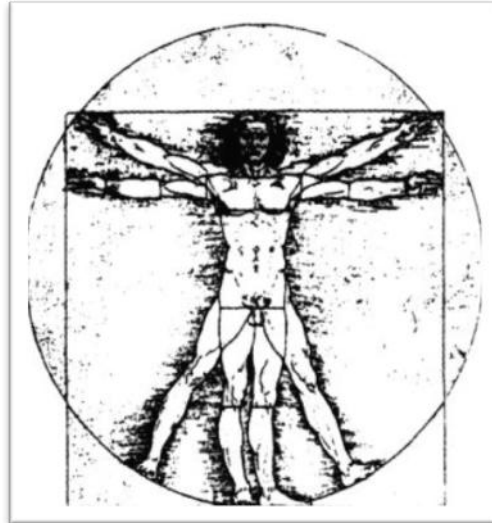


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ORIGINAL ARTICLE

**CORRELATION BETWEEN RISK FACTORS FOR ONSET OF DISC HERNIATION AND LOCALIZATION OF THE PATHOLOGIC CHANGE**

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**ABSTRACT**

**Background:** Almost 70% of the population suffers from neck pain at some point during a lifetime. Our aim was to show the impact of the risk factors on the incidence of disc herniation and the localization of the pathology.

**Materials and methods:** This was a cross-sectional study in which MRI data of the cervical spine and data from the questionnaire designed for the study were used. The focus group consisted of 98 subjects aged 35-70 years with refractory neck pain.

**Results:** Our study showed that in male subjects 40% of the herniated discs were at level of C3/C4 and C6/C7 respectively, and 47.06% of the herniated discs were at C5/C6 level in female subjects. Sedentary work had a significant impact on the prevalence of cervical disk herniation (Chi-square=16.88; df=3; p=0.00082), most commonly found (46.15%) at C5/C6 level.

**Conclusion:** Disc herniation is most common in the middle cervical spine (C5/6). Significant predictors for the analyzed risk factors of cervical discs herniation are: age, genetic predisposition and work-related daily slouching or straining the neck.

**Keywords:** MRI, herniated disc, refractory neck pain, cervical spine, neck

**INTRODUCION**

Contemporary life diseases are non-communicable diseases that have become the leading cause of morbidity and mortality in developed countries. This epidemiological shift has taken large proportions in developing countries as well. The causes of chronic non-communicable diseases are complex and prevention has to include many risk factors that contribute to their onset. Neck pain is a very common phenomenon. It affects almost 70% of the population at some point during a lifetime [1]. Medical history is of great help in differentiation of the diverse pathology of the cervical spine. Nature, length and location of the pain, associated numbness or paresthesias in one or both upper extremities, pain duration and length, other musculoskeletal symptoms and past history of previous trauma are of particular importance. One of the main causes of neck pain or cervical syndrome is degenerative cervical spine disease. Studies have shown that almost 20% of asymptomatic patients younger than 40 years have had some form of a degenerative (intervertebral) disc disease [2].

The motive for undertaking this study has been the increasing number of degenerative cervical spinal diseases.

**AIMS**

The aim of this study was to present the type of degenerative cervical spinal diseases and the direct influence of the risk factors on the onset of these degenerative diseases.

Specific aims:

- To present the sociological characteristics of patients with degenerative spinal diseases (sex, age, working habits);
- To identify the risk factors for the appearance of cervical spine disc herniation;
- To determine the localization of the pathologic change in the cervical spine.

## MATERIALS AND METHODS

This was a cross-sectional study conducted at the University Institute of Radiology in Skopje, Macedonia where data of patients' results were collected and findings were analyzed. MRI data of the cervical spine and specialists' radiological reports of patients were used as well as data from the questionnaire designed for the purposes of the study.

