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ORIGINAL RESEARCH

Assessment of Correlation between Ankylosing Spondylitis Disease Activity Score and MRI Scoring in Patients with Ankylosing Spondylitis: A Cross-sectional Study

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ABSTRACT

Aim: To evaluate the correlation between Ankylosing Spondylitis Disease Activity Score based on C-reactive protein (ASDAS-CRP) and MRI-based inflammatory scores (SPARCC and Berlin scores) in patients with Ankylosing Spondylitis.**Material and Methods:** This hospital-based, cross-sectional observational study was conducted Department of General Medicine, ShriRamkrishna Institute of Medical Sciences &Sanaka Hospitals, Durgapur, West Bengal, India. Eighty patients diagnosed with Ankylosing Spondylitis according to the Modified New York Criteria were enrolled. Clinical evaluation included detailed history, physical examination, and calculation of ASDAS-CRP scores. MRI of the sacroiliac joints and lumbar spine was performed using a 1.5 Tesla scanner, and scoring was done using the SPARCC and Berlin MRI indices. Statistical analysis was performed to assess the correlation between clinical and MRI scores using Pearson or Spearman correlation coefficients, with a p-value of <0.05 considered statistically significant.**Results:** The mean age of the study population was 36.2 ± 8.5 years, with a male predominance (77.5%). The mean disease duration was 6.8 ± 3.4 years, and 83.8% of patients were HLA-B27 positive. The mean ASDAS-CRP score was 2.9 ± 0.7, with the majority having high or very high disease activity. MRI findings showed active sacroiliitis in 91.3% and spinal inflammation in 82.5% of patients. A moderate positive correlation was observed between ASDAS-CRP and SPARCC scores (r=0.62, p<0.001) and between ASDAS-CRP and Berlin scores (r=0.57, p<0.001). Patients with high or very high ASDAS-CRP scores had significantly more active sacroiliac and spinal inflammation on MRI compared to those with lower disease activity (p=0.045 and p=0.032, respectively).**Conclusion:** A significant moderate correlation exists between clinical disease activity measured by ASDAS-CRP and inflammatory changes detected by MRI in Ankylosing Spondylitis. Integrating clinical assessment with MRI evaluation enhances disease monitoring and can guide more effective treatment strategies.

Keywords: Ankylosing Spondylitis, ASDAS-CRP, MRI Scoring, SPARCC Score, Berlin Score

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INTRODUCTION

Ankylosing Spondylitis (AS) is a chronic, immune-mediated inflammatory disease primarily affecting the axial skeleton, leading to structural and functional impairments that significantly impact quality of life. The disease is characterized by inflammation of the sacroiliac joints, spine, and entheses, and over time can cause ankylosis and irreversible structural damage. Early detection and accurate monitoring of disease activity are crucial in preventing progression and optimizing patient outcomes. In this context, the accurate assessment of disease activity forms the cornerstone of clinical management in AS.[1]

Traditionally, the evaluation of disease activity in AS has been largely dependent on patient-reported outcomes and clinical indices. Tools such as the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) have been widely used to gauge symptom severity and functional impairment. However, reliance solely on subjective measures has certain limitations, as these assessments may not always correlate with underlying objective inflammation. To address this gap, the Ankylosing Spondylitis Disease Activity Score (ASDAS) was developed, incorporating both patient-reported symptoms and an acute phase reactant such as C-reactive protein (CRP) or erythrocyte sedimentation rate (ESR), thereby providing a more objective evaluation of disease activity.[2]

Parallel to the evolution of clinical scoring systems, imaging modalities have revolutionized the assessment of inflammatory activity in AS. Magnetic Resonance Imaging (MRI), in particular, has emerged as the gold standard for detecting early sacroiliitis and spinal inflammation, even before radiographic changes become apparent. MRI offers the unique advantage of visualizing both active inflammation and structural damage without radiation exposure. It is especially valuable in cases where clinical assessments alone are insufficient or inconclusive. MRI scoring systems such as the Spondyloarthritis Research Consortium of Canada (SPARCC) score for the sacroiliac joints and Berlin MRI score for the spine have been developed to quantify the burden of inflammation in a standardized and reproducible manner.[3]

