

Research Article

Prevalence of HLA-B27 in Patients with Ankylosing Spondylitis in a Tertiary Care Hospital of Central India

Akshaya Khattri^{1*}, Sanyogita Jain², Saurabh G. Agarwal³, Rajdeep Paul⁴, Deepak Kumar Nadkarni⁵, Gyaneshwar Mishra⁶, Arpita Soni⁷

¹Junior Resident, Department of Microbiology, Chirayu Medical College & Hospital, Bhopal, Madhya Pradesh, India

².Professor, Department of Microbiology, Chirayu Medical College & Hospital, Bhopal, Madhya Pradesh, India

³.Professor & Head, Department of Microbiology, Chirayu Medical College & Hospital, Bhopal, Madhya Pradesh, India

⁴.Assistant Professor, Department of Microbiology, Chirayu Medical College & Hospital, Bhopal, Madhya Pradesh, India

⁵.Professor & Head, Department of Orthopaedics, Chirayu Medical College & Hospital, Bhopal, Madhya Pradesh, India

⁶.Senior Resident, Department of Orthopaedics, Chirayu Medical College & Hospital, Bhopal, Madhya Pradesh, India

⁷Junior Resident, Department of Microbiology, Chirayu Medical College & Hospital, Bhopal, Madhya Pradesh, India

*Corresponding Author

Dr. Akshaya Khattri

Department of
Microbiology, Chirayu Medical
College & Hospital, Bhopal -
462030, India

Email:

akshay.khatri09@gmail.com

Article History

Received: 02.02.2026

Revised: 11.02.2026

Accepted: 17.02.2026

Published: 12.04.2026

Citations:

Khatri, R., Ghosh, S., & Das, U. (n.d.).

Imaging vs histopathology in

gynecological tumors: A systematic

review and meta-analysis. *J Surg Radiol*,

V5(4) 18-24

Abstract: **Introduction:** Ankylosing Spondylitis (AS) is strongly associated with the HLA-B27 allele; however, its prevalence and clinical implications vary across populations. Data from Central India remain limited, and regional genetic patterns may differ from other Indian cohorts. **Objective:** To determine the prevalence of HLA-B27 among AS patients in Central India and to evaluate its association with demographic characteristics, clinical manifestations, and disease severity indicators. **Methods:** This cross-sectional study included 200 consecutive patients diagnosed with AS according to the modified New York criteria. Genomic DNA extracted from peripheral blood samples was analyzed for HLA-B27 using real-time polymerase chain reaction. Clinical parameters, including early disease onset (<30 years), extra-articular manifestations (EAMs), and functional limitation, were compared between HLA-B27 positive and negative groups using appropriate statistical tests. **Results:** HLA-B27 was detected in 44 patients (22.0%), while 156 (78.0%) were negative. HLA-B27 positive patients were younger at presentation and demonstrated a significantly higher frequency of extra-articular manifestations compared to negative patients (15.9% vs 3.8%, $p = 0.004$). Early onset of disease (59.1% vs 43.6%) and functional limitation (29.5% vs 19.9%) were more frequent among HLA-B27 positive individuals but did not reach statistical significance. HLA-B27 negative patients predominantly exhibited isolated axial disease. **Conclusion:** The prevalence of HLA-B27 among AS patients in Central India is substantially lower than that reported in many Western and Northern Indian populations. Nevertheless, HLA-B27 positivity remains significantly associated with systemic manifestations. The predominance of HLA-B27 negative AS highlights regional heterogeneity and underscores the need for region-sensitive diagnostic approaches and further multicentric genetic investigations.

Keywords: Ankylosing Spondylitis; HLA-B27; Prevalence; Central India; Extra-articular manifestations; Genetic epidemiology; PCR.

