Frequency and Localization of Spinal Cord Demyelination in MS Patients, Coexistence of Intervertebral Disc Protrusion

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INTRODUCTION

The clinical and pathological manifestations of multiple sclerosis are due to areas of demyelination which occur throughout the white matter of the central nervous system (8). The distribution of plaques characterizing demyelination is well defined (22): position abutting the ventricles, juxtacortical, subtentorial, spinal cord (1). Clinical presentation of MS is very variable according to localization of lesions. The many of MRI studies show that not all of the affected areas tend to cause disability (10, 15). In about 95-99% of patients with clinically definite MS and in about 50-70% of those at presentation with CIS asymptomatic multiple white matter abnormalities suggestive of demyelination in brain MRI are seen (1,25). Clinically silent cord lesions consistent with demyelination are often detected also in the spinal cord (20). Literature data shows that asymptomatic lesions in spinal cord are verified in about 30-40% of patients presenting with CIS suggestive of MS (4, 9, 16, 23). In CDMS patients lesions in the spinal cord can be detected by MRI in up to 90% (2, 6, 21). Multiple focal demyelination are usually identified in relapsing remitting (RR) course of disease rather than secondary progressive (SP) or primary progressive (PP) when abnormalities in spinal cord are found to be more confluent, diffuse throughout the cord (3, 10, 14, 15, 17, 21).

The importance of spinal cord lesions lies in their presumed greater potential to result in clinical symptoms and disability than white matter lesions in brain (3, 5, 10, 17), involving as they do clinically eloquent pathways (pyramidal tracts, spinothalamic tracts, and posterior columns) (21).

Typical imaging features of MS lesions in spinal cord are the following: more frequently located in cervical and thoracic portions (7, 8, 13); usually located peripherically (especially in the posterior and lateral columns), but may involve the central gray matter; rarely exceeds two vertebral segments in length and occupy more than half of the cord cross- sectional area; acute lesions may be associated to cord swelling, whereas chronic lesions are not hypointense on T1-weighted images, enhancing lesions are less frequently seen in the spinal cord than in the brain (17), but they are often associated with new clinical symptoms (10,15,28).

Mostly both, brain and spinal cord are affected by demyelination. Noctiti et al has found that only 2.3% of patients with CDMS had two or more spinal cord lesions concomitantly with normal brain MRI.
Pathophysiological changes, such as disc protrusion, are surprisingly common findings in cervical spine even among young adults (12, 24), however, some authors have found pathological findings to be more common in symptomatic participants (24). Matsumoto et al., so as Tani et al describes that degenerative changes in spine are highest at C5-6, following C4-5 and C6-7, rare C2-3, C3-4 levels.

**AIM OF THE STUDY**

The aim of the study was to analyze areas of high T2 signal characteristic of demyelination in spinal cord in relationship to clinical manifestation of spinal disturbances and coexistence of intervertebral disc protrusion.

**MATERIALS AND METHODS**

Retrospective data of 150 patients (103 female, 47 male) from Latvian MS data base with clinically definite RRMS according to McDonald criteria were analyzed. Only patients with whole spinal cord scanned and existence of spinal cord lesions in MRI were included. MRI system of GE SIGNA was operated with magnets at field strength 1.0 Tesla (5 mm slice thickness), using standardized protocols for spinal cord investigation. Each patient underwent 1 or more serial MRI of the brain and spinal cord but only first imaging of spinal cord with adequate visibility or no artifacts was included. Focal lesions in the spinal cord were defined as areas of hypointensity (T1-weighted images) or hyper-intensity (T2-weighted images) sharply demarcated from surrounding tissue. Clinical characteristics (relapse type by localization and amount, onset of disease) were analyzed and compared with radiological (number and distribution of spinal cord lesions) findings. Regarding protrusions of intervertebral discs only quantity, distribution and correlation with cord lesions were examined. No gradation by severity of intervertebral disc protrusion was made. Descriptive analysis was performed using statistical program SPSS 17. To reflect the standard deviations for the calculated values standard error of the mean was used. Correlations were calculated as Spearman’s rank correlation coefficient. For correlation coefficients a P value of less than 0.01 was considered statistically significant.

**RESULTS**

All together 701 (from total of 150 patients) demyelinated loci of spinal cord were analyzed on the MR images (Table 1). Total of 54.1% of patients experienced not more than 4 lesions.

<table>
<thead>
<tr>
<th>Table 1. Total and average amount of lesions</th>
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<tr>
<td>Amount of lesions</td>
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<tr>
<td>Total</td>
</tr>
<tr>
<td>Cervical</td>
</tr>
<tr>
<td>Thoracic</td>
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Total of 33.5% patients experienced spinal symptoms during the first manifestation of MS. Age at onset of disease varied from 13-53 years; median parameters are seen in Table2. The mean age at onset of those patients who initially presented with cerebral manifestation was 32.02±9.41 years in total, 32.06±9.91 in women, and 30.2±8.57 in men, in cases of spinal manifestation 31.02±10.9 in women and 29.52±6.1 years in men. Most of the patients have had at least one spinal episode before MRI scan (average 1.14±0.84) with duration ranged from <1 month to more than 10 years. The patients having MRI performed 5-10 years and more since onset of cord symptoms were describing at least 3 spinal episodes.

