

Original Article

Trend of the incidence of cervical spondylosis: decrease with aging in the elderly and increase with aging in the young and the adults

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Abstract: Background and purpose: Numerous clinical studies have indicated that the incidence of cervical spondylosis increases with age. However, the relationship between age and the incidence of cervical spondylosis is still unclear. It is essential to address the relationship between age the incidence of cervical spondylosis via more clinical data. Methods: A retrospective analysis of 4271 cases of cervical spondylosis has been done in this study. A chi-square test was used to analyze the associations between different variables. A One-Way Analysis of Variance was used to test the equality of three or more means at one time by using variances for risk factors. Results: The most prominent features of cervical spondylosis were bulge or herniation at C3-4, C4-5 and C5-6. The incidence of cervical spondylosis increased with age before 50 years old and decreased with age after 59. The age risk factors have no relationship with the incidence of cervical spondylosis. There was an increase with age before 50 years old and a decrease with age after 59 for the occurrence of imaging features for cervical spondylosis patients. Conclusion: The incidence of cervical spondylosis decreases with aging in the elderly and increases with aging in the young and the adults. This analysis suggests that aging is not a contributor to the occurrence of cervical spondylosis in the elderly.

Keywords: Cervical spondylosis, incidence, age

Introduction

Cervical spondylosis is a chronic 'wear and tear' degenerative process of the cervical spine that affects the vertebral bodies and intervertebral disks in the neck, and can develop into disk ruptures and herniation, osteophyte, compression of the spinal cord, or cervical spondylosis myelopathy [1, 2]. Cervical spondylosis can be identified in the majority of people older than 40 years. Symptoms of cervical spondylosis include one, or a combination, of the following: numbness, weakness and tingling in the neck and/or arms, pain in the neck and/or arms, neck stiffness, headaches, symptomatic compression of the spinal cord (myelopathy), nerve roots (radiculopathy), or problems with bladder function from cervical myelopathy [3, 4]. Prolonged cord compression from cervical

spondylosis can result into irreversible histological spinal cord changes such as intradural fibrosis, ischemia, destruction of the blood-spinal cord barrier, demyelination, and neuronal apoptosis within the spinal cord [5]. Decompressive surgery may rescue these changes and halt or even reverse the deterioration in myelopathy patients and contribute to an improvement in functional and neurological status [6].

Cervical spondylosis is a common disease especially in the elderly population, which is a disorder for age-related wear affecting the disks and vertebrae of cervical spine [7]. Compelling clinical evidence has implicated that that age is a risk factor and a contributor to the incidence of cervical spondylosis which increases with aging [8, 9]. With the aging of population, the patients suffering from cervical

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Table 1. The distribution of different age range and gender

Gender	Age distribution (year)								N
	≤29	30-39	40-49	50-59	60-69	70-79	80-89	≥90	
Total	21	186	837	1731	956	415	124	1	4271
Male	7	93	387	685	375	173	72	1	1793
Female	14	93	450	1046	581	242	52	0	2478

Table 2. Percentage of risk factors

Risk factors	Cases	Percentage (%)
Hypertension	1413	33.1
Diabetes	573	13.4
Cardiovascular diseases	818	19.2
Cerebral infarct	2673	62.6
Smoking	667	15.6
Drinking	486	11.4
Hyperlipidemia	1546	36.2

Table 3. Clinical symptoms and signs

Symptoms or signs	Cases	Percentage (%)
Headache	84	2.0
Dizziness	390	9.1
Fatigue	72	1.7
Nausea and vomiting	197	4.6
Weakness and tingling in the neck and/or arms	848	19.9
Pain in the back, neck and/or arms	901	21.1
Vertigo and instability of walking	234	5.5

Table 4. Imaging features

Imaging features	Cases	Percentage (%)
Bulge or herniation at C2-C3	21	0.5
Bulge or herniation at C3-C4	2622	61.4
Bulge or herniation at C4-C5	3298	77.2
Bulge or herniation at C5-C6	3582	83.9
Bulge or herniation at C6-C7	2777	65.0
Bulge or herniation at C7-T1	262	6.1
Hyperosteoegeny	3424	80.2
Spinal stenosis	781	18.3
Calcification	39	0.9
Hypertrophic ligamentum flavum	1714	40.1
Disc degeneration	767	18.0

spondylosis are increasing. However, the relationship between age the incidence of cervical spondylosis remains obscure. It is essential to clarify relationship between age the incidence

of cervical spondylosis under more clinical data. This study has examined the clinical data of cervical spondylosis from December 2014 to January 2014 in our hospital in Northern China. The present clinical investigation has demonstrated that the trend of the incidence of cervical spondylosis decreases with aging in the elderly and increases with aging in the young and the adults.

