

CERVICAL SPONDYLOSIS ON X-RAY: A PROSPECTIVE STUDY OF RADIOGRAPHIC FINDINGS AND THEIR FREQUENCY

Syed Zaigham Ali Shah^{*1}, Javairia Khan², Muhammad Kaleem Akhter³, Ayesha Wajid⁴, Farzeen Zehra⁵, Sidra Rasheed⁶

^{*1}Chief Radiology Technologist, Human Resource Development Centre (HRDC) Skardu, Pakistan

²Medical Imaging Technologist, Cancer Care Hospital & Research Centre Lahore, Pakistan

³MS Diagnostic Ultrasound, University of Lahore, Pakistan, Operation Theatre Technologist, Mayo Hospital Lahore, Pakistan

⁴Staff Nurse Mayo hospital Lahore

^{5,6}BS Hons. RIT, Government College University Faisalabad (GCUF), Pakistan

^{*1}chieftech.radiology@hrdcskd.pk, ²javakhan3213@gmail.com, ³kaleem.akhter05@gmail.com,

⁴ayeshawajid282@gmail.com, ⁵farzeen929276@gmail.com, ⁶srasheed59@gmail.com

DOI: <https://doi.org/10.5281/zenodo.15266635>

Keywords

Cervical Vertebrae, Cervical Spondylosis, Lordosis, Myeloradiculopathy, Osteophytes

Article History

Received on 15 March 2025

Accepted on 15 April 2025

Published on 23 April 2025

Copyright @Author

Corresponding Author: *

Syed Zaigham Ali Shah

Abstract

Introduction: Cervical spondylosis is a type of degenerative skeletal disease that primarily affects the cervical region of the spine. Poor neck posture puts excessive strain on the cervical spine which leads to significant morbidity. The disease presents on X-ray films in the form of various radiological patterns creating diagnostic difficulty among clinicians. Identifying the patterns prevalent in our society along with their age and sex distribution can help clinicians to diagnose cervical spondylosis early to start prompt treatment and decrease the morbidity associated with the disease.

Method: This research employed a prospective cross-sectional design, with data collection taking place at Surraya Azeem Waqf Teaching Hospital Chuburji, Lahore. X-rays of 252 patients diagnosed with cervical spondylosis on radiology during the duration of our study were included in the study. Age, Gender, Clinical history, and radiological findings on Anteroposterior or lateral cervical spine X-rays were documented. Data was analyzed using Med-CALC. To evaluate gender disparities in radiological findings, a chi-square test was performed, and the associated p-values were used to assess the statistical significance of the findings.

Results: Of these 252 patients, 48% patients had a moderate degree of cervical spondylosis, and 37.7% had straightening of the cervical spine. All the patients had anterior marginal osteophytes. The most frequently observed level of anterior marginal osteophytes was C5 (96.4%). The most frequently affected cervical intervertebral disc space was C5-C6 (81.7%). Bilateral cervical ribs were present in 1.5% of patients. Statistical analysis revealed a significant positive relationship between patient age and the degree of cervical spondylosis, with a p-value of less than 0.001 ($p < 0.001$). Unlike age, gender was not identified as a significant factor influencing the prevalence of cervical curvature abnormalities, anterior marginal osteophytes, disc-space reduction, or cervical spondylosis severity, as evidenced by the non-significant p-values ($p > 0.05$).

Conclusion: Cervical curvature abnormality was equally prevalent in both

genders suffering from cervical spondylosis while the severity of cervical spondylosis exhibited a positive correlation with increasing age. The most frequently involved vertebra in cervical spondylosis was C5 and the least affected vertebra was C3.

INTRODUCTION

Cervical spondylosis refers to the degeneration of the cervical spine, a common condition, that causes a range of symptoms to develop over time, including localized neck pain, radicular symptoms, myelopathy, and complex presentations involving both myelopathic and radicular features [1][2]. The most common etiological factor for the disease is excessive cervical motion that leads to repetitive trauma to the cervical spine and cervical intervertebral disc leading to their early degeneration [3][4][5][6]. In this era of globalization, and rapid development of the economy, the world has undergone a deep transition from active physical activity to passive machine-based jobs[7][8][9]. Our lives have been centralized mostly around computers and Android phones [10][11]. Most people prefer to work on their laptops by becoming freelancers as the mode of earning provides them with the facility to work at home [12][13][14]. The recent epidemiological surveys on cervical spondylosis have shown increased morbidity of the disease which was quite rare in the past. A global survey in 2017 reported a neck pain prevalence of 3551.1 per 100000 people and an incidence of 806.6 per 100,000 population [15]. Many recent studies in the literature have projected the rising statistics of cervical spondylosis globally hence turning it into a hot topic to study as the morbidity associated with the disease has poor life outcomes [16][17][18][19].

