SIGNIFICANCEOF TORG-PAVLOVRATIOANDSPACE AVAILABLE FOR CORD (SAC) ON MRI IN CERVICAL SPONDYLOSIS

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Abstract

Background: Cervical spondylosis is a prevalent degenerative condition of the cervical spine, characterized by progressive structural alterations that result in narrowing of the spinal canal and potential spinal cord compression. Magnetic resonance imaging (MRI) serves as the modality of choice for evaluating these changes due to its superior soft-tissue contrast and ability to visualize neural structures. Quantitative indices such as the Torg-Pavlov ratio and Space Available for Cord (SAC) provide objective metrics for assessing the degree of canal stenosis, yet they remain underreported in routine radiological practice.

Methods: This prospective observational study included 190 patients with MRI-confirmed cervical spondylosis over an 18-month period. MRI morphometry was performed to measure the sagittal spinal canal diameter, vertebral body diameter, and spinal cord diameter at the level of maximum stenosis. Torg-Pavlov ratio and SAC were calculated, and clinical severity was graded. Correlation between imaging parameters and symptom severity was analyzed using Spearman's coefficient.

Results: Mean Torg-Pavlov ratios were 0.94 (mild), 0.84 (moderate), and 0.74 (severe). SAC values were 5.8 mm, 4.7 mm, and 3.1 mm, respectively. Both indices correlated inversely with symptom severity (Torg-Pavlov ratio: $r = -0.58$, $p = 0.04$; SAC: $r = -0.42$, $p = 0.02$). C5-C6 and C3-C4 levels were most frequently involved.

Conclusion: Torg-Pavlov ratio and SAC are reliable morphometric parameters that significantly correlate with clinical severity in cervical spondylosis. Their routine inclusion in MRI reports can enhance diagnostic accuracy and guide clinical decision-making.

Keywords: Cervical spondylosis, MRI, Torg-Pavlov ratio, SAC, spinal stenosis, myelopathy

Introduction

Cervical spondylosis encompasses the spectrum of degenerative changes that affect the intervertebral discs, vertebral bodies, facet joints, uncovertebral joints, and ligamentous structures of the cervical spine. It is highly prevalent in the aging population, with radiographic evidence present in over 85% of individuals beyond 60 years of age [1]. These degenerative changes culminate in narrowing of the spinal canal and foramina, predisposing to cervical spondylotic myelopathy (CSM) — the leading cause of spinal cord dysfunction in adults [2]. The pathological process involves disc dehydration and collapse, osteophyte formation, ligamentum flavum hypertrophy, and facet joint arthropathy. These anatomical alterations produce mechanical compression and ischemia of the spinal cord, resulting in progressive neurological deficits [3]. MRI has revolutionized the evaluation of cervical spondylosis by allowing direct visualization of the spinal cord, canal dimensions, and adjacent soft tissue structures [4]. Traditional qualitative assessments of stenosis lack reproducibility, making objective morphometric indices essential. The Torg-Pavlov ratio (canal diameter/vertebral body diameter) and SAC (canal diameter minus cord diameter) provide such objective metrics [5,6]. Despite their utility, these indices are not routinely reported in MRI assessments, often resulting in under-recognition of canal stenosis severity [7]. This study aims to evaluate these parameters in a cohort of patients and establish their correlation with clinical severity.

Materials and Methods

Study Design

This prospective observational study was conducted at K.D. Medical College Hospital & Research Centre, Mathura, from July 2023 to December 2024. Ethical clearance was obtained from the institutional review board.

Participants

The study enrolled 190 patients (aged 25–70 years) presenting with clinical features suggestive of cervical spondylosis.