Despite these advancements, the relationship between clinical disease activity indices and MRI findings in AS remains complex. Several studies have explored the correlation between ASDAS and MRI scores, with varying degrees of association reported. Some studies suggest a moderate correlation, indicating that higher clinical disease activity often reflects greater inflammatory burden on imaging. Others, however, highlight discrepancies, especially in patients with significant symptomatology but minimal objective inflammation, or vice versa. Factors such as the presence of comorbid conditions, including fibromyalgia, can further complicate this relationship by amplifying patient-reported symptoms independent of true inflammatory activity.[4,5]

Moreover, the presence of extra-articular manifestations and associated comorbidities such as cardiovascular disease, metabolic syndrome, and psychological disorders can influence both disease activity measures and MRI findings. These comorbidities may not only increase symptom burden but also modulate systemic inflammation, thereby affecting laboratory parameters like CRP and clinical assessments. Consequently, comprehensive evaluation strategies that integrate clinical, laboratory, and imaging data are critical in providing an accurate representation of disease activity in AS patients.[6]

The advent of biologic therapies, particularly tumor necrosis factor (TNF) inhibitors and interleukin-17 (IL-17) inhibitors, has further underscored the need for precise assessment tools. Early and effective intervention with biologics has been shown to reduce spinal inflammation, prevent radiographic progression, and improve patient outcomes. Clinical trials investigating the efficacy of biologics have consistently used MRI as an outcome measure to objectively demonstrate reduction in inflammation. Therefore, understanding the correlation between clinical disease activity scores such as ASDAS and MRI findings has important implications not only for routine clinical practice but also for research settings and therapeutic decision-making.[7,8]

International guidelines now advocate a treat-to-target approach in the management of AS and axial spondyloarthritis, emphasizing regular monitoring and adjustment of therapy based on predefined targets of disease activity. In this framework, ASDAS has been recognized as a preferred tool for disease monitoring, given its sensitivity to change and ability to capture both subjective and objective components of inflammation. However, the real-world correlation between ASDAS scores and MRI-documented inflammation needs further

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exploration, particularly in diverse patient populations and across different stages of disease duration.[9,10]

AIM AND OBJECTIVES

Aim

The aim of this study was to assess the correlation between the Ankylosing Spondylitis Disease Activity Score based on C-reactive protein (ASDAS-CRP) and MRI scoring in patients diagnosed with Ankylosing Spondylitis (AS), specifically focusing on the inflammatory activity in the sacroiliac joints and spine.

Objectives

1. To evaluate the disease activity in patients with Ankylosing Spondylitis using the ASDAS-CRP score.
2. To assess the inflammatory changes in the sacroiliac joints and spine of patients with Ankylosing Spondylitis using MRI scoring systems (SPARCC for sacroiliac joints and Berlin MRI Spine Score for spinal inflammation).
3. To determine the correlation between ASDAS-CRP scores and MRI findings, specifically the SPARCC sacroiliac joint score and Berlin spine score, in assessing disease activity and inflammation.
4. To compare the presence of active inflammation in the sacroiliac joints and spine across different disease activity levels as classified by the ASDAS-CRP score.

MATERIALS AND METHODS

Study Design

This was a hospital-based, cross-sectional observational study. The study aimed to assess the correlation between the Ankylosing Spondylitis Disease Activity Score (ASDAS-CRP) and MRI scoring in patients diagnosed with Ankylosing Spondylitis (AS).

Study Population

A total of 80 patients diagnosed with Ankylosing Spondylitis as per the Modified New York Criteria were consecutively recruited from both outpatient and inpatient services of the Department of General medicine and tropical medicine. All patients were aged between 18 and 55 years.

Study Place

The study was conducted in the Department of General Medicine in collaboration withDepartment of Orthopaedic and Department of Pathology, ShriRamkrishna Institute of Medical Sciences &Sanaka Hospitals, Durgapur, West Bengal, India.

Study Period

The study was carried out over a period one year and five months, from July 2023 to November 2024.

Ethical Considerations

The study received approval from the Institutional Ethics Committee before initiation. Written informed consent was obtained from all participants prior to enrollment to ensure their voluntary participation and confidentiality. All procedures conformed to ethical guidelines in research involving human participants.