Clinical data and methods

4271 cases of cervical spondylosis were collected in the Fourth Affiliated Hospital of Harbin Medical University in the Northern China. All data from January 2014 to December 2015 was obtained from the all departments of the Fourth Affiliated Hospital of Harbin Medical University. This study was approved by the research ethics board of Harbin Medical University. Diagnosis was determined in accordance with 2012 ICD-9-CM *Diagnosis Code 721 (721.0 Cervical spondylosis without myelopathy, 721.1 Cervical spondylosis with myelopathy)* and the diagnostic criteria of diagnosis and treatment for cervical spondylosis issued by China's Rehabilitation Medicine association.

The comprehensive diagnostic process included medical history, physical examination and diagnostic tests. The exclusion from the study included cervical vertebral trauma, cervical vertebral surgery, congenital spinal deformity, syringomyelia, amyotrophic lateral sclerosis, spinal cord tumor, spinal cord injury, adhesive arachnoiditis, cervical injury, tumor or infection. Computed tomography scans and/or magnetic resonance imaging were performed to confirm the diagnosis of cervical spondylosis. The clinical data was collected, including varia-

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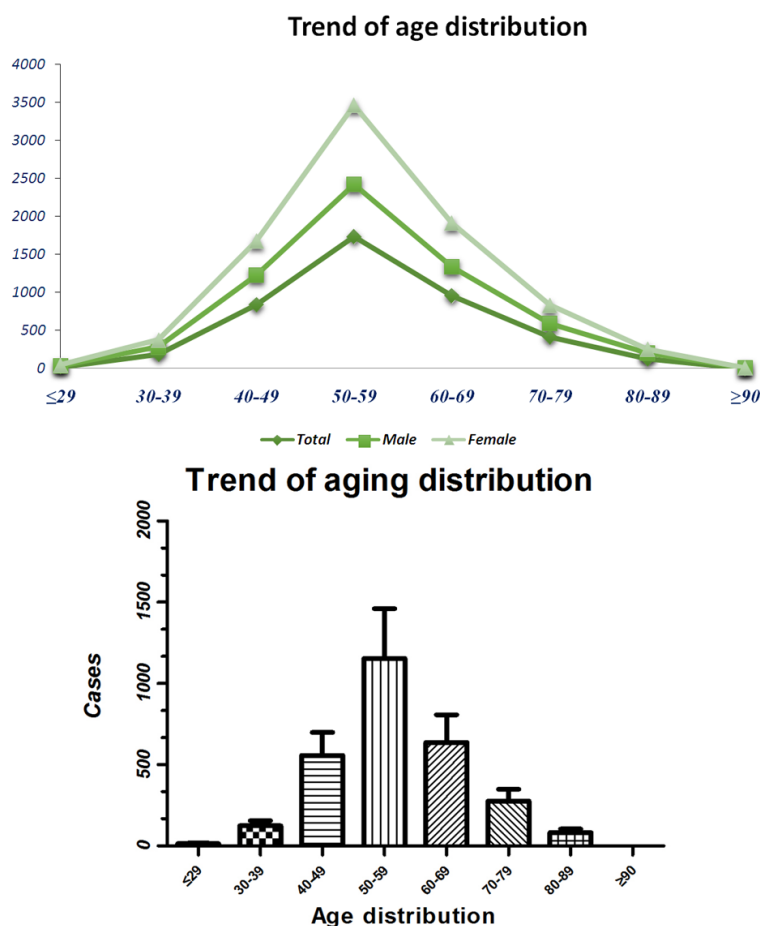


Figure 1. Age distribution of patients for cervical spondylosis. The incidence of cervical spondylosis varies by age group, with the highest incidence of collected cases occurring in age between 50 and 59 years.

bles on sociodemographic characteristics, age-related risk factors, and physical examination findings.

