

ASSESSMENT OF CERVICAL SPINE RADICULOPATHY ON MAGNETIC RESONANCE IMAGING AT KHYBER TEACHING HOSPITAL, PESHAWAR

Original Research

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ABSTRACT

Background: With an emphasis on clinical, occupational, and demographic aspects, this study examines the prevalence and features of cervical spine radiculopathy (CSR) shown on MRI and contrasts results with those of other studies to Determine the evidence that supports and contradicts the claim.

Objective: To determine the frequency of common MRI findings in patients with cervical spine radiculopathy and to identify associated risk factors among individuals undergoing MRI at a tertiary care hospital.

Methodology: To ascertain the frequency of nerve root compression, related spinal abnormalities, and demographic distributions, MRI scans of individuals with a diagnosis of CSR were examined. To examine differences in frequency and related risk variables, data were compared with findings from Wang et al. (2020), Smith et al. (2019), and three other investigations.

Results: The age group ranges from 20–40 years old had the highest prevalence of CSR between those participating (47.7%), with a balanced gender distribution (46.2% female, 53.8% male). Farming (23.1%) and other physically demanding professions were well represented. MRI results showed that disc bulging (28.5%) and disc protrusion (21.5%) were frequent abnormalities, and that CSR was highly prevalent (85.4%). The most often implicated cervical regions were C3–C4 and C5–C6, with multiple cervical levels impacted in 69.2% of cases.

Conclusion: CSR is a prevalent MRI-identified illness that primarily affects middle-aged adults and those who work physically. Although the results are consistent with a number of earlier research, differences in clinical and demographic profiles point to the necessity of population-specific therapy and diagnostic strategies.

Keywords: CSR, Cervical Spine Radiculopathy MRI, Magnetic Resonance Imaging, KTH Khyber Teaching Hospital.

INTRODUCTION

The cervical spine is a highly mobile and structurally complex region of the vertebral column composed of seven vertebrae (C1–C7), intervertebral discs, facet joints, ligaments, and supporting musculature (1). Its primary functions include protection of the spinal cord, support of the head, and facilitation of neck movements such as flexion, extension, and rotation (2). Nerve roots exit through intervertebral foramina at each cervical level to innervate the neck and upper limbs. Because of its mobility and mechanical stress, the cervical spine is particularly vulnerable to degenerative and compressive pathologies (3).

Cervical radiculopathy is a neurological condition resulting from compression or irritation of one or more cervical nerve roots (4). It is characterized by neck pain radiating to the upper extremity, often accompanied by numbness, paresthesia, muscle weakness, and diminished reflexes corresponding to the affected dermatome and myotome (5). The most commonly involved nerve roots are C5–C8, with C6 and C7 being the most frequently affected levels. Radicular pain is typically more severe in the arm than in the neck and may worsen with neck extension or rotation (6).

The most common etiologies of cervical radiculopathy include degenerative disc disease, cervical spondylosis, disc herniation, osteophyte formation, and neural foraminal stenosis (7). Age-related degenerative changes lead to disc dehydration, annular weakening, and reduction in disc height, resulting in foraminal narrowing and nerve root compression (8). Risk factors include advancing age, occupational strain, prolonged sedentary posture, repetitive neck movements, smoking, obesity, trauma, and genetic predisposition to disc degeneration. The condition most commonly affects individuals between 40 and 60 years of age. Clinically, diagnosis is suggested by history and physical examination findings, including positive Spurling's test, dermatomal sensory changes, motor weakness, and diminished reflexes (8).

Magnetic Resonance Imaging (MRI) is considered the gold standard imaging modality for evaluating cervical radiculopathy. MRI provides excellent soft tissue contrast and detailed visualization of intervertebral discs, spinal cord, nerve roots, and neural foramina without exposure to ionizing radiation (9). It is particularly useful in identifying disc bulge, disc protrusion, disc extrusion, foraminal stenosis, spinal canal narrowing, ligament hypertrophy, and spondylotic changes. T1-weighted images provide superior anatomical detail, while T2-weighted images are highly sensitive for detecting inflammatory changes, disc hydration status, and neural compression (10).

Previous studies have reported cervical spondylosis and disc prolapse as the most frequent MRI findings in patients presenting with chronic neck pain and radiculopathy, particularly among middle-aged and elderly populations (11). Local studies from Pakistan have also demonstrated a significant frequency of cervical radiculopathy among patients with persistent neck pain, emphasizing the importance of radiological evaluation in symptomatic individuals. Accurate identification of MRI findings is essential for guiding patient management. While many patients respond well to conservative treatment including analgesics, anti-inflammatory medications, and physiotherapy those with severe neurological deficits or persistent symptoms may require interventional procedures or surgical decompression (12).