INTRODUCTION

Gynecological malignancies, encompassing ovarian, Ankylosing Spondylitis (AS) is a chronic, progressive inflammatory disease primarily involving the axial skeleton, particularly the sacroiliac joints and spine. It represents the prototypical and most severe form of the spondyloarthropathies and typically manifests in young adults with inflammatory back pain, stiffness, and progressive limitation of spinal mobility. The underlying pathological process is characterized by enthesitis and aberrant new bone formation, ultimately leading to ankylosis, structural deformity, and long-term functional impairment.

Genetic predisposition plays a central role in AS pathogenesis, and the Human Leukocyte Antigen B27 (HLA-B27) allele remains the strongest known genetic risk factor for the disease. In Western populations, HLA-B27 positivity is observed in approximately 80-95% of

AS patients, with prevalence frequently approaching 90% [1]. In India, however, reported frequencies vary widely, ranging from 50% to 90%, reflecting marked ethnic diversity and regional variation within the country [2]. Although HLA-B27 is strongly associated with disease susceptibility, its distribution and clinical expression are influenced by population genetics, environmental exposures, and local immunogenetic backgrounds.

Several Indian studies have highlighted considerable heterogeneity in HLA-B27 prevalence. Northern Indian cohorts often demonstrate high positivity rates comparable to Western data [3,4], whereas studies from other regions report comparatively lower frequencies [5,6]. Such variability suggests that the genetic architecture of AS may not be uniform across the Indian subcontinent. Despite this, region-specific epidemiological data remain limited, particularly from

Central India, where few systematic investigations have been conducted.

Beyond conferring susceptibility, HLA-B27 has been implicated in shaping disease phenotype. Numerous studies have reported associations between HLA-B27 positivity and earlier disease onset, increased inflammatory burden, axial predominance, and a higher likelihood of extra-articular manifestations such as acute anterior uveitis and inflammatory bowel disease [7,8]. Conversely, in populations where HLA-B27 prevalence is lower, the diagnostic utility of this marker may be diminished, potentially contributing to under-recognition or delayed diagnosis of AS. At the same time, HLA-B27 positive individuals in such settings may represent a distinct clinical subgroup with more systemic involvement [9,10].

Given the documented regional heterogeneity within India and the limited data from Central India, there is a need to clarify both the prevalence and the clinical implications of HLA-B27 in this population. Understanding these regional patterns is important not only for epidemiological characterization but also for refining diagnostic interpretation and anticipating disease behavior.

The present study was therefore undertaken to determine the prevalence of HLA-B27 among patients with Ankylosing Spondylitis attending a tertiary care hospital in Central India and to evaluate its association with demographic characteristics, clinical manifestations, and disease severity indicators.

MATERIALS AND METHODS

Study Design and Setting

This hospital-based cross-sectional observational study was conducted over a 12-month period in the Departments of Microbiology and Orthopaedics at a tertiary care teaching hospital in Central India. The study aimed to determine the prevalence of HLA-B27 among patients diagnosed with Ankylosing Spondylitis (AS) and to evaluate its association with demographic characteristics, clinical manifestations, and disease severity indicators.

Study Population

A total of 200 consecutive patients clinically diagnosed with Ankylosing Spondylitis during the study period were enrolled.

Inclusion Criteria

- Patients aged ≥ 10 years
- Diagnosis of AS according to the modified New York criteria (1984)
- Provision of written informed consent (and assent where applicable)

Exclusion Criteria

- Patients with other inflammatory arthritides (e.g., rheumatoid arthritis, psoriatic arthritis)

- Incomplete clinical or laboratory data
- Refusal to participate

Clinical Assessment

All participants underwent detailed clinical evaluation by the Orthopaedics department. The following data were recorded:

- Age and gender
- Duration of symptoms
- Pattern of joint involvement (axial and/or peripheral)
- Presence of extra-articular manifestations (acute anterior uveitis, inflammatory bowel disease, myelopathy, peripheral neuropathy)

Disease Severity Indicators

Severity parameters were predefined as:

Early age of onset: onset of symptoms before 30 years of age

- Extra-articular manifestations (EAMs): presence of ≥ 1 systemic manifestation
- Functional limitation: categorized as moderate-to-severe based on documented clinical evaluation and BASFI-type functional assessment where available

Sample Collection

Approximately 3-5 mL of peripheral venous blood was collected under aseptic conditions in sterile EDTA vacutainers from each participant.

