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Diagnostic Value of Different Mri Sequence Combinations in Evaluation of Spinal Pathology among Patients at Ibom Multi-Specialty Hospital, Uyo

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Abstract **Original Research Article**

Introduction: Spinal pathologies contribute significantly to morbidity, disability, and reduced quality of life globally, particularly in low and middle income countries where access to timely and accurate diagnosis remains a major challenge.

Methodology: The study design adopted was retrospective cross-sectional study design with the use of MRI records of 200 patients suspected of having spinal pathology between January 2022 and December 2025 at Ibom Multi-specialty Hospital, Uyo. The information was gathered through MRI images, radiological reports, and patient records. Data were analyzed using descriptive statistics, Chi-square test and the Spearman correlation test.

Results: Results indicated that degenerative spinal diseases (64.0%) were the most common pathology with the next being the traumatic (12.5%) and neoplastic diseases (10.0%). The classification of pathological subtypes revealed that spondylosis (40.6%) were the predominant subtype. The combination of MRI sequences (T2+ STIR+ myelography) showed the best diagnostic findings (32.0%). The difference in diagnostic yield between various sequence combinations was found to be statistically significant ($\chi^2(20)=721.637$, $p< 0.001$). Also, age exhibited significant moderate positive relationship with the spinal pathology incidence ($\rho=0.483$, $p=0.024$) and there was no significant relationship between gender and spinal pathology ($\chi2=1.105$, $df=1$, $p=0.293$).

Conclusion: The study concludes that MRI is a very efficient modality in the assessment and categorization of spinal pathologies, and sequence combinations that are optimized will greatly enhance the diagnostic accuracy. These results indicate that standardization of protocols and specific clinical measures especially on the elderly are required.

Keywords: Spinal pathology, Magnetic Resonance Imaging (MRI), Diagnostic yield, MRI sequences, Degenerative spinal disease.

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INTRODUCTION

Spinal pathology encompasses diverse pathological conditions of the spine and are observed across all age groups, with degenerative diseases and neoplasms being the most common (1). Spinal pathology are broadly categorized into neoplastic, traumatic, congenital, metabolic, inflammatory, infectious, and degenerative processes, each capable of producing distinct forms of vertebral changes depending on the severity of deformity and architectural disruption (2). With respect to clinical manifestations, vertebral pathologies may present with diverse patterns of spinal pain that often overlap and closely resemble one another. When a nerve root is compressed by a herniated disc or narrowing of the spinal canal, it often produces symptoms such as back pain, sciatica, numbness, tingling sensation, muscle weakness, and radiculopathy (3,4).

Low bone mineral density (osteoporosis) is a major risk factor in both sexes for vertebral compression fractures. Other risk factors are age, activity level, obesity, smoking, sedentary lifestyle, repetitive stress injuries, trauma, and certain diseases like arthritis, thyroid disease, malignancy, diabetes, and infection (5,6). In children, vertebral collapse can be caused by Langerhans cell histiocytosis, chronic recurrent multifocal osteomyelitis, osteogenesis imperfecta, infections, and neoplasms (7-9).

Since the vertebral column is a vital structure that safeguards the spinal cord and provides bodily support, a comprehensive evaluation is required to identify underlying pathologies in symptomatic patients, thereby enabling timely treatment and reducing associated discomfort and complications. Medical imaging plays a pivotal role in the early detection, characterization, and management of spinal pathologies. While X-rays are useful for initial assessment of spinal alignment, fractures, and degenerative changes, computed tomography (CT) offers superior visualization of cortical bones and is highly effective in detecting complex fractures and bony abnormalities. Nuclear medicine imaging, particularly positron emission tomography (PET) scan, can help in identifying infections, inflammation, and metastatic spread. However, magnetic resonance imaging (MRI) is the gold standard for evaluating spinal pathology in vertebral column structures, including intervertebral disc, spinal cord, nerve roots, and ligaments. This is due to its excellent soft tissue differentiation, lack of ionizing radiation, non-invasiveness, use of various sequences to diagnose pathologies, and its multiplanar ability. It is particularly valuable in diagnosing disc herniation, spinal stenosis, infections, neoplasms, and bone marrow lesions (10).

