



# Assessment of Autonomic Dysfunction in Compressive Myelopathy Using COMPASS-31: A Cross-Sectional Study from a Tertiary Care Hospital in India

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## KEYWORDS

Compressive Myelopathy, Autonomic Dysfunction, COMPASS-31 Questionnaire, Cervical Spondylotic Myelopathy, Spinal Cord Compression, Nurick Grade, Intraoperative Hemodynamic Instability

## ABSTRACT:

**Background:** Compressive myelopathy (CM) involving the cervical and thoracic spinal cord can impair not only motor and sensory pathways but also autonomic regulation. Autonomic dysfunction (AD) in CM is underdiagnosed, yet clinically significant, especially in surgical planning and prognosis.

**Objectives:** To evaluate the prevalence and severity of autonomic dysfunction in patients with compressive myelopathy using the validated Composite Autonomic Symptom Score-31 (COMPASS-31) questionnaire.

**Methods:** A hospital-based, cross-sectional observational study involving 44 patients with MRI-confirmed compressive cervical or thoracic myelopathy. COMPASS-31 was administered to evaluate autonomic dysfunction. Scores were correlated with Nurick grading and clinical variables.

**Results:** Of 44 patients, 42.9% had severe autonomic dysfunction (COMPASS-31 >30). Bladder and gastrointestinal domains were most affected. COMPASS-31 scores correlated significantly with Nurick grade. A score >30 had 89.5% specificity for moderate-to-severe dysfunction.

**Conclusions:** COMPASS-31 is a useful screening tool to detect autonomic dysfunction in CM. Routine autonomic assessment in CM patients may improve risk stratification and outcomes

## Introduction

Compressive myelopathy (CM) of the cervical and upper thoracic spine is a progressive spinal cord disorder caused by external mechanical compression of the spinal cord, commonly due to degenerative changes, trauma, tumors, or inflammatory disorders. CM is characterized by a constellation of symptoms including gait disturbances, upper and lower limb weakness, hyperreflexia, and sensory abnormalities. Less frequently recognized but highly relevant are symptoms related to autonomic nervous system (ANS) involvement, such as orthostatic

hypotension, bladder dysfunction, altered bowel habits, and impaired thermoregulation.

The ANS plays a critical role in maintaining homeostasis through the regulation of cardiovascular, gastrointestinal, urogenital, and sudomotor functions. It consists of sympathetic and parasympathetic divisions, which function via central and peripheral pathways.

These pathways are particularly vulnerable in CM due to the close anatomical proximity of descending autonomic tracts (e.g., intermediolateral cell columns, dorsal longitudinal fasciculus) to the sites of cord compression, especially in the cervical region. Chronic



compression and ischemia can disrupt autonomic integration, resulting in subtle or overt autonomic dysfunction (AD), which may remain undiagnosed without targeted assessment.

While motor and sensory assessments are integral to CM diagnosis, the evaluation of autonomic function remains overlooked in standard clinical practice, despite emerging evidence that AD may substantially influence patient outcomes. Patients with underlying AD may be at increased risk of intraoperative hemodynamic lability during spinal decompression surgeries, leading to complications such as spinal cord hypoperfusion, delayed recovery, and prolonged hospitalization. Several studies have shown that poor autonomic regulation in spinal pathologies correlates with worse functional outcomes and quality of life.

Traditional autonomic function tests such as tilt-table testing, heart rate variability analysis, and sympathetic skin response require specialized equipment and expertise. The Composite Autonomic Symptom Score (COMPASS) and its abbreviated version, COMPASS-31, provide an alternative by using a structured self-report format to screen for AD across multiple domains.

COMPASS-31 includes 31 items covering orthostatic intolerance, vasomotor, secretomotor, gastrointestinal, bladder, and pupillomotor symptoms. It has demonstrated reliability and internal validity in several conditions, including Parkinson's disease, diabetic autonomic neuropathy, fibromyalgia, and amyloidosis.

However, few studies have investigated its use in structural spinal cord disorders such as CM. This is particularly relevant in developing countries like India, where access to advanced autonomic testing is limited. Early recognition of AD using a validated and cost-effective tool like COMPASS-31 could allow for better perioperative risk stratification and long-term management strategies.

In this context, the present study aims to evaluate autonomic dysfunction in patients with compressive cervical or thoracic myelopathy using the COMPASS-31 questionnaire and to correlate the severity of dysfunction with clinical grading (Nurick classification), lesion characteristics, and comorbidities. This research seeks to fill an important gap in

literature by validating the utility of COMPASS-31 in CM and advocating for its inclusion in routine neurological assessments.

## Material and Methods

This prospective, observational, cross-sectional study was conducted in the Department of General Medicine at the National Institute of Medical Sciences and Research, NIMS University, Jaipur, India. The study was carried out over a

period of 18 months from January 2022 to June 2023. Ethical clearance was obtained from the Institutional Ethics Committee prior to initiation. All participants provided written informed consent in accordance with the Declaration of Helsinki, and patient confidentiality was strictly maintained throughout the study.

