

Original Research Article

Diagnostic performance of the Bengali version of inflammatory back pain criteria in patients with axial spondylarthritis: a case control study

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ABSTRACT

Background: Axial Spondyloarthritis (axSpA) is a chronic inflammatory disease affecting the spine, which requires accurate and early diagnosis for effective management. Inflammatory back pain (IBP) is a key symptom of axSpA. While several diagnostic criteria sets for IBP exist, limited data is available on the Bengali version of these criteria. This study aimed to evaluate the diagnostic performance of the Bengali version of IBP criteria sets (Calin, Berlin set 8a, Berlin set 7b and ASAS) in patients with axSpA and mechanical back pain (MBP).

Methods: A total of 100 participants (50 axSpA patients and 50 MBP controls) were enrolled between April 2019 and September 2019 at Chattogram Medical College Hospital. Sensitivity, specificity, positive and negative predictive values and likelihood ratios were calculated for each IBP criteria set. ROC curve analysis was performed to assess overall diagnostic accuracy.

Results: The sensitivity of the Bengali Calin criteria was 88.4%, with a specificity of 78.9%. Berlin set 8a criteria demonstrated the highest sensitivity (92.3%) but lower specificity (77.0%). ASAS IBP criteria performed moderately with 78.0% sensitivity and 69.5% specificity.

Conclusions: The Bengali version of IBP criteria sets demonstrated strong diagnostic performance, with Berlin set 8a showing the highest sensitivity. These tools can aid in the early detection of axSpA in clinical settings in Bangladesh. Future research should focus on validating these criteria in larger, diverse populations.

Keyword: Axial spondyloarthritis, Bengali version, Diagnostic accuracy, Inflammatory back pain, Sensitivity and specificity, Screening criteria

INTRODUCTION

axSpA is a chronic inflammatory rheumatic disease that primarily affects the axial skeleton, particularly the sacroiliac joints and spine. The disease usually begins in early adulthood and commonly presents with chronic back pain long before definitive radiographic changes become evident.¹ Delayed diagnosis of axSpA is frequent and may result in progressive structural damage, functional impairment, reduced quality of life and increased socioeconomic burden.² Early identification of axSpA

therefore remains a major clinical challenge and an important goal in routine clinical practice. IBP is considered the cardinal clinical feature of axSpA and serves as a key screening symptom for early disease recognition.³ In contrast to mechanical back pain, IBP is typically characterized by an insidious onset, onset at a younger age, prolonged morning stiffness, improvement with exercise, lack of improvement with rest and nocturnal pain that may awaken the patient during the second half of the night.⁴ Recognition of these characteristic features allows clinicians to differentiate inflammatory causes of back pain from mechanical etiologies, even in the absence

of definite radiographic sacroiliitis. Several classification and screening criteria have been proposed over the past decades to improve the identification of IBP and facilitate early diagnosis of axSpA. The Calin criteria were among the earliest tools developed, emphasizing clinical history as a screening method for ankylosing spondylitis.⁵ Subsequently, the Berlin criteria were introduced to refine symptom-based assessment and improve diagnostic performance, with different versions focusing on either higher sensitivity or specificity.⁶

More recently, the assessment of spondyloarthritis international society (ASAS) proposed standardized IBP criteria to harmonize clinical evaluation across different settings and populations.⁷ However, previous studies have demonstrated considerable variability in the sensitivity and specificity of these criteria sets depending on patient characteristics, disease stage and study population.⁸ The validity of IBP criteria is strongly influenced by cultural and linguistic factors. Direct translation of questionnaires without appropriate cross-cultural adaptation may alter symptom interpretation and compromise diagnostic accuracy.⁹ International guidelines recommend a structured process of translation, back-translation and validation before implementing clinical assessment tools in new languages.¹⁰