Magnetic resonance imaging (MRI) is the preferred imaging modality for assessing spinal pathologies, but its diagnostic efficacy in assessing spinal pathology is largely determined by the careful selection and combination of complementary sequences, although each sequence provides unique diagnostic strength but their combinations allow for comprehensive visualization of spinal anatomy and pathology in axial, sagittal and coronal planes thereby enhancing the detection of subtle lesions. Magnetic Resonance Imaging employs a variety of sequences and also leverages on its multiplanar capability to characterize pathological changes (11). Nevertheless, no individual sequence offers complete diagnostic accuracy across the diverse range of spinal diseases. A standard MRI protocol generally incorporates sagittal T1-weighted, sagittal T2-weighted, sagittal STIR (or T2 fat-suppressed), and axial T2 images, which together provide a detailed evaluation of vertebral marrow, intervertebral discs, neural structures, and pathological changes such as edema or inflammation (12,13). While these core sequences effectively detect most degenerative and traumatic lesions, diagnostic precision can be enhanced by supplementing them with targeted sequences based on the clinical scenario. In particular, contrast-enhanced T1 with fat suppression increases reliability in differentiating infection and tumour, while diffusion-weighted imaging (DWI) assists in separating abscesses from phlegmon and in characterizing vertebral fractures, despite

technical challenges (14). Susceptibility-weighted or gradient echo imaging improves detection of hemorrhagic changes in acute trauma, and three-dimensional heavily T2-weighted sequences (MR myelography) offer superior visualization of CSF pathways and intradural abnormalities (15). Furthermore, advanced diffusion techniques such as diffusion tensor imaging (DTI) and diffusion kurtosis imaging (DKI) show promise for revealing subtle cord injuries not detected by routine MRI (16). Thus, the greatest diagnostic value of spinal MRI lies in combining complementary sequences, which collectively enhance both sensitivity and specificity across degenerative, infectious, neoplastic, and traumatic conditions.

On MRI, the most common structural (anatomical) and mechanical (load-related or degenerative) changes include: endplate and marrow changes, Schmorl's nodes, spinal canal stenosis, intervertebral foramina narrowing, intervertebral disc changes, facet joint changes, alignment and mechanical instability, ligamentous and soft tissue changes (17). The role of accurate MRI image interpretation in spinal pathology assessment is crucial, as variation in spinal intensity and morphological alterations provides valuable insights into the presence, extent, and nature of spinal abnormalities. These findings support accurate diagnosis, guide treatment planning, and help in differentiating between degenerative, infectious, traumatic, and neoplastic conditions (18). The aim of the current study is to investigate the diagnostic yield of different MRI sequence combinations in identifying and characterizing spinal pathologies and to explore demographic variations in their occurrence.

METHODS

Ethical approval (UUTH/AD/S/96/VOL.XXII/058) was obtained from the Health Research Ethics Committee of University Of Uyo Teaching Hospital, Uyo, Akwa Ibom State. All patients' information that were obtained was treated with high level of confidentiality.

The centre for this study was Ibom Multi-specialty Hospital, Uyo, Akwa Ibom State, Nigeria. It is a major referral centre in Akwa Ibom State. The hospital was commissioned in 2015 by the Akwa Ibom State government with a mission of reserving medical tourism in the country through top-notch Quaternary Medical service.

A cross-sectional retrospective study was conducted to establish the diagnostic yield and value of different MRI sequence combinations in the evaluation of spinal pathology.

The population for this study are all MRI images, reports, and cases. The study entailed the evaluation of the records of all the patients who underwent MRI scan for suspected spinal pathology, the clinicians' requests, and report for MRI from January 2022 to December, 2025 at Ibom Multispecialty Hospital, Ekit Itam, Uyo, Akwa Ibom State.

A purposive sampling technique was used

The study adopted Taro Yamane's formula to determine the study's sample size:

$n= N/ (1+N[e]^2)$.

N =The population of patients with suspected spinal pathology who underwent MRI scan in Ibom multi-specialty hospital during the projected period.

e = The margin error or desired level of precision set to 0.05

n = ? N = 400 e = 0.05

n = 400/(1+400(0.0025)

n =400/(1+1)

n =400/2

n =200

A sample size of 200 spinal pathology MRI images were retrieved from the MRI suite database of Ibom multi-specialty hospital, Uyo, Akwa Ibom State.

