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ARTICLE ORIGINAL / RESEARCH ARTICLE

Magnetic resonance imaging pattern in patients with non-traumatic spinal cord compression in a private medical imaging center in Bafoussam - Cameroon

Profil en imagerie par résonance magnétique chez les patients présentant une compression médullaire non traumatique dans un centre privé d'imagerie médicale à Bafoussam, Cameroun

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RÉSUMÉ

Background: Magnetic resonance imaging (MRI) plays a pivotal role in evaluating suspected cases of non-traumatic spinal cord compression. This study aimed to characterize MRI findings in patients with non-traumatic spinal cord compression at the Centre de Radiologie et d'Imagerie Médicale de l'Ouest (CRIMO).
Materials and Methods: A cross-sectional study was conducted from January to June 2024, analyzing spine MRI scans of patients presenting with non-traumatic spinal cord compression. Socio-demographic data, clinical indications, and imaging results were collected. Data were entered into Excel (version 16) and analyzed using SPSS (version 25). Descriptive statistics were presented via frequency tables and bar charts. Pearson's correlation was used to evaluate associations between clinical presentation and imaging-confirmed spinal cord compression, with statistical significance set at $p < 0.05$.
Results: Among 100 participants (age range: 16–87 years; 53 males; sex ratio: 1.12), spinal cord compression was identified in 41% of cases. Degenerative spine disease was the leading cause (73%, $p = 0.004$). The cervical spine was the most frequently affected region (54%), and the extradural compartment was involved in 85.4% of cases. A weak positive correlation was observed between clinical symptoms and imaging-confirmed compression ($r = 0.206$, $p = 0.039$).
Conclusion: Spinal cord compression is frequent in non-traumatic MRI examinations, most often resulting from degenerative pathology. The cervical spine and the extradural compartment are the most involved sites. The weak yet statistically significant correlation between clinical symptoms and MRI findings underscores the indispensable role of imaging in ensuring diagnostic accuracy. Given that clinical manifestations are often insidious and nonspecific, MRI should be considered essential even in patients presenting with mild or atypical symptoms.

ABSTRACT

Contexte : L'imagerie par résonance magnétique (IRM) est un outil essentiel dans l'évaluation des cas suspects de compression médullaire non traumatique. Cette étude visait à analyser les caractéristiques IRM chez les patients présentant une compression médullaire non traumatique au Centre de Radiologie et d'Imagerie Médicale de l'Ouest (CRIMO).

Matériels et Méthodes : Une étude transversale de janvier à juin 2024, portant sur les résultats d'IRM du rachis chez des patients atteints de compression médullaire non traumatique. Les variables étudiées étaient sociodémographiques, cliniques et imagériques. Les données ont été saisies dans Excel 16 et analysées à l'aide du logiciel SPSS 25. Les statistiques descriptives présentées sous forme de tableaux de fréquence et de diagrammes en barres. Le test de corrélation de Pearson utilisé pour évaluer la relation entre la présentation clinique et la compression médullaire, avec un seuil de signification fixé à 95 % d'intervalle de confiance.

Résultats : Parmi les 100 participants (âgés de 16 à 87 ans ; 53 hommes ; ratio de sexe : 1,12), une compression médullaire a été identifiée dans 41 % des cas. La maladie dégénérative du rachis était la cause la plus fréquente (73 %, p = 0,004). La région cervicale était la plus souvent atteinte (54 %), et le compartiment extradural était impliqué dans 85,4 % des cas. Une faible corrélation positive a été observée entre les symptômes cliniques et la compression médullaire (r = 0,206, p = 0,039).

Conclusion : La compression médullaire non traumatique est très fréquente à l'IRM et principalement due à une pathologie dégénérative du rachis. La moelle cervicale et le compartiment extradural sont les plus fréquemment touchés. La faible mais significative corrélation entre les symptômes cliniques et les résultats IRM met en évidence la nécessité incontournable de l'imagerie dans le diagnostic précoce. Les manifestations cliniques, souvent insidieuses et peu spécifiques, justifient le recours à l'IRM même lorsque les symptômes paraissent légers.