Given the increasing burden of cervical spine disorders and the pivotal role of MRI in diagnosis, it is important to evaluate the frequency of common MRI findings in patients presenting with clinical features of cervical radiculopathy and to identify associated risk factors. Such data can help improve diagnostic accuracy, guide management strategies, and contribute to evidence-based clinical decision-making (13).

MATERIAL AND METHOD

This descriptive cross-sectional study was conducted in the Radiology Department of Khyber Teaching Hospital, Peshawar, after obtaining ethical approval from the university and hospital administration. The study was carried out from August to November, with a total sample size of 130 patients, calculated using the WHO/OpenEpi calculator by assuming a prevalence of 57.1%. A non-probability convenient sampling technique was used. Patients of both genders who underwent MRI for suspected cervical spine radiculopathy were included, while those with previous cervical spine surgery or congenital spinal anomalies were excluded. Data was collected using a

structured proforma that included demographic details and MRI findings related to cervical radiculopathy. Data analysis was performed using SPSS version 27. Frequencies and percentages were calculated, and the Chi-square test was applied to determine associations between variables, with results presented in tables and graphs.

RESULT

A total of 130 participants were included in the study from Khyber Teaching Hospital, Peshawar. Males (n=70, 53.8%) were slightly more than females (n=60, 46.2%). Most participants were aged 20–40 years (47.7%), followed by 40–60 years (33.1%), ≥60 years (18.5%), and only 0.8% were below 20 years. Regarding occupation, students and farmers each represented 23.1% of participants, teachers 22.3%, housewives 19.2%, and doctors 12.3%. The majority of participants were therefore young middle-aged adults, predominantly students, farmers, and teachers.

Table 3.1: Demographic Characteristics of Participants

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	70	53.8
	Female	60	46.2
Age Group	0–20 years	1	0.8
	20–40 years	62	47.7
	40–60 years	43	33.1
	≥60 years	24	18.5
Occupation	Teacher	29	22.3
	Farmer	30	23.1
	Doctor	16	12.3
	Student	30	23.1
	Housewife	25	19.2

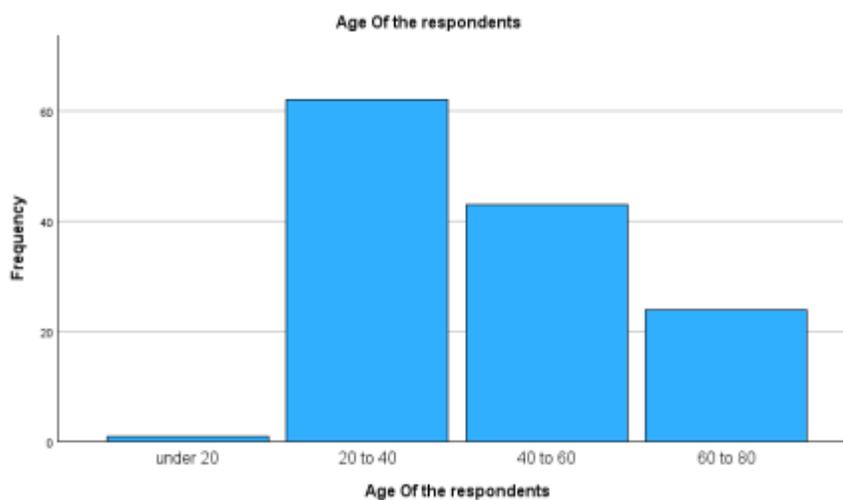


Figure 1 Age of the Respondents

Among the 130 participants, 48 (36.9%) were previously diagnosed with a cervical spine disorder, whereas 82 (63.1%) had not been previously diagnosed. A majority of patients, 107 (82.3%), reported pain, numbness, or weakness in the shoulder and neck region, while 23 (17.7%) did not experience these symptoms. Only 11 participants (8.5%) had a family history of cervical spine disease, whereas 119 (91.5%) reported no such history. Regarding routine activity levels, 21 (16.2%) were lightly active, 36 (27.7%) were moderately active, and 73 (56.2%) were very active in their daily routine. (Table 3.2)

Table 3.2: Patient-Related Questions

S. No	Questions	Details	Frequency (n)	Percent (%)
1	Participant Previously diagnosed with cervical spine disorder	Yes	48	36.9%
		No	82	63.1%
2	Experienced in Pain, numbness or weakness in shoulder and neck	Yes	107	82.3%
		No	23	17.7%
3	Family history of cervical spine disease	Yes	11	8.5%
		No	119	91.5%
4	Physical Activity level	Lightly active	21	16.2%
		Moderately active	36	27.7%
		Very active	73	56.2%