DNA Extraction

Genomic DNA was extracted using the HiPurA® DNA/RNA Purification Kit (HiMedia Laboratories Pvt. Ltd., India) according to the manufacturer's instructions. DNA concentration and purity were assessed where required. Extracted DNA samples were stored at 2-8°C for short-term use and at -20°C for longer storage until analysis.

HLA-B27 Detection by Real-Time PCR

HLA-B27 detection was performed using the Hi-PCR® HLA-B27 Probe PCR Kit (MBPCR202; HiMedia Laboratories Pvt. Ltd., India), a hydrolysis probe-based real-time PCR assay.

PCR amplification was carried out in a final reaction volume of 25 μ L containing master mix, primer-probe mix, and 5 μ L of extracted genomic DNA, as per manufacturer instructions. Each run included positive and negative controls.

Amplification was performed on the Alta RT-96 Real-Time PCR System (Athenese-Dx Pvt. Ltd., India) under the following cycling conditions:

- Initial denaturation: 95°C for 10 minutes
- Denaturation: 95°C for 15 seconds
- Annealing and fluorescence acquisition: 56°C for 30 seconds (40 cycles)
- Final hold: 4°C
- Fluorescence signals were recorded in the FAM channel for HLA-B27 detection and the JOE channel for internal control monitoring. A cycle

threshold (Ct) value within the manufacturer-specified range was interpreted as positive. The analytical sensitivity (limit of detection) of the assay is 1 copy/ μ L (5 copies per reaction).

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean \pm standard deviation (SD) and range. Categorical variables were presented as frequencies and percentages.

Comparisons between HLA-B27 positive and negative groups were performed using the Chi-square test or

Fisher's exact test for categorical variables. A p-value < 0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Human Ethics Committee of Chirayu Medical College & Hospital, Bhopal (Ref. No. CMCH/IEC/2024/109; approval dated 30/08/2024). Written informed consent was obtained from all participants prior to enrollment. Confidentiality of patient data was strictly maintained throughout the study.

RESULTS

Study Population Characteristics

A total of 200 patients diagnosed with Ankylosing Spondylitis (AS) were included in the study. The overall mean age was 33.5 years (range: 10-77 years). Males constituted 70.0% (n = 140) of the study population, indicating a clear male predominance.

Prevalence of HLA-B27

HLA-B27 positivity was detected in 44 out of 200 patients (22.0%), while 156 patients (78.0%) were negative.

Table 1. Prevalence of HLA-B27 Among AS Patients (N = 200)

HLA-B27 Status	Number (n)	Percentage (%)
Positive	44	22.0
Negative	156	78.0
Total	200	100.0

The overall prevalence of HLA-B27 in this Central Indian cohort was 22%.

