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Research Paper

Investigating Cervical Degenerative Disc Disease: An Iranian Population-based Demographic Analysis

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ABSTRACT

Background and Objectives: Degenerative cervical disease is one of the most common causes of referral to health centers and imposes a heavy burden on health systems. With the increase in life expectancy and the increase in the elderly population in Iran, similar to other countries, the prevalence of this disorder has increased significantly. This study investigates the demographic and radiological findings in patients with degenerative cervical disease who underwent surgery for the first time in Iran.

Methods: In this cross-sectional study, the medical profiles of 301 patients with a definitive diagnosis of degenerative cervical disease who underwent surgery in Shafa yahyaeian Hospital in Tehran from 2010 to 2019 were reviewed. The demographic characteristics and radiographic findings of the patients were extracted by referring to the patient's medical profiles using a checklist.

Results: The mean age of the patients was 51.12 ±11.2 years. A total of 202 (67.1%) were women. The mean body mass index was 27.1±3.11 kg/m^2. A history of neck surgery was reported in 6% of patients. Meanwhile, 51.6% of patients had education higher than a diploma, more than half of the patients were employees, and in 147(48.8%) of the patients, the C5/C6 level was involved. C6/C7 and C4/C5 level involvement were 68(22.6%) and 56(18.6%), respectively.

Conclusion: This study showed that the frequency of cervical discs in women was higher compared to men, especially in the fifth and sixth decades of life. Based on radiological findings, C5 and C6 were the most common levels of involvement. The prevalence of cervical disc disease was higher in people with higher education as well as employees than in other professions.

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1. Introduction

The spine is a complex structure consisting of muscles, vertebrae, cartilage, discs, and ligaments that are degenerated with age. The discs act as supportive mattresses for the vertebrae [1-3]. Aging and exhaustion in the body's natural process are the main factors in depreciating degenerative conditions of the spine. In addition to aging, many factors, in addition to time, can speed up these degenerative spinal disorders, including the following items: Arthritis, osteoporosis, trauma, infection, and repeated and vigorous movements, which usually occur in people with highly physical occupations [4-7].

Over time, above the age of 35, the natural fluid in the disc gradually becomes dehydrated. A soft gelatinous substance that contains a lot of water gradually dries and loses its elasticity [8, 9].

Degenerative cervical disc disease can cause radiant pain, numbness, and weakness in the shoulders, arms, and hands [7]. The most common and obvious symptoms of cervical discopathy are neck pain and stiffness. When one of these conditions puts pressure on one or more nerves, they move out of the spinal cord [10].

Epidemiological data on cervical radiculopathy and cervical disc radiculopathy are rare. Previous studies have reported an annual cervical disc incidence rate of 83.2 per 100000 and a total of 107.3 for men and 63.5 for women. [6, 11] The incidence and prevalence of this disorder is higher in men compared to women [6]. The most affected age range for cases was reported in the fourth and fifth decades [12].

2. Methods

The study population consisted of 356 cases with definite diagnoses of cervical degenerative disease that underwent surgery in Shafa yahyaeian Hospital in Tehran from 2011 to 2020 and met the inclusion criteria. After evaluating the inclusion criteria, the records of 301 patients with cervical degenerative were evaluated for demographic and radiographic findings. The patients were selected by convenience sampling method and sequentially from among the patients referred to the hospital. The inclusion criteria comprised the following items: Having neck degenerative diseases that require surgery, including cervical disc, cervical osteophytes, patients with myelopathy problems caused by cervical disc degeneration; having posterior longitudinal ligament; having cervical spinal canal stenosis; and the availability of access to demographic and radiological findings of patients. Meanwhile, the exclusion criteria were as follows: Having other cervical diseases, such as trauma; having cervical bone tumors; having congenital deformities; and a lack of access or incomplete records or radiologic records of patients.