In South Asian countries, including Bangladesh, chronic back pain is highly prevalent, yet data on axSpA remain limited and awareness among primary care physicians is often inadequate. This frequently leads to misclassification of inflammatory back pain as mechanical back pain and contributes to significant diagnostic delay. Bengali is one of the most widely spoken languages worldwide, yet validated Bengali versions of IBP criteria have been scarce. The absence of standardized and culturally adapted IBP assessment tools limits effective screening and early referral of axSpA patients in Bengali-speaking populations. Previous studies conducted in other populations have reported that the Berlin set 8a criteria tend to show higher sensitivity, while the Calin criteria demonstrate higher specificity and the ASAS criteria provide a more balanced diagnostic performance.⁸

However, these findings cannot be directly extrapolated to Bengali-speaking populations due to differences in symptom perception, healthcare-seeking behavior and disease presentation. Against this background, the present study aimed to evaluate and compare the diagnostic performance of the Bengali versions of the Calin, Berlin set 8a, Berlin set 7b and ASAS inflammatory back pain criteria in patients with axial spondylarthritis and mechanical back pain.

By assessing sensitivity, specificity, predictive values, likelihood ratios and receiver operating characteristic curves, this study seeks to identify the most appropriate IBP screening tool for clinical use in Bangladesh. Establishing reliable and validated Bengali IBP criteria may facilitate earlier diagnosis, timely referral and

improved clinical outcomes for patients with axSpA in this population.

METHODS

Medical data were collected from patients either consulted spontaneously or referred for further evaluation to Medicine Indoor or Physical Medicine Indoor of Chattogram Medical College Hospital between April 2019 to September 2019. So, in this study number of cases were 50 and control were the similar number. So total sample size was 100.

Inclusion criteria

Chronic back pain for ≥ 3 months. Radiographic sacroiliitis by modified NY criteria or sacroiliitis on MRI STIR image. Normal ESR and CRP. Normal pelvis and SI joint on both x-ray (radiographic) and MRI (non-radiographic) STIR image.

Exclusion criteria

Diagnosed case of axSpA by clinical arm of ASAS axial spondylarthritis classification without radiographic support. Any evidence of concomitant disease explaining back pain in SpA patient such as osteoarthritis, PLID, advanced spondylolisthesis, fracture, trauma, malignancy, infection etc. Those who not gave consent. Family history of spondyloarthropathy. Any SpA features (arthritis, enthesitis, psoriasis, dactylitis, chrons/colitis, uveitis, good response to NSAID, elevated CRP).

Data collection tools

Final Bengali IBP tool was submitted to all case and control and data was collected with a face-to-face interview. Data regarding HLA-B27 and CRP was obtained from the patient medical records when available.

Statistical analysis

Sensitivity and specificity was measured by 2/2 contingency table. According to Empirical nonparametric method, Receiver Operating Characteristic (ROC) analyses were performed to evaluate the performances of Bengali version of Calin, Berlin set 8a, Berlin 7b and ASAS IBP criteria and the Area Under Curve (AUC) was computed for each criterion. ROC curves provided a graphical representation of the overall accuracy of a test by plotting sensitivity against specificity for all thresholds, while the AUC quantified the accuracy of the test.

This study also calculated positive and negative likelihood ratio (LR), positive predictive value (PPV), negative predictive value (NPV) to evaluate the external validity of each tool. The ability of the tool to detect IBP was also evaluated to SpA patients. Statistical analysis used SPSS (Version 23.0) statistical software.

RESULTS

A total number of 100 male and female were enrolled in this study. The mean age of SpA group was 39.30 (\pm 13.31) years and 35.58 (\pm 14.56) years in the MBP group. In both group 54.0% participant was male, 46.0% was female. Most of the patient in the SpA group was 40-49 (38%) years and 19-29 (39.6%) years in the MBP group. Most of the patients belonged to the urban areas about 27 (61.4%) in SpA and 34 (75.6%) in the MBP group. 34.7% (n=17) completed their primary level among SpA patients whereas 31.3% (n=15) patients completed the graduation level of their education. In both groups, housewife was predominant, around 19 (43.2%) of SpA and 11 (25.6%) in the MBP group.