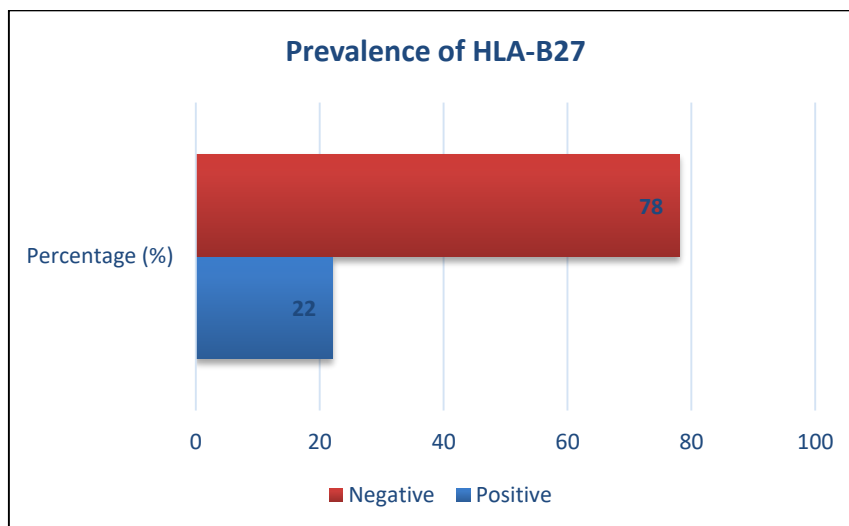


Figure 1: Distribution of HLA-B27 status among Ankylosing Spondylitis patients. HLA-B27 positivity was observed in 22% of patients, while 78% were negative.

Age and Gender Distribution by HLA-B27 Status

The mean age of HLA-B27 positive patients was 31.2 years compared to 34.0 years in the negative group. Male predominance was observed in both groups.

Table 2. Age and Gender Distribution According to HLA-B27 Status

Variable	HLA-B27 Positive (n=44)	HLA-B27 Negative (n=156)
Mean age (years)	31.2	34.0
Age range (years)	10-77	10-75
Male, n (%)	32 (72.7%)	108 (69.2%)

Female, n (%)	12 (27.3%)	48 (30.8%)
---------------	------------	------------

There was no statistically significant difference in gender distribution between groups.

Clinical and Severity Profile According to HLA-B27 Status

Isolated axial disease was significantly more frequent among HLA-B27 negative patients (94.2%) compared to HLA-B27 positive patients (70.5%) ($p < 0.001$). Early onset (<30 years) was more common among HLA-B27 positive individuals, although this difference did not reach statistical significance ($p = 0.069$). True extra-articular manifestations (EAMs), defined as acute anterior uveitis, inflammatory bowel disease, myelopathy, or peripheral neuropathy, were significantly associated with HLA-B27 positivity ($p = 0.004$). Functional limitation was more frequent among HLA-B27 positive patients but was not statistically significant.

Table 3. Association of Clinical and Severity Indicators with HLA-B27 Status

Variable	HLA-B27 Positive (n = 44)	HLA-B27 Negative (n = 156)	p-value
Disease Pattern			
Isolated axial disease	31 (70.5%)	147 (94.2%)	$<0.001^*$
Peripheral involvement without EAM	6 (13.6%)	3 (1.9%)	0.003*
Any extra-articular manifestation (EAM ≥ 1) **	7 (15.9%)	6 (3.8%)	0.004*
Severity Indicators			
Early onset (<30 years)	26 (59.1%)	68 (43.6%)	0.069
Functional limitation (moderate-severe)	13 (29.5%)	31 (19.9%)	0.17
Extra-Articular Manifestations			
Acute anterior uveitis	3 (6.8%)	2 (1.3%)	0.089†
Inflammatory bowel disease	1 (2.3%)	2 (1.3%)	0.49†
Myelopathy	2 (4.5%)	1 (0.6%)	0.12†
Peripheral neuropathy	1 (2.3%)	1 (0.6%)	0.38†