1. Introduction

Spinal cord injuries (SCI) are highly disabling conditions that result not only in motor and sensory deficits but also in multi-organ dysfunction [1]. Non-traumatic spinal cord injury (NTSCI) encompasses spinal cord damage from non-traumatic causes such as vertebral spondylosis (spinal stenosis), tumorous compression, vascular ischemia, and congenital anomalies.

Globally, the prevalence of spinal cord compression is estimated at 236–1,298 cases per million inhabitants, while the incidence of SCI ranges from 40 to 80 cases per million people [2]. Between 2000 and 2024, the overall incidence rate of SCI was approximately 23.77 per million people, with non-traumatic spinal cord injuries (NTSCI) at a rate of 17.93 per million people [3]. Individuals with SCI face a two-to five-fold higher risk of premature mortality compared to the general population [2].

In Sub-Saharan Africa, non-traumatic spinal cord diseases are reported as a frequent indication for neurological admission and represent an important component of neurological disability and preventable death: nearly half of affected patients experience long-term disability, and hospital mortality approaches 10% [4–6]. These outcomes carry profound social and economic consequences for patients, families, and healthcare systems.

In Cameroon, the burden of non-traumatic myelopathy is especially profound. Hospital-based series from major cities such as Yaoundé suggest myelopathies constitute up to 6–10% of all neurological admissions, with the majority being due to non-traumatic etiologies. Remarkably, these cases frequently result in significant functional disability, impaired quality of life, and increased economic strain for patients and their families due to prolonged hospitalization, rehabilitation needs, and the direct and indirect costs of care [6]. Importantly, these cases are often associated with long delays from symptom onset to appropriate medical attention—sometimes measured in weeks to months—further contributing to the risk of irreversible neurological sequelae [5–7].

Early diagnosis and timely intervention are critical to preventing irreversible neurological damage. Magnetic resonance imaging (MRI) has transformed the evaluation and management of spinal cord disease, providing unparalleled resolution for soft-tissue, intramedullary, and paraspinal pathologies without the risks associated with ionizing radiation [8, 9]. For NTSCC, MRI offers several irreplaceable benefits: (1) precise localization of lesions, (2) accurate distinction

between compressive and non-compressive causes, (3) detailed characterization of tissue involvement—including edema, necrosis, neoplastic infiltration, or infectious abscess, and (4) the ability to guide both surgical planning and non-surgical management decisions. [10–12].

However, the paradox remains that, despite its critical importance, MRI is often out of reach in much of Sub-Saharan Africa due to high acquisition and maintenance costs, the need for specialized infrastructure (power, shielding, temperature control), and the requirement for skilled operators and interpreters [13–15]. Where available, MRI is almost exclusively found in urban private clinics or tertiary referral hospitals [5, 7, 16].

The initial assessment of patients with suspected spinal cord pathology in many parts of Cameroon is frequently dependent on clinical examination and—when available—plain radiography or CT, which are often insufficient for soft-tissue or early parenchymal lesions. Due to cost, availability, and logistic considerations, advanced imaging is rarely accessible, even in tertiary health centers, and is almost never available in primary or secondary care settings. Delays of weeks to months from symptom onset to presentation and diagnosis are well documented, contributing to irreversible neurologic deficits and functional impairment by the time of intervention [5, 6].

In Cameroon, public and private hospitals in cities such as Yaoundé, Douala, and Bafoussam now possess MRI units, but the per-capita density remains drastically below international recommendations, often less than one scanner per million inhabitants, with wide urban–rural disparities [16]. Investigating the role of MRI in this context is therefore essential to optimize diagnostic strategies and resource allocation.

This study aimed to describe the MRI features of non-traumatic spinal cord compression in patients evaluated at a private medical imaging centre in Bafoussam.

2. Matériels et Méthodes

2.1 Study design

This was a cross-sectional study, focusing on spine MRI imaging in patients presenting with non-traumatic compressive myelopathy.

2.2 Study Site

The study was conducted at Centre de Radiologie et Imagerie Medicale de l'Ouest (CRIMO), a referral private medical imaging centre located in Bafoussam, the capital of the West Region of Cameroon. It is one of only two facilities in the region offering MRI services. It is equipped with a NEUSOFT Superstar 0.35 Tesla machine. Since the installation of its MRI unit in 2021, the centre has consistently provided spinal imaging to patients from across the West Region, the neighbouring North West Region, and occasionally from other parts of Cameroon. Its strategic location and sustained MRI service delivery made it an ideal site for this study.

