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The Prevalence And Characteristics Of Baastrup Disease In Patients With Nonspecific Low Back Pain In South-South Nigeria: A Pilot Study.

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Abstract
Objective: *This pilot study aimed to evaluate the prevalence and characteristics of Baastrup disease (BD) among patients presenting with nonspecific low back pain (LBP) at a tertiary hospital in Southern Nigeria.*
Methods: *158 patients (mean age 57.4 ± 14.1 years) underwentan examination ofthe lumbar spine using a 1.5T General Electric MRI scanner. Clinical records were reviewed to document demographics (age, gender, BMI) and imaging findings indicative of BD.*
Results: *Baastrup disease was identified in 52 participants (33%). Among these, interspinous bursitis was observed in 100% of cases, with 28.9% exhibiting kissing spinous processes. Only 36.5% of respondents reported the classic symptom of midline back pain. Prevalence of BD was higherin males (63.5%) than females (36.5%,) with male-to female-ratio of 1.7 :1. This gender difference was statistically significant (P <0. 025). There was no significant* association *between BMI and the incidence of BD* ($p < 0.05$).*Additionally, 98.1% of patients demonstrated degenerative changes, emphasising the relationship between BD and spinal degeneration.*
Conclusions: *Baastrup disease is prevalent among patients with nonspecific LBP in our study population. The findings stress the need for enhanced MRI assessments to accurately identify BD and associated conditions. Further research with larger sample sizes and diverse populations is warranted to deepen understanding of BD's implications on spinal health.*

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I. Introduction

Low back pain (LBP) can be defined as pain between the lower aspect of the ribs and the lower fold of the buttocks. The pain may arise from bones, muscles, or nerves[1]. Based on symptom duration, LBP is classified into acute, sub-acute, and chronic forms[1]. The World Health Organization (WHO) has reported trends in LBP prevalence, particularly in low- and middle-income countries, where it contributes significantly to disability and diminishes quality of life[2]. With an estimated lifetime prevalence rate of 56.2%, annual prevalence of 39.1%, and point prevalence of 17.2%, Nigeria is a particularly affected nation[3]. Despite this considerable burden, specific causal studies focusing on interspinous pathologies, particularly Baastrup disease, remain limited.

Baastrup disease, also known as "kissing spine," is an often-overlooked condition that may significantly contribute to non-specific adult low back pain[4]. First described by Christian Ingerslev Baastrup in 1933[4], this condition arises from the close approximation of adjacent spinous processes, often linked to degenerative changes of the spine, mechanical stress, and altered spinal dynamics[4]. It is characterised by the development of complications such as interspinous bursitis, fibrosis, and potentially the formation of epidural cysts, which can exacerbate the patient's symptoms [5,6]. Patients experiencing Baastrup disease typically present with midline back pain that radiates both cephalad and caudal, particularly aggravated during extension movements and alleviated during flexion [7,8]. The clinical recognition of this condition can be challenging, often resulting in misdiagnosis and inappropriate treatment pathways. Imaging modality magnetic resonance imaging is important in diagnosing BD[9].

The gold standard for evaluating most spinal lesions is magnetic resonance imaging (MRI).[10] This is attributed to its high soft-tissue resolution, noninvasiveness, and multi-axial and multi-planar imaging capabilities. The intervertebral discs, nerve roots, spinal canal and foramina are clearly delineated.[11,12]It allows

for elucidation of the morphology of the spinal structures and has an acknowledged role in planning surgical management,[10] hence its role in the evaluation of patients with LBP.

Most previous studies on LBP in Nigeria have focused on spondylotic changes. None of these studies mentioned Baastrup's disease as one of the potential causes of LBP. The current study is probably the first in our setting to highlight the contribution of Baastrup disease to LBP and it is hoped that it will provide information on MRI frequency and pattern of occurrence of Baastrup's disease in our environment and document the associated MRI findings in the disease.