* Statistically significant at $p < 0.05$

** Individual EAM categories were mutually exclusive; no patient had more than one EAM.

† Fisher's exact test used due to small cell counts

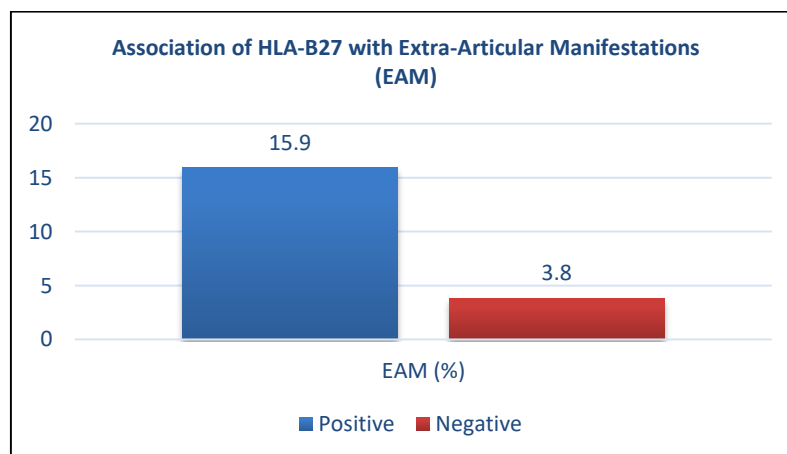


Figure 2: Comparison of extra-articular manifestations between HLA-B27 positive and negative patients. HLA-B27 positivity was significantly associated with systemic involvement (15.9% vs 3.8%, $p = 0.004$).

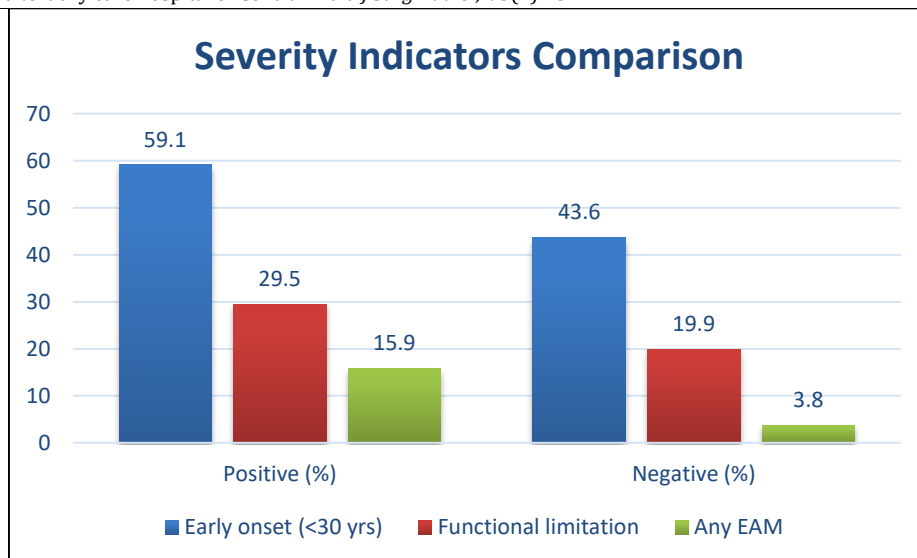


Figure 3: Comparative analysis of severity indicators between HLA-B27 positive and negative groups. Extra-articular manifestations were significantly associated with HLA-B27 positivity, whereas early onset and functional limitation did not reach statistical significance.

Summary of Key Findings

In summary, HLA-B27 prevalence in this cohort was 22%. HLA-B27 positive patients were younger at presentation and demonstrated a significantly higher frequency of extra-articular manifestations. Although early onset and functional limitation were more frequent among HLA-B27 positive individuals, these associations did not reach statistical significance. In contrast, HLA-B27 negative patients predominantly presented with isolated axial disease.

DISCUSSION

The present study demonstrates that HLA-B27 prevalence among patients with Ankylosing Spondylitis (AS) in Central India is 22%, with nearly four-fifths of patients being HLA-B27 negative. Despite this comparatively low prevalence, HLA-B27 positivity was significantly associated with extra-articular manifestations (15.9% vs 3.8%, $p = 0.004$), while trends toward earlier onset and greater functional limitation did not achieve statistical significance. These findings suggest that, within this population, HLA-B27 may exert a stronger influence on disease phenotype than on overall disease susceptibility.

The magnitude of reduction in HLA-B27 prevalence observed in our cohort is striking. In Western populations, HLA-B27 positivity is reported in 80-95% of AS patients [1] (Brahmachari et al., 2022), and even within India, Northern cohorts frequently demonstrate rates between 50% and 90% [2-4] (Gupta et al., 2023; Singh et al., 2023; Kumar et al., 2023). Although regional variability within India has been acknowledged [5,6] (Patel et al., 2022; Rajesh et al., 2023), the 22% prevalence identified in the present study suggests that Central India may represent a distinct epidemiological subset in which the relative contribution of HLA-B27 to AS susceptibility is attenuated. This divergence reinforces the concept that AS pathogenesis is shaped by population-specific genetic architecture rather than uniform allele-driven mechanisms.