Among the clinical characteristics of both groups, the duration of disease in the SpA group was 115(\pm 79) months and 62(\pm 7) months in the MBP group. Biochemically, the level of hemoglobin was near to equal in both groups. The level of CRP was significantly higher in SpA group (25.95 \pm 30.24) as it is a clinical feature of SpA then MBP patients (2.41 \pm 1.09). SGPT level was relatively higher in SpA patient (55.83 \pm 76.38) then (0.81 \pm 0.12) in the MBP group. Among the features of SpA in the cases (n=50) elevated CRP level was predominant 39 (79.6%). Others feature was good response to NSAID 36 (73.5%), arthritis 25 (51.0%), enthesitis 18 (36.0%). History of uveitis anterior was present in 4 (8.3%) cases. positive family history of SpA found only 4 (8.3%) and psoriasis 3 (6.0%) in the case group. SpA feature was absent in the MBP group as exclusion criteria. In the imaging, most patients presented with bilateral sacroiliitis 76.0% (n=38) and unilateral sacroiliitis was found in 24.0% (n=12) cases. The calculated BASDAI for 50 axSpA patients was 2.780 (\pm 1.232).

Here, sensitivity ranged from 87.0% to 89.0%, specificity ranged from 77.0% to 80.0%, $\ddagger\ddagger$ positive predictive value was 76.0%, negative predictive value was 90.0%. The highest positive likelihood ratio 7.02 and lowest negative likelihood ratio was 0.064. 76.0% (n=38) in SpA group and 10.0% (n=5) in MBP group patients were diagnosed as IBP positive by Calin criteria. Performance of the Bengali version of Calin IBP criteria is demonstrated in Table 2.

Here, sensitivity ranged from 90.0% to 93.0%, specificity ranged from 75.0% to 79.0%, $\ddagger\ddagger$ positive predictive value was 72.0%, negative predictive value was 94.0%. Highest positive likelihood ratio 2.51 and lowest negative likelihood ratio was 0.299. 72.0% (n=36) in SpA group and 6.0% (n=3) in MBP group patients were diagnosed as IBP positive by Berlin set 8a criteria. Performance of the Bengali version of Berlin set 8a IBP criteria is demonstrated in Table 3.

Here, sensitivity ranged from 80.0% to 85.0%, specificity ranged from 64.0% to 70.0%, $\ddagger\ddagger$ positive predictive value was 58.0%, negative predictive value was 88.0%. Highest

positive likelihood ratio 2.565 and lowest negative likelihood ratio was 0.253. 58.0% (n=29) in SpA group and 12.0% (n=6) in MBP group patients were diagnosed as IBP positive by Berlin 7b criteria. Performance of the Bengali version of Berlin set 7b IBP criteria is demonstrated in Table 4.

Here, sensitivity ranged was 78.0% and specificity was 69.5%, $\ddagger\ddagger$ positive predictive value was 80.0%, negative predictive value was 94.0%. Highest positive likelihood ratio was 5.302 and lowest negative likelihood ratio was 0.085. 64.0% (n=32) in SpA group and 18.0% (n=9) in MBP group patients were diagnosed as IBP positive by ASAS criteria. Performance of the Bengali version of ASAS IBP criteria is demonstrated in Table 5.

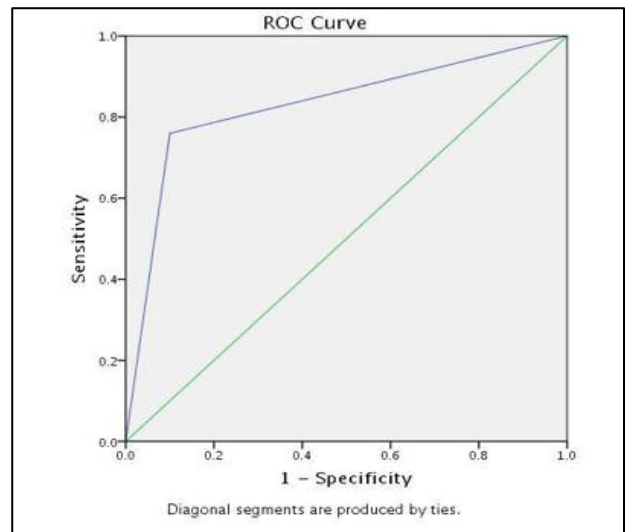


Figure 1: ROC curve score for Calin IBP criteria.