Although the diagnosis of cervical spondylosis is primarily based on a comprehensive clinical evaluation of the patient's medical history, the diagnosis is further confirmed by using various new imaging findings including X-rays, CT-scan, and MRIs [20][21]. Among all these novel radiological imaging techniques that provide deep insight into disease, X-ray is still considered the best initial imaging modality of choice worldwide as the mode of imaging is cheap, safe in terms of low radiation dose and short procedure timings hence doesn't create a sense of anxiety among patients [22][23].

The variation in radiological findings of X-rays in patients with cervical spondylosis makes the

interpretation difficult. It has been seen in many studies that there is a disparity in diagnoses made by clinicians who correlate radiology with clinical symptoms and radiologists who report on the same film [24][25]. The main aim of this study is to identify and describe the key radiological features of cervical spondylosis and compare their frequency of distribution in both males and females. Further, the results will identify whether certain radiological patterns are more prevalent in the older age group or not.

1. LITERATURE REVIEW

Xinghu Yu and Liangbi Xiang noted that conventional X-ray evaluation for cervical spondylosis (CS) relies heavily on clinical experience, visual interpretation, and region-of-interest (ROI) analysis. However, this approach can be time-consuming, subjective, and error-prone, particularly for inexperienced clinicians, due to the low resolution of X-rays. To address this, they proposed a fuzzy calculation-based approach for CS classification. By extracting 10 effective ROIs from X-ray images, they established an X-ray symptom-disease table for CS. This table enabled the development of a fuzzy calculation model to improve diagnosis accuracy. Another study examined the X-ray manifestations of cervical spondylosis in patients with vertebral artery type (VCS) and those with radiculopathy. The study included 120 patients (60 with VCS and 60 with cervical spondylotic radiculopathy) aged 25-65 years. X-ray measurements included cervical curvature, joint angles, and segmental distribution. The data were compared between the two groups, and X-ray imaging features of VCS were further analyzed in conjunction with clinical manifestations [12].

Machino et al. established clinical cut-off values for the 10-second grip and release (G&R) and 10-second step quantitative tests, which can aid in diagnosing cervical spondylotic myelopathy (CSM). Additionally, they examined how aging and gender influence these values in a large cohort of healthy individuals.[13].

A comprehensive evaluation of cervical spondylosis involves cervical spine X-rays in multiple views (AP, oblique, and LAT). Radiographic findings may include alterations in cervical curvature, degenerative changes in joints, osteophyte formation, reduced disc space, endplate sclerosis, and the presence of a cervical rib, which, although not directly related to cervical spondylosis, may be incidentally detected on X-ray [14-16].

2. MATERIAL AND METHODS

3.1. Ethical Approval

Approval for this study was granted by the Departmental Board of Studies, Department of Radiological Sciences and Medical Imaging (DRSMI).

3.2. Study Design

The study employed a prospective cross-sectional design.

3.3. Sampling Technique

It was a convenient sampling technique in which all the cervical radiographs were included which were performed during the study duration.

3.4. Settings

The study was conducted at the Radiology Department, Surraya Azeem Waqf Teaching Hospital, Chuburji, Lahore.

3.5. Duration

The study duration was 10 months from December 2019 to September 2020.

3.6. Sample Size and Detail

The study sample consisted of 252 cervical radiographs from a population of 252 patients,

comprising 131 women and 121 men, with ages ranging from 27 to 92 years and a mean age of 54.4 years.