Inclusion Criteria

Patients who met the following criteria were included in the study:

- Aged between 18 and 55 years.
- Diagnosed with Ankylosing Spondylitis according to the Modified New York Criteria.
- No prior biological therapy within the last 3 months.
- Availability of recent MRI of the sacroiliac joints and spine (within the last 4 weeks).
- Willingness to participate and provide written informed consent.

Exclusion Criteria

Patients were excluded from the study if they met any of the following conditions:

- Presence of other inflammatory rheumatic diseases (e.g., rheumatoid arthritis, psoriatic arthritis).
- History of spinal surgery or spinal fractures.
- Contraindications to MRI, such as the presence of pacemakers or metallic implants incompatible with MRI.
- Pregnancy or lactation.
- Incomplete clinical data or poor-quality MRI images.

Clinical Assessment

All participants underwent a comprehensive clinical evaluation, which included a detailed medical history and thorough physical examination. The disease activity was assessed using the Ankylosing Spondylitis Disease Activity Score based on C-reactive protein (ASDAS-CRP), which incorporates components like:

- Patient’s global assessment of disease activity.
- Severity of back pain.
- Presence of peripheral pain or swelling.
- Duration of morning stiffness.
- Serum C-reactive protein (CRP) levels (measured in mg/L).

The role of pathologist includes:

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- **Histopathological Analysis of Tissue Samples**: Although this study primarily focuses on disease activity and MRI findings, pathologists may analyze tissue biopsies (e.g., synovial biopsies or bone samples) to assess the presence of inflammation, fibrosis, or structural changes associated with ankylosing spondylitis (AS).
- **Identifying Inflammatory Changes**: Pathologists can assess the degree of inflammation in affected tissues, such as the sacroiliac joints, spine, or peripheral joints, which correlates with MRI findings.
- **Assisting in Disease Understanding**: Providing insights into the pathogenesis of AS, especially if there are unusual findings in MRI scans, such as bone erosion, syndesmophytes, or enthesitis, which can be corroborated by tissue examination.
- **Differentiating AS from Other Conditions**: Pathologists may help rule out other conditions with similar MRI findings (e.g., psoriatic arthritis or osteoarthritis), ensuring accurate diagnosis.

MRI Acquisition and Scoring: Magnetic Resonance Imaging (MRI) of the sacroiliac joints and lumbar spine was performed for all patients using a 1.5 Tesla MRI scanner. The MRI imaging followed standardized protocols including T1-weighted spin echo sequences and Short Tau Inversion Recovery (STIR) sequences for optimal visualization of inflammatory lesions. The MRI images were independently evaluated by two experienced musculoskeletal radiologists who were blinded to the clinical details of the patients.

MRI scoring was conducted using:

- **Spondyloarthritis Research Consortium of Canada (SPARCC) MRI Index** for assessing sacroiliac joint inflammation.
- **Berlin MRI Spine Score** for evaluating spinal inflammation.
- For each patient, the mean of the scores from the two radiologists was used for the final analysis. In case of a discrepancy exceeding 10% between the two readers, a consensus reading was performed to ensure accuracy and consistency.

Outcome Measures

The primary outcome measure was the correlation between the ASDAS-CRP and MRI scores (SPARCC and Berlin scores) for assessing disease activity and inflammation in patients with Ankylosing Spondylitis.

Statistical Analysis

Data were compiled and analyzed using SPSS version 26.0. Descriptive statistics were used to summarize baseline characteristics. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables were presented as frequencies and percentages. The correlation between ASDAS-CRP and MRI scores (SPARCC and Berlin scores) was assessed using Pearson or Spearman correlation coefficients, depending on the normality of the data. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1: Baseline Demographic and Clinical Characteristics

Characteristic	Value
Mean age (years)	36.2 ± 8.5
Gender	
Male	62 (77.5%)
Female	18 (22.5%)
Mean disease duration (years)	6.8 ± 3.4
Mean CRP level (mg/L)	12.6 ± 8.2
HLA-B27 positivity	67 (83.8%)