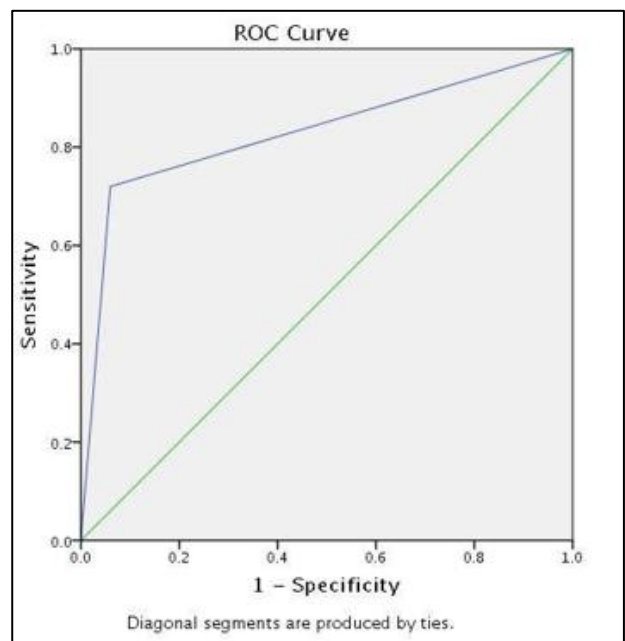


Figure 2: ROC curve score for Berlin set 8a IBP criteria.

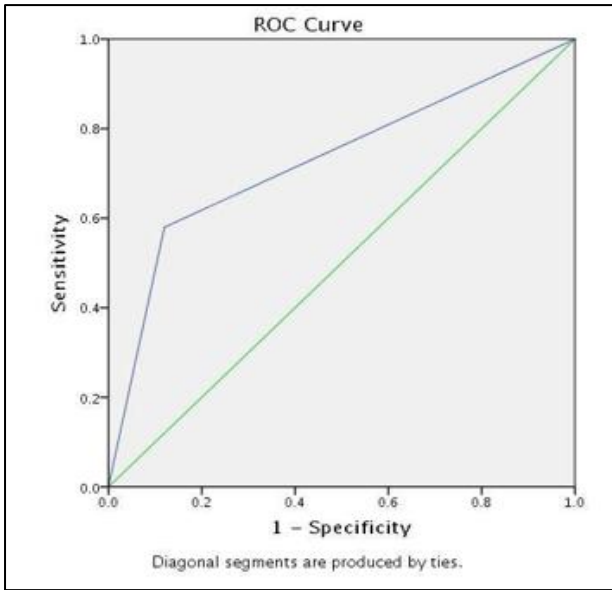


Figure 3: ROC curve score for Berlin set 7b IBP criteria.

Among the available criteria sets for the definition of IBP, Berlin criteria set 8a have the highest sensitivity (92.3%), Calin criteria have the highest specificity (78.9%). Berlin 8a also shows the specificity (77.0%) which is nearer to Calin. And the recently described ASAS IBP criteria show the most balanced performance with no clear superiority over the other two (sensitivity 78.0% and specificity 69.5%). Highest+LR of 4.022 (95% CI 2.517-6.426) and OR 12.0 (95% CI 3.952-36.436) both were found for Berlin set 8a criteria. Comparison of different IBP criteria sets is shown in Table 6.

Regarding individual performance of IBP items revealed some significant findings. IBP item ‘pain improves with activity, not with rest’ showed the highest sensitivity (97.0%) and best specificity was found for ‘morning stiffness >30 min’ (88.0%). Highest+LR 9.50 (95% CI) was observed for the item ‘pain awakens second half of night’. and ‘pain response to exercise’ showed significant OR 8.367 (95% CI). The performance of individual items of the IBP criteria sets for the detection of IBP Is Shown In table 7.

Table 1: Demographic and clinical characteristics of SpA (n=50) and MBP group (n=50).