Inclusion criteria:

* Adults aged 25–70 years
* Clinical signs of cervical spondylosis (neck pain, radiculopathy, or myelopathy)
* MRI evidence of cervical degenerative changes

Exclusion criteria:

* Prior cervical spine surgery
* Trauma, neoplasm, congenital anomalies, or infection

MRI Protocol

MRI was performed using a 1.5T scanner. Imaging sequences included T1W sagittal, T2W sagittal and axial, and gradient echo sequences where needed.
Measurements:
* Sagittal spinal canal diameter at mid-vertebral level
* Vertebral body sagittal diameter
* Sagittal spinal cord diameter
Derived indices:
Torg-Pavlov ratio** = canal diameter / vertebral body diameter
SAC** = canal diameter – cord diameter

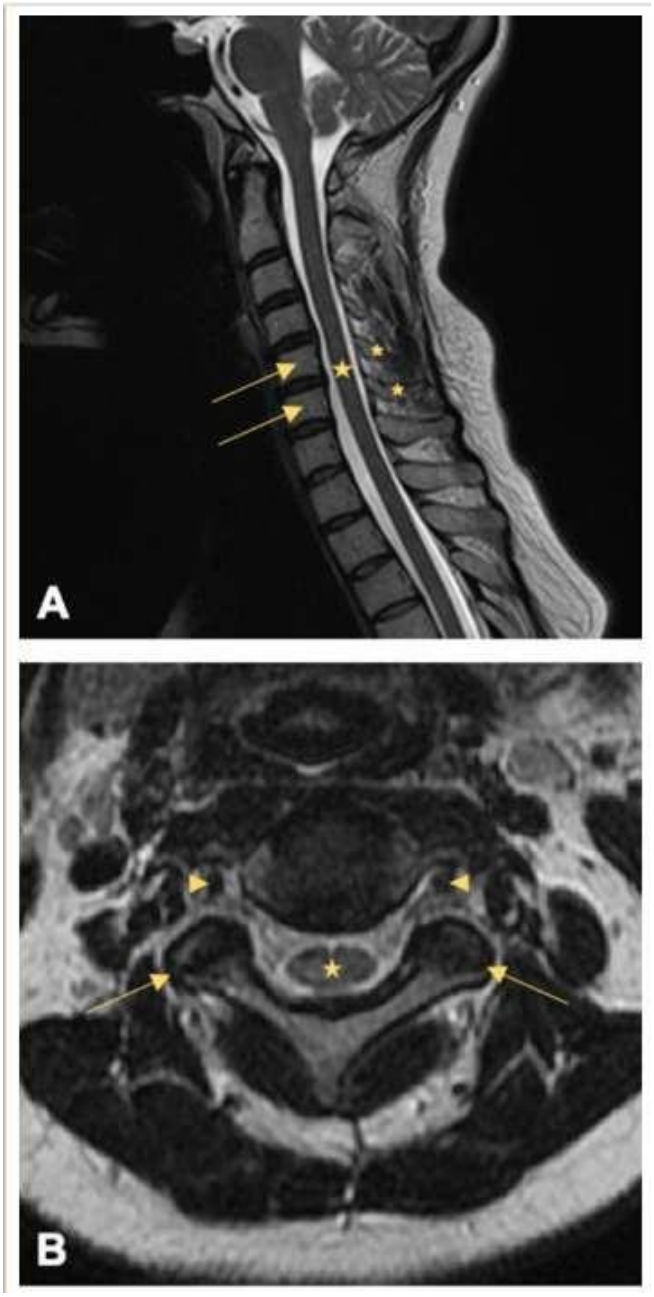

Figure 1: A T2-weighted MRI of the cervical spine demonstrates the C1-C7 vertebral bodies (indicated by arrows), spinous processes (asterisks), and spinal cord (star) within the spinal canal in the midsagittal view (A). The axial view highlights the facet joints (arrows), transverse processes and foramina (arrowheads), and a cross-section of the spinal cord (star; B).