The clinical manifestation represented the following: ① no symptoms of cervical spondylosis: cervical degenerative changes without clinical manifestations; ② mild stenosis of intervertebral space and less osteophyte formation with neck stiffness, stiff neck pain, shoulder pain and stiff symptoms and signs; ③ cervical radiculopathy: root distribution (numbness or/and pain) and signs; ④ cervical spondylotic myelopathy: canal stenosis with the clinical manifestations of cervical cord compression such as numbness, gait instability, difficulty walking; ⑤ sympathetic cervical spondylosis: clinical manifestations of sympathetic nervous system such as dizziness, headache, poor sleep, loss of memory, tinnitus, nau-

sea, diarrhea, palpitations, or sweating; ⑥ the vertebral artery type of cervical spondylosis: cataplexy attack, vertigo.

Retrospective analysis of 4271-case cervical spondylosis has been conducted. The data was edited and entered into a computer to be analyzed using SPSS, Windows version 13.0 (IBM Corporation, Armonk, NY, USA). A chi-square test was introduced to analyze the associations between two different variables. A One-Way Analysis of Variance was used to test the equality of three or more means at one time by using variances for risk factors. A *P*-value of less than 0.005 was taken to indicate statistical significance.

Results

The general clinical data analysis

Demographic items included age and gender, clinical symptoms and signs, risk factors, and imaging features. The distribution of different age range and risk factors were detailed in **Tables 1** and **2**. 4271 cases included 1793 male and 2478 female.

The general clinical data demonstrated that the main symptoms and signs of cervical spondylosis involved pain in the back, neck and/or arms, weakness and tingling in the neck and/or arms, dizziness, headache, vertigo and instability of walking, nausea and vomiting, and neck stiffness. The most prevalence symptom was pain in the back, neck or/and arms (**Table 3**). The imaging examination with computed tomography or/and magnetic resonance imaging presented the most prominent characteristic features of cervical spondylosis: bulge or herniation at C3-4, C4-5 and C5-6, spinal stenosis, vertebral hyperostosis, and hypertrophic ligamentum flavum (**Table 4**).

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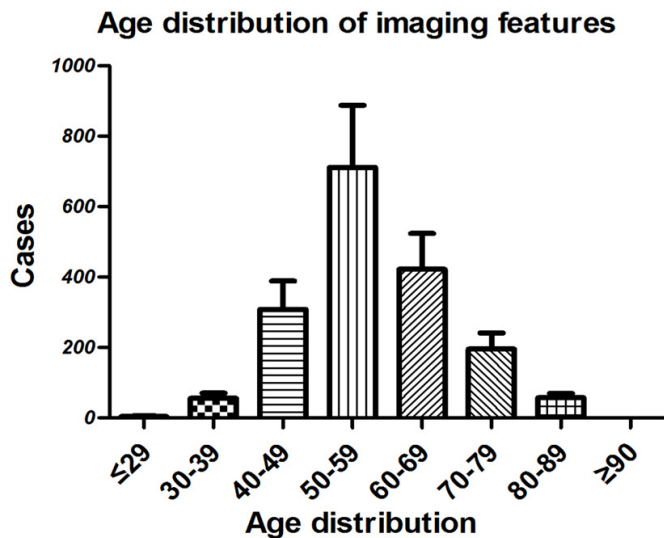
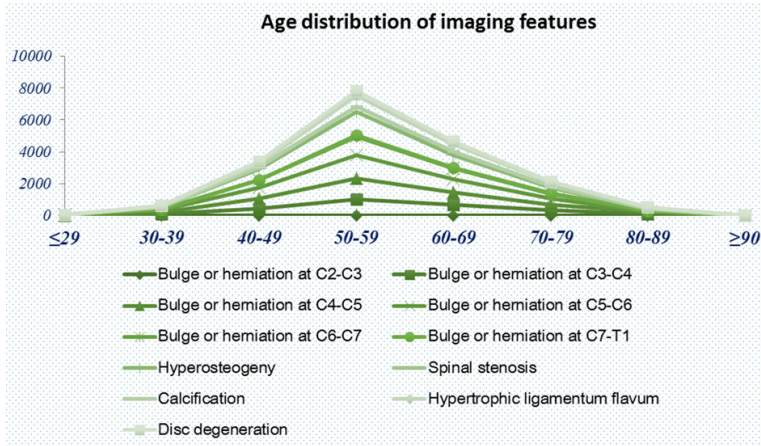


Figure 2. Age distribution of imaging features for cervical spondylosis patients. The incidence of imaging features varies by age group, with the highest incidence of collected cases occurring in age between 50 and 59 years. There was an increase with age before 50 years old and a decrease with age after 59 for the occurrence of imaging features for cervical spondylosis patients.