Characteristics	Case (n=50)	%	Control (n=50)	%
Age (in years), Mean±SD	Mean 39.30±13.31		Mean 35.58±14.56	
0-18	0	0.0%	4	8.3
19-29	6	12.0%	19	39.6
30-39	11	22.0%	8	16.7
40-49	19	38.0%	7	14.6
50-59	11	22.0%	6	12.5
>60	3	6.0%	4	8.3
Male/ Female	27/ 23	54.0%/ 46.0%	27/ 23	54%/46
Residence				
Urban	27	61.4%	34	75.6
Semi-urban	10	22.7%	5	11.1
Rural	7	15.9%	6	13.3
Monthly family expenditure (taka in thousand)				
Below 20	10	20.8%	23	59.0
between 20-50	29	60.4%	16	41
Above 50	11	17.8%	0	0.00
Educational status				
Primary	17	34.7%	5	10.4
SSC	8	16.3%	11	22.9
HSC	10	20.4%	10	20.8
Graduation	10	20.4%	15	31.3
Post-graduation	4	8.2%	1	2.1
Illiterate	0	0.00%	6	12,5
Marital status				
Married	42	44.0%	32	64.0
Unmarried	6	12.0%	18	36.0
Smoking				
Smoker	16	32.0%	20	40.0
Non-smoker	34	68.0%	30	60.0
Alcohol				
Alcoholic	0	0.0	2	4.1

Continued.

Characteristics	Case (n=50)	%	Control (n=50)	%
Non alcoholic	49	100.0	47	95.9
Occupation 78.0				
Rickshaw puller	0	0.0	0	0.0
Day labor	2	4.5	1	2.3
Service holder	15	34.1	10	23.3
Business	6	13.6	8	18.6
Driver	0	0.0	0	0.0
Housewife	19	43.2	11	25.6
Student	2	4.5	13	30.2
Life style				
Moderate	24	49.0	21	45.7
Sedentary	17	34.7	17	37.0
Hard worker	8	16.3	8	17.4
Clinical characteristics				
Duration of disease (months)	115±79		62±70	
Biochemical				
CBC	12.17±1.73		12.27±1.35	
CRP	25.95±30.24		2.41±1.09	
ESR	52.90±32.62		19.15±11.76	
HLAB27				
Positive		10 (52.6%)	0 (0%)	
Negative		9 (47.4%)	2 (100%)	
SGPT	55.83±76.38		27.122±8.70	
S.Creatinine	0.86±0.16		0.81±0.12	
SpA feature				
Arthritis				
No		24 (49.0)		
Yes		25 (51.0)		
Enthesitis				
No		32 (64.0)		
Yes		18 (36.0)		
Family history of SpA				
No		44 (91.7)		
Yes		4 (8.3)		
Uveitis anterior				
No		43 (91.5)		
Yes		4 (8.5)		
Psoriasis				
No		47 (94.0)		
Yes		3 (6.0)		
Good response to NSAID				
No		12 (24.5)		
Yes		36 (73.5)		
Crohn's/ Colitis				
No		50 (100.0)		
Yes		0 0.0		
Elevated CRP				
No		9 (18.4)		
Yes		39 (79.6)		
Dactylitis				
No		49 (98.0)		
Yes		1 (2.0)		
Sacroiliitis (Unilateral)		12 (24.0)		

Continued.

Characteristics	Case (n=50)	%	Control (n=50)	%
Sacroiliitis (Bilateral)		38 (76.0)		
BASDAI	2.780±1.232			
Presence of IBP				
Calin		38 (76.0)		5 (10.0)
Berlin set 8a		36 (72.0)		3 (6.0)
Berlin set 7b		29 (58.0)		6 (12.0)
ASAS		32 (64.0)		9 (18.0)

Table 2: Sensitivity and specificity for Bengali version of Calin IBP criteria.

	Sensitivity	Specificity	PPV	NPV	+ve LR	-ve LR
IBP Calin criteria	0.884	0.789	0.76	0.9	4.198 (2.51-7.02)	0.147 (0.064-0.339)

Table 3: Sensitivity and specificity for Bengali version of Berlin set 8a IBP criteria.