This was a 4-year retrospective study of

clinically suspected spinal pathology that were referred for spinal MRI at Ibom Multi-specialty Hospital, Ekit Itam, Uyo, Akwa Ibom State. All examinations were performed using 1.5 Tesla Vantage Elan Toshiba MRI scanner 2012 model. Relevant MRI images, reports and records of patients were retrieved from the archives and reviewed. Ethical guidelines on medical research were followed. Data collection was conducted over a period of 2 to 3 weeks following the receipt of institutional permission and ethical approval. Records from January 2022 to December 2025 were reviewed and extracted. Clinical information such as age, address, gender, medical history, presenting complaints, provisional diagnosis were extracted from the request forms and MRI sequence combinations used for the various pathologies were collected from the database of the host computer while MRI features, diagnosis and spinal pathology subtypes were obtained from patients' MRI scan reports. Eligible records were identified using the radiology department's archive system. Only records that met the inclusion criteria were selected. No direct contact was made with patients, as the study relied solely on existing MRI images, request forms, reports and records. All data were anonymized at the point of extraction to ensure confidentiality. Data was recorded using a structured data collection proforma that was designed specifically for the study. The proforma consisted of the following sections: Record identification code (no patient names or hospital numbers), demographic variables (age and gender), medical history, presenting complaints, provisional diagnosis, MRI sequence combinations performed, MRI pathology findings, diagnosis, spinal pathology subtype and comment or remarks. Collected data were entered into a password protected electronic spreadsheet and stored on a secure computer, accessible only to the researcher, Backup copies were stored on an encrypted external storage device. Hard copies of the proforma that was used was kept in locked cabinet. All data were retained in accordance with institutional and ethical guidelines, after which they were securely destroyed.

The IBM Statistical Package for Social Science (SPSS) version 25.0 (SPSS Incorporated, Chicago, Illinois) was used to analyze the data that was collected. Data analysis included descriptive statistics such as mean, frequency and percentage which was used to summarize the data. Statistical test such as chi square was used to compare proportion of patients with various MRI findings and clinical presentation.

RESULTS

Socio-Demographic Characteristics of Participants

Table 4.1 shows the gender and age distribution among the participants involved in this study. The study population consisted predominantly of males (62.5%) compared to females (37.5%).

Figure 4.1 also shows the age distribution among the participants and the findings reveal that the majority of participants were aged 60 years and above (39.5%), followed by those aged 40–49 years (25.5%), indicating that spinal conditions were more common among older individuals in this sample.

Table 4.2 shows the descriptive statistics of age among the participants. The mean age of participants was 53.33 with a standard deviation of 15.67 years, with ages ranging from 10 to 89 years, this implies that most patients presenting for MRI examinations to assess spinal pathologies were middle-aged to elderly.

Table 4.1 Distribution of Gender

Variable	Category	Frequency	Percentage (%)
Gender	Male	125	62.5
	Female	75	37.5
	Total	200	100.0