II. MethodologyAnd Methods

Study Site: This study was conducted at the Radiology Department of the Rivers State University Teaching Hospital (RSUTH) in Port Harcourt, Nigeria. RSUTH is a 375-bed multi-speciality hospital and a population of over five million people. The diverse patient population treated at RSUTH ensures a broad representation in the study, allowing for comprehensive insights into low back pain (LBP) within varying socioeconomic contexts[3].

Study Design and Duration: This research used a cross-sectional study design and a convenient non-random sampling method to assess the prevalence and characteristics of Baastrup disease among patients with non-specific LBP. This design is appropriate for determining prevalence but inherently limits the establishment of causal relationships. The study was conducted over a seven-month period, from January to August 2023, providing ample time for participant recruitment and data collection.

Study Population and Sampling: The study population consisted of patients referred for lumbar spine MRI due to non-specific LBP at the RSUTH Radiology Department. Non-specific LBP is defined as mechanical low back pain that arises intrinsically from the spine, intervertebral disks, or surrounding soft tissues [13].

Inclusion Criteria: Participants recruited into the study included adults aged 21 years and above and individuals diagnosed with non-specific LBP based on established clinical guidelines.
Exclusion Criteria: Participants were excluded from the study if they were under 21, had contraindications for MRI (such as pacemakers or metallic implants), had a history of spinal surgery, exhibited visible spinal anomalies, were unable to provide informed consent due to cognitive impairment, or were diagnosed with specific low back pain related to neoplastic, infectious, or traumatic conditions.

Sample Size Determination: Sample size calculations were based on an internal dataset from the RSUTH Radiology Department, which indicated an average of approximately 2 MRI scans for LBP referrals daily. This translates to roughly 10 referrals per week, leading to an estimated total of around 260 referrals over a six-month study duration. A sample size was calculated using the Taro Yamane formula[14]:

Using the Taro Yamane method,[14]

$$n = \frac{N}{1+N(e)^2}$$

where, n = sample size, N = population under study (260), E = margin of error (usually 0.05)

Therefore, $n = \frac{260}{1+260(0.05)^2}$

This calculation provided a sample size of approximately 158 participants, which allows for adequate statistical power to detect significant findings. A power analysis[15] was performed to determine the required sample size for detecting significant differences in prevalence across demographic groups. Based on previous literature indicating an 8.2% prevalence, we anticipated a minimum clinically relevant effect size of 10%. Applying a significance level of 0.05 and targeting a statistical power of 0.80, G*Power software (version. 3.1.9.7; Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany) indicated a necessary sample size of 158. This ensured adequate powerto detect hypothesized prevalence differences in BD among patients and reinforced the study's ensuring that it is sufficient for the intended statistical comparisons.

Sampling Technique: To recruit 158 patients who met the inclusion criteria, a purposive sampling method was employed. This sampling method ensured that the study focused on participants directly experiencing non-specific LBP, thus promoting the relevance of the collected data. However, selection bias, a major limitation, may affect the ability to generalise the results. Efforts were made to include a diverse participant pool regarding age, sex, and other demographic characteristics to mitigate these concerns.

Procedure methodology

Each participant underwent a comprehensive clinical evaluation, which included collecting demographic data (age, sex, weight, height) and calculating Body Mass Index (BMI) according to WHO criteria. Additional historical data, including occupational history and physical activity levels, were obtained to help identify potential risk factors for LBP. Including these factors would allow for more nuanced analyses, helping to account for possible confounders in assessing the relationship between Baastrup disease and LBP.

MRI Imaging Protocol

All recruited subjects underwent an MRI of the lumbar spine. The MRI scans were performed by a radiographer trained in MRI techniques and images were acquired using a GE^{R} Medical System Signa Creator 1.5 Tesla superconducting magnet, bore size 60cm manufactured in January 2018, using spine phased array coils. All MRI images were interpretedunder the supervision of a Consultant Radiologist with more than 5 years' post fellowship experience.