	Sensitivity	Specificity	PPV	NPV	+ve LR	-ve LR
Berlin set 8a IBP	0.923	0.77	0.72	0.94	4.022 (2.517-6.426)	0.1 (0.33-0.299)

Table 4: Sensitivity and specificity for Bengali version of Berlin set 7b IBP criteria.

	Sensitivity	Specificity	PPV	NPV	+ve LR	-ve LR
IBP Berlin 7b criteria	0.829	0.677	0.58	0.88	2.565 (2.565-2.565)	0.253 (0.253-0.253)

Table 5: Sensitivity and specificity for Bengali version of ASAS IBP criteria.

	Sensitivity	Specificity	PPV	NPV	+ve LR	-ve LR
ASAS IBP criteria	0.78	0.695	0.64	0.82	2.55827 (2.55826-2.55829)	0.31588 (0.31588-0.31588)

Table 6: Performance of different criteria sets in detecting IBP in patient with axSpA.

IBP criteria sets	axSpA patients
Calin	
Sensitivity (%)	88.4
Specificity (%)	78.9
+LR (95% CI)	4.198 (2.51-7.02)
-LR (95% CI)	0.147(0.064-0.339)
OR (95% CI)	1.315 (0.306-5.847)
Berlin 8a	
Sensitivity (%)	92.3
Specificity (%)	77.0
+LR (95% CI)	4.022 (2.517-6.426)
-LR (95% CI)	0.1 (0.033-0.299)
OR (95% CI)	12.0 (3.952-36.436)
Berlin 7b	
Sensitivity (%)	82.9
Specificity (%)	67.7
+LR (95% CI)	2.565 (2.565-2.565)
-LR (95% CI)	0.253 (0.253-0.253)
OR (95% CI)	4.833 (2.201-10.616)
ASAS	
Sensitivity (%)	78.0
Specificity (%)	69.5

Continued.

IBP criteria sets	axSpA patients
+LR (95% CI)	2.55827 (2.55826-2.55829)
-LR (95% CI)	0.31588 (0.31588-0.31588)
OR (95% CI)	1.3 (.066-2.976)

Table 7: individual performance of IBP items.

Items	Sensitivity	Specificity	+LR (95% CI)	-LR (95% CI)	P	OR (95% CI)
Insidious onset	65.8	57.4	1.55415 (1.55415-1.55415)	0.592 (0.592-0.592)	0.000	1.080 (0.741-1.575)
Age at onset back pain (year) <30	44	40	1.369 (1.369-1.369)	1.40 (1.40-1.40)	0.000	0.733 (0.498-1.079)
Age at onset back pain (year) <40	78	16	1.08 (1.08-1.08)	1.37 (1.37-1.37)	0.000	0.929 (0.767-1.125)
Morning stiffness >30 min	54	88	4.5 (4.49-4.50)	1.92 (1.92-1.92)	0.000	4.50 (2.036-9.945)
Pain improves with exercise or activity	85	81	8.36 (8.36-8.36)	5.55 (5.55-5.55)	0.000	8.367 (3.610-19.395)
Pain improves with activity not with rest	97	15	8.2 (8.19-8.20)	5.00 (5.00-5.00)	0.000	1.250 (1.088-1.436)
Pain awakens second half of night	59	70	9.50 (9.49-9.50)	1.56 (1.56-1.56)	0.000	1.973 (1.117-3.198)
Alternating buttock pain	84	70	2.8 (2.501-2.911)	0.228 (0.228-0.228)	0.000	2.800 (1.803-4.349)
Pain at night (with improvement upon getting up)	76	34	1.15 (1.15-1.15)	0.70 (0.70-0.70)	0.000	1.152 (0.894-1.483)

DISCUSSION

The study aimed to evaluate the diagnostic performance of the Bengali versions of various IBP criteria for patients with axSpA. Medical data were collected from patients either consulted spontaneously or referred for further evaluation to Medicine Indoor or Physical Medicine Indoor of Chattogram Medical College Hospital. This study number of cases were 50 and control were the similar number. So total sample size was 100. Sensitivity is a critical factor in early diagnosis, as it ensures that the majority of axSpA patients are correctly identified.