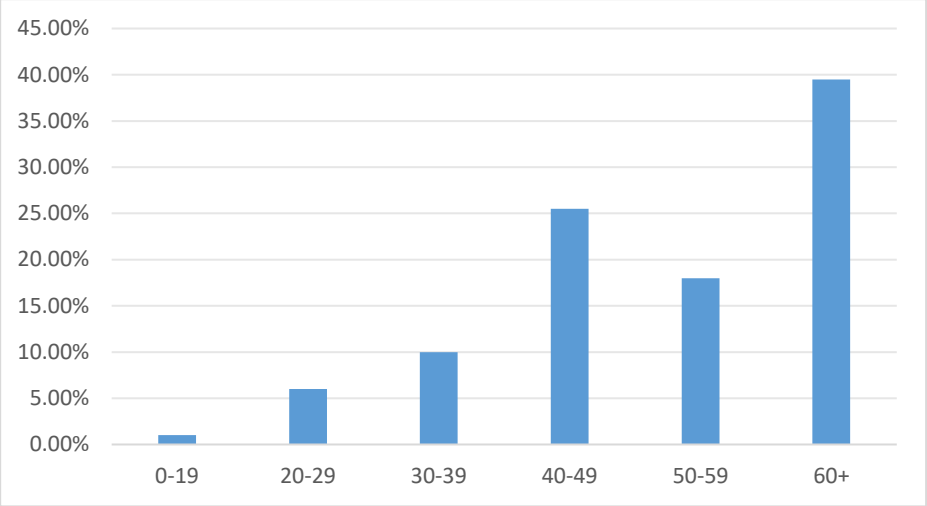


Figure 4-1Distribution of Age groups among participants

Table 4.2 Descriptive statistics of Age

Variable	Mean (years)	Minimum (years)	Maximum (years)	Std dev
Age	53.33	10	89	15.67

Prevalence of spinal pathologies

Figure 4.2 shows the prevalence of different spinal pathologies. Degenerative spinal pathologies were the most prevalent (64.0%), the next in line in order of highest prevalence were traumatic (12.5%), neoplastic (10.0%), inflammatory (9.5%), infectious (2.0%), metabolic (1.0%), and normal findings (1.0%) which were relatively less common. This indicates that the majority of the spinal cases among the study population were degenerative conditions.

Classification of detected pathologies

Total concordant Degenerative cases identified: 106

Proportion of actual Degenerative spinal pathologies reported: $\frac{106}{128} \times \frac{100}{1} = 82.8\%$

82.8% of 64%= 53%

Table 4.3 shows the classification of subtypes into degenerative categories. Among these degenerative conditions, spondylosis (40.6%) and spinal canal stenosis (23.4%) were the most

frequent. A sizeable proportion of cases (17.2%) were identified as discordant due to some disagreement of provisional diagnosis and MRI image findings, resulting in a corrected prevalence of 53% actual degenerative cases across the entire population.

Total concordant inflammatory cases identified: 18

Proportion of actual Inflammatory spinal pathologies reported: $\frac{18}{19} \times \frac{100}{1} = 94.7\%$

Table 4.4 revealed that inflammatory myelopathy (31.6%) and inflammatory spinal canal stenosis (26.3%) were the most frequent inflammatory conditions. After excluding discordant cases, 94.7% of cases were confirmed as actual inflammatory pathologies.

Total Infectious cases identified: 4, hence Proportion of actual Infectious spinal pathologies reported is 100%

Table 4.5 shows that all infectious pathologies were evenly distributed across four subtypes (25.0% each), with a 100% clinical-radiological concordance, indicating complete agreement between the provisional diagnosis and MRI findings in the classification of subtypes into broad categories,

Total concordant Neoplastic cases identified: 15

Proportion of actual Neoplastic spinal pathologies reported: $\frac{15}{20} \times \frac{100}{1} = 75.0\%$

Table 4.6 illustrates that malignant neoplasms constituted the majority (70.0%) of neoplastic cases, while benign cases were few (5.0%). After removing discordant cases, the proportion of actual neoplastic pathologies was 75.0%, indicating some classification disagreement.

Total concordant Traumatic cases identified: 22

Proportion of actual Neoplastic spinal pathologies reported: $\frac{22}{25} \times \frac{100}{1} = 88.0\%$

Table 4.7 shows that fractures and fracture-related spinal cord injuries (24.0%) and spinal cord injuries (20.0%) were the most common traumatic conditions. The adjusted proportion of actual traumatic cases was 88.0%, indicating relatively high clinical-radiological agreement in the classification.

Total Metabolic cases identified: 2, hence proportion of actual Metabolic spinal pathologies reported is 100%

Table 4.8 revealed that metabolic spinal pathologies were rare, with only two cases identified, each representing 50.0%, and both were confirmed as actual cases (100% clinical-radiological concordance agreement) in the classification..

Diagnostic yield of Different MRI sequence combinations

Table 4.9 presents the distribution of diagnostic yield of different MRI sequence combinations. The highest diagnostic yields were observed with T2+STIR+MYELO (32.0%) and T1+T2+STIR+MYELO (31.0%), indicating that combining multiple sequences improves diagnostic performance. Simpler sequences such as T2 (0.5%), T1+T2 (0.5%), T1+STIR (0.5%) demonstrated minimal diagnostic yield. Some simpler sequences also demonstrated better diagnostic yields such as T2+STIR (9%) and T1+T2+STIR (5.5%).