The analysis of age distribution for cervical spondylosis

The total data showed that the incidence of cervical spondylosis increased with age before 50 years old and decreased with age after 59. The same results were found in both the male and the female subjects (**Figure 1** and **Table 1**).

The imaging findings (**Figure 2** and **Table 5**) are consistent with the previous results that the incidence of cervical spondylosis increased with age before 50 years old and decreased with age after 59. There was an increase with age before 50 years old and decrease with age after 59 for the occurrence of bulge or hernia-

tion at C3-C4, bulge or herniation at C4-C5, bulge or herniation at C5-C6, bulge or herniation at C6-C7, bulge or herniation at C7-T1, hyperosteoegeny, spinal stenosis, hypertrophic ligamentum flavum and disc degeneration. The same founding was observed in the *bulge or herniation at C2-C3* and *calcification* although there was no obvious change in the number of cases among the different age group.

The relationship between risk factors and the incidence of cervical spondylosis

The association between the clinical risk factors and cervical spondylosis on the basis of age had been demonstrated in **Table 6**. A One-Way Analysis of Variance showed that the age-related risk factors (hypertension, hyperlipidemia, diabetes, cerebral infarct, cardiovascular diseases, smoking and drinking) have no relationship with the incidence of cervical spondylosis.

Discussion

Cervical spondylosis is a common pathological entity that can result in various clinical manifestations in the adult population. It can present in a variety of ways but the most common presentations are weakness and tingling in the neck and/or arms, pain in the neck and/or arms, functional deficits of the upper extremity, particularly the hand [10, 11]. In this study, the one-hospital based clinical data was retrospectively analyzed, which was collected from hospitalized patients with a diagnosis of cervical spondylosis. The one-hospital based clinical investigation identified that the most prevalence symptom of cervical spondylosis is pain in the back, neck and/or arms, and the most prominent characteristic features is bulge at C3-4, C4-5 and C5-6. There was no relation between the onset of cervical spondy-

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Table 5. Age distribution of imaging features for cervical spondylosis patients

Imaging features	Age distribution (year)							
	≤29	30-39	40-49	50-59	60-69	70-79	80-89	≥90
Bulge or herniation at C2-C3	0	1	3	7	6	4	0	0
Bulge or herniation at C3-C4	5	75	450	1012	653	322	105	0
Bulge or herniation at C4-C5	8	111	614	1312	786	357	109	1
Bulge or herniation at C5-C6	13	142	675	1464	818	364	105	1
Bulge or herniation at C6-C7	7	72	463	1162	676	311	85	1
Bulge or herniation at C7-T1	0	4	37	111	63	39	8	0
Hyperosteoegeny	7	116	662	1444	793	324	78	0
Spinal stenosis	1	12	122	316	196	98	36	0
Calcification	0	1	9	10	12	5	2	0
Hypertrophic ligamentum flavum	1	26	198	681	474	262	71	1
Disc degeneration	3	45	151	306	168	66	27	1

losis and the age-related risk factors (hypertension, besides hyperlipidemia, diabetes, cerebral infarct, cardiovascular diseases, smoking and drinking). The great significance of this study has found that the occurrence of cervical spondylosis increases with age before 50 years old, and decreases with age after 59, in spite of difference with the past reports that the occurrence of cervical spondylosis increases with aging. This investigation implicates that aging is not a contributor to the occurrence of cervical spondylosis in the elderly although the incidence of cervical spondylosis is proportional to the progress of age.

It is well-known that cervical spondylosis is an age-related 'wear and tear' degeneration of vertebrae and discs in the neck. Abundant clinical and pathological data evidences that cervical spondylosis is a common occurrence in the elderly [9, 12]. With the progress of cervical spondylotic changes, symptoms often slowly come into emergence over time and get worse with aging, such as headache, neck stiffness, pain in the back, neck and/or arms, weakness and tingling in the neck and/or arms, dizziness, and so on [10, 13]. It is well accepted that age is the major risk factor of cervical spondylosis. However, our previous studies demonstrated that the incidence of cervical spondylosis decreases with age in the elderly population, especially after 60 years old, although increased with age before 50 years old. Our further investigation subsequently provided that there is no relationship between the incidence of cervical spondylosis in the elderly and the age-related risk factors.