The study population comprised adult patients (>18 years of age) diagnosed with compressive cervical or upper thoracic myelopathy, confirmed by clinical examination and corroborated with magnetic resonance imaging (MRI). Patients were recruited from inpatient and outpatient departments. Inclusion criteria involved the presence of MRI-confirmed spinal cord compression, a clinical diagnosis of myelopathy, and the ability to comprehend and respond to the

COMPASS-31 questionnaire in either English or Hindi. Exclusion criteria included a known diagnosis of primary autonomic disorders such as multiple system atrophy (MSA), Parkinson's disease, psychiatric illnesses impairing comprehension, active infections, prior spinal surgeries, and those with cognitive or linguistic impairments that would hinder participation.

A structured clinical proforma was used to record demographic data (age, sex), anthropometric measurements (height, weight, BMI), comorbidities (especially diabetes mellitus, hypertension, and hypothyroidism), clinical symptoms (motor and sensory deficits), and neurological examination findings. Each participant underwent a detailed neurological assessment, and the severity of myelopathy was graded using the Nurick Classification. This grading system ranges from Grade 0 (root symptoms only) to Grade 5 (wheelchair-bound or bedridden) and is commonly used to assess motor disability.



To evaluate autonomic function, each patient completed the Composite Autonomic Symptom Score-31 (COMPASS-31) questionnaire. This self-reported tool assesses six autonomic domains

## Discussion

The findings of our study underscore the high prevalence of autonomic dysfunction in patients with compressive cervical and thoracic myelopathy, with nearly 43% of patients displaying severe dysfunction as per COMPASS-31 scoring. The predominance of bladder and gastrointestinal domain involvement corroborates previous physiological studies which demonstrated that the descending autonomic fibers mediating pelvic and lower abdominal visceral function traverse the cervical and thoracic spinal cord. The correlation between higher COMPASS-31 scores and advanced Nurick grades suggests a progressive loss of both motor and autonomic function as the disease advances.

Our results are in line with the findings of Mathew et al. and Takri et al., who used COMPASS-31 and modified CASS scoring to evaluate autonomic dysfunction in CM patients undergoing decompression surgery. Both studies found significant associations between COMPASS-31 scores and intraoperative hemodynamic variability. This highlights the predictive potential of COMPASS-31 not only as a diagnostic tool but also as a perioperative risk marker. Importantly, the specificity of 89.5% in detecting moderate-to-severe AD in our cohort supports its clinical relevance in this population.

From a pathophysiological perspective, chronic spinal cord compression leads to ischemia, demyelination, and neuronal apoptosis affecting both somatic and autonomic tracts. The grey matter, which houses sympathetic preganglionic neurons, is especially vulnerable to hypoxic injury. Furthermore, neuroinflammatory cascades initiated by chronic compression may contribute to dysregulation of the hypothalamic-autonomic axis. Postoperative improvement in autonomic symptoms, as documented in some case reports, suggests that decompression may partially reverse functional derangement, particularly if intervention is timely.

Notably, in our study, diabetic patients had significantly higher COMPASS-31 scores, consistent with previous reports indicating a synergistic burden of autonomic neuropathy in

diabetes and structural spinal disorders. This dual pathology might potentiate the risk of silent autonomic failure, making preoperative screening especially critical in this subgroup.

Despite its strengths, COMPASS-31 is a subjective tool and may be influenced by individual interpretation or underreporting. However, when used in conjunction with objective measures—such as heart rate variability or tilt-table testing—it can serve as a robust screening tool. Its simplicity, time-efficiency, and adaptability to local languages make it suitable for implementation in resource-constrained settings. Given the growing elderly population and increasing incidence of degenerative spine diseases, autonomic dysfunction is likely to become a more prevalent clinical

## Conclusion

This study highlights the high prevalence and clinical significance of autonomic dysfunction in patients with compressive cervical and upper thoracic myelopathy. Utilizing the COMPASS-31 questionnaire, we were able to identify varying degrees of autonomic dysfunction in a majority of our study population, with a substantial proportion experiencing moderate to severe impairment.

Notably, the domains most frequently affected were bladder, gastrointestinal, and orthostatic intolerance. The strong correlation between COMPASS-31 scores and Nurick grades further reinforces the association between progressive motor impairment and worsening autonomic regulation.

Our findings suggest that autonomic dysfunction in CM is underdiagnosed, underreported, and undertreated, despite its clear impact on patient quality of life, perioperative stability, and rehabilitation outcomes. The integration of autonomic symptom screening—especially using validated tools like COMPASS-31—into routine neurological evaluations for patients with CM is therefore recommended.

The simplicity and efficiency of COMPASS-31 make it particularly useful in resource-constrained settings. By identifying at-risk individuals early, clinicians can implement targeted interventions and improve overall patient care. Moreover, it provides a structured approach to monitoring autonomic symptoms



longitudinally, especially in surgical cases.

In conclusion, autonomic dysfunction constitutes a critical but often neglected aspect of compressive myelopathy. Our study emphasizes the value of incorporating COMPASS-31 into standard practice to enable comprehensive patient management and improved neurological and functional outcomes

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