In Table 4.10 the results of the Chi-square test on significance of diagnostic yield of sequences and the findings reveal that there was a statistically significant association between MRI sequence combinations and diagnostic yield ($\chi^2 = 721.637$, df = 20, $p < 0.05$), indicating that the choice of MRI sequence significantly affects diagnostic outcomes.

Relationship between age, gender and prevalence of spinal pathologies

Table 4.11 shows the cross-tabulation of gender and incidence of spinal pathology in the sample. A higher number of males (124) compared to females (73) presented with spinal pathologies. However, both genders had very few cases without spinal pathology.

The results from Table 4.12 show that there was no statistically significant association between gender and the prevalence of spinal pathologies ($\chi^2 = 1.105$, df = 1, $p = 0.293$), suggesting that

spinal pathologies occur independent of gender in this population.

Table 4.13 shows the results of the Spearman's correlation test between age and spinal pathologies which reveals that there was a moderate positive correlation between age and spinal pathologies ($\rho = 0.483$, $p = 0.024$), indicating that the likelihood of spinal pathologies increases with advancing age, and this relationship is statistically significant.

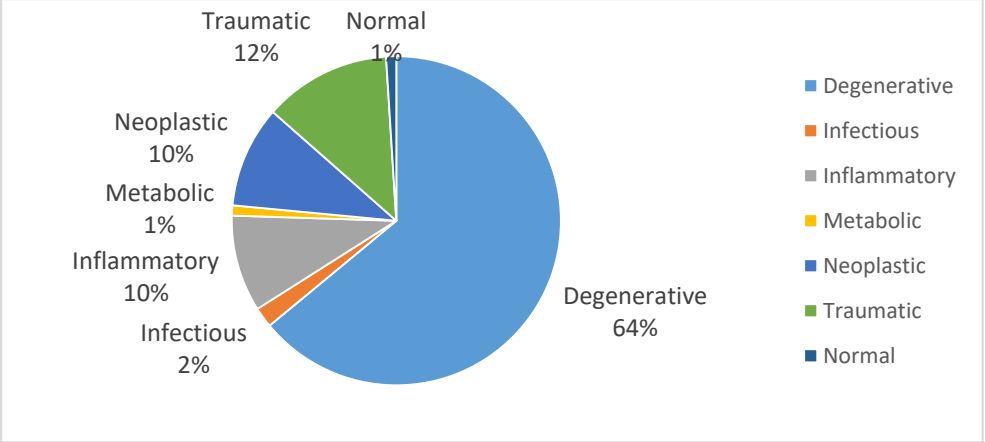


Figure 4-2 Distribution of spinal pathologies among participants.

Table 4.3 Distribution of Degenerative pathologies sub-types among patients (n=128)

Degenerative Pathologies	Included Provisional Diagnoses	Frequency	Percentage (%)
Degenerative Disc Disease	Degenerative disc disease, Cervical disc degenerative disease, Lumbar disc degenerative disease, Disc prolapse, L2/L3 disc herniation, L4/L5 disc herniation	15	11.7
Spondylosis	Cervical spondylosis, Lumbar spondylosis, Thoracolumbar spondylosis, Spondylosis	52	40.6
Spinal Canal Stenosis (degenerative)	Lumbar spinal stenosis, Cervical spinal stenosis, Degenerative lumbar canal stenosis, Degenerative spinal canal stenosis, Lumbar stenosis, Cervical canal stenosis, Spinal canal stenosis	30	23.4
Degenerative Myelopathy	Cervical myelopathy, Degenerative cervical myelopathy	6	4.7
Degenerative Radiculopathy	Lumbar spondyloradiculopathy	1	0.8
Degenerative Disc Narrowing /	L4/L5 disc narrowing, L4/L5 IV disc compression	2	1.6

Compression			
Discordant cases	Metastasis, Sciatica, Trigeminal Neuralgia	22	17.2
Total		128	100.0

Table 4.4 Distribution of Inflammatory spinal pathologies sub-types (n=19)