Patients were positioned supine in the MRI scanner with straight legs to maintain lumbar lordosis, ensuring the median sagittal plane was equidistant from the table edges. A radiofrequency surface coil was placed over the lumbar spine, centring the scan at L2. The table was moved until the patient reached the isocentre.

T1-weighted sagittal images were acquired using a repetition time/echo time (TR/TE) of 648.0/7.2 m/s, along with T2-weighted sagittal and axial images using TR/TE of 2,500.0/103.5 m/s. Short-tau inversion recovery (STIR) and coronal images were also obtained, with a slice thickness of 4 mm for sagittal and axial images. A field of view of 350 mm and 200 mm was used for sagittal and axial images, respectively, with a matrix size 192 by 256. Axial sequences extended from the superior aspect of L1 to the inferior aspect of S1.

Images were stored as DICOM files for analysis. MRI parameters evaluated included kissing spinous processes, bone oedema at articulating surfaces (T1W hypointensity and T2W/STIR hyperintensity), lumbar levels of the affected spinous processes, interspinous bursitis (T1W hypointensity and T2W/STIR hyperintensity), and signs of degenerative spine disease (e.g., disc abnormalities and Modic changes). An MRI diagnosis of Baastrup disease was confirmed based on the presence of interspinous bursitis, bone oedema, and kissing spinous processes, as seen in Figures 1 and 2.

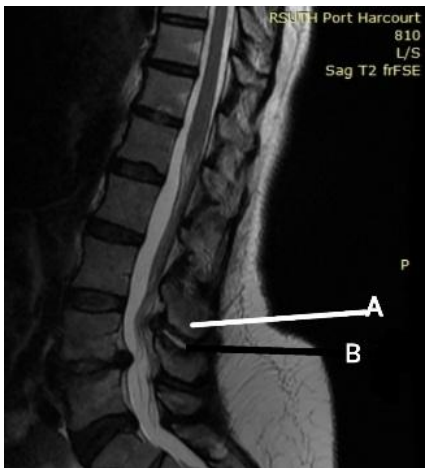

Figure 1: MRI findings in BD on Sagittal T2W MRI of Lumbar spine: (A) high signal intensity in articulating surface of the affected spinous processes, representing Bone oedema. (B) The high signal intensity between spinous processes of L4-L5 representing interspinous bursitis

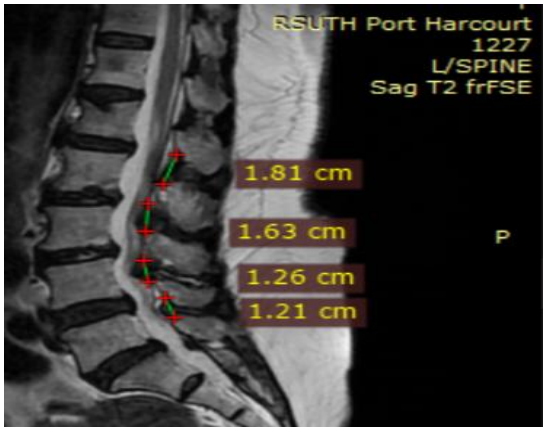

Figure2: Sagittal T2W MRI showing a close approximation of the spinous processes(kissingspine). Note the close approximation of L3-L4 and L4-L5 spinal levels in BD relative to other lumber spinal levels without BD.

Data Management and Analysis

Data analysis was conducted using SPSS version 21 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics analysed continuous variables, while categorical data was analysed using chi-square tests to evaluate associations between demographics and MRI findings. Logistic regression was used to control for potential confounding variables and provide a more comprehensive understanding of the relationships among variables.

Ethics approval

This research study was approved by the Research and Ethics Committee of the Rivers State University Teaching Hospital (REC Study#: 22021103). All individuals have provided written informed consent for this research study. The methodology ensured participant safety and confidentiality were maintained throughout the research process. Potential risks such as claustrophobia were communicated to the participants and addressed.