2.3 Study Population

The study population comprised MRI examination request forms and corresponding radiological reports of patients who underwent spine MRI at CRIMO, between January and June 2024. Were excludes MRI request forms or reports that were incomplete or lacked essential clinical or demographic data.

2.4 Sampling Procedure

A consecutive sampling technique was employed to collect demographic and clinical data from eligible patient request forms and MRI reports.

2.5 Data Collection Procedure

For each consenting participant, a structured data collection form was used to extract relevant information. The form was divided into three sections :

• Demographic Section : Included variables such as age and gender.

• Exam Request Section : Captured clinical indications, presenting symptoms (e.g., paraparesis, tetraparesis), type of MRI requested, and duration of symptom onset.

• MRI Report Section : Documented radiological findings including: degenerative disc disease, metastatic spinal compression, tumoral lesions, and inflammatory causes of spinal cord compression.

All patients underwent standard MRI safety screening to exclude contraindications such as metallic implants, pacemakers, aneurysm clips, prosthetic heart valves, and metallic tattoos. The

procedure was explained to each patient, and concerns were addressed prior to scanning. Patients were instructed to remove metallic items (e.g., jewellery, watches, hairpins) and change into gowns when necessary. An intravenous line was placed for contrast administration when indicated.

MRI scans were performed using a NEUSOFT Superstar 0.35 Tesla machine. Medium and large body surface coils were used for thoracic and lumbar imaging, while a dedicated neck coil was used for cervical spine studies. Patients were positioned supine on the MRI table, with head orientation adjusted as needed, and instructed to remain still throughout the procedure.

The imaging protocol included the following sequences:

• Non-contrast studies: T2 TSE sagittal, T2 STIR sagittal, T1 TSE sagittal, T2 TSE coronal, T2* axial, and B-FFE3D.

• Contrast-enhanced studies: Additional sequences included T1 TSE axial, T1 STIR sagittal post-injection, and T1 TSE axial post-injection.

Radiological findings were reviewed and categorized based on the underlying pathology as follow:

- Degenerative etiologies: disc protrusion, osteophyte formation, or ligamentous hypertrophy. MRI demonstrates reduced canal diameter and intramedullary T2 hyperintensity, reflecting chronic cord injury [17, 18].
- Tumoral etiologies: characterized by space occupying lesions with distinct enhancement patterns. Intradural extramedullary tumors such as meningiomas or schwannomas often appear well circumscribed with homogeneous enhancement, whereas intramedullary tumors like astrocytomas or ependymomas present as fusiform cord enlargement with variable signal intensity and enhancement [18, 19].
- Inflammatory and infectious causes of cord compression were distinguished by diffuse or segmental T2 hyperintensity without a discrete mass. Myelitis typically shows longitudinally extensive lesions, while spondylodiscitis demonstrates disc and vertebral body signal changes with post contrast enhancement and possible epidural extension [17, 19].

2.6 Data Management

To ensure data integrity, security, and accessibility, all information recorded on the data collection forms was entered into Microsoft Excel (version 2016), cleaned, and coded. The finalized dataset was stored in a secured folder on a password-protected laptop. A backup copy was saved on an encrypted flash drive and stored in a secure location.

2.7 Data Analysis

The cleaned dataset was exported from Excel and analyzed using the Statistical Package for Social Sciences (SPSS), version 25. Both qualitative and quantitative variables were examined.

• Qualitative data (e.g., clinical indications, MRI findings) were summarized using frequencies and proportions, and results were presented in frequency tables and bar charts.

• Quantitative data (e.g., age, duration of symptoms) were analyzed using measures of central tendency, specifically mean and standard deviation.

To assess relationships:

• Pearson correlation was used to evaluate the association between clinical presentation and spinal cord compression.

• Binomial test was applied to determine the relationship between spinal pathologies and spinal cord compression, with statistical significance set at $p < 0.05$.

