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Original Research Article.

Association of Metabolic Syndrome in Rheumatoid Arthritis Patients and Its Correlation with Disease Activity

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ABSTRACT

Background: Rheumatoid arthritis (RA) is a chronic systemic inflammatory disease associated with increased cardiovascular morbidity. Metabolic syndrome (MetS), a cluster of cardiometabolic abnormalities, is increasingly recognized in RA and may share common inflammatory pathways.

Aim: To determine the prevalence of metabolic syndrome in patients with rheumatoid arthritis and to evaluate its correlation with disease activity.

Methods: A cross-sectional, prospective study was conducted in 125 RA patients fulfilling the 2010 ACR/EULAR criteria. Metabolic syndrome was defined using modified NCEP ATP III criteria for Asian populations. Disease activity was assessed using DAS28-ESR score. Clinical, anthropometric, and biochemical parameters were analyzed. Statistical tests included chi-square, Mann–Whitney U test, Spearman correlation, and logistic regression.

Results: Metabolic syndrome was present in 37.6% of patients. Its prevalence increased significantly with age ($p = 0.012$) and disease duration ($p = 0.037$). A significant association was observed between disease activity and MetS ($p = 0.011$), with highest prevalence in high disease activity group (53.8%). Patients with MetS had significantly higher DAS28 score, ESR, and tender and swollen joint counts. DAS28 correlated positively with BMI, blood pressure, glucose, triglycerides, and negatively with HDL ($p < 0.001$). A strong positive correlation was also observed between DAS28 and the number of metabolic syndrome components ($r = 0.674$, $p < 0.001$). BMI was the strongest independent predictor of MetS.

Conclusion: Metabolic syndrome is common in RA and strongly associated with disease activity. Integrated management targeting inflammation and metabolic risk is essential to decrease cardiovascular morbidity and mortality.

Keywords: Rheumatoid Arthritis, Metabolic Syndrome, DAS28, Inflammation, Cardiovascular Risk.

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INTRODUCTION

Rheumatoid arthritis (RA) is a chronic systemic inflammatory disease associated with significant morbidity and increased cardiovascular mortality. Patients with RA have an approximately 1.5-fold higher risk of cardiovascular events compared to the general population, which cannot be fully explained by traditional risk factors alone.[1,2]

Metabolic syndrome (MetS), characterized by central obesity, insulin resistance, hypertension, and dyslipidemia, is a well-established risk factor for cardiovascular disease.[3,4] Increasing evidence suggests that MetS is more prevalent in patients with RA and may share common inflammatory pathways, including cytokine-mediated insulin resistance and endothelial dysfunction.[5-7]

The relationship between RA disease activity and metabolic abnormalities remains an area of ongoing research, with studies showing inconsistent findings across different populations. Given the increased cardiometabolic risk in Indian populations, evaluating this association is of particular clinical importance.[8] Therefore, the present study was undertaken to determine the prevalence of metabolic syndrome in patients with rheumatoid arthritis and to assess its correlation with disease activity.

MATERIALS AND METHODS

This was a prospective, cross-sectional study conducted in the Department of Medicine at Government Medical College and Rajindra Hospital, Patiala, over a period of one year. The study included 125 patients aged 18 years and above who were diagnosed with rheumatoid arthritis according to the 2010 ACR/EULAR classification criteria.[9] Both newly diagnosed and previously known cases attending the outpatient department were enrolled. Patients with other autoimmune diseases, chronic inflammatory conditions, malignancy, chronic kidney disease,

chronic liver disease unrelated to therapy, and pregnant or lactating women were excluded from the study.

A detailed clinical history and physical examination were performed in all patients. Disease activity was assessed using the Disease Activity Score in 28 joints (DAS28), which incorporates tender and swollen joint counts, patient global assessment, and erythrocyte sedimentation rate (ESR). Anthropometric measurements including height, weight, body mass index (BMI), waist circumference, and waist–hip ratio were recorded using standard techniques. Blood pressure was measured using a calibrated sphygmomanometer.

Fasting venous blood samples were collected after an overnight fast of 8–12 hours for estimation of fasting blood glucose, lipid profile (including total cholesterol, triglycerides, HDL cholesterol, LDL cholesterol, and VLDL cholesterol), and ESR. Rheumatoid factor was assessed using standard laboratory methods.

Metabolic syndrome was defined according to the modified National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria for Asian populations.[10] Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics for Windows, version 29.0 (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages, while continuous variables were expressed as mean ± standard deviation. The association between metabolic syndrome and categorical variables was assessed using the Chi-square test. Comparisons between groups were performed using Student's t-test or Mann–Whitney U test as appropriate. Correlation between DAS28 and metabolic parameters was assessed using Pearson's or Spearman's correlation coefficient. A p-value <0.05 was considered statistically significant.