Clinical Grading
Mild: Neck pain, no neurological deficit
Moderate: Sensory symptoms (paresthesia, hypoesthesia)
Severe: Motor weakness, gait disturbance, sphincter dysfunction
Statistical Analysis
Data were analyzed with SPSS v25. Spearman's correlation determined associations between morphometry and severity. ANOVA compared means ($p < 0.05$ significant).

Results

Demographics

* Mean age: 49.6 ± 5.9 years
* Gender: 52.6% female, 47.4% male

Morphometric Analysis

Symptom Grade	Torg-Pavlov Ratio (mean ± SD)	SAC (mm) (mean ± SD)
Mild	0.94 ± 0.05	5.8 ± 0.6
Moderate	0.84 ± 0.04	4.7 ± 0.5
Severe	0.74 ± 0.03	3.1 ± 0.4

Significant correlations were observed:

* Torg-Pavlov ratio: r = -0.58, p = 0.04
* SAC: r = -0.42, p = 0.02

Most affected levels:

* C5-C6: 19.5%
* C3-C4: 18.9%
* C6-C7: 16.8%

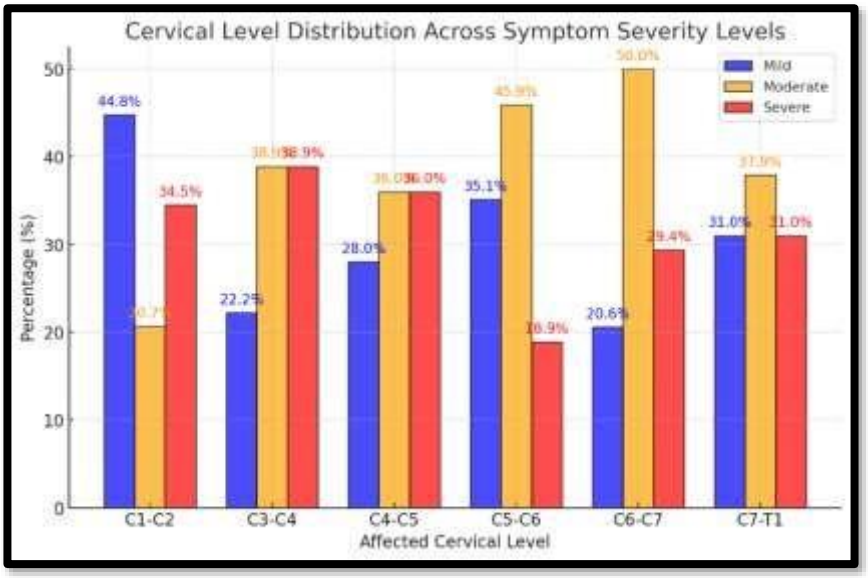

Figure 2 Cervical Level Distribution across Symptom Severity Level

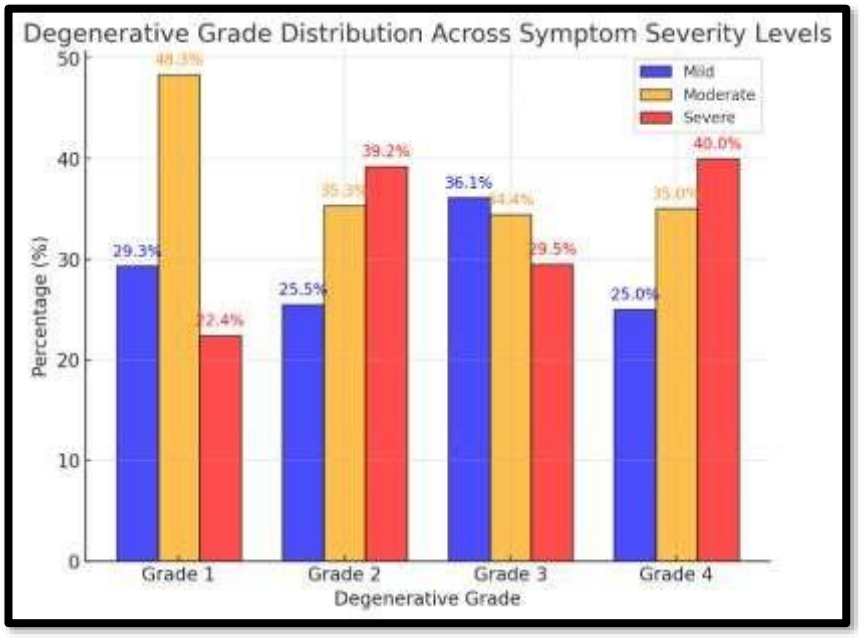

Figure 3. Degenerative Grade Distribution Across Symptom Severity Levels

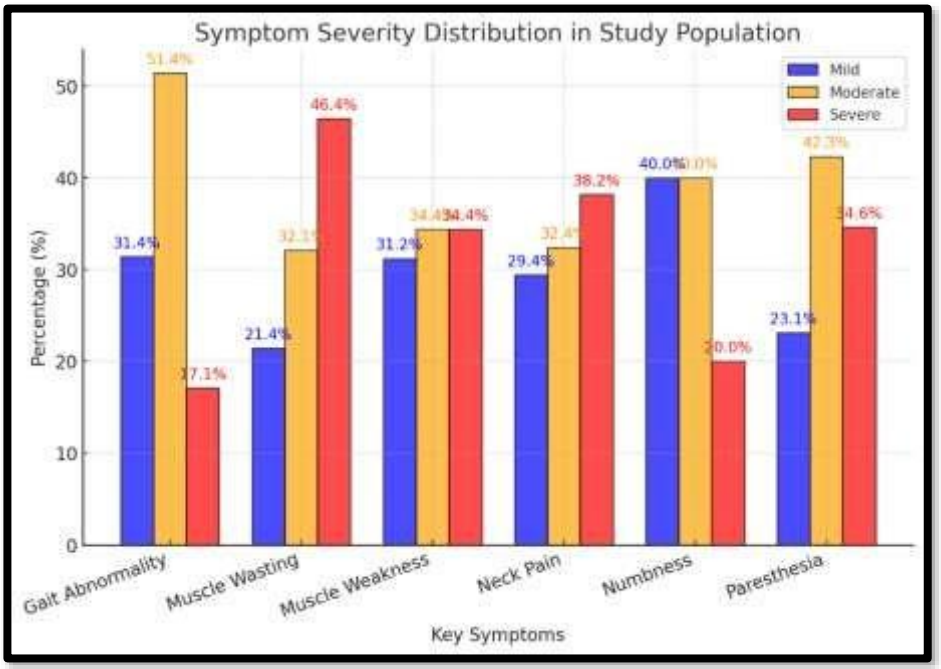

Figure 4. Symptom Severity Distribution in Study Population

Discussion

The present study confirms that both Torg-Pavlov ratio and SAC decline with increasing symptom severity, mirroring previous reports [1,5,6]. These morphometric indices provide reproducible, objective assessment of spinal canal compromise. Biomechanical studies highlight C5-C6 and C3-C4 as levels of maximal mechanical stress, explaining their frequent involvement [8]. Torg-Pavlov ratio <0.8 and SAC <4 mm thresholds observed in our study align with existing literature associating these cutoffs with severe myelopathy and poor functional outcomes [9,10]. Routine incorporation of these indices in MRI reporting can aid clinicians in identifying patients at risk for progression and prioritizing surgical referral.

Conclusion

The Torg-Pavlov ratio and SAC are reliable, easily obtained MRI morphometric parameters that correlate strongly with clinical severity in cervical spondylosis. Routine reporting of these indices is recommended to improve diagnostic accuracy and facilitate early intervention.

Limitations

* Single-center study limits generalizability
* Functional outcome scores (e.g., JOA, Nurick) were not applied
* No postoperative or long-term follow-up

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