2.8 Ethical Considerations

Ethical approval for this study was obtained from the Institutional Review Board of the University of Buea (Ref: 2024/2394-02/UB/SG/IRB/FHS), alongside authorization from ST Louis University Institute and administrative clearance from CRIMO (Ref: 015-03-06-2024).

Informed consent was obtained from all patients undergoing spine MRI who agreed to participate. Data collected were used solely for research purposes, and confidentiality was strictly maintained throughout the study.

3. Résultats

3.1 Demographic characteristics of participants

A total of 100 patients were finally included in this study. More than half of the participants 53 (53.0%) were males with a sex ratio of 1.13 **(Table I).** The age group above

55 represents half of the participants (50%) with extremes of 16 and 87 years.

Table I: Demographic distribution of participants

n=100		Gender of participant		Total
		Male n (%)	Female n (%)	n (%)
Age group	15-35	13 (13.0%)	8 (8.0%)	21 (21%)
	36-55	18 (18.0%)	11 (11.0%)	29 (29%)
	>55	22 (22.0%)	28 (28.0%)	50 (50%)
Total		53 (53.0%)	47.0%	100 (100%)

3.2 Proportion of spinal cord compression

Based on MRI results, 41 (41%) participants showed evidence of spinal cord compression.

Among the patients presenting with spinal cord compression on MRI, 28 were males (68.3%). The highest incidence of spinal cord compression was observed in the age group above 55 accounting for 58.5% of cases of spinal cord compression **(Table II).**

Table II: Demographic distribution of patients with spinal cord compression

Presence of compression n=41		Age group (years)			Total
		15-35	36-55	>55	
Gender of participant	Male	5	8	15	28
	Female	2	2	9	13
Total		7	10	24	41

3.3 Causes of spinal cord compression

Degenerative disease of the spine emerged as the predominant cause of spinal cord compression, accounting for 30 cases (73.2%). Following closely was inflammatory/autoimmune responses with 5 cases (12.2%), while metastasis represented the least common cause, with 2 cases (4.8%) as illustrated by **figure 1**.

3.4 Affected spinal cord compartment

The compartment mostly affected by compression was the extradural section, with 35 cases (85.4%). Both the intra-dural and intra-medullary compartments each accounted for 3 cases (7.3%).

3.5 Level of spinal cord compression

The cervical region exhibits the highest frequency of compression, accounting for 22 cases (54%), followed by the lumbar region with 13 cases (32%). Cases involving multiple sites of compression are rare, representing only 1 case (2%) as presented on **figure 2.**

