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## MRI Findings of Cervical Spine Lesions among Symptomatic Patients and Their Risk Factors

**Background:** Cervical spine and intervertebral discs are potentially prone to functional disorders.

**Objectives:** This study sought type and distribution of different pathologies in the cervical spine and a possible relationship between the MRI findings and the probable risk factors of the degenerative disorders.

**Material and methods:** This descriptive cross-sectional research was carried out from October 2000 to January 2002 in three referral centers in Tehran. All the patients had referred for cervical MRI for neck pain and/or radicular pain.

**Results:** Totally 342 patients entered the study. Sixty percent of patients were male. The mean age was 55.1 ± 12.1 years. Seventy-nine percent of patients had abnormal MRI findings (238 patients (70%) had signs of degenerative processes and 31 patients (9%) had the other findings) with a total 308 pathologies. The most common findings were disc bulging/protrusion (%21.1), disc dehydration (%20.1), disc herniation (%18.1), and canal stenosis (%17.5). Older age, male gender and history of neck trauma were associated with increasing probability of degenerative changes (P-Values < 0.05).

**Conclusion:** Types of cervical spine pathologies are comparable to other reports. The anatomical distribution of disc bulging and protrusion in our study are similar to other reports. Likewise age, gender and a history of trauma to the neck were closely associated with the degenerative signs on the MR images.

**Keywords:** Spinal disease, Cervical, Spondylosis, Magnetic Resonance Imaging

### Introduction

The erect posture in the mankind renders human vertebral column and its accessories in general, and the cervical spine and the intervertebral disc spaces in particular prone to damage and susceptible to dysfunction studies have shown that the biomechanics of this region is a function of many influential factors such as age, sex, occupation, and weight. Even some harmless daily activities such as standing, walking, and lying down can trigger spine problems.<sup>1</sup>

Also, the cervical spine is a common site for degenerative changes<sup>2</sup> as the greatest spinal mobility happens in neck.<sup>3</sup> The most common form of the spinal cord dysfunction after the fourth decade of life is cervical spondylitic myelopathy that includes a spectrum of cervical spine degenerative changes.<sup>3,4</sup> Degenerative changes of the spine are numerous and the patients' symptoms depend on the type and location of the pathology.<sup>3</sup> However, there are few studies on the correlation between the influential factors and the radiological findings in cervical disc degenerative diseases, as compared to the ample research on the lumbar discs diseases due to the higher incidence of the latter. In this study, we have tried to investigate the pathologic MRI findings of symptomatic patients referred for cervical MRI and to assess the correlation between the some probable risk factors for the cervical spine lesions and the MRI findings.

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## Materials and methods

This descriptive cross-sectional study considered all the patients who referred for cervical MRI to the Medical Imaging Center of Imam Khomeini hospital, Baqeyatollah and Arad hospitals from October 2000 to January 2002. All the patients had neck pain and/or radicular pain in the upper limb. The patients under 10 years of age were excluded for their young age, and also that naturally they were not exposed to risk factors such as cigarette smoking.

Initially, all the patients were interviewed by a trained radiology staff that filled out a questionnaire on the patient's age, gender, weight, history of trauma to the neck, and exercise. The MR images were then taken by a superconductive 1.5 Tesla Picker system at the Medical Imaging Center, a 0.5 Tesla C.T Max in Baqeyatollah, and a 0.3 Tesla Hitachi Airis type I in Arad. The reporting radiologists were necessarily blinded to the patients' records. Cervical canal stenosis determined by pavlove index.

The Chi square and Student t-test data analysis were done with SPSS, ver. 10 and the first type error was considered 0.05.

## Results

Of the original 420 patients of the study, 78 patients dropped out due to incomplete patient information.

Thus, a total of 342 patients with at least a chief complaint of neck pain were surveyed. Two-hundred and two (60%) were male and 140 (40%) female. The mean age was 55.1 ±12.1 years (age range of 16 to 97 years). The mean BMI (body mass index) was 23.7 ±3.1 kg/m<sup>2</sup>, ranging 18.3 to 40.2 kg/m<sup>2</sup>.

Forty-one patients (12%) were professional athletes. Eighty-one patients (23.7) smoked cigarettes. A positive history for cervical trauma, was given by 92 patients(27%) .

Cervical MR images were normal in 73(21%) patients, showed some signs of degenerative diseases (including disc bulging, protrusion or herniation, canal stenosis, disc space narrowing and osteophytosis) in 238 (70%), and revealed other findings of non-degenerative type in 31 (9%).(Table1)

In patients with degenerative changes on cervical MRI (238), we found a total of 274 abnormal degenerative changes (i.e. %15 of the patients had more than one pathology).(Figures1 and 2) Among the 31 non-degenerative MR images, we found 34 pathologic changes.(Table1)

The types and frequencies of the degenerative and non-degenerative changes are presented in (Tables 2 and 3).