III. Results

Participant Demographics

Table 1 shows the demographic characteristics: 158 participants with nonspecific low back pain (LBP) underwent lumbosacral spine MRI during the study period. Participants ranged from 21 to 80 years, with a mean age of 57.4 ± 14.1 years. A substantial portion (27.2%) of respondents belonged to the 61-70 age group, while the least represented age group (3.8%) was 21-30 years. Of these participants, 51.3% were male, indicating a relatively balanced gender distribution within the sample.

Table 1: Socio-demographics characteristics of the participants.

Characteristics	Frequency (N=158)	Percentage (%)
Age Group (years)		
21 - 30	6	3.8
31 - 40	17	10.8
41 - 50	31	19.6
51 - 60	32	20.3
61 - 70	43	27.2
71+	29	18.2
Total	158	100.0
Mean Age (SD)	57.4 (14.1)	
Sex		
Male	81	51.3
Female	77	48.7

Characteristics	Frequency (N=158)	Percentage (%)
P-value		0.75

Body Mass Index (BMI)

Table 2 shows the BMI of the study population. The mean BMI of the study population was 27.8 kg/m², with underweight respondents constituting the lowest frequency (0.6%). The overweight population was the largest group at 47%, while 15.2% of participants had a normal BMI (18.5-24.9 kg/m²), and 36.7% were classified as obese (BMI >30 kg/m²).

Table 2: BMI of the study population

BMI Ranges	Frequency (N=158)	Percentage (%)
<18.4 (Underweight)	1	0.6
18.5 - 24.9 (Normal)	24	15.2
25.0 - 29.9 (Overweight)	75	47.5
30.0 - 34.9 (Mildly Obese)	44	27.8
35.0 - 39.9 (Moderately Obese)	11	7.0
40+ (Morbidly Obese)	3	1.9
Total	158	100
Mean BMI (SD)	27.8 (3.73)	

Prevalence and MRI Findings of Baastrup Disease (BD).

The participants' MRI showed a range of findings, including normal findings, features of BD and degenerative changes. One (0.6 %) participant had a normal study. 52 out of 158 (33%) participants had MRI evidence of Baastrup disease with one or more lumber levels affected.

MRI findings, as seen in Table 3, revealed that 28.9% of patients displayed kissing spinous processes, while interspinous bursitis was present in all 52 cases examined. Bone edema was noted in 9.6% of participants. Among the lumbar levels affected by Baastrup disease, L4-L5 exhibited the highest frequency (15.8%), followed by L3-L4 (10.38%), highlighting the prevalent lumbar involvement in this condition.

Table 3: Spectrum of MRI Findings in Participants.

Characteristic	Frequency (n = 52)	Percentage (%)
Kissing Spinous Process		
Yes	15	28.9
No	37	71.1
Interspinous Bursitis		
Yes	52	100
No	0	0
Bone Edema		
Yes	5	9.6
No	47	90.4
Total		
Yes	72	
No	141	
Lumbar Vertebral Level Affected in BD		
Lumbar Level	**Frequency (n=260)**	**Percentage (%)**
L1 - L2	Yes 1	0.38
	No 51	19.6
L2 - L3	Yes 6	2.31
	No 46	17.7
L3-L4	Yes 27	10.38
	No 25	9.61
L4 - L5	Yes 41	15.8
	No 11	4.23

Characteristic	Frequency (n = 52)	Percentage (%)
L5 - S1	Yes 16	6.15
	No 36	13.8
Total		
Yes	91	35
No	169	65

Figure 4 shows the affected vertebral levels. In decreasing order of occurrence, out of the 52 patients with BD, 21 (23.1%) had two spinal level involvement involving mostly L4-L5 and L3-L4, 18 (19.8%) had one spinal level involvement, 8(8.8 %) had three spinal level involvement. In contrast, 5(5.5%) had 4 spinal level involvement.