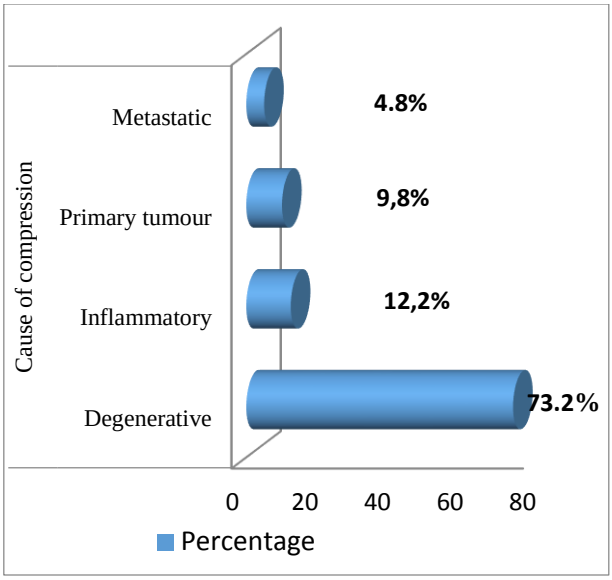

Figure 1 : Causes of spinal cord compression

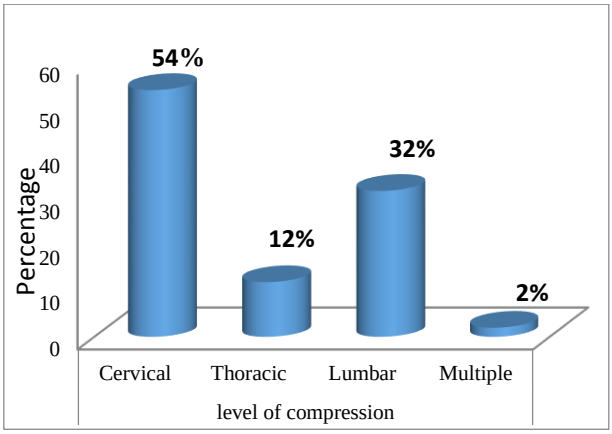

Figure 2: Level of spinal cord compression

3.6 Correlation between clinical presentation and spinal cord compression

Patient's clinical presentation such as paraparesis, paraplegia, tetraparesis, and tetraplegia, were correlated with MRI findings to establish relationship between clinical presentation and the occurrence of spinal cord compression. A weak positive correlation between these two variables was established as shown on **table III**. Pearson correlation coefficient of 0.206 with P-value associated with the correlation coefficient = 0.039.

Table III: Pearson correlations of clinical presentation and spinal cord compression on MRI

		Spinal cord compression
Clinical presentation	Pearson Correlation	0.206
	Sig. (2-tailed)	0.039*
	n	100

***. Correlation is significant at the 0.05 level (2-tailed).**

3.7 Binomial test for cause of compression

A binomial test was used to observe a statistically significant difference in proportions between degenerative disease and other cause of spinal cord compression **(Table IV).**

Table IV: Binomial test for cause of spinal cord compression on MRI

	Category	n	Observed Pro.	Test Prop.	Exact Sig. (2-tailed)
Cause of compression	Degenerative	30	0.73	0.50	0.004
	Others	11	0.27		
Total		41	1.00		

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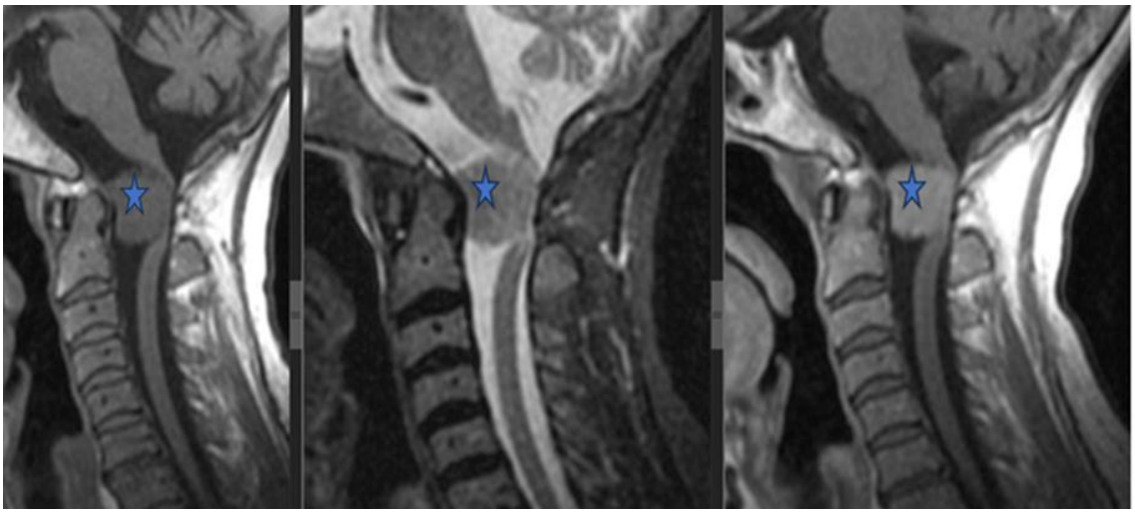

Figure 3: Cervical MRI, sagittal slices in T1, T2, and T1 with gadolinium. An intradural extramedullary mass (blue star) is located behind the odontoid process of the axis, with well-defined but irregular margins. It appears homogeneously hypointense on T1, hypointense on T2, and enhances after contrast injection. The lesion displaces and compresses the spinal cord. This appearance is compatible with a meningioma or a schwannoma.