**Table1:** Distribution of normal and abnormal findings among the patients

Finding	Number of patients	Among total patients	Number of total Findings
Degenerative	238	%70	274
Non degenerative	31	%9	34
Normal	73	%21	-----

**Table2:** Types and distribution of different changes among cervical degenerative pathologies

Degenerative findings	Frequency	Among total findings	Among total degenerative findings
Disc bulging/protrusion	67	%21.1	%23.7
Disc dehydration	62	%20.1	% 22.6
Disc herniation	56	%18.1	%20.4
Canal stenosis	54	%17.5	%19.7
Disc space narrowing	24	%7.8	%8.7
Osteophytosis	11	%3.6	%4

**Table 3:** Types and distribution of different changes among cervical non-degenerative pathologies

Non-degenerative findings	Frequency	Among total findings	Among total non-degenerative pathologies
Cord compression	21	%6.8	%62
Abnormal bright signal	8	%2.6	%23.5
Syrinx	5	%1.6	%14.5

**Table 4:** The first and second most common levels for 3 frequent findings in the present study

Type of pathology	Most common level	Second most common level
Disc protrusion	c6-c7 (%65)	c5-c6 (%37)
Disc herniation	c6-c7 (%59)	c5-c6 (%42)
Canal stenosis	c5-c6 (%70)	c4-c5 (%22)



**Figure 1:** Sagittal myelogram reveals thecal sac compression at C<sub>3</sub>-C<sub>4</sub>, C<sub>4</sub>-C<sub>5</sub> and C<sub>5</sub>-C<sub>6</sub> levels due to spondylotic canal stenosis.



**Figure 2:** Sagittal T2/W image reveals disc space narrowing, disc dehydration and marginal spur formation at C<sub>3</sub>-C<sub>4</sub>, C<sub>4</sub>-C<sub>5</sub> and C<sub>5</sub>-C<sub>6</sub> levels (spondylosis)

The most common sites for 3 types of the degenerative lesions in the neck are shown in Table 4.

The mean age of patients with degenerative changes was  $59.1 \pm 12.3$  vs.  $46 \pm 10.1$  years in the normal persons (P-Value<0.001). Female to male ratio in the normal MRI group was 1.6, while in the group with degenerative change it was 0.51 (P-Value<0.01).

The BMI in patients with abnormal MRI was not significantly different from those with normal MRI

findings (respectively  $23.6 \pm 9.6$  and  $23.8 \pm 11$  kg/m<sup>2</sup>, P-Value=0.87). The two groups were not different regarding cigarette smoking either (P-Value>0.05).

However, the two groups differed significantly in the the history of cervical trauma (P-Value=0.048). Among the patients with degenerative changes, the ratio of past cervical trauma was 0.45 as compared to 0.23 in the patients with normal MRI.

## Discussion

Degenerative changes in the spinal column constitute a series of pathological changes: spondylosis, arthritic changes of the vertebrae, degenerative changes in the discs and spinal ligaments and canal stenosis.<sup>2,5</sup> As it was mentioned earlier, chronic degenerative changes of the cervical spine are the main causes for progressive spinal cord and neural roots problems.<sup>2</sup> The commonest etiology for spinal dysfunction after the 4th decade of life is cervical spondylitic myelopathy from degenerative changes.<sup>3,4,6</sup>

It appears that the acute changes that lead to disc herniation and the chronic ones leading to spondylosis are two faces of a single pathologic process. However, they must be regarded as different entities due to their different age patterns, presenting features, and neurologic changes.<sup>3</sup> In the present study, the most common findings were spondylitic changes, which corresponded to the results of other studies.<sup>2,5</sup>

Of 342 symptomatic patients who were assessed, %21 had normal MRIs which can be partly due to inherent or technical failure of MR imaging in detecting structural changes.<sup>7</sup> Nonetheless, it has been shown that severity of myelopathy and patient's symptoms could be incompatible with the imaging results<sup>3,5</sup>, especially after 40 years of age.<sup>4</sup>

In current study, we observed the higher mean age in the group of patients with degenerative findings on MRI.

Previous studies have shown that there is a close positive correlation between the frequency and severity of cervical spine disc degeneration and patients age.<sup>6,8-11,13</sup> In other MR studies, including one which was carried out on 497 asymptomatic patients, all the degenerative finding would linearly increase with patients age<sup>8</sup> so that in the 7th decade of life up to 75% of people show degenerative changes of spine.<sup>3,5,6</sup>

Moreover, the number of men was about twice the number of women in degenerative group. (male to female ratio of 2). In most studies, men are involved more than women both in prevalence and severity.<sup>2,3,6,11</sup> Yet, some believe that the prevalences are the same in both genders but men show severer forms of the disease.<sup>4</sup>

Some reports has shown males have significantly larger sagittal canal diameters than females<sup>11</sup> but others reported that a significantly smaller canal/body ratio in men in comparison with women, may implicate the male prevalence of cervical myelopathy.<sup>12</sup>This could mean that in similar conditions, men are susceptible to canal narrowing and may demonstrate myelopathic symptoms earlier than women.

Some reports stated that disc herniation commonly occurred at C6-C7 (70%) and then C5-C6.<sup>6</sup> The most favorite sites of degenerative changes have been C5-C6, together with C6-C7 ranking the same or the second.<sup>3-6,10</sup>These reports matches with our results.

As noted before, degenerative changes can lead to stenotic changes of spine. patients with a sagittal diameter in the cervical spinal canal of less than 12 mm have a high risk of cervical myelopathy.<sup>11</sup>

History of neck trauma is also a predisposing factor. We showed that the frequency of trauma was 1.14 times higher with the degenerative changes than the normal ones.

There was no significant relationship between the degenerative changes and cigarette smoking in spite of some reports that claimed smokers were more prevalent among the patients with degenerative disc diseases in comparison to the normal population.<sup>6</sup>

Considering these factors and applying of preventive affairs might be are apparently the effective to decline the frequency of these changes.

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