The baseline demographic and clinical characteristics of the study population are summarized in Table 1. The mean age of the enrolled 80 patients was 36.2 ± 8.5 years, indicating a predominantly young to middle-aged cohort. Males comprised the majority of the study population, accounting for 77.5% (62 patients), while females made up 22.5% (18 patients), reflecting the known male predominance in Ankylosing Spondylitis. The mean disease duration among patients was 6.8 ± 3.4 years, suggesting that most participants had an established disease course. The mean C-reactive protein (CRP) level was recorded as 12.6 ± 8.2 mg/L, reflecting ongoing inflammatory activity. A high prevalence of

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HLA-B27 positivity was observed, with 83.8% (67 patients) testing positive, which aligns with the genetic association commonly reported in AS populations.

Table 2: Distribution of Ankylosing Spondylitis Disease Activity Scores (ASDAS-CRP)

ASDAS-CRP Score Range	Number of Patients (%)
<1.3 (Inactive disease)	4 (5.0%)
1.3–2.1 (Moderate disease activity)	18 (22.5%)
2.1–3.5 (High disease activity)	36 (45.0%)
>3.5 (Very high disease activity)	22 (27.5%)
Mean ASDAS-CRP score	**2.9 ± 0.7**

The distribution of Ankylosing Spondylitis Disease Activity Scores (ASDAS-CRP) among the study participants is presented in Table 2. A small proportion of patients, 5.0% (4 patients), had inactive disease with ASDAS-CRP scores of less than 1.3. Moderate disease activity (ASDAS-CRP scores between 1.3 and 2.1) was noted in 22.5% (18 patients). The majority of the patients, 45.0% (36 patients), exhibited high disease activity with scores between 2.1 and 3.5. Additionally, very high disease activity (ASDAS-CRP >3.5) was observed in 27.5% (22 patients). The mean ASDAS-CRP score for the cohort was 2.9 ± 0.7, indicating that most patients fell into the high disease activity range.

Table 3: MRI Scores among the Study Population

MRI Parameter	Mean ± SD
SPARCC Sacroiliac Joint Score	18.4 ± 6.5
Berlin Spine MRI Score	12.2 ± 5.1
Presence of active sacroiliitis	73 (91.3%)
Presence of spinal inflammation	66 (82.5%)

MRI findings among the study population are detailed in Table 3. The mean SPARCC Sacroiliac Joint (SIJ) score was 18.4 ± 6.5, while the mean Berlin Spine MRI score was 12.2 ± 5.1. Active sacroiliitis, defined by inflammatory changes in the sacroiliac joints on MRI, was present in 91.3% (73 patients). Similarly, spinal inflammation was detected in 82.5% (66 patients). These findings highlight that MRI evidence of active inflammation was common in this patient cohort, supporting the clinical diagnosis and severity of the disease.

Table 4: Correlation between ASDAS-CRP and MRI Scores

Correlation	Correlation Coefficient (r)	p-value
ASDAS-CRP vs SPARCC SIJ Score	0.62	<0.001
ASDAS-CRP vs Berlin Spine Score	0.57	<0.001

The correlation analysis between ASDAS-CRP scores and MRI findings is presented in Table 4. A moderate positive correlation was found between ASDAS-CRP and SPARCC SIJ scores, with a correlation coefficient (r) of 0.62 and a p-value of <0.001, indicating a statistically significant relationship. Similarly, a moderate positive correlation was observed between ASDAS-CRP and Berlin Spine scores, with an r value of 0.57 and a p-value of <0.001. These results suggest that higher disease activity, as assessed by ASDAS-CRP, is associated with greater inflammatory burden on MRI, both in the sacroiliac joints and spine.