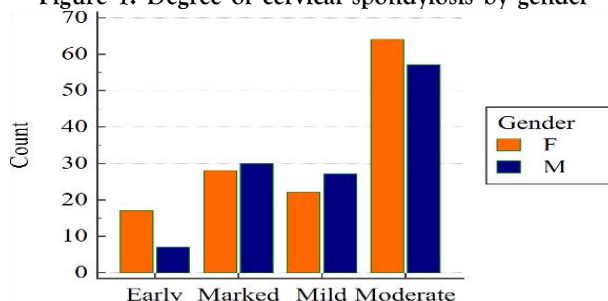
3. RESULTS:

X-rays of 252 patients presenting at Surraya Azeem Waqf Teaching Hospital diagnosed with cervical spondylosis based on radiology were enrolled in our study. Of these 252 patients, there were 131 females and 121 males. The degree of cervical spondylosis of enrolled patients was graded by Kallgrens Criteria. Almost 9.5% of patients had an early degree, 23% had a marked degree, 19.4% had a mild degree and 48% of patients had a moderate degree of cervical spondylosis. The grading of severity of cervical spondylosis stratified by age is given in Figure 1. On detailed radiological review, 62.3% of patients had normal curvature of the cervical spine whereas 37.7% had straightening of the cervical spine. Anterior Marginal Osteophytes were present in all the patients enrolled in our study. About 5.6% of patients had one, 25% had two, and 48.8% had more than two anterior marginal osteophytes. Only 20% had anterior marginal osteophytes at all levels. The most frequently observed level of anterior marginal osteophytes was C5 (96.4%) followed by C6 (81.7%), C4 (76.6%), C3 (51.2%), C7 (41.3%) and C2 (23%). Almost 46% of the enrolled patients experienced disc space reduction at more than two levels of cervical vertebrae. The most frequently affected cervical intervertebral disc space was C5-C6 (81.7%) followed by C4-C5 (78.2%), C6-C7 (52%), C3-C4 (27.4%) and C2-C3 (23%). Bilateral cervical ribs were present in 1.5% of patients whereas unilateral cervical ribs were present in 3.9% of patients. Most of the unilateral cervical ribs were right-sided (70%).

Table 1: Comparison of Radiological Features in Males and Females

Features	Male	Female
Cervical spine curvature		
Normal	71	86
Straightening	50	45
Anterior Marginal Osteophytes		
Present	121 (100)	131(100)
Absent	0 (0)	0 (0)
Disc Space Reduction		
Present	112	118
Absent	9	13

Figure 1: Degree of cervical spondylosis by gender



The significance of association of the study variable with gender was tested by Chi-square test. The test did not show any significant difference in the frequency of cervical curvature abnormalities, anterior marginal osteophytes, presence of disc-space reduction, and degree of cervical spondylosis between males and females ($p > 0.05$). A strong correlation ($p < 0.001$) was found between the severity of cervical spondylosis and increasing age. The correlation between cervical spondylosis severity and patient age is illustrated graphically in Figure 2.

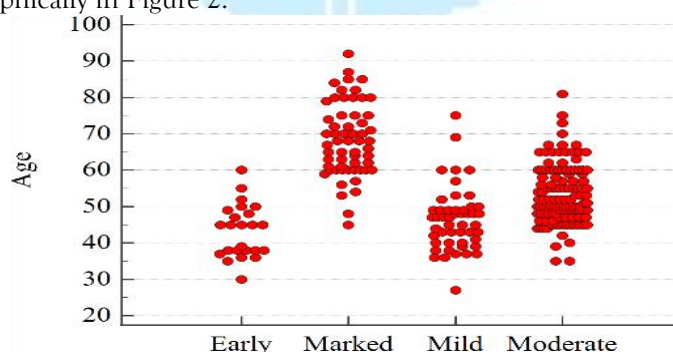


Figure 2: Degree of Cervical Spondylosis and Advancing Age

4. DISCUSSION

Cervical spondylosis, characterized by wear and tear on the cervical spine, frequently leads to neck pain and discomfort that radiates to the upper limbs, and may be accompanied by sensory disturbances, including tingling and numbness, resulting from nerve root impingement [1]. The rising trend of cervical spondylosis cases may be attributed to the widespread adoption of technology, resulting in increased screen time and sedentary behavior, which can contribute to neck strain and degenerative changes in the cervical spine [26]. Further, poor sitting posture also results in malalignment of cervical vertebrae which makes an individual prone to develop cervical spondylosis [27][28]. The disease is more common in women though its incidence is