The present clinical analysis has been executed to further confirm the conclusion on the basis of cervical spondylosis 4271 cases from another hospital. The present results are consistent with the previous ones that the trend of age-related distribution for cervical spondylosis is an increase with age before 50 years old and a decrease with age after 59. These results also showed that the age-related risk factors (hypertension, hyperlipidemia, diabetes, cerebral infarct, cardiovascular diseases, smoking and drinking) have no relationship with the trend of age-related distribution for cervical spondylosis. Therefore, this conclusion is more confirmed that the incidence of cervical spondylosis decreases with age in the elderly and increases with age in the young and adults.

Accordingly, we inferred the pathogenesis of cervical spondylosis that the volume and inflammation of the nucleus gets lesser in the elderly since chronic age-related degeneration of cervical spondylosis will enhance the atrophy of the nucleus with the progress of age. On the contrary, with the advance of aging in the young and adults, discs gradually their strength and resiliency, and easily induce the occurrence of bulge or/and herniation. Therefore, the clinical presentation will become pronounced. Thus, the pressure from the nucleus in the elderly will become gradually less because of age-related atrophy, with the result in the lower incidence of annulus injury and occurrence of cervical spondylosis, and the less clinical manifestations, especially after 60 years old. In view of the different age range, the inflammatory effect of the nucleus in the young and the adults before 50

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Table 6. The relationship between risk factors and the incidence of cervical spondylosis on the basis of age

Risk factors	Age distribution (year)								P-value	F	R
	≤29	30-39	40-49	50-59	60-69	70-79	80-89	≥90			
	21	186	837	1731	956	415	124	1			
Hypertension	1 (4.76)	22 (11.83)	195 (23.3)	530 (30.62)	410 (42.89)	198 (47.71)	56 (45.16)	1 (100)	0.6637	0.7159	0.3852
Diabetes	1 (4.76)	7 (3.76)	83 (9.92)	218 (12.59)	166 (17.36)	84 (20.24)	14 (11.29)	0 (0)	0.5882	0.8339	0.4218
Cardiovascular diseases	1 (4.76)	12 (6.45)	82 (9.8)	270 (15.6)	244 (25.52)	138 (33.25)	71 (57.26)	0 (0)	0.6047	0.8072	0.4139
Cerebral infarct	2 (9.52)	19 (10.22)	258 (30.82)	1103 (63.72)	813 (85.04)	368 (88.67)	109 (87.9)	1 (100)	0.5909	0.8295	0.4206
Smoking	1 (4.76)	26 (13.98)	155 (18.52)	273 (15.77)	137 (14.33)	59 (14.22)	16 (12.9)	0 (0)	0.6069	0.8037	0.4129
Drinking	1 (4.76)	23 (12.37)	114 (13.62)	191 (11.03)	111 (11.60)	42 (10.12)	4 (3.23)	0 (0)	0.6025	0.8107	0.415
Hyperlipidemia	1 (4.76)	47 (25.27)	297 (35.48)	687 (39.69)	360 (37.66)	137 (33.01)	17 (13.71)	0 (0)	0.5743	0.8568	0.4248

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is stronger than the degenerative process, and the highest incidence of cervical spondylosis corresponds to the age range (around 50). Inversely, the inflammatory effect of the nucleus is weaker than the degeneration in the elderly, the incidence of cervical spondylosis will decrease with the advance of age.

Age may play a different role in the pathogenesis of cervical spondylosis in the different age range. The young and adults will contribute to the occurrence of cervical spondylosis by “wear and tear” while the elderly will decrease the occurrence of cervical spondylosis by “atrophy”. Thus, cervical spondylosis will have a different clinical feature in different age range. In consideration that the previous finding that the incidence of cervical spondylosis increases with age in the young and adults, and decreases with age in the elderly, these results implicate that surgery is not the preferred treatment measures in the elderly patients with cervical spondylosis [12, 14]. If it isn't an emergency suffering from cervical spondylosis, nonoperative therapeutic interventions will be designed for the elderly patients with cervical spondylosis as the first adoption, such as physical therapy and pain medications. With the advance of age, the volume of nucleus becomes smaller because of its atrophy, and the pressure from the nucleus is less. Hence, the first-selected treatment for the elderly patients with cervical spondylosis is nonoperative interventions in a rehabilitation center if they have no acute symptoms and signs.

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Disclosure of conflict of interest

None.

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