Table 5: Comparison of MRI Inflammation Presence across Disease Activity Categories

Disease Activity (ASDAS-CRP category)	Active Sacroiliitis Present (%)	Spinal Inflammation Present (%)
Inactive/Moderate (n=22)	18 (81.8%)	15 (68.2%)
High/Very High (n=58)	55 (94.8%)	51 (87.9%)
p-value	0.045	0.032

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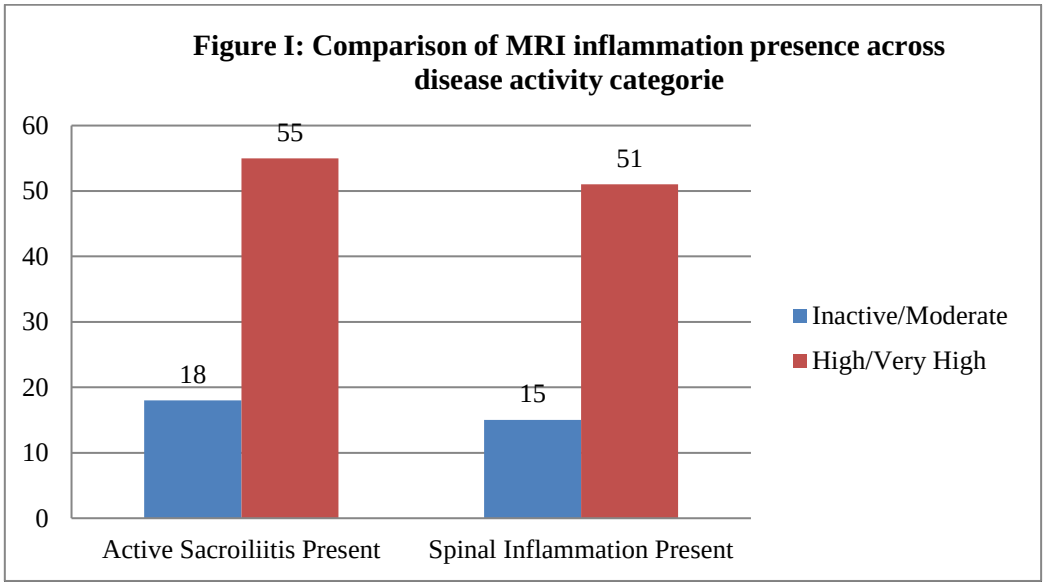

Table 5 compares the presence of MRI-detected inflammation across different ASDAS-CRP disease activity categories. Among patients with inactive or moderate disease activity (n=22), active sacroiliitis was present in 81.8% and spinal inflammation was noted in 68.2%. In contrast, among those with high or very high disease activity (n=58), active sacroiliitis was observed in 94.8% and spinal inflammation in 87.9% of cases. The difference between these groups was statistically significant for both sacroiliitis (p=0.045) and spinal inflammation (p=0.032). This indicates that patients with higher clinical disease activity are significantly more likely to have active inflammatory changes detectable on MRI.

DISCUSSION

The demographic profile of our study population showed a mean age of 36.2 years with a clear male predominance (77.5%), findings that are consistent with the typical epidemiological characteristics of Ankylosing Spondylitis described in the literature. A high prevalence of HLA-B27 positivity (83.8%) was observed, which corroborates the genetic association highlighted by **Warde et al (2011)**, who reported that HLA-B27 positivity plays a crucial role in disease susceptibility through aberrant peptide processing.[11] Similarly, **Evans et al (2011)** emphasized the interaction between HLA-B27 and ERAP1 genes, further supporting the strong genetic background seen in AS patients.[12] The mean disease duration of 6.8 years and elevated CRP levels in our study indicate ongoing inflammatory activity, which aligns with observations made by **Walsh et al (2021)**, who highlighted that active systemic inflammation is a key feature in the clinical course of axial spondyloarthritis.[13]

The distribution of disease activity scores in our cohort, where most patients fell into the high (45.0%) or very high (27.5%) activity categories, reflects a substantial inflammatory burden. The mean ASDAS-CRP score of 2.9 ± 0.7 in our study suggests that active disease is common among clinic-based populations, similar to findings reported by **Proft et al (2022)**, who validated the ASDAS as a reliable index in assessing disease severity in axial SpA. In their study, elevated ASDAS scores were strongly associated with objective signs of inflammation, reinforcing the clinical relevance of ASDAS-CRP in routine practice.[14] Furthermore, the role of sex differences could also be considered, as **Cunha et al (2022)** noted that males with axial SpA often present with more severe radiographic and clinical disease, which may partly explain the higher disease activity seen in our predominantly male cohort.[15]