also rising in males [29]. The diagnosis of cervical spondylosis is difficult as it requires a correlation of clinical presentation with the radiological features of cervical spine x-ray film [30]. The imaging findings vary from simple alteration in curvature of the cervical spine to formation of osteophytes and variation of intervertebral disc space [31]. It is therefore important for clinicians to identify radiological features that are more prevalent in patients with cervical spondylosis [21]. The radiological patterns identified in x-rays of patients suffering from cervical spondylosis in our study are alteration in cervical spine curvature, presence of osteophytes, reduction of intervertebral disc, and presence of cervical rib [31]. Normal cervical spine shows physiological lordosis. This physiological

lordosis enables the spine to enable load bearing of the head and maintains spinal stability [32]. A study conducted by Zhou et al in 2016 reported abnormal cervical curvature in 71.67% of patients presenting with neck pain who are 26 to 35 years old [33]. Cui et al reported abnormal cervical curvature in 29.1% of their study participants [34] whereas another study revealed abnormal cervical curvature in 57.8% of patients with cervical spondylosis [35]. While in our study, we found abnormal cervical curvature of cervical spine straightening in only 37.7% of patients suffering from cervical spondylosis. Cervical osteophytes were present in all the patients in our study contrary to the study by David et al., in which osteophytes were present in 81.3% of patients [36]. Our study's findings align with the results reported by David et al in terms of levels of vertebrae at which cervical osteophytes are present as anterior marginal osteophytes were more commonly present at C5-level vertebrae in both studies. But the least common vertebra affected by cervical osteophytes was C3 in our study in contrast to the study of David et al in which the least commonly affected vertebra was C7 [36]. This study reveals a notable correlation between advancing age and the severity of cervical spondylosis, echoing the findings of Moon et al. (2018), who also observed an age-related increase in disease severity [38].

Our study has a few limitations. Firstly, it is a single-centered study so the results could not be generalized. Secondly, this is a simple prevalence study with no follow-up of patients to look for a correlation of symptoms with the treatment outcomes. A multi-centered prospective study will therefore fill these gaps.

5. CONCLUSION

Cervical curvature abnormality was equally prevalent in both genders suffering from cervical spondylosis but the elderly population exhibited a greater severity of cervical spondylosis. The most frequently involved vertebra in cervical spondylosis was C5 and the least affected vertebra was C3.

REFERENCES

- Theodore N. Degenerative cervical spondylosis. *New England Journal of Medicine*. 2020 Jul 9;383(2):159-68.
- Maeda F, Joaquim AF. Degenerative Cervical Myelopathy: Natural History, clinical presentation, current diagnosis and treatment update. *International Journal of Orthopaedics*. 2020 Aug 28;7(4):1313-21.
- Cyr A. Cervical Spine, Upper Extremity Neuropathies, and Overuse Injuries in Cyclists. *Physical Medicine and Rehabilitation Clinics*. 2022 Feb 1;33(1):187-99.
- Alare K, Omoniyo T, Adekanle T. Postural Predisposition to Cervical Spondylosis Among Housewives, Teachers, Computers and Smart Phones Users. *International Journal of Neurologic Physical Therapy*. 2021 Aug 18;7(2):14.
- Chu EC. Preventing the progression of text neck in a young man: A case report. *Radiology Case Reports*. 2022 Mar 1;17(3):978-82.
- Nag PK. Musculoskeletal disorders: Office menace. *InOffice Buildings 2019* (pp. 105-126). Springer, Singapore.
- Abrahamsson E, Ollander Axelsson J. Virtual leadership: Moving teams online during the covid-19 crisis.
- Kohntopp T, McCann J. Leadership in Virtual Organizations: Influence on Workplace Engagement. *The Palgrave Handbook of Workplace Well-Being*. 2020:1-26.
- Weisblat IA. Technology and globalization: The evolution of human interactions, values, and management practices. *InAdvances in the Technology of Managing People: Contemporary Issues in Business 2019 Jun 10*. Emerald Publishing Limited.
- Tijunaitis K, Jeske D, Shultz KS. Virtuality at work and social media use among dispersed workers: Promoting network ties, shared vision and trust. *Employee Relations: The International Journal*. 2019 Apr 1.
- Valenduc G. New forms of work and employment in the digital economy. *InThe deconstruction of employment as a political question 2019* (pp. 63-80). Palgrave Macmillan, Cham.



