in 62% cases, IBR was in 51% cases, Babinski sign was in 13%% and ankle clonus was in 13% cases5.

In this study, severity of motor myelopathic signs has been determined by Nurick score. In one study it was shown that prevalence of the motor myelopathic signs correlated with the severity of cervical spondylotic myelopathy15. In this study, all the respondents had normal signal intensity on T1WI of MRI. About 75% study patients had Type-0 signal intensity change in the spinal cord on T2WI of MRI followed by 22.2% patients had Type-1 signal intensity change in the spinal cord on T2WI of MRI and only 2.8% patients had Type-2 signal intensity change in the spinal cord on T2WI of MRI.

In another study, there were 46.7% Type-0 signal intensity change in the spinal cord on T2WI of MRI followed by 38.5% Type-1 signal intensity change in the spinal cord on T2WI of MRI and 25.4% Type- 2 signal intensity change in the spinal cord on T2WI of MRI11.

In this study, all the respondents had normal intensity in the spinal cord on T1WI of MRI, but variable intensity on T2WI. So, we evaluate the pattern of signal intensity in the spinal cord on T2WI of MRI and from that predicted the severity of motor myelopathic signs in the patients which was determined by Nurick score. Studypatients having low Nurick score (0-2) had Type-0 signal intensity change and those having high Nurick score (3-5) had either Type-1 or Type-2 signal intensity change in the spinal cord on T2WI of MRI which is statistically highly significant ($p<0.001$). As this study was for a short period of time and being small consisting of limited number of patients, it may not be possible to generalize the findings to reference population.

Conclusion:

Prediction of motor myelopathic severity in patients with cervical spondylotic myelopathy can be done perfectly with the help of signal intensity change of the spinal cord on MRI which is very much helpful in patients' management.

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