<table>
<thead>
<tr>
<th>Table 2. Summary of clinical and radiological characteristics</th>
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<tr>
<td>Median age at onset of MS (total)</td>
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<tr>
<td>Median age at onset of spinal manifestation</td>
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<tr>
<td>Duration of spinal MS presentation at the time of MRI examination</td>
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<td>Spinal cord lesions before clinical manifestation</td>
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<td>Episodes of spinal disturbances pre MRI.</td>
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<td>Duration to MRI if only one clinical episode of spinal manifestation noted</td>
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<tr>
<td>MRI duration &gt;1yr and at least 2 spinal episodes</td>
</tr>
<tr>
<td>MRI duration &gt;10 yr and only 1 spinal relapse</td>
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<tr>
<td>High T2 signal</td>
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<tr>
<td>Amount of lesions having 1 spinal relapse</td>
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</tbody>
</table>

The correlation between age at onset and amount of spinal lesions was not fixed (p=0.025). There was no significant difference between increased number of lesions in both groups: cerebral onset or spinal onset (p=0.130). Concerning amount of lesions in spinal cord showed correlation between increased lesion count and higher relapse rate (p=0.008), which is summarized in Table3.
Table 3. Correlation between average amount of lesions and relapse rate.

<table>
<thead>
<tr>
<th>N spinal relapse</th>
<th>Amount of lesions</th>
<th>Mean</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>3.9±2.5</td>
<td>2.99-4.82</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>4.6±2.8</td>
<td>3.89-5.31</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>5.48±3.02</td>
<td>4.44-6.52</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>5.7±3.2</td>
<td>3.04-8.45</td>
</tr>
</tbody>
</table>

In all 150 cases analyzed total number of focal loci varied from 1 to 16. Only one lesion was detected in 8.3%, 2-13%, 3-10.7%, 4-15.4%, 7-10.7%, and 8-16 in 12% of patients. Silent lesions were more visible in cervical proportions (31 of 144 patients) compare to thoracic (10 of 144 patients), Fig.1.

Fig. 1.

Data regarding distribution of lesions in spinal cord by MRI is showed in Fig.2.

Fig. 2

Coexistence of intervertebral disc protrusions in MS patients was observed in 36.5% cases; with mean number 2.07±1.17. The distribution of protrusions is presented in

Distribution of intervertebral disc protrusion (N)

Fig. 3.

No correlation between coexistence of intervertebral disc and spinal cord lesions at the same level was found (p=0.577).

DISCUSSION

There are no many literature data describing spinal cord abnormalities, as well as degenerative findings of spine in MS patients. The most studies are performed in late 90ties. But with increasing quality of MRI techniques over the last years this question regarding evaluation of spinal cord has became more actual and more studied. Based on our results and on previous studies, the MRI characteristics of spinal cord in patients suffering from MS include well defined distribution of lesions and correlation with clinical data. The both, previous information and our data shows that demyelinating lesions may be clinically silent, and also that frequency of lesions located in spinal cord is high. The distribution of spinal cord lesions which is summarized in Fig.2 is quite similar to that reported in previous trials. The same similarities are found if compare with other authors regarding localization of degenerative changes in spine. We could not found reports where characteristics of intervertebral disc abnormalities were described based on MS population that why our results were compared with data from general population. So as there are cases described when MS is not initially diagnosed because of similarity of the symptoms of disc protrusion to those of MS and the same conversely, it would be very interestingly to appraise also correlations with clinical findings in both situations. The correlations obtained between spinal relapse rate and increased amount of spinal cord lesions demonstrate necessity for enlarged evaluation of clinical signs in MS patients, especially of those when MRI of spinal cord is not performed and clinical symptoms are contributing to anatomical localization typical to those which are showed as more frequently involved in demyelinating process. Also possibility of coexistence of degenerative changes should be kept in mind especially in cases when older patients are examined so as the findings are proportionally turning up with age. Although no correlation detected between level of intervertebral disc protrusion and location of spinal cord lesions, interestingly that both are more frequently found in cervical proportion, around C3 to C7 level. We are not able to rule out that the potential investments in producing similar studies with larger population may result with new surprising findings.
CONCLUSIONS

More frequently lesions were located in cervical rather than thoracic cord. Most of the patients having spinal cord lesions have had at least one clinical episode showing spinal cord dysfunction. No correlation between spinal cord lesions and coexistence of intervertebral disc protrusion at the same level were found.

Conflict of interest: None

REFERENCES


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