The data were collected using a two-part checklist. The first part consisted of demographic information (age, sex, body mass index, history of cervical disc in first-degree relatives, occupation, and education level of patients). Meanwhile, the second part included radiographic findings of patients (site of spine involvement, cervical lordosis, localized kyphosis determination, myelopathy, and severity of involvement). Radiographic findings were extracted and evaluated by referring to the imaging department and from the picture archiving and communication system. All the findings of patients were evaluated clinically by a spine surgery sub-specialist. The diagnosis of patients was based on the findings of magnetic resonance imaging. All findings were evaluated and classified by two independent physicians (an orthopedic surgeon and a radiologist).

Data analysis

After data collection, all patient data were analyzed using the SPSS software, version 22. Descriptive statistics, such as numbers and percentages were used to report qualitative variables. The normal distribution of quantitative variables, such as age, was assessed by the Kolmogorov-Smirnov test. Qualitative variables were analyzed by descriptive statistics (based on the number and percentage of its report). The chi-square test is used to evaluate qualitative variables. Also, $P<0.05$ are considered statistically significant.

3. Results

In this study, 301 patients who underwent degenerative surgery of cervical disc were reviewed. The mean age of patients was 51.12±11.2 years and ranged from 20 to 81 years. The median age of patients was 50 years. Overall, 202(67.1%) cases were female and the rest were male. Nearly, half of the patients had at least one underlying disease. The mean body mass index of patients was 3.11±27.1 kg/m^2. A history of neck surgery was reported in nearly 6% of patients. A total of 24% of the patients were smokers or had a history of smoking. The demographic characteristics of patients are fully reported in Table 1. In addition, 51.6% of patients had a higher education than a diploma. In terms of employment status and job type, more than half of the patients were employees or secretaries (Table 2).

Table 1. Demographic characteristics of patients (n=301)

Variables		Mean±SD/N0. (%)
		Patients
Age (y)		51.12±11.2
Sex	Female	202(67.1)
	Male	99(32.9)
Body mass index (kg/m^2)		3.11±27.1
Smoke	No	228(75.4)
	Yes	73(24.6)
History of neck surgery	No	19(6.3)
	Yes	282(93.7)
Comorbidity	No	169(56.4)
	Yes	132(43.9)

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Radiological findings

Based on the radiological findings, 147(48.8%) of patients had involvement in C5/C6 level. The frequency of involvement of C6/C7 and C4/C5 levels were 68(22.6%) and 56(18.6%), respectively. Spondylosis and disc herniation were the most common etiology of cervical pathology. Myelopathy was reported in 38% of cases. In terms of severity of the disease, the majority of patients were mild or moderate type (Table 3).

4. Discussion

Cervical degenerative disease is one of the most common causes of referring to orthopedic centers and they impose a heavy burden on health systematics. With increasing age, the chance of occurrence of this disorder increases significantly. In addition to direct costs, this disease imposes heavy costs on the health system by absenteeism in government and administrative centers. The recognition of demographic characteristics and radiological findings of this disorder is important, considering the aging of our population, and can help health policymakers. Given the importance of the issue, this study

Table 2. Education level and occupation

Variables		No. (%)
		Patients (n=301)
Educational Level	Illiterate or elementary	47(15.6)
	Diploma	98(32.6)
	>Diploma	156(51.8)
Occupation	Unemployed	28(9.4)
	Employee	162(53.8)
	Health workers	48(15.9)
	Freelance job	63(20.9)

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Table 3. Radiologic findings (n=301)

Variables		No. (%) Patients
Cervical disc levels	C2/C3	30(10)
	C3/C4	56(18.6)
	C5/C6	147(48.8)
	C6/C7	68(22.6)
Degeneration	Mild	115(38.2)
	Moderate	129(42.9)
	Severe	57(18.9)
Etiology	Spondylosis with disc degeneration	179(59.5)
	Disc herniation	88(29.2)
	Others	34(11.3)
Types of lesion	Radiculopathy	98(32.1)
	Myelopathy	116(38.1)
	Both	28(9.3)
	Others	60(19.9)