MRI findings in our study revealed high mean SPARCC and Berlin scores, with 91.3% of patients showing active sacroiliitis and 82.5% exhibiting spinal inflammation. These results are consistent with findings from the SPACE study as reported by **Lorenzin et al (2020)**, who demonstrated that MRI-detectable inflammation in the sacroiliac joints and spine is common, even in early disease stages.[16] Additionally, **Weber et al (2015)** found that while SIJ MRI remains essential for diagnosis, spinal MRI can provide incremental diagnostic value, particularly in patients with non-radiographic axial SpA. Our findings support the notion that both SIJ and spinal imaging contribute

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significantly to the evaluation of disease activity and structural damage.[17]

A moderate positive correlation was observed between ASDAS-CRP scores and MRI inflammatory scores (SPARCC SIJ score r = 0.62, Berlin Spine score r = 0.57), both statistically significant. This finding highlights the relationship between clinical disease activity and MRI evidence of inflammation. **Lau et al (2017)** similarly reported that MRI activity scores for the sacroiliac joints and spine were significantly correlated with ASDAS scores, underlining the importance of combining clinical and imaging assessments in axial SpA.[18] Furthermore, studies such as that by **Arnbak et al (2012)** emphasized that MRI findings not only reflect current inflammation but can also predict disease progression over time, thus serving as an important biomarker alongside clinical indices.[19]

The comparison of MRI-detected inflammation across different ASDAS-CRP activity categories in our study revealed that patients with higher disease activity had a significantly greater prevalence of active sacroiliitis and spinal inflammation. These results align with the observations made by **Nair et al (2022)** in rheumatoid arthritis, where imaging modalities like musculoskeletal ultrasonography showed strong concordance with clinical activity indices, suggesting that imaging can accurately mirror disease burden.[20] Although MRI remains more expensive and less accessible than laboratory markers, its ability to detect subclinical inflammation, as discussed by **Mabray et al (2015)** in the context of imaging innovations, makes it an invaluable tool for comprehensive disease assessment.[21]

LIMITATIONS OF THE STUDY

- **Cross-Sectional Design**: As this is a cross-sectional study, it provides a snapshot of the correlation between ASDAS-CRP scores and MRI findings at a single point in time. It does not allow for the evaluation of the progression of disease or the impact of long-term treatment.
- **Single Centre**: The study was conducted at a single tertiary care hospital, which may limit the generalizability of the findings to other populations with Ankylosing Spondylitis. The sample may not be representative of all patients with AS in different geographic regions or healthcare settings.
- **Limited Sample Size**: With only 80 participants, the sample size may be insufficient to detect subtle differences in disease activity and MRI findings, particularly in less common manifestations of the disease.
- **MRI Imaging Limitations**: While MRI is a sensitive tool for detecting inflammation, it is not perfect. Variability in image quality, interpretation errors, and the subjective nature of MRI scoring could introduce bias. Even though consensus readings were performed in case of discrepancies, some degree of observer variability cannot be entirely ruled out.
- **Exclusion of Patients on Biological Therapy**: The exclusion of patients who have received biological therapy within the last three months may limit the applicability of the findings to patients on active biologic treatments. The effect of these therapies on disease activity and MRI findings was not assessed.
- **Absence of Other Disease Modifying Anti-Rheumatic Drugs (DMARDs) Assessment**: The study did not assess the impact of non-biologic DMARDs on disease activity and MRI findings, potentially missing relevant information about the role of these treatments in modifying disease progression.

CONCLUSION

In this study,authors found thata moderate to strong correlation between the ASDAS-CRP disease activity score and MRI scores (SPARCC and Berlin) in assessing inflammation in the sacroiliac joints and spine in patients with Ankylosing Spondylitis. The findings suggest that higher disease activity, as measured by ASDAS-CRP, is associated with increased inflammatory burden on MRI, supporting the utility of both clinical and imaging tools in monitoring disease activity.

MRI imaging remains a valuable adjunct to clinical assessments, particularly in detecting subclinical inflammation, which may not be fully captured by disease activity scores alone. The study emphasizes the importance of multimodal assessment in the management of Ankylosing Spondylitis, although further longitudinal studies with larger sample sizes and diverse patient populations are needed to validate these findings and explore the long-term outcomes of combined clinical and MRI monitoring.

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