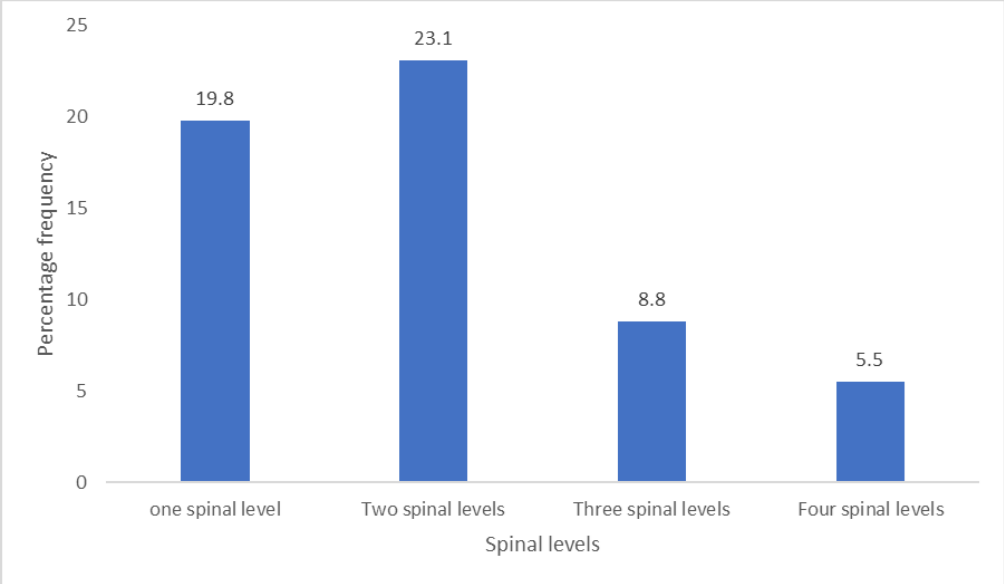

Figure 4; Lumbar vertebral level affectation in BD

Clinical findings in BD

The participants' MRI showed a range of findings, including normal findings and features of BD and degenerative changes. However, only one (0.6 %) participant had a normal study. The classical symptom of Baastrup disease, midline back pain that radiates cephalad and caudal but not laterally, was recorded in 19 (36.5%) respondents with Baastrup disease. The pain was relieved by flexion in 11(21.2%) cases and aggravated by extension in 7 (13.5%). 33(63.5%) of respondents with BD did not have classical midline back pain.

Logistic Regression Analysis

Table 4: shows the logistic regression analysis results indicated a statistically significant association between gender and Baastrup disease, suggesting that males are at higher risk ($p = 0.025$). Notably, no significant associations were found regarding age or BMI ($p > 0.05$).

Table 4: Logistic regression Showing the association of Age, gender and BMI withBaastrup Disease

Predictors	Crude OR (95% C.I)	p-value	Adjusted OR (95% C.I)	p-value
Age Group (years)				
<= 21	-	-	-	-
22 – 31	0.49 (0.01-3.83)	0.603	0.44 (0.10-4.31)	0.650
32 – 41	0.89 (0.15-1.11)	0.080	0.95 (0.14-1.09)	0.070
42+	0.89 (1.92-2.44)	0.070	0.57 (0.23-2.77)	0.670
Gender				
Male	-	-	-	-
Female	0.76 (0.23-0.93)	0.031	0.85 (0.21-0.81)	0.025*

Predictors	Crude OR (95% C.I)	p-value	Adjusted OR (95% C.I)	p-value
BMI				
Underweight	-	-	-	-
Normal	1.39 (0.32-9.59)	0.280	1.94 (0.53-90.16)	0.138
Overweight	1.59 (0.43-6.67)	0.201	2.23 (0.76-12.32)	0.081
Obese	1.29 (0.30-4.70)	0.309	1.91 (0.52-7.28)	0.102
Morbidly Obese	0.69 (0.32-1.22)	0.200	0.69 (1.32-1.52)	0.571