Beyond its clinical implications, the present study contributes important region-specific data to the national epidemiology of AS in India. While prior studies have demonstrated heterogeneity in HLA-B27 distribution across different Indian regions [2-6] (Gupta et al., 2023; Patel et al., 2022; Rajesh et al., 2023), data from Central India have remained comparatively limited. The markedly lower prevalence identified in this cohort strengthens the evidence that HLA-B27 distribution across India is not homogeneous and may vary substantially even within the same country. Such regional stratification is critical for refining national prevalence estimates, contextualizing genetic risk interpretation, and guiding region-sensitive diagnostic strategies. These findings support the need for geographically stratified epidemiological surveillance rather than reliance on aggregated national averages.

From a mechanistic perspective, the variability in prevalence supports an evolving view of AS as a genetically heterogeneous disorder. Reveille (2012) [11] highlighted that differences in HLA-B27 subtype distribution influence disease association, with HLA-B*2705 conferring stronger susceptibility in Caucasian populations. Furthermore, Colbert et al. (2014) [12] described how HLA-B27-associated misfolding and immune activation contribute to inflammatory cascades, while Brown et al. (2016) [13] emphasized the interaction of HLA-B27 with additional susceptibility loci such as ERAP1 and IL23R within the IL-23/IL-17 axis. The comparatively low prevalence observed in our

cohort may therefore reflect regional subtype variation or a proportionally greater influence of non-HLA genetic and environmental modifiers in Central India.

Importantly, although prevalence was reduced, the phenotypic impact of HLA-B27 remained evident. The significant association with extra-articular manifestations aligns with prior Indian studies [7,8] (Thakur et al., 2022; Chauhan et al., 2023) and with international cohorts demonstrating strong correlations between HLA-B27 and acute anterior uveitis [14] (Haroon et al., 2013). This suggests that while allele frequency varies geographically, its qualitative immunopathogenic behavior remains conserved. In this population, HLA-B27 continues to function as a marker of systemic inflammatory propensity even when it is not the predominant susceptibility determinant.

The absence of statistically significant associations with early onset and functional limitation warrants cautious interpretation. Although earlier symptom onset among HLA-B27 carriers has been documented in previous studies [11,15] (Reveille, 2012; Sieper et al., 2009), the modest effect size observed here may reflect limited statistical power within the HLA-B27 positive subgroup or indicate that structural severity is influenced by additional genetic and environmental determinants. Indian data have demonstrated heterogeneous correlations between HLA-B27 status and disease progression [2,9] (Gupta et al., 2023; Ghosh et al., 2022), reinforcing the concept that disease severity is multifactorial and not exclusively allele-driven.

Perhaps the most clinically consequential observation is the predominance of HLA-B27 negative AS (78%). This finding challenges the traditional diagnostic paradigm that strongly associates AS with HLA-B27 positivity. Rudwaleit et al. (2009) [16] emphasized that axial spondyloarthritis can develop independently of HLA-B27 and may represent a partially distinct immunogenetic phenotype. In our cohort, HLA-B27 negative patients predominantly exhibited isolated axial involvement with fewer systemic manifestations, suggesting a comparatively localized inflammatory profile. These findings lend support to a spectrum-based model of AS in which multiple immunogenetic pathways converge on similar clinical outcomes.

From a diagnostic perspective, these data have practical implications. In high-prevalence Western settings, HLA-B27 testing meaningfully increases post-test probability in patients with inflammatory back pain [15] (Sieper et al., 2009). However, in Central India—where the majority of AS patients are HLA-B27 negative—over-reliance on this marker may contribute to delayed recognition. Our findings underscore the need for region-sensitive diagnostic interpretation, with greater emphasis on clinical features and imaging evidence rather than dependence on genetic testing alone.