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was designed to evaluate demographic and radiological findings in patients with degenerative cervical disease. The findings showed that the mean age of the patients was 51 years and more than half of the patients were less than 60 years, which indicates that the age range of these patients has declined. This study showed that patients have a high risk of developing the disease in most age groups; however, due to the nature of the disease in the fifth and sixth decades of life, the frequency of the disease increases significantly more. Nearly two-thirds of the patients were women, suggesting the prevalence of the disease was higher in women. The higher prevalence of this disease in women than men can be justified due to osteoporosis, as well as the role of hormones and the faster rate of bone loss in women than men. Nearly half of the patients had at least one underlying disease. The mean body mass index was 27.1 kg/m^2 and more than half of the patients had body mass index higher than normal. More than 60 of the cases were overweight or obese. One in four patients had a smoking or history of smoking. The majority of patients had high school education and nearly half of the patients had academic education. The frequency of the disease was higher in employed people than in unemployed patients. Among the employed people, the frequency of the disease was much higher among individuals employed in administrative centers using computer systems. In other words, jobs and the use of computer systems are significantly associated with increased cervical disc. Radiologic findings showed that in more than half of patients C5, C6, and C7 levels were the most common levels of involvement for the cervical disc. In terms of etiology, spondylosis, cervical disc, or both was the most common cause of cervical disc disease and the patient's need for surgery. The majority of patients had moderate and mild disease, which is consistent with the results of studies in this field [11-36]. In 2021, Tao et al. analyzed epidemiological and radiological findings in 1581 patients with cervical disc, the frequency of the disease was higher in women than men. The mean age of the patients was nearly 42 years. According to the findings of this study, more than half of the patients had mild to moderate degeneration. In our study, the rate of severe degeneration was slightly higher than in this study. Based on the results of this study, the highest level of involvement was C5/C6 and the lowest affected level was C2/C3 which confirmed the results of our study [37]. Radhakrishnan et al. investigated epidemiological characteristics of cervical radiculopathy in 561 patients, the mean age of patients was 47.6 years. The previous history of lumbar

radiculopathy was present in 41%. C6 and C7 nerve roots were the most common levels of involvement that were in line with the results of our study. In 68.4% of patients, the cervical disc was related to spondylosis, disc, or both, which confirmed the results of our study. Pain recurrence occurred in 31.7% of patients and 26% underwent surgery for cervical disc radiculopathy. [11] In another study, Shimizu et al. looked at the prevalence and predictive factors of cervical disc disease in 121 patients with adult spinal deformities, showing an average age of 55.3, and matched the results of our study. In their study, they reported the average body mass index of patients to be close to 24.5 kg/m^2, which was lower than the average body mass index in our study, which can be justified due to differences in the population under study as well as differences in patients' lifestyles in the two studies [38]. In our study, the average body mass index was higher and the frequency of people with higher weight was higher in our study. Our results showed that the frequency of women with cervical disc disease was higher than men. In the study, 35 of the 41 patients were asymptomatic or had myelopathy. Cervical disc disease was more noticeable at C4 and 5 levels, which is in line with the results of our study.

5. Conclusion

The results of this study showed that cervical disc herniation frequency was higher in females especially in the fifth and sixth decades of life than in males. Based on radiologic findings, C5 and C6 were the most common levels of involvement. The frequency of cervical disc herniation in higher education and also employees was higher than in other professions. Prospective and extensive studies with appropriate control groups are recommended for the more accurate evaluation of these results for policy-making in the health sector.

Ethical Considerations

Compliance with ethical guidelines

All procedures performed in studies involving human participants followed the ethical standards of the institutional and or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Ethic Committe of Iran University of Medical Sciences (Code: IR.IUMS.REC.1402.305). Meanwhile, there is no information (names, initials, hospital identification numbers, or photographs) in the submitted manuscript that can be used to identify patients.

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Authors' contributions

Conception and study design, acquisition, data analysis and creation of new software used in the work: Seyyed Mani Mahdavi, Javad Moeini; Manuscript writing: Farshad Nikouei and Mohammadreza Shakeri; Investigating work integrity and data validation: Hasan Ghandhari; Revising and finalizing the manuscript: Mohammadreza Chehrassan and Mohammadreza Shakeri.

Conflict of interest

The authors declared no conflict of interest.

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