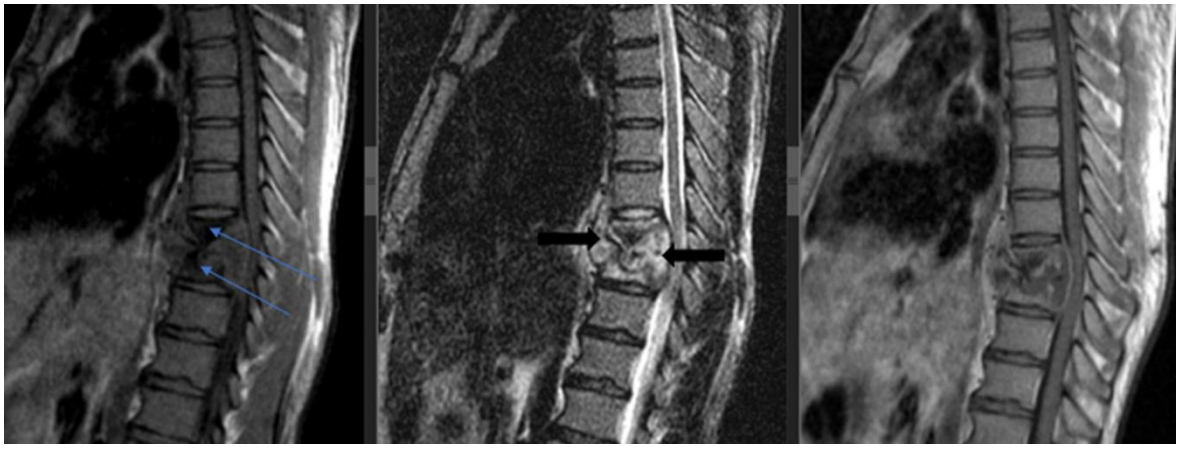

Figure 4: Dorsal spine MRI, Sagittal slices, T1, STIR and T1+Gadolinium. 46 years old male with persistent back pain in a febrile context. D9 and D10 vertebral bodies collapse (blue arrows), hypointense on T1 and hyperintense in T2, with loss of D9-D10 disc height. Paravertebral soft tissue collection in T2 hyperintensity (black arrows), contrast enhancement after injection of Gadolinium

and with extra-axial compression of the spinal cord. These findings are suggestive of a spondylodiscitis with compressive anterior epiduritis.

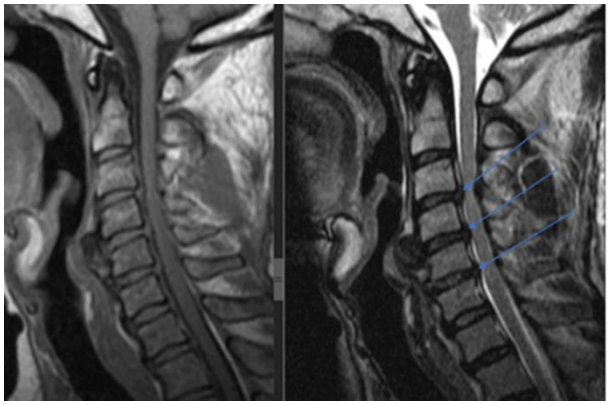

Figure 5: Cervical spine MRI, Sagittal slices, STIR and T2 sequences. 52 years old male presenting with cervical nevralgia. C3-C4, C4-C5 and C5-C6 decreased disc signal on T2 with posterior disc protrusion into the spinal canal (blue arrows) and premedullary subarachnoid spaces flattening. Anterior indentation of the spinal cord especially at levels C3-C4 and C4-C5 without associated cord signal abnormality.

4. Discussion

This study aimed to provide a comprehensive assessment of non‑traumatic spinal cord compression (NTSCC) among patients undergoing MRI of the spine at CRIMO SARL, focusing on prevalence, etiologies, anatomical distribution, and clinico‑radiological correlation. Our findings revealed a substantial occurrence of spinal cord compression (41%), with degenerative disease emerging as the leading cause (73.2%). The cervical region was the most frequently affected (54%), extradural lesions predominated (85.4%), and a weak but statistically significant correlation was observed between clinical presentation and MRI findings.

4.1 Demographic distribution of participants

The predominance of male participants (53%) is consistent with several studies [1, 20, 21], suggesting that men may be more exposed to occupational and lifestyle risk factors for degenerative spinal disease. However, other reports [22, 23] have documented a female predominance, highlighting possible regional or methodological differences. The concentration of cases among older adults, particularly those above 55 years (50%), aligns with previous studies [1, 23] and reflects the natural history of degenerative spinal changes, which accumulate with age. This reinforces the notion that aging populations in Sub‑Saharan Africa may face a growing burden of NTSCC.

