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CORRELATION OF SPURLING TEST WITH MAGNETIC RESONANCE IMAGING FINDINGS IN PATIENTS WITH CERVICAL DISK HERNIATION

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ABSTRACT
Objective: To determine the diagnostic accuracy of the Spurling test in detecting nerve root compression confirmed by magnetic resonance imaging in patients with cervical disc herniation.
Study Design: Cross sectional validation study
Study Setting and Duration: Department of Neurosurgery Hayatabad Medical Complex, Peshawar, from 9-11-2025—9-04-2026.
Methodology: This study was conducted on eighty patients aged 18 to 65 years with cervical disc herniation confirmed on MRI and symptoms lasting at least four weeks were selected. Patients with previous cervical spine surgery, infection, tumour, paralysis/numbness, pregnancy and contraindications to MRI were excluded. The Spurling test was performed for all patients. All patients underwent cervical spine MRI. Diagnostic accuracy was calculated for Spurling test for the detection of nerve root compression. SPSS 25 was used for data analysis. A 2x2 contingency table was used for diagnostic accuracy.
Results: The study included 80 patients, 49 (61.2%) were male and 31 (38.8%) were female. The median age of the cohort was 50.5 years. Nerve root compression on MRI was present in 60 patients (75.0%). The Spurling test was positive in 41 patients (51.2%). The sensitivity of the Spurling test was 66.67%, specificity was 95.0%. The diagnostic accuracy of the Spurling test was 73.75%.
Conclusion: The Spurling test in the current study exhibited high specificity and excellent positive predictive value for detecting nerve root compression in patients with cervical disc herniation.

KEYWORDS: Spurling test, cervical disc herniation, nerve root compression, magnetic resonance imaging, diagnostic accuracy, radiculopathy.

INTRODUCTION

Cervical disc herniation is a clinically significant spinal disorder described by the nucleus pulposus material displacement beyond normal confines of intervertebral disc typically contribute to the nerve root compression manifesting in the form of neck pain and sensory disturbances within the upper limbs. Spectrum of clinical presentations ranges from the mild distress to considerable neurological deficit which can considerably impair the daily routine functions. Accurate diagnosis is considered as foundation for the effective clinical management with imaging modalities playing essential roles.[1-3]

Spurling test is carried out by extending, rotating and applying the axial compression to cervical spine of the patient with encouraging result described by the radicular symptoms reproduction; radiating in arm ipsilateral to manoeuvre. Spurling test has reported the variable diagnostic accuracy; evidence showed that it has high specificity but usually shows modest sensitivity in cervical radiculopathy, demonstrating that whereas a positive outcome intensely supports the nerve root involvement.[4-6].

MRI is considered as gold standard for inspecting the disc herniations and neural compression in cervical disk herniation due to the superior soft tissue resolve and spinal cord compression without the utilization of ionising radiation.[7, 8] MRI helps accurately in recognition of herniated disc location, size and degree of central canal stenosis as this detail is invaluable for the diagnosis and surgery.[8,9] Integration of MRI findings with the clinical tests thus forms the foundation for clinical decision making. Though Spurling test can amplify the clinical suspicion as the validation of disc pathology sometime hinges on the MRI evidence, therefore balancing the clinical and imaging evidence is indispensable. Quantifiable MRI metrics have been utilised for grading the severity and herniation extent and to correlate such features with the explicit symptoms and outcomes after the intervention. It has been emphasized

that MRI's diagnostic utility for other cervical pathological changes, strengthening modality's local relevance in the evaluation of neck pain.[9-11]
Spurling test is a low budget bedside manoeuvre that helps in reproduce the nerve root symptoms but its diagnostic accuracy differs based on severity and disc pathology level whereas MRI offers the thorough visualisation of disc herniation and related degenerative changes. Establishing the strength of correlation in a positive Spurling test and MRI confirmed cervical disc herniation would improve the diagnostic sureness and support more targeted clinical decision making. Understanding this relationship can assist clinicians to identify the patients who truly necessitate advanced imaging, thus improving the early diagnosis and leading to more efficient utilization of healthcare resources. The aim of this study is to determine the correlation of between Spurling test and MRI findings in patients with cervical disc herniation.