The high sensitivity of the Berlin set 8a in this study makes it an effective tool for identifying patients who require further evaluation for axSpA. This study evaluated the performance of the Bengali version of different criteria sets of IBP in 50 axSpA patients, who fulfilled the imaging arm of the new ASAS axSpA classification criteria and 50 patients with MBP. The result of this study suggested that Berlin set 8a criteria was most sensitive (92.3%) and Calin criteria was most specific (78.9%). Recently described ASAS IBP criteria showed a good performance with no clear superiority over the other two (sensitivity 78.0% and specificity 69.5%).¹¹

Among the clinical variables all SpA patients had higher CRP values (25.95±30.24) in comparison to control (2.41±1.09). Presence of IBP among the SpA and MBP patients, detected by Calin, Berlin 8a, Belin 7b and ASAS criteria were 76.0% and 10.0%, 72.0% and 6.0%, 58.0% and 12.0%, 64.0% and 18.0% respectively. The estimated BASDAI for axSpA patients was 2.780 (±1.232). On the other hand, the specificity of the Calin criteria was higher, which means it performed better in distinguishing patients with axSpA from those with mechanical back pain (MBP). The balanced performance of the ASAS IBP criteria, with a sensitivity of 78.0% and specificity of 69.5%, was also noteworthy. While it did not outperform the Berlin set 8a or the Calin criteria in sensitivity or specificity, it still proved valuable for its overall diagnostic accuracy, making it a reliable option in diverse clinical settings.¹² Assessment of individual performance of IBP items revealed some significant findings. In this study, item “age at onset” showed good sensitivity (78.0%) and low specificity (16.0%) for SpA, which was consistent with the previous study (96.0% sensitivity and 16.0% specificity).⁸ Item “insidious onset” was not clarified by previous studies or original developer of various criteria set. As per the structure of the NHANES questionnaire, there were various options for the item “insidious onset”. It was

measured the item in 2 options in this study, ‘over 3 weeks’ and ‘Month up to a year’.

The sensitivity and specificity were 98.0% and 14.0% respectively for the option ‘over 3 weeks’, which is a very poor trade-off with specificity in the case of SpA and dissimilar to other study.^{13,14} However, the sensitivity and specificity became 65.8% and 57.6% for the option ‘month up to a year’ and the OR also became 1.080 with 95% CI. It is a balanced trade-off and very similar to the previous study (70.0% sensitivity and 58.0% specificity.⁸ So, in this study, the option of ‘month up to year’ has been accepted for the item “Insidious onset” and analyzed in criteria set validity.^{15,16} The ROC curve analysis further supported these findings, demonstrating strong overall diagnostic accuracy for the Bengali IBP criteria sets. However, it is important to note that while the sensitivity and specificity of the Bengali version of the IBP criteria were promising, further validation in larger and more diverse populations is necessary to confirm their applicability across different demographic groups. Additionally, this study highlights the critical need for the cultural and linguistic adaptation of diagnostic criteria to ensure their effectiveness in non-Western populations, where symptom perception and healthcare-seeking behavior may differ. The success of this study paves the way for the widespread use of these validated criteria in clinical practice, potentially improving early diagnosis and management of axSpA in Bangladesh.

CONCLUSION

This study demonstrates that the Bengali versions of established inflammatory back pain criteria are effective tools for identifying axial spondyloarthritis in clinical practice. Among the evaluated sets, Berlin criteria set 8a showed the highest sensitivity, making it particularly useful for early screening, while the Calin criteria offered the best specificity for differentiating inflammatory from mechanical back pain. The ASAS criteria provided a balanced diagnostic performance. Overall, these findings support the clinical utility of culturally adapted Bengali IBP criteria. Their routine use may facilitate earlier diagnosis, timely referral and improved management of axSpA in Bangladesh.

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