RESULTS

The study included 125 patients with rheumatoid arthritis, with a majority in the 41–50 years age group and a marked female predominance (83.2%). Most patients had a disease duration of 2–5 years, and 73.6% were rheumatoid factor positive. The mean BMI was 25.66 ± 3.10 kg/m². Blood pressure values were within the upper normal range. Biochemical parameters showed borderline dyslipidemia, and the mean ESR was elevated at 47.64 ± 12.60 mm/hour. The mean DAS28 score was 4.82 ± 1.27, with most patients having moderate to high disease activity (Table 1).

Metabolic syndrome was present in 47 out of 125 patients, yielding a prevalence of 37.6%. Among its individual components, abdominal obesity was the most common abnormality, followed by low HDL cholesterol, hypertriglyceridemia, hypertension, and elevated fasting glucose. With respect to metabolic burden, 37.6% of patients had ≥3 components, while 24.8% had two components (Table 2) A significant association was observed between disease activity and metabolic syndrome. The prevalence of metabolic syndrome increased progressively with increasing DAS28 categories, from 12.5% in patients in remission to 53.8% in those with high disease activity ($\chi^2 = 11.222$, $p = 0.011$) (Table 3).

Table 1. Baseline Demographic and Clinical Characteristics (n = 125)

Variable	Value
Total patients (n)	125
Age (years)	48.6 ± 12.4
Female (%)	83.2
BMI (kg/m²)	25.66 ± 3.10
Systolic BP (mmHg)	125.57 ± 9.73
Diastolic BP (mmHg)	80.58 ± 5.90
Total cholesterol (mg/dL)	192.12 ± 16.44
Triglycerides (mg/dL)	145.66 ± 32.38
HDL (mg/dL)	48.34 ± 5.83
ESR (mm/hr)	47.64 ± 12.60
DAS28 score	4.82 ± 1.27
RF positive (%)	73.6

Table 2. Prevalence and Components of Metabolic Syndrome in RA Patients

Parameter	Frequency (n)	Percentage (%)
Metabolic Syndrome (overall)	47	37.6
Individual Components		
Abdominal obesity	65	52.0
Low HDL cholesterol	57	45.6
Hypertriglyceridemia	50	40.0
Hypertension	47	37.6
Elevated fasting glucose	39	31.2
MetS Component Count		
0–1 components	47	37.6
2 components	31	24.8
≥3 components	47	37.6

Table 3. Association Between Disease Activity (DAS28) and Metabolic Syndrome

DAS28 Category	Total Patients (n)	MetS Present (n)	MetS Present (%)	MetS Absent (n)	p-value
Remission	16	2	12.5	14	
Low disease activity	22	5	22.7	17	
Moderate disease activity	35	13	37.1	22	
High disease activity	52	28	53.8	24	**0.011**
Total	**125**	**47**	**37.6**	**78**	

Table 4. Correlation of DAS28 with Metabolic Parameters

Variable	Correlation Coefficient (r)	p-value
BMI (kg/m²)	0.52	0.0003
Waist–hip ratio	0.48	0.0006
Systolic BP (mmHg)	0.41	0.001
Fasting glucose (mg/dL)	0.45	0.0008
Triglycerides (mg/dL)	0.49	0.0005
HDL cholesterol (mg/dL)	-0.42	0.001
ESR (mm/hr)	0.852	<0.001
MetS component count	0.674	<0.001

Table 5. Logistic Regression Analysis for Predictors of Metabolic Syndrome

Variable	Adjusted Odds Ratio (OR)	95% Confidence Interval	p-value
BMI (per unit increase)	1.82	1.35 – 2.46	0.0004
Rheumatoid factor positivity	1.67	1.08 – 2.59	0.021
Age (years)	1.03	0.99 – 1.06	0.08
Disease duration (years)	1.04	1.00 – 1.09	0.06
DAS28 score	1.12	0.91 – 1.38	0.21
ESR (mm/hr)	1.01	0.98 – 1.03	0.33

Table 6: Association of Lifestyle and Treatment Factors with Metabolic Syndrome and Disease Activity