Inflammatory Pathologies	Included Provisional Diagnoses	Frequency	Percentage (%)
Inflammatory Myelopathy	Myelopathy	6	31.6
Inflammatory Spinal Canal Stenosis	Cervical spinal stenosis, Lumbar spinal stenosis, Degenerative lumbar canal stenosis, Spinal canal stenosis	5	26.3
Inflammatory Disc Disease	Degenerative disc disease	2	10.5
Inflammatory Spinal Degeneration	Degenerative spinal disease	3	15.8
Inflammatory Radiculopathy	Sciatica	1	5.3
Post-inflammatory spinal complication	Failed back syndrome	1	5.3
Discordant cases	Fracture and spinal cord injury	1	5.3
Total		19	100.0

Table 4.5 Distribution of Infectious spinal pathologies sub-types (n=4)

Infectious pathologies	Included Provisional Diagnoses	Frequency	Percentage (%)
Spondylodiscitis	Discitis	1	25.0
Pott's Disease	Pott's Disease	1	25.0
Infectious spinal canal stenosis	Spinal canal stenosis	1	25.0
TB of the spine	TB of the spine	1	25.0
Total		4	100.0

Table 4.6 Distribution of Neoplastic spinal pathologies (n=20)

Neoplastic Pathologies	Included Provisional Diagnoses	Frequency	Percentage (%)
Benign	Suspected tumor	1	5.0
	Metastasis to pleura and spine,		
	Metastasis to the spine,	14	70.0
Malignant	Multiple myeloma		
Discordant cases	Degenerative spinal disease, suspected infection, vertebral body collapse, Lumbar spondylosis	5	25.0
Total		20	100.0

Table 4.7 Distribution of Traumatic spinal pathologies (n=25)

Traumatic Pathologies	Included Provisional Diagnoses	Frequency	Percentage (%)
Spinal Cord Injury (SCI)	Acute traumatic spinal cord injury, Cervical cord injury, Spinal cord injury	5	20.0
Fractures and Fracture-related SCI	Cervical spine fracture, Fracture, Spinal fracture, Fracture and spinal cord injury, Spinal fracture and spinal cord injury	6	24.0
Cord Compression Injuries	Cord compression	4	16.0
Spinal Instability / Vertebral Displacement	C5/C6 Grade 2 spondylolisthesis	1	4.0
Disc Injury	Intervertebral disc prolapsed	1	4.0
Nerve Root Compression	Cervical nerve compression	1	4.0
Post-traumatic Neurological Deficit	Myelopathy	1	4.0
Spinal Shock	Spinal shock	1	4.0
Suspected Spinal Trauma	Suspected cervical spine injury, Trauma	2	8.0
Discordant cases	Cervical spondylosis, Degenerative spinal disease	3	12.0
Total		25	100.0

Table 4.8 Distribution of Metabolic spinal pathologies (n=2)

Metabolic Pathologies	Included Diagnoses	Frequency	Percentage (%)
Vertebral body collapse	L4 vertebral body collapse	1	50.0
Metabolic spinal stenosis	Lumbar spinal stenosis	1	50.0
Total		2	100.0

Table 4.9 Distribution of Diagnostic yield of Different MRI sequence combinations

MRI sequence combination	Cases detected	Total Cases	Average Diagnostic Yield (%)
T1+STIR	1	200	0.5
T1+STIR+GRE	1	200	0.5
T1+T2	2	200	1.0
T1+T2+STIR	11	200	5.5
T1+T2+STIR+CONTRAST	1	200	0.5
T1+T2+STIR+DWI+MYELO+CONTRAST	1	200	0.5
T1+T2+STIR+DWI+MYELO+T1CON	1	200	0.5
T1+T2+STIR+GRE	1	200	0.5
T1+T2+STIR+GRE+MYELO	11	200	5.5
T1+T2+STIR+MYELO	62	200	31.0
T1+T2+STIR+MYELO+CONTRAST	1	200	0.5
T1+T2+STIR+MYELO+T1CON	7	200	3.5
T1+T2+STIR+T1CON	2	200	1.0
T2	1	200	0.5
T2+STIR	18	200	9.0
T2+STIR+DWI	1	200	0.5
T2+STIR+DWI+MYELO+T1CON	1	200	0.5
T2+STIR+GRE+MYELO	6	200	3.0
T2+STIR+MYELO	64	200	32.0
T2+STIR+MYELO+T1CON	2	200	1.0
T2+STIR+T1CON	2	200	1.0
Normal diagnosis	3	200	1.5
Total	200		100.00