Collectively, this study highlights Central India as a distinct epidemiological context in which HLA-B27 prevalence is comparatively low but its association with systemic manifestations remains preserved. These findings reinforce the heterogeneity of AS across populations and underscore the importance of multicentric genetic profiling and longitudinal investigations to better delineate disease mechanisms in diverse Indian settings.

CONCLUSION

This study demonstrates that HLA-B27 prevalence among patients with Ankylosing Spondylitis in Central India is markedly lower (22%) than that reported in most Western and Northern Indian populations. Despite this reduced frequency, HLA-B27 positivity remained significantly associated with extra-articular manifestations, indicating that its phenotypic influence on systemic inflammatory expression is preserved even in low-prevalence settings. In contrast, the predominance of HLA-B27 negative AS suggests that alternative genetic and environmental determinants may contribute more substantially to disease susceptibility in this region. These findings position Central India as a distinct epidemiological subset within the broader national landscape and highlight the importance of region-specific interpretation of genetic markers. In populations where HLA-B27 prevalence is comparatively low, diagnostic reliance on this allele alone may be insufficient, underscoring the continued importance of clinical assessment and imaging-based evaluation. Larger multicentric studies incorporating HLA subtyping and expanded genetic profiling are warranted to further clarify the immunogenetic architecture of Ankylosing Spondylitis across diverse Indian populations.

Limitations

This study has certain limitations. First, it was conducted at a single tertiary care center, which may limit generalizability to the broader Central Indian population. Second, HLA-B27 subtyping was not performed; therefore, potential subtype-specific variations in disease association could not be evaluated. Third, standardized disease activity indices such as BASDAI and radiographic progression scoring were not uniformly available for all patients, limiting detailed severity stratification. Finally, the cross-sectional design precludes assessment of longitudinal disease progression or causal inference regarding HLA-B27-associated outcomes. Despite these limitations, the study provides valuable region-specific data in an area where epidemiological evidence remains limited.

Future Directions

Future multicentric studies involving larger and more diverse populations across different regions of India are warranted to validate these findings. Incorporation of HLA-B27 subtyping, expanded genetic profiling

(including non-HLA susceptibility loci), and longitudinal follow-up would allow deeper characterization of genotype-phenotype correlations. Prospective cohort studies assessing radiographic progression, treatment response, and long-term functional outcomes could further clarify the clinical implications of HLA-B27 status in low-prevalence settings. Additionally, exploration of environmental and microbiome-related factors may provide insight into the high proportion of HLA-B27 negative Ankylosing Spondylitis observed in this region.

Acknowledgements

The authors acknowledge the support of the technical staffs of Molecular Testing Laboratory, Departments of Microbiology and all clinicians from Departments of Orthopaedics at Chirayu Medical College & Hospital, Bhopal, for their assistance in patient recruitment and laboratory procedures.

Funding

No external funding was received for this study.

Conflict of Interest

The authors declare that they have no conflict of interest related to this study.

Data Availability Statement

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Author Contributions

Conceptualization: Akshaya Khattri (AK), Sanyogita Jain (SJ), Rajdeep Paul (RP), Saurabh G. Agarwal (SGA); **Methodology:** AK, RP, SJ, SGA; **Investigation:** AK, RP, Deepak Kumar Nadkarni (DKN); **Formal Analysis:** AK, RP; **Data Curation:** AK, RP; **Resources:** SGA, DKN; **Supervision:** SJ, SGA, DKN; **Validation:** SJ, SGA; **Writing -Original Draft:** AK; **Writing - Review & Editing:** RP, SJ, SGA, DKN; **Project Administration:** SGA. All authors read and approved the final manuscript.