METHODOLOGY

The present study was conducted in Department of Neurosurgery Hayatabad Medical Complex, Peshawar, as a cross sectional validation study, after taking ethical approval from the hospital (**Approval no. 2657**). The sample size was 80 patients, which was calculated using the WHO sample size calculator, taking confidence level of 95%, absolute precision of 14.8%, and taking sensitivity (64%) and specificity (86%) of Spurling test for cervical disk herniation [5] along with the reported rate of cervical disk herniation (50.8%) at > 1 cervical level based on the findings of a previous study [6]. Consecutive non-probability sampling technique was used.
Patients aged 18 to 65 years with MRI-confirmed cervical disc herniation who were symptomatic for at least four weeks were included. Patients with previous spinal surgery or fusion, spinal infection or tumour, severe neurological deficit like paralysis or numbness, pregnancy or breastfeeding and contraindications for magnetic resonance imaging such as metal implants and claustrophobia were excluded from the study.
After taking consent from the patients, their demographic data was collected, all the eligible patients underwent the Spurling test, the Spurling test was performed by a neurosurgeon who was blinded to the MRI findings. The test was conducted with the patient in a seated position. The neck was passively extended laterally flexed toward the symptomatic side, and axial compression was applied. If radicular arm pain was reproduced on the affected, it was labelled positive, if no radicular pain was reproduced it was labelled negative. The test was performed before the MRI review to ensure blinding and the result was recorded on a predesigned proforma.
All the patients underwent magnetic resonance imaging of the cervical spine using a 1.5 Tesla machine. Standard imaging included sagittal T1-weighted, sagittal T2-weighted and axial T2-weighted sequences through the disc levels. All MRI scans were reported by a consultant radiologist who was blinded to the Spurling test results. For all patients the type of disc herniation was recorded (bulge, protrusion, extrusion, or sequestration according to modified Pfirrmann criteria). The level of herniation was also documented (C2-C3, C3-C4, C4-C5, C5-C6, C6-C7 and or C7-T1). The presence or absence of nerve root compression was documented, which was defined as effacement or displacement of the cervical nerve root by disc material, osteophytes, or combined pathology.
Data was analyzed using SPSS 25. For quantitative variables including age, body mass index, duration of symptoms median and interquartile range were calculated after checking the normality of data using Shapiro Wilk test. For categorical variables including gender, type of herniation, level of herniation, MRI findings and Spurling test findings for nerve root decompression and symptoms frequencies and percentages were used. For assessing the diagnostic accuracy of Spurling test, a two-by-two contingency table was used.

RESULTS

The study enrolled 80 patients with cervical disc herniation which was confirmed on magnetic resonance imaging. The median age of the patients was 50.50 years (IQR: 35-59) (Table I). Among the patients there were 49 (61.2%) male (Figure 1). Regarding the presenting symptoms, majority of the patients showed mix symptoms with neck pain and radicular pain found in 54 (67.5%) patients (Table II)
Table III presents the type and level of disc herniation according to the MRI reports.
Among those patients presenting with nerve root compression, the Spurling test was positive in 41 (51.2%) patients, while MRI was positive in 60 (75%) patients (Table IV).
Table V presents the 2x2 contingency table.
The diagnostic accuracy of spurling test in detecting root nerve compression showed that the test had sensitivity of 66.67%, specificity 95% and diagnostic accuracy of 73.75% (Table VI)

Table 1. Baseline characteristics

Baseline characteristics	Median	IQR
Age (Years)	50.50	35-59
BMI (Kg/m^2)	25.12	23.46-26.52