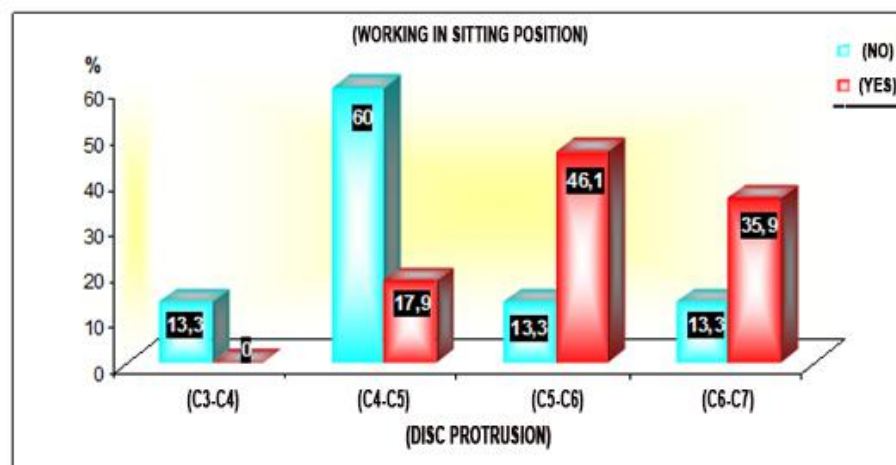
The focus group consisted of subjects at the age of 35-70 years with refractory neck pain. The examined group included subjects who had a working diagnosis of cervical brachial syndrome or cervical radiculopathy referred to the University Clinic of Radiology in Skopje for MRI of the cervical spine and determination of its pathological changes. Sample size: the examined group consisted of 98 subjects who were referred for MRI to detect cervicobrachial syndrome for the first time.

## RESULTS

We have analyzed the correlation between the protrusion degree of cervical intervertebral discs and sex of the subjects, type of their profession and factors associated with their lifestyle (smoking cigarettes and physical inactivity).

There was a non-significant difference between men and women with cervical intervertebral disc degeneration regarding the level at which disc herniation appeared (Chi-square=5.79; df=3; p=0.113). Of 20 diagnosed herniated discs in men, 40% of the protrusions were at C3-C4 level and the same number at C6-C7 level. On the other hand, the largest percentage (47.06%) of herniated discs in women was found at C5-C6 level. Statistical testing of the level of herniated discs between males and females was not significant ( $X^2 = 5.97$ ; df=3; p= 0.113).

A non-significant difference was found between subjects with cervical intervertebral disc degeneration whose daily work activities were or were not related to computer use regarding the level at which disc herniation developed (Chi-square=4.98; df=3; p=0.17). Subjects who spent a great deal of working hours using computers more often developed herniated disc at C5-C6 and C6-C7 levels than subjects who did not work with computers (40% vs. 34.48 and 40% vs. 20.69%, respectively).



**Fig. 1.** Distribution of intervertebral disc protrusion level according to working in sitting position.

Sedentary jobs had a significant influence on the level of cervical spine herniation (Chi-square=16.88; df=3; p=0.00082). The C4-C5 level was most commonly affected by disc herniation (60%) in the group of subjects who did not spend long sitting hours in the workplace, whereas the largest percentage (46.15%) of subjects who had a sedentary job had herniated disc at C5-C6 level. The remaining types of jobs, such as lifting heavy weights every day, jobs involving everyday slouching or straining the neck, work with vibrating machines had no significant influence on the level where cervical spine herniated disc appeared. Subjects with cervical spine degenerative changes, whose job was lifting heavy weights every day, had non-significantly more often herniated disc at C4-C5 in comparison with subjects who did not have that type of work (39.13% vs. 22.58%) (X<sup>2</sup>=5.38; df=3; p=0.15). Subjects who slouched and strained their neck everyday at their workplace compared to subjects who did not have such jobs had non-significantly more often herniated disc at C3-C4 (4.35% vs. 0%), at C4-C5 (34.78% vs. 0%), or at C6-C7 level (30.43% vs. 25%) (X<sup>2</sup> = 6.85; df =3; p=0.077). Both diagnostic protrusions of intervertebral discs (I.V.) of the cervical spine were located at C5-C6 level in subjects who worked with vibrating machines. This segment of the spinal neck was also the most common location for herniated disc (18 – 34.61%) in the group of 52 diagnosed protrusions in patients who did not work with vibrating machines (Fisher's exact two tailed p=0.374).