IV. Discussion

This study showed that prevalence of Baastrup disease (BD) among patients with nonspecific low back pain (LBP) was 33%. This finding highlights BD as a significant contributor to LBP within our local population. Notably, the prevalence identified in this study markedly surpasses previously published reports in other regions. While several studies have investigated BD, most prior publications comprise case reports or small-scale cadaveric investigations[16,17]. Maes et al. [17] examined a larger sample size of 539 patients, revealing a prevalence of 8.2%. In our study, the significantly higher frequency of 33% may stem from the age distribution of our cohort, wherein the average participant was older (57.4 years) compared to the broader demographics observed in previous studies, which included younger participants from a range of 7 to 89 years[17]. This age-related trend underscores the critical need for age-specific diagnostic criteria and raises the necessity for future studies to employ a similar age stratification to facilitate accurate comparisons.

The discrepancy in BD prevalence may also arise from definitions used to establish the diagnosis. For example, Kwong et al. [16] utilized abdomen-pelvic CT to ascertain prevalence and reported a higher frequency of 41%. While their approach enabled the identification of BD, the limitations of non-spinal focused imaging could yield incidental findings rather than definitive diagnoses. As MRI is the preferred method for assessing soft tissue structures, our findings emphasize the role of MRI in providing comprehensive insights into the pathology associated with BD. Also, the criteria employed in our study involved comprehensive imaging assessments that focused on three major indicators: interspinous bursitis, bone oedema, and kissing spinous processes, enhancing the overall diagnostic accuracy.

Interestingly, the limited number of reported cases of BD from our environment in the literature shows the need for broader research. Traditional teaching may categorize BD as solely a condition affecting older adults, but our results challenge this notion. While a significant number of participants diagnosed with BD (85%) were aged 41 years and above, the spectrum of age in which BD may present is broader than previously acknowledged. Data indicating that non-specific low back pain symptoms may appear in younger athletes engaged in sports necessitate clinical awareness[18]. This may be noted in competitive sports involving repetitive spinal flexion and extension, such as gymnastics, which may predispose athletes to develop BD and associated pathologies[18].

The gender distribution of BD in our study indicated a male predominance (male-to-female ratio of 1.7:1). This finding contrasts with previous studies, such as those conducted by Kwong et al.[16] and Maes et al.[17], where they noted no significant gender-based discrepancies (p-value > 0.05). In our research, males demonstrated a statistically significant higher susceptibility to BD ($p = 0.025$), suggesting exploring potential biological differences in spinal anatomy or lifestyle factors between genders that could contribute to these findings. Nonetheless, caution must be exercised in interpreting these results, as our pilot sample size may not offer a comprehensive picture of the population.

While our results suggest a lack of significant associations between BMI and the incidence of BD ($p > 0.05$), this finding is an important area for further research. Existing literature suggests that excess body weight may increase stress on the lumbar spine, predisposing individuals to degenerative conditions[19]. However, direct links between BMI and BD are limited, thus requiring more research. Given the complex interactions between physical health, lifestyle factors, and structural diseases of the spine, an extensive investigation that includes a large sample size and considers BMI as a confounding factor in BD is needed.

The clinical presentation of Baastrup disease is important for proper diagnosis and treatment. Only 19 of 52 respondents (36.5%) reported the classic symptom of midline back pain that radiates from cephalad and caudal and is aggravated by extension while being relieved with flexion. A significant portion (63.5%) of the participants with BD did not exhibit these classic symptoms. This disparity shows that clinical manifestations alone may not suffice for diagnosing BD, advocating for thorough radiologic investigations that include MRI as a standard process in assessing patients with nonspecific LBP.