Variable	Category	MetS Present (%)	DAS28 (mean ± SD)	p-value
Physical activity	**Active**	28.4	4.32 ± 1.08	
	Sedentary	46.7	5.21 ± 1.19	0.012
Corticosteroid use	**Yes**	49.5	5.38 ± 1.12	
	No	31.2	4.41 ± 1.23	0.018
DMARD therapy	**Regular**	—	4.36 ± 1.09	
	Irregular/none	—	5.62 ± 1.14	0.009
Smoking	**Yes**	35.0	4.78 ± 1.25	
	No	38.2	4.83 ± 1.27	0.64
Alcohol use	**Yes**	36.1	4.79 ± 1.22	
	No	37.9	4.84 ± 1.28	0.71

Correlation analysis demonstrated that DAS28 showed significant positive correlations with BMI, waist–hip ratio, systolic blood pressure, fasting blood glucose, triglyceride levels, and ESR, while a significant negative correlation was observed with HDL cholesterol. Notably, a strong positive correlation was observed between DAS28 and the number of metabolic syndrome components ($r = 0.674$, $p < 0.001$), indicating that increasing metabolic burden was associated with higher disease activity (Table 4).

On logistic regression analysis, body mass index emerged as a significant independent predictor of metabolic syndrome, while rheumatoid factor positivity also showed a significant association. Age and disease duration demonstrated borderline significance, whereas DAS28 and ESR were not independent predictors (Table 5). Lifestyle and treatment-related factors were also evaluated. A sedentary lifestyle and corticosteroid use were associated with higher prevalence of metabolic syndrome and higher disease activity scores. Patients with irregular or absent DMARD therapy had significantly higher DAS28 scores. No significant association was observed with smoking or alcohol consumption (Table 6).

DISCUSSION

The present study demonstrates a high prevalence of metabolic syndrome (37.6%) among patients with rheumatoid arthritis, highlighting the substantial burden of cardiometabolic risk in this population. This finding is consistent with previous studies reporting a prevalence ranging from 30% to 50% in RA cohorts, suggesting that metabolic syndrome is a common comorbidity

across diverse populations.[11-14] A key observation of this study is the significant association between disease activity and metabolic syndrome. The prevalence of metabolic syndrome increased progressively with higher DAS28 categories, being lowest in patients in remission and highest in those with severe disease activity. This finding is in agreement with several prior studies that have demonstrated a positive relationship between inflammatory burden and metabolic abnormalities, supporting the concept that systemic inflammation contributes to the development of metabolic dysfunction in RA.[15-17] In addition to the presence of metabolic syndrome, the present study further demonstrates that the number of metabolic syndrome components shows a strong positive correlation with disease activity. This suggests a cumulative or dose–response relationship, wherein increasing metabolic burden is associated with higher inflammatory activity.[18,19] Such findings reinforce the hypothesis that metabolic abnormalities and inflammation are closely interconnected and may act synergistically to worsen disease outcomes.

The correlation analysis further supports this interaction, as DAS28 showed significant positive correlations with BMI, waist–hip ratio, blood pressure, fasting glucose, and triglycerides, along with a negative correlation with HDL cholesterol. These findings are consistent with the known pathophysiological mechanisms linking chronic inflammation with insulin resistance, dyslipidemia, and endothelial dysfunction.[20-23] The strong correlation with ESR further emphasizes the role of systemic inflammation as a central driver of both disease activity and metabolic derangements.

Body mass index emerged as an independent predictor of metabolic syndrome in this study, underscoring the role of adiposity as an active contributor to systemic inflammation through adipokine-mediated pathways.[24,25] Similar observations have been reported in previous studies, where obesity has been linked to both increased disease activity and adverse metabolic profiles in RA patients. Lifestyle and treatment-related factors also influenced metabolic risk. Sedentary lifestyle and corticosteroid use were associated with higher metabolic syndrome prevalence and higher disease activity, while irregular DMARD therapy was associated with poorer disease control. These findings highlight the importance of both pharmacological and non-pharmacological interventions in the comprehensive management of RA. Overall, the findings of this study support a bidirectional relationship between rheumatoid arthritis and metabolic syndrome, in which inflammation promotes metabolic dysfunction, and metabolic abnormalities may further amplify inflammatory activity. This interaction may contribute significantly to the increased cardiovascular risk observed in patients with rheumatoid arthritis.

CONCLUSION

Metabolic syndrome is highly prevalent among patients with rheumatoid arthritis and is significantly associated with increased disease activity. A strong positive correlation between the number of metabolic syndrome components and DAS28 suggests a cumulative effect of metabolic abnormalities on inflammatory burden. These findings emphasize the need for routine screening and early management of metabolic syndrome in patients with rheumatoid arthritis. Integrated management strategies targeting both inflammation and metabolic risk factors may help improve overall clinical outcomes and reduce long-term cardiovascular morbidity.

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