Table 4.10 Chi-square test on significance of Diagnostic yield of sequences

Test	Value
Chi-square (χ^2)	721.637
Valid sample size (n)	197
Degree of freedom	20
P-value	<0.001

Table 4.11 Cross tabulation for Chi-square test (Gender vs Pathology)

Gender	Pathology (yes)	Pathology (No)	Total
Male	124	1	125
Female	73	2	75
Total	197	3	200

Table 4.12 Chi-square test summary

Variable	χ^2 value	df	p-value	Decision
Gender vs spinal pathology	1.105	1	0.293	Not significant

Table 4.13 Spearman's correlation test between age and spinal pathologies

Test	Spearman's rho (ρ)	p-value	Interpretation
Age vs Spinal pathologies	0.483	0.024	Moderate relationship

DISCUSSION

Prevalence of spinal pathologies

This study highlighted that degenerative spinal pathologies were the most common category (64.0%) of patients who underwent MRI examination for suspected spinal disorders or problems in Uyo, Akwa Ibom State. The next type of spinal pathologies with the most prevalence were traumatic (12.5%), neoplastic (10.0%), and inflammatory (9.5%) conditions; on the other hand infectious (2.0%) and metabolic (1.0%) pathologies were relatively uncommon. This distribution reveals that the bulk of the disorders reported among the study population were chronic and non-communicable spinal conditions.

The high prevalence of degenerative conditions seen in this study is similar to that of Gopalkrishnan et al. (19) who reported degenerative disc disease as the most common cause of low back pain in patients that underwent MRI evaluation. Similarly, Armenta et al. (20) found that lumbar canal stenosis, disc

herniation, and spondylolisthesis, which are conditions largely linked to degeneration, were the most common spinal pathologies in their large cohort study. These similarities support the idea that degenerative changes are the most common and important contributors to spinal disorders globally.

The reason for the predominance of degenerative conditions may be due to structural deterioration with increasing age, accumulation of bio-mechanical stress, occupational hazards, and lifestyle factors such as physical inactivity and poor posture. This is further supported by the age distribution in the present study where a significant proportion of the participants were aged 60 years and above.

In contrast, Miseer et al. (21) found that the most common causes of spinal pathology in a tertiary hospital setting were trauma and infection. This discrepancy may be explained by the difference in study populations as the study by Miseer et al. (21) specifically focused on hospitalized patients with more severe and acute presentations compared to the present study which included both outpatients and referred cases for MRI, representing a broader clinical spectrum.

Classification of detected spinal pathologies using MRI

The classification of the spinal pathologies subtypes into categories based on the MRI findings revealed that there is a wide range of pathologies, and spondylosis and spinal canal stenosis were the most frequent subcategories within the degenerative group. Abnormalities of the spine relating to the intervertebral disc, such as disc degeneration and disc herniation, were also a significant source of overall burden. In addition, high proportion of actual cases were identified in most categories after discordant cases had been excluded, suggesting consistent categorization of the diagnoses.

These results highlight the importance of MRI as the primary clinical benchmark for the non-invasive characterization of spinal pathology. MRI is more superior compared to other imaging modalities in its soft tissue contrast, multi-planar imaging, and its ability to visualize in sufficient detail the structures in the spine, allowing for accurate differentiation of different pathological entities. This is consistent with the results of Gopalkrishnan et al. (19), who highlighted the key role of MRI in the proper classification of spinal lesions, which results in better decisions regarding the treatment and better clinical outcome.

Furthermore, Faizo (22) reported that MRI is very effective in differentiating between various types of pathologies of the spine, especially abnormalities associated with the spine's discs such as bulges and protrusions, which are also prominent in this current study. It is clinically significant to be able to properly classify pathologies subtypes into categories as this can lead to targeted therapeutic interventions, improved prognostication and better management of patients. The existence of certain discordant cases among the categories, though very few, demonstrates the difficulty in observing the overlap of the disease and the need for standardized criteria for reporting and ongoing training for radiologists for improved diagnostic performance.