4.2 Proportion of spinal cord compression

The proportion of spinal cord compression in our cohort (41%) is comparable to findings from Mali (30.6%) [1] and Senegal (37%) [24], and falls within the range reported across Sub‑Saharan Africa [20, 25]. The higher occurrence among older adults mirrors the Ghanaian study [9], which reported 76% of cases in individuals above 56 years. This age association is in accordance with the role of degenerative pathology as a dominant etiology in older populations. In contrast, studies focusing on pediatric cohorts [21, 25] reported higher rates of congenital or infectious causes, illustrating how age structure strongly influences the etiological spectrum.

4.3 Causes of non‑traumatic spinal cord compression

Degenerative disease accounted for nearly three‑quarters of cases in our study, consistent with reports from Ghana and Mali, where degenerative pathology represented 57–76% of cases [1, 9]. This finding reflects the global trend in which spondylolysis changes, disc herniation, and ligamentous hypertrophy are the leading causes of NTSCC in adults [26]. However, our results differ from those in Togo [27], where tumoral processes predominated (44%). Such variation may reflect referral bias in tertiary hospitals, differences in population age structure, or regional epidemiology of malignancies. Similarly, pediatric studies [25, 27] highlight congenital anomalies and infectious etiologies such as Pott's disease, which are less common in adult cohorts like ours.

4.4 Topography of spinal cord compression

Extradural compression was the most frequent pattern (85.4%), in line with prior studies [1, 23]. This is expected, as degenerative changes typically originate in the extradural compartment through disc herniation, osteophytes formation, or ligamentum flavum hypertrophy. The high frequency of cervical involvement (54%) also mirrors findings from other African and international studies [1, 28]. The cervical spine is particularly vulnerable due to its mobility and narrower canal diameter, making it a common site of clinically significant compression. By contrast, some studies [24, 28, 29] reported thoracic predominance, possibly reflecting differences in referral populations or disease etiologies.

4.5 Clinical and MRI correlation

We observed only a weak positive correlation between clinical presentation and MRI findings (p = 0.039). This modest association highlights the diagnostic challenge of NTSCC: clinical symptoms are often non-specific and may overlap with peripheral neuropathies or musculoskeletal disorders. Similar observations have been reported in other studies, where MRI frequently revealed significant pathology in patients with subtle or atypical symptoms [26, 28]. This underscores the indispensable role of MRI in confirming diagnosis, guiding treatment, and preventing delays that could lead to irreversible neurological deficits.

4.6 Strengths and Limitations

A key strength of this study is that it included all eligible participants within a defined period, providing a representative snapshot of patients undergoing spinal MRI in a newly equipped center in Cameroon.

However, limitations include the single-center design, relatively small sample size, and lack of data on occupational risk factors or long-term outcomes. These factors may limit generalizability and preclude assessment of prognostic implications. The use of a low‑field MRI system (0.35T) may have limited image resolution and sensitivity, which should be considered when interpreting the findings.

5. Conclusion

This study provides important insights into the burden and characteristics of NTSCC in Cameroon. The high prevalence of degenerative disease, predominance of cervical and extradural lesions, and weak clinico-radiological correlation emphasize the need for early MRI evaluation in at-risk populations, particularly older adults to ensure diagnostic accuracy. Given that clinical manifestations are often insidious and nonspecific; MRI should be considered essential even in patients presenting with mild or atypical symptoms

From a health systems perspective, our findings highlight the critical role of expanding MRI access in Sub-Saharan Africa. Despite recent installations, financial and infrastructural barriers remain major obstacles. Policymakers should consider strategies such as subsidized imaging, integration into national insurance schemes, and training of radiologists and neurosurgeons to optimize use of MRI in spinal pathology.

Future research should include multicenter studies with larger cohorts, cost-effectiveness analyses comparing MRI and CT, and longitudinal follow-up to correlate MRI features with clinical outcomes. Such evidence will be vital to inform diagnostic protocols and resource allocation in low-resource settings.

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