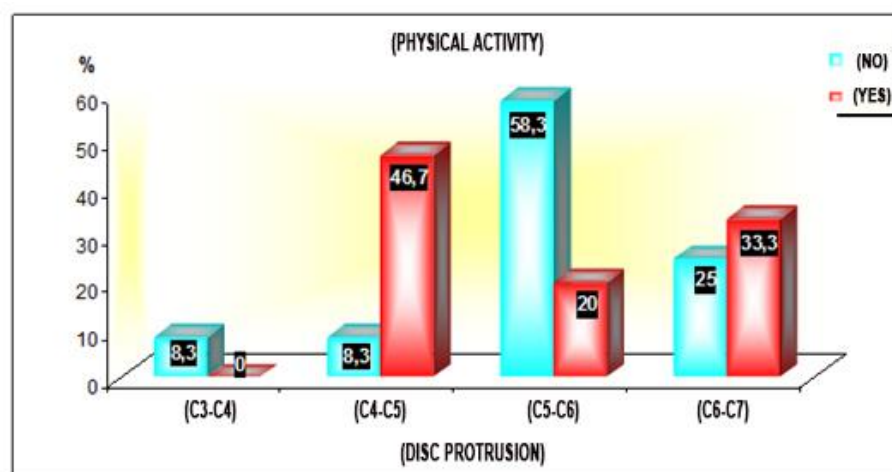


Fig. 2. Distribution of intervertebral disc protrusion level according to physical activity.

## DISCUSSION

The investigation of the location of cervical spine pathology in Macedonia along with the risk factors for its onset is the first one of this kind in our country. This study has provided data that would be of crucial importance for promotion and improvement of the health as well as for advancement in primary prevention.

The results obtained in this study about the incidence of pathologic changes of I.V. cervical spine in the examined subjects have shown that more than half of the study subjects (50 – 51.02%) had cervical spine I.V. disc herniation to a certain degree. In a population-based study conducted in Rochester, Minneapolis, USA, the average annual incidence per 100.000 population for cervical radiculopathy was 107.3 in males and 63.5 in females. The cause of cervical radiculopathy in 21.9% of the examined patients was intervertebral disc protrusion, whereas in 68.4% a result of spondylosis, disc protrusion or both [3].

Another study about the risk factors also realized in the USA reported 13.000.000 United States military individuals within the Armed Forces affected by cervical radiculopathy, the incidence being 1.79 cases per 1.000 persons on an annual basis. The same study also demonstrated that individuals older than 40 years, female sex and White race had a greater risk of developing cervical radiculopathy [4]. The results of our study have shown that the onset of cervical I.V. disc herniation was significantly dependent on sex of the subjects, and hence a more common finding of these pathologic changes was observed in women. Cervical I.V. disc herniation was found in 18 (36%) male and in 32 (64%) female subjects. Kelley LA. suggested that cervical disc herniation was of almost equal male and female incidence [5]. Marchiori and Henderson noticed that higher incidence of herniated disc was found in females than in males [6]. The same conclusion was presented by Shoenfeld [4]. These results are in agreement with the findings in our study indicating that female subjects are of higher risk of developing cervical disc herniation.

Regarding the results about the influence of the occupational risk factors, cervical I.V. disc herniation was non-significantly associated with computer use, but was significantly associated with the rest of the examined occupational risk factors. Seventy percentages of subjects whose daily work activities were associated with long sitting hours had a positive finding of I.V. disc herniation. Jobs that required everyday lifting heavy weights had a significant influence on the appearance of cervical I.V. disc herniation, which was detected in 42% of the examined subjects involved in this type of work. Also, subjects whose work required everyday slouching and straining the neck were more likely to experience cervical disc herniation (registered in 84% of subjects). In each of the groups with and without herniated disc two subjects who worked with vibrating machines were registered. Behavioral factors analyzed by practicing physical activity were non-significantly associated with cervical I.V. disc herniation. One recent survey performed in Poland has shown that 23-28% of coal miners suffered from neck pain in comparison with 4% found in the control subjects. Degenerative changes in the cervical spine as narrowed intervertebral disc spaces and spondylophytes were found in these coal miners. This proved the direct correlation between occupational factors and spinal degenerative diseases [7]. The results about the influence of the occupational risk factors in our study have demonstrated that they had the largest impact on the onset of cervical disc herniation. Our results have illustrated that cervical I.V. disc herniation was non-significantly associated with computer use, but was significantly associated with sedentary work, everyday lifting of heavy weights, and everyday slouching or straining the neck. In 70% of examined subjects who work in sitting position for long hours, two or several cervical spine disc herniation were observed, whereas this type of pathologic changes were detected in 42% of subjects whose everyday work was lifting heavy weights and in 84% of subjects whose workplace was connected with everyday straining the neck.