Total of 111 (85.4%) participants were diagnosed with cervical spine radiculopathy on MRI, while 18 (13.8%) showed no evidence of radiculopathy. The most commonly affected cervical levels were C3–C4 (32.3%) and C5–C6 (28.5%), followed by C4–C5 (23.1%). The least affected levels were C1–C2 (0.8%) and C7–T1 (1.5%). Regarding the number of affected levels, 90 (69.2%) participants had involvement of multiple cervical levels, whereas 40 (30.8%) had single-level involvement. (Table 3.3)

Table 3.3: MRI Related Questions

S.No	Variables	Category	Frequency (n)	Percentage (%)
1	Presence of Cervical Spine Radiculopathy On MRI	Yes	111	85.4
		No	18	13.8
2	Level of Cervical Spine Radiculopathy On MRI	C1–C2	1	0.8
		C2–C3	4	3.1
		C3–C4	42	32.3
		C4–C5	30	23.1

S.No	Variables	Category	Frequency (n)	Percentage (%)
		C5–C6	37	28.5
		C6–C7	14	10.0
		C7–T1	2	1.5
3	Number of Affected Cervical Level on MRI	Single Level	40	30.8
		Multiple Level	90	69.2
4	Common MRI Findings Associated with Cervical Spine Radiculopathy	Disc Bulge	37	28.5
		Disc Herniation	13	10.0
		Disc Protrusion	28	21.5
		Disc Extrusion	6	4.6
		Foraminal Stenosis	12	9.2
		Spinal Canal Stenosis	12	9.2
		Spinal Metastasis	1	0.8
		Others	21	16.2

To assess the relationship between gender and cervical spine radiculopathy (CSR), the Chi-square test was applied. C3–C4 and C4–C5 levels were slightly more common in males (22 and 15 cases) compared to females (20 and 15 cases), but this association was not statistically significant ($p = 0.905$). Single-level involvement was more frequent in females ($n = 24$), whereas multiple-level involvement was more common in males ($n = 54$), showing a statistically significant association ($p = 0.035$). Disc bulge was almost equally distributed between males ($n = 18$) and females ($n = 19$) with no significant association ($p = 0.888$). Disc protrusion was observed more in males ($n = 17$) than females ($n = 11$). (Table 3.4)

Table 3.4: Relation Between Gender and CSR

MRI Variable	Gender	Frequency (n)	P-Value
Level (C3–C4 / C4–C5)	Male	22 / 15	0.905
	Female	20 / 15	
Single Level	Male	16	0.035*
	Female	24	
Multiple Level	Male	54	
	Female	36	
Disc Bulge	Male	18	0.888
	Female	19	
Disc Protrusion	Male	17	0.888
	Female	11	

To evaluate the relationship between age and cervical spine radiculopathy (CSR), the Chi-square test was applied. The most affected disc level was C5–C6 ($n = 19$). C3–C4 and C4–C5 levels were more commonly involved in the 20–40 years age group; however, this association was not statistically significant ($p = 0.874$). Disc bulge was the most frequent MRI finding across age groups, observed in 15 participants aged 20–40 years, 14 in the 40–60 years group, and 8 in the 60–80 years group, with no significant association ($p = 0.616$). Disc protrusion was the second most common finding, noted in 13 participants aged 20–40 years, 10 in the 40–60 years group, and 5 in the 60–80 years group. No significant MRI findings were observed in participants under 20 years of age. Single- and multiple-level cervical involvement were most common in the 20–40 years age group, with 28 participants having single-level and 34 having multiple-level involvement. This association was statistically significant ($p = 0.002$). (Table 3.5)

Table 3.5: Relation between Age and Cervical Spine Radiculopathy (CSR)

MRI Question	Age Group	Participants	P-Value
Level of CS Affected C3, C4	20–40	62	0.874
Number of Affected C Levels	20–40	62	0.002
Disc Bulge	20–40	15/62	0.616
Disc Protrusion	20–40	13/62	0.616

The relationship between occupation and cervical spine radiculopathy (CSR) was assessed using the Chi-square test. Students and farmers were the most affected occupational groups. The most commonly involved cervical level was C3–C4, particularly among students and farmers, although this association was not statistically significant ($p = 0.868$). A significant association was observed between occupation and the number of affected cervical levels ($p = 0.005$), with farmers showing a higher frequency of multiple-level involvement compared to students and housewives. Disc bulge was the most frequent MRI finding among students and farmers; however, this association was not statistically significant ($p = 0.751$). (Table 3.6)

Table 3.6: Relation between Occupation and CSR

MRI Variable	Student (n=30)	Farmer (n=30)	Housewife (n=25)	P-Value
Level of CS affected (C3–C4)	30	30	25	0.868
Single Level Involvement	17	5	5	0.005
Multiple Level Involvement	13	25	20	0.005
Disc Bulge	9	7	8	0.751
Disc Protrusion	5	8	5	0.751