Our findings regarding the spectrum of positive MRI findings are significant, as interspinous bursitis was present in 100% of the participants diagnosed with BD. Identifying bone oedema among 9.6% of patients signifies underlying inflammatory processes in the development of BD. The presence of kissing spinous processes in 28.9% of cases reinforces that multiple MRI indicators must be considered for an accurate

diagnosis. Previous literature documented a broader array of MRI findings associated with BD, such as cystic lesions, sclerosis, and midline epidural fibrotic masses [9]. Our study's reliance on MRI may limit the breadth of the clinical picture, urging further investigation into the diagnostic protocols that integrate various imaging modalities capable of revealing a more complete understanding of this condition.

Compounding our understanding of BD, the study found a strong association between BD and degenerative changes, with 98.1% of participants exhibiting signs of degeneration or other degenerative processes in the spine. This raises essential considerations regarding the potential interrelations between these two conditions. Researchers should remain circumspect, recognizing that while BD may co-occur with degenerative pathologies, exploring whether these factors present causative relationships or signify common underlying mechanics leading to LBP remains crucial.

The study identified that the most frequently affected spinal level in cases of Baastrup disease was L4-L5 (78.8%). The anatomical significance of this region is of note as it serves as a pivotal junction for mechanical loading and movement. This suggests it may be susceptible to wear and tear due to its functional role in weight-bearing and mobility [16].

The multiplicity of affected spinal levels observed in participants (with many having two or more levels affected) further emphasises the complex nature of BD. As indicated by previous studies,[20-23] BD at multiple levels warrants careful diagnostic evaluations to understand better how structural dynamics and movement may contribute to its development. This multifactorial process underscores the need for comprehensive assessments in a clinical environment to accurately diagnose and differentiate BD from other spinal conditions.

While this pilot study provides valuable insights, certain limitations should be acknowledged. The cross-sectional design inherently restricts the ability to infer causation. While sufficient for a pilot study, the sample size may not fully represent the broader population of patients with nonspecific LBP. Furthermore, reliance on self-reported symptoms could introduce bias, as individuals may interpret their pain differently.

V. Clinical Implications And Future Research Directions

The present study placed Baastrup disease at the forefront as a significant contributor to nonspecific low back pain among the Nigerian population. Increasing awareness and clinical vigilance are required to diagnose and manage it properly. Longitudinal studies with more extensive, heterogeneous populations of patients would be suitable for future research, relating the course of Baastrup disease to degenerative changes that could avail useful information in formulating better management strategies for the disease.

VI. Recommendations

1. Multicentred studies should be conducted to include diverse populations and understand the prevalence and characteristics of Baastrup disease across different demographics.
2. Multidisciplinary approaches combining clinical evaluations, imaging modalities, and patient-reported outcomes should be developed to obtain a diagnostic criterion for Baastrup disease.
3. Collaboration between rheumatologists, orthopaedists, and radiologists should be encouraged to enhance awareness and improve diagnostic protocols for Baastrup disease in clinical practice.
4. Increase educational initiatives for healthcare providers regarding the recognition, diagnosis, and management of Baastrup disease is recommended to ensure timely intervention and effective patient care.

By implementing these recommendations, future studies can enhance the understanding of Baastrup disease and its impact on patients suffering from low back pain, ultimately improving clinical outcomes.

VII. Conclusion

This pilot study shows that Baastrup disease is an important cause of nonspecific low back pain and that its prevalence in this study population was high. The results also support placing more emphasis in clinical practice on imaging tests to arrive at an early and precise diagnosis of this condition. Future studies should work toward refining the diagnostic criteria and expanding the demographic, clinical, and radiological aspects explored in this pilot study, with the final goal of improving patient management and outcomes for individuals affected by Baastrup disease.

- **Contributors**: All authors were involved in the study conception and design, analysis, and interpretation of data. All authors approved the final version of the article to be published. Study conception and design: COB, UEW, MAN, RED, NNC, AMO. Data acquisition: COB, AMO, MAN. Analysis and interpretation of data: COB, UEW, MAN, RED, NNC, AMO
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