It can be concluded from the results obtained in our study that occupations connected with sitting for long hours at the work desk, everyday slouching or straining the neck, work with computers, lifting heavy weights and presence of vibrations during working hours are risk factors for development of degenerative cervical diseases.

In this study we analyzed the correlation of the level of cervical I.V. disc herniation and the demographic characteristics of the examined subjects, as well as the occupational and behavioral factors. The statistical analysis did not confirm influence of the sex on the location of cervical degenerative changes. With reference to the occupational risk factors, there was a positive correlation concerning the level at which I.V. disc herniation developed in those subjects who worked in sitting position in the workplace. In these subjects disc herniation was found at C5-C6 (40%) and at C6-C7 level (40%).

Therefore, a conclusion can be drawn that work with personal computers influenced on the development of degenerative cervical I.V. disc diseases, most often as a result of slouched and strained posture with neck extension. Jobs connected with long sitting hours also had a significant influence on the level of cervical I.V. disc herniation. The C4-C5 was the most common level at which disc herniation (60%) appeared in the group of subjects who did not work in sitting position for long hours as opposed to subjects with long sitting hours in the workplace, where the largest percentage (46.15%) had herniated disc at C5-C6 level.

Herniated I.V. disc is predominantly found in younger subjects, that is, subjects under the age of 40 years as opposed to I.V. disc degeneration that is predominantly found in subjects older than 40 years as a result of the natural process of ageing. Subjects older than 40 years are at a higher risk of developing cervical radiculopathy [4]. Genetic predisposition and environmental factors were investigated in the Twin Spine study [8]. It was a multidisciplinary and multinational research project, which had been started in 1991 including collaborators primarily from Canada, Finland and the United States of America. The principal goal of the research was to investigate the etiology and pathogenesis of disc degeneration. Among the most significant findings were the influence of heredity on I.V. disc degeneration and the identification of the first gene forms associated with I.V. disc degeneration. Also, the investigation analyzed the effects of smoking exposure and other important occupational exposures on disc degeneration in identical twins that served as a control group. As a result of this study, today I.V. disc degeneration is considered to be determined by environmental factors, but genetic predisposition plays an important role. In another study conducted in Great Britain, MacGregor *et al.* examined 1.064 twins with low back or neck pain and concluded that genetic factors rather than environmental factors had larger influence on the onset of these symptoms [9]. In our study genetic predisposition also played an important role in development of pathologic conditions in the cervical spine. In 42% of examined subjects with positive familial history, disc degeneration in some segment of the cervical spine was diagnosed.

We analyzed the association of the cervical spine herniation location regarding demographic characteristics, occupational and behavioral factors. Statistical analysis did not confirm the influence of sex on the level of degenerative cervical I.V. disc herniation. The results obtained showed that in the group of male subjects with diagnosed cervical I.V. disc herniation, 40% had herniated disc at C3-C4 and the same percentage of subjects at C6-C7 level, whereas in 47.06% of female subjects, herniated disc developed at C6-C7 level. In the literature C5-C6 and C6-C7 have been demonstrated as the most common levels at which disc herniation appear regardless of the sex. A statistically significant difference was being registered between groups of subjects who are involved in physical activities and those who are inactive regarding the level of cervical I.V. disc herniation. Subjects who were physically active significantly more often have herniated disc at C4-C5 level (46.67 vs. 8.33).

The remaining occupational or behavioral factors have no influence on the development of cervical I.V. disc herniation.

Recommendations can be drawn from this study concerning the necessity of undertaking measures and actions for health promotion starting from early age related to the problem of cervical intervertebral disc degeneration. These include: regular systematic examinations and establishment of healthy lifestyle among the young population, raising the awareness level of the parents, raising the awareness of the employed and their managerial team about the problem of spinal degenerative diseases, risk factors and inevitability of their prevention, ergonomic changes at the workplaces, creation and continuous work of centers for intensive ergonomic counseling, education and practice.

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