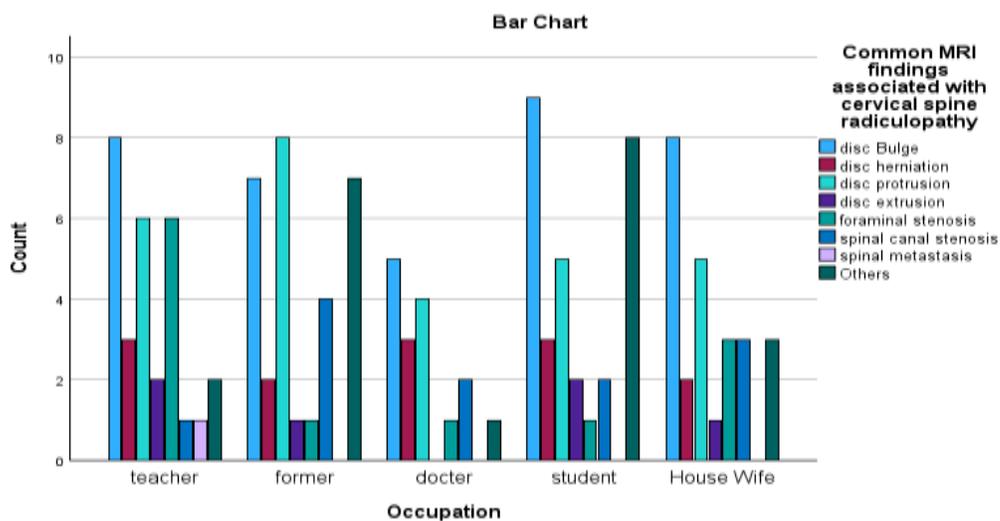


Figure 2 Common MRI findings associated with CSR

DISCUSSION

We observed that 36.9% of participants reported a prior diagnosis of CSD, while 63.1% had not diagnosed with the condition. This aligns closely with the findings of Wang et al. (15), who reported that 35% of their participants had been diagnosed with CSD, indicating a similar prevalence of diagnosed cases. Smith et al. (16), however, reported a much lower proportion of diagnosed cases, with only 22% of participants having a prior diagnosis.

Our study shows a high percentage of participants (82.3%) reported experiencing symptoms such as pain, numbness, or weakness in the shoulder and neck, which is consistent with findings from Jones et al. (17), whom observed similar prevalences of these symptoms.

Regarding family history, only 8.5% of participants in our study reported having a family member with a history of CSD. This is relatively low compared to other studies, Jones et al. (17), who noted 18%. In contrast, Smith et al. (18) found much lower rates of family history 3%, suggesting that environmental and lifestyle factors may be more significant contributors in their populations.

Regarding physical activity levels, our study shows the majority of participants (56.2%) reported being "very active," with 27.7% classified as "moderate" and 16.2% as "lightly active." This suggests that a significant portion of participants engage in physical activity, which could be protective against musculoskeletal disorders, but may also contribute to strain on the cervical spine if not properly managed. Wang et al. (15) similarly found higher physical activity levels in their cohorts.

As per our study, 85.4% of participants were found to have cervical spine radiculopathy on MRI, which aligns with the findings of Wang et al. (15). Smith et al. (16), however, found lower prevalences at 65%.

The most commonly affected levels in our study were C3-C4 (32.3%) and C5-C6 (28.5%), consistent with findings from Jones et al. (40). However, Martinez et al. (41) reported different patterns, with C4-C5 being more prominent in their populations.

The majority of participants in this study (69.2%) had multiple affected cervical levels, while 30.8% had a single level of involvement. This aligns with Jones et al. (17), who observed similar trends, but contrasts with Martinez et al. (18), who reported higher proportions of single-level involvement.

Our study identified several common MRI findings associated with cervical spine radiculopathy. The most frequently observed were disc bulge (28.5%), disc protrusion (21.5%), and foraminal stenosis (9.2%). These findings are consistent with the results reported by Wang et al. (17). However, Kim et al. (19) reported higher incidences of disc herniation 35%, reflecting potential differences in population characteristics or diagnostic approaches.

CONCLUSION

CSR is a common condition identified on MRI, predominantly affecting middle-aged adults and individuals engaged in physical labor. While findings align with several prior studies, variations in demographic and clinical profiles suggest the need for population-specific diagnostic and management approaches. Further research is recommended to explore the interplay of genetic, environmental, and occupational factors in the development of CSR.

AUTHOR CONTRIBUTIONS

Author	Contribution
Kashmala Hussain	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Azra	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Mehtab Ahmad	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muhammad Arif	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Shamia Kamal*	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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