Diagnostic yield of MRI sequence combinations

Diagnostic Yield of Sequence Combinations of MRI: - The study showed that combinations of MRI sequences had a significant effect on diagnostic yield, with the combination T2+STIR+MYELO (32.0%) and T1+T2+STIR+MYELO (31.0%) showing the highest detection rates. In contrast, less complex combinations of sequences resulted in less diagnostic outputs. The Chi-square analysis showed furthermore that there is a statistically significant difference in diagnostic yield between the different MRI sequence combinations ($\chi^2 = 721.637$, $df = 20$, $p < 0.001$).

This finding reveals the importance of multi-sequence Magnetic Resonance Imaging protocols in improving diagnostic performance. The addition of sequences such as STIR makes it easier to detect edema and inflammation, and myelographic sequences make it easier to see

the spinal canal and nerve roots. The combination of these sequences enables the assessment of both soft tissue and structural abnormalities ultimately improving the diagnostic yield.

These results are consistent with those of Gopalkrishnan et al. (19) and Faizo (22) who both highlighted the importance of using multiple MRI sequences including contrast enhanced imaging as needed to enhance lesion detection and characterization. The high variation in diagnostic yield level in this study indicates that inappropriate or limited sequence selection may influence the detection and characterization of spinal pathologies and may lead to missed or delayed diagnosis.

The implication of this finding is that radiology departments should focus on development and implementation of standardized and protocol-driven MRI sequence combinations for specific clinical indications. This would not only improve the efficiency of diagnosis but also optimize the resources and outcome of the patients.

Relationship between Age, Gender and Spinal Pathologies

The current study showed a statistically significant moderate positive correlation relationship between age and incidence of spinal pathologies ($\rho = 0.483$, $p = 0.024$), which shows that the risk of developing spinal disorders tends to increase as age advances. This finding is similar to Elnour (23) who found that the prevalence of spinal disorders was highest among those aged over 50 years, as well as Armenta et al. (20) who found that the group of people between 51-60 years were the most affected.

The observed relationship between age and spinal pathology can be attributed to degenerative changes associated with ageing, including intervertebral disc dehydration, loss of disc elasticity, formation of osteophytes and narrowing of the spinal canal. Furthermore, as explained by Rando et al. (26) the body's ability to repair and replace damaged cells gradually declines with age. Consequently, the cumulative effects of mechanical stress and environmental risk factors may increasingly outweigh the body's capacity for tissue repair and regeneration. Overtime, these changes contribute to increased susceptibility to spinal pathologies among older individuals. Green et al. (25) also found that age is an important risk factor for a number of spinal disorders, further endorsing this finding.

Conversely, the study did not find any statistically significant association between gender and spinal pathologies ($\chi^2 = 1.105$, $p = 0.293$), which may indicate that both males and females are equally vulnerable to spinal disorders in this population. This finding is consistent with the study by Elnour (23), who also found no significant association between gender and MRI findings. However, this finding contradicts the findings of Alshami (24), who found gender differences in some spinal conditions, especially higher prevalence of some disorders in females. The discrepancy between these two studies may be caused by differences in study design, population characteristics, or healthcare-seeking behavior. It is also possible that differences between the genders can be specific to a particular condition rather than generalizable across all spinal pathologies.

CONCLUSION

Spinal disorders are a serious health concern for patients undergoing MRI examinations at Ibom Multi-Specialty Hospital, Uyo, Akwa Ibom State, with degenerative conditions being the most common. The high rates of these conditions highlight the effects of aging, lifestyle choices, and ongoing mechanical stress on spinal health. These results emphasize the need for improved preventive healthcare measures and early diagnosis to lessen the impact of spinal disorders.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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DATA AVAILABILITY

The datasets generated and analysed during the current study are available from the corresponding author on reasonable request.

AUTHOR CONTRIBUTIONS

Ohagwu C.C. supervised the study design and data analysis, critically reviewed the manuscript, approved the final version for submission and drafted the manuscript.

Umoh A.I. conceived the study, collected and analysed the data.

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