- Tarasova DI. FREELANCING IN PANDEMIC. In **АКТУАЛЬНЫЕ ПРОБЛЕМЫ ПРОФЕССИОНАЛЬНОЙ СФЕРЫ В СОВРЕМЕННОМ МИРЕ 2021** (pp. 34-35).
- Van der Zwan P, Hessels J, Burger M. Happy free willies? Investigating the relationship between freelancing and subjective well-being. *Small Business Economics*. 2020 Aug;55(2):475-91.
- Tudy RA. From the corporate world to freelancing: The phenomenon of working from home in the Philippines. *Community, Work & Family*. 2021 Jan 1;24(1):77-92.
- Safiri S, Kolahi AA, Hoy D, Buchbinder R, Mansournia MA, Bettampadi D, Ashrafi-Asgarabad A, Almasi-Hashiani A, Smith E, Sepidarkish M, Cross M. Global, regional, and national burden of neck pain in the general population, 1990-2017: systematic analysis of the global burden of disease study 2017. *Bmj*. 2020 Mar 26;368.
- Kazeminasab S, Nejadghaderi SA, Amiri P, Pourfathi H, Araj-Khodaei M, Sullman MJ, Kolahi AA, Safiri S. Neck pain: global epidemiology, trends and risk factors. *BMC Musculoskeletal Disorders*. 2022 Dec;23(1):1-3.
- Wu D, Wong P, Guo C, Tam LS, Gu J. Pattern and trend of five major musculoskeletal disorders in China from 1990 to 2017: findings from the Global Burden of Disease Study 2017. *BMC medicine*. 2021 Dec;19(1):1-3.
- Hurwitz EL, Randhawa K, Yu H, Côté P, Haldeman S. The Global Spine Care Initiative: a summary of the global burden of low back and neck pain studies. *European Spine Journal*. 2018 Sep;27(6):796-801.
- Arshad MU, Jamshaid G, Khan B, ul Hassan J, Akram A. Prevalence of Neck Pain related to working hours among Bankers, A cross-sectional Study: Prevalence of Neck Pain related to working hours among Bankers, A cross-sectional Study. *Pakistan BioMedical Journal*. 2021 Dec 27;4(2).
- Ibrahim AG, Alahmari MA, Alsuayri HF, Algomshah MM, Almlfi GS, Alamri DA, Saeed Al-Akalbi S, Hassan Althunayan K, Ibrahim Ali Alhammad S, Esmail Buarish S, Alsaleh AA. A Review on Diagnosis and Management of Cervical Spondylosis.
- Yu X, Liu M, Meng L, Xiang L. Classifying cervical spondylosis based on x-ray quantitative diagnosis. *Neurocomputing*. 2015 Oct 1;165:222-7.
- Kaur N, Arumugam N, Gambhir S. Reliability and validity of X-ray findings in cervical dysfunction: A brief review. *Saudi Journal of Sports Medicine*. 2018 May 1;18(2):59.
- Yin S, Li X, Gao H, Kaynak O. Data-based techniques focused on modern industry: An overview. *IEEE Transactions on Industrial Electronics*. 2014 Feb 25;62(1):657-67.
- Doi K, Giger ML, Nishikawa RM, Hoffmann KR, MacMahon H, Schmidt RA, Chua KG. Digital radiography: A useful clinical tool for computer-aided diagnosis by quantitative analysis of radiographic images. *Acta Radiologica*. 1993 Jan 1;34(5):426-39.
- Giger ML, Doi K, MacMahon H, Nishikawa RM, Hoffmann KR, Vyborny CJ, Schmidt RA, Jia H, Abe K, Chen X. An "intelligent" workstation for computer-aided diagnosis. *Radiographics*. 1993 May;13(3):647-56.
- Lv Y, Tian W, Chen D, Liu Y, Wang L, Duan F. The prevalence and associated factors of symptomatic cervical Spondylosis in Chinese adults: a community-based cross-sectional study. *BMC Musculoskeletal Disorders*. 2018 Dec;19(1):1-2.
- Lee DY, Park KS, Hwang SC, Nam DC, Park JS, Jeong ST, Lee YB, Kang BH, Kim DH. Risk factors of cervical spondylosis in workers requiring neck flexion and extension actions in farming and fishing communities. *Journal of the Korean Orthopaedic Association*. 2016 Jun 1;51(3):199-206.
- Alare K, Omoniyo T, Adekanle T. Postural Predisposition to Cervical Spondylosis Among Housewives, Teachers, Computers and Smart Phones Users. *International Journal of Neurologic Physical Therapy*. 2021 Aug 18;7(2):14