Duration of symptoms (Weeks)	10	6.25-12

Figure 1. Gender distribution

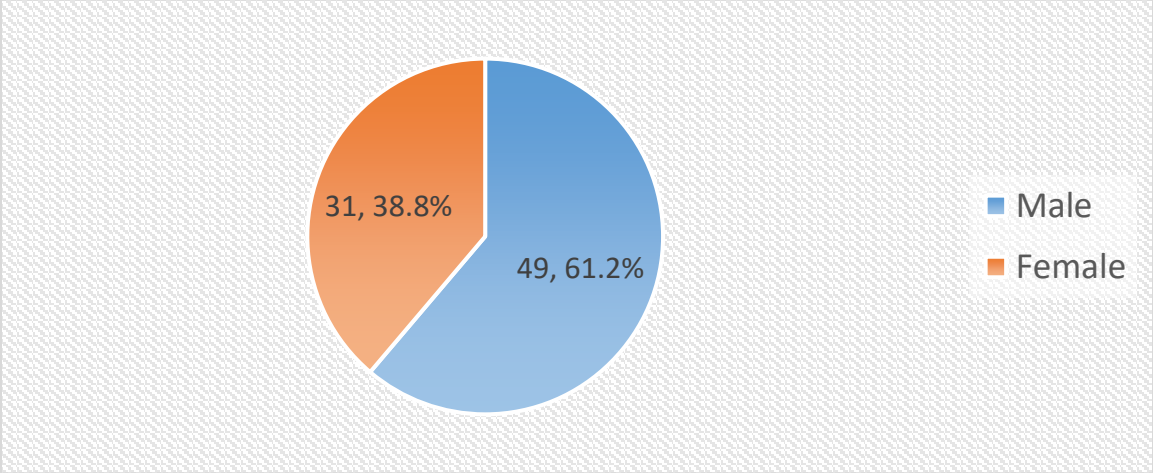

Table 2. Symptoms presentation

Symptoms presentation	n	%
Neck pain	6	7.5%
Radiating arm pain	20	25.0%
Mixed (Neck + Radicular)	54	67.5%

Table III. MRI findings on type and level of herniation

		n	%
MRI finding on type of herniation	Bulge	20	25.0%
	Protrusion	32	40.0%
	Extrusion	22	27.5%
	Sequestration	6	7.5%
Level of herniation	C4-C5	12	15.0%
	C5-C6	32	40.0%
	C6-C7	30	37.5%
	Other (C3-C4, C7-T1)	6	7.5%

Table IV. Nerve root compression on Surling test and MRI

Nerve root compression		n	%
Spurling test	Positive	41	51.2%
	Negative	39	48.8%
MRI	Positive	60	75.0%
	Negative	20	25.0%

Table V. 2x2 contingency table for nerve root compression on spurling test and MRI

		Nerve root compression on MRI			
		Positive		Negative	
		n	%	n	%
Spurling test	Positive	40	66.7%	1	5.0%
	Negative	20	33.3%	19	95.0%

Table VI. Diagnostic accuracy of Spurling test in detecting nerve root compression

Sensitivity	Specificity	PPV	NPV	Diagnostic accuracy
66.67%	95%	97.56%	48.72%	73.75%
PPV= Positive Predictive Value, NPV = Negative Predictive Value				

DISCUSSION

The present study evaluated the diagnostic accuracy of spurling test in detecting cervical nerve root decompression in patients presented with cervical disc herniation. The patients had median age of 50.50 years, which aligns with the study of Zafar et al. who reported that the majority of their disc degenerative diseases patients were in the age bracket of 40 to 59 years. Similar age pattern has been reported by several other local studies.[13-14] The present study found a higher frequency of male patients, which aligns well with a local study by Ismail et al. conducted on 102 symptomatic adults and reported that 54.9% were male patients. Similarly Akhlaq *et al*. reported that majority of their participants were males.[16]

The clinical presentation of patients in the present study showed that the majority 54 (67.5%) had mixed neck and radicular arm pain, while radiating arm pain only was seen in 20 (25.0%) and isolated neck pain in only 6 (7.5%). This pattern aligns well with the findings of Sleijser-Koehorst *et al*. who reported that arm pain intensity was higher than neck pain intensity in their patients with cervical nerve root involvement.[5] Shahid et al. conducted a study on 196 patients with chronic cervical pain and reported that moderate pain was present in 73.5% of patients. Sultana et al. reported that patients with positive Spurling tests had significantly lower quality of life scores highlighting the clinical impact of cervical radiculopathy.[18]