REFERENCES

1. Brahmachari SK, Nair R, Sharma S, Verma P, Kulkarni A, Mehra NK. Prevalence of HLA-B27 in patients with ankylosing spondylitis in an Indian population: a retrospective study. *Rheumatol Int*. 2022;42(3):435-442.
2. Gupta R, Pandey A, Das S, Singh P, Tiwari R, Chandra K. HLA-B27 and its association with ankylosing spondylitis in India: a systematic review and meta-analysis. *Indian J Rheumatol*. 2023;18(1):40-48.
3. Singh S, Chander V, Poonia R, Malik A, Bansal P, Yadav R. Genetic and clinical aspects of ankylosing spondylitis in Indian patients: a cross-sectional study. *Clin Rheumatol*. 2023;42(6):1907-1914.
4. Kumar S, Sharma A, Goel N, Mishra V, Aggarwal R, Prasad A. Prevalence of HLA-B27 and its clinical correlation in ankylosing spondylitis: evidence from a tertiary care center in North India. *J Clin Rheumatol*. 2023;29(3):165-170.
5. Patel P, Verma M, Sinha A, Rao R, Iyer S, Narayan V. Association of HLA-B27 with ankylosing spondylitis in Indian patients: a study from a tertiary care hospital. *Int J Rheum Dis*. 2022;25(12):1567-1575.
6. Rajesh N, Sharma S, Kapoor R, Gupta V, Tandon A, Meena R. HLA-B27 prevalence and disease manifestations in ankylosing spondylitis: a study from a tertiary care center in Central India. *J Rheum Dis*. 2023;30(1):60-67.
7. Thakur A, Singh S, Sharma S, Verma R, Gupta P, Jain A. Clinical and genetic profile of ankylosing spondylitis in Indian population: a focus on HLA-B27. *J Indian Rheumatol Assoc*. 2022;10(4):187-194.
8. Chauhan S, Agarwal P, Tiwari S, Singh N, Bhatia R, Mishra D. HLA-B27 positivity and its correlation with clinical severity of ankylosing spondylitis. *Asian Pac J Rheumatol*. 2023;17(1):47-54.
9. Ghosh P, Bhattacharya S, Roy S, Mukherjee D, Dasgupta A, Sen A. Epidemiology of HLA-B27 and its association with ankylosing spondylitis in the Indian subcontinent: a meta-analysis. *Clin Med Insights Arthritis Musculoskelet Disord*. 2022;15:117954412211118.
10. Mehta A, Singh M, Khandelwal N, Arora V, Gupta D, Bhatnagar S. HLA-B27 and its impact on disease progression in ankylosing spondylitis patients: a cohort study from an Indian tertiary care center. *J Orthop Sci*. 2023;28(3):456-463.
11. Reveille JD. Genetics of spondyloarthritis—beyond HLA-B27. *Nat Rev Rheumatol*. 2012;8(5):296-304.
12. Colbert RA, Navid F, Gill T. The role of HLA-B27 in spondyloarthritis: pathogenic mechanisms and clinical implications. *Curr Opin Rheumatol*. 2014;26(4):377-383.
13. Brown MA, Kenna T, Wordsworth BP. Genetics of ankylosing spondylitis—insights into pathogenesis. *Nat Rev Rheumatol*. 2016;12(2):81-91.
14. Haroon N, Inman RD, Leach TJ, Weisman MH, Lee M, Rahbar MH. The impact of HLA-B27 on disease phenotype and radiographic progression in ankylosing spondylitis. *Arthritis Rheum*. 2013;65(9):2648-2655.
15. Sieper J, Rudwaleit M, Baraliakos X, Brandt J, Braun J, Burgos-Vargas R, et al. The Assessment of SpondyloArthritis international Society (ASAS) handbook: a guide to assess spondyloarthritis. *Ann Rheum Dis*. 2009;68(Suppl 2):ii1-ii44.
16. Rudwaleit M, van der Heijde D, Landewe R, Akkoc N, Brandt J, Chou CT, et al. The development of Assessment of SpondyloArthritis international Society classification criteria for axial spondyloarthritis. *Ann Rheum Dis*. 2009;68(6):770-776