Regarding the morphological characteristics of disc herniation, the present study found that protrusion was the most common type 32 (40.0%), followed by extrusion 22 (27.5%), bulge 20 (25.0%), and sequestration 6 (7.5%). Similar findings were reported by Azemi *et al*. as they documented protrusion as the most common morphology of disc herniation in their study, followed by extrusion.[19] The level-wise distribution in this study showed C5-C6 as the most frequently involved level 32 (40.0%), followed by C6-C7 30 (37.5%), these findings are consistent with Akhlaq *et al*. who reported that C6 and C7 were the most affected nerve roots in 71.4% of their cases.[16]

The diagnostic accuracy of the Spurling test in the present study showed a sensitivity of 66.67% and specificity of 95.0%. These findings are aligned with the meta-analysis conducted by Lin et al which reported a pooled sensitivity of 67% and specificity of 93% when using imaging as the reference standard.[4] Another meta-analysis conducted by Thoomes *et al*. updated the evidence on physical examination tests for cervical radiculopathy and reported that Spurling's test showed high specificity ranging from 0.84 to 1.00 across different studies, with sensitivity values ranging from 0.38 to 0.98.[20] The variation in sensitivity across studies show the differences in test implementation, patient populations and reference standards. The present study's specificity of 95.0% falls well in the range of the aforementioned review, validating the test's utility as a confirmatory tool. A study by Park et al. introduced neck tornado test as a different screening tool for cervical radiculopathy and reported a sensitivity of 85% and specificity of 87%, suggesting that newer tests may offer alternative diagnostic options.[21]

Sleijser-Koehorst *et al*. proposed diagnostic models for cervical nerve root involvement and found that the Spurling test had an odds ratio of 8.0 in their combined model, which indicated that a positive test increases the likelihood of nerve root involvement.[5]

This study presented several novel findings, it provided specific data on the diagnostic accuracy of the Spurling test in a population of patients with MRI-confirmed disc herniation. This addresses a clinical scenario where the clinicians already know that a herniation exists and needs to determine whether it is causing nerve root compression in a Pakistani population adding to the limited regional data on nerve root compression in disc herniation patients. The high positive predictive value of 97.6% provided a strong evidence that in patients with known disc herniation, a positive Spurling test can reliably guide clinical decision-making toward considering surgical intervention.

Limitations of the study:

The sample size of 80 patients while sufficient enough for diagnostic accuracy calculations, may limit the precision of subgroup analyses. The study was conducted at a single centre which may affect the generalisability of findings to other settings. The inclusion criterion required all patients to have MRI-confirmed disc herniation may introduce selection bias, as the results apply only to this specific population and not to the broader group of patients with suspected radiculopathy who may have other causes of nerve root compression. The cross-sectional design does not allow assessment of the stability of test performance over time or the correlation with clinical outcomes following treatment.

Despite these limitations, the present study makes a meaningful contribution to the literature by providing precise estimates of the Spurling test's diagnostic performance in patients with MRI-confirmed cervical disc herniation. The findings support the clinical utility of the test as a confirmatory tool in this specific population and add to the growing

body of evidence from Pakistani cohorts that can inform regional clinical practice guidelines. Future research should focus on multicentre studies with larger sample sizes, inclusion of asymptomatic controls, assessment of inter-rater reliability, and longitudinal follow-up to determine the relationship between test results and clinical outcomes. Additionally, studies comparing the diagnostic accuracy of the Spurling test with other provocative tests and test combinations would help establish optimal diagnostic pathways for patients with suspected cervical radiculopathy.

CONCLUSION

From the present study it is concluded that, the Spurling test demonstrated high specificity (95.0%) and favorable positive predictive value (97.56%) for detecting nerve root compression in patients with MRI-confirmed cervical disc herniation, making Spurling test a valuable tool in this population. The moderate sensitivity (66.67%) and low negative predictive value (48.72%) indicated that a negative test cannot reliably exclude nerve root compression, and therefore clinical decision-making should not rely only on a negative result.

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