

Clinical Significance of Rheumatologic Autoantibodies in Treatment-Naïve Patients with Lymphoma, Breast, and Gastrointestinal Cancers: A Case-Control Study

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ABSTRACT

Background: The production of autoantibodies in cancer patients is a recognized phenomenon, yet their clinical significance and diagnostic yield remain debated. This study evaluated the frequency of rheumatologic autoantibodies in treatment-naïve patients and their association with clinical parameters.

Materials and Methods: In this case-control study, 150 treatment-naïve cancer patients (50 lymphoma, 50 breast cancer, 50 GI cancers) and 150 matched healthy controls were enrolled. A broad rheumatologic panel was performed. Clinical staging and molecular subtyping were recorded, and the 24-month progression-free survival (PFS) was also evaluated in a DLBCL subgroup to assess the prognostic weight of ANA and RF positivity.

Results: ANA and RF positivity were significantly more prevalent in cancer patients (particularly breast and lymphoma) than in controls. However, specific markers (anti-dsDNA, anti-CCP) were almost entirely negative. In lymphoma, aggressive types showed higher numerical autoantibody positivity than indolent forms, though not reaching statistical significance (p -value < 0.05). ANA and RF positivity were not significantly associated with 2-year PFS in the DLBCL subgroup ($p > 0.05$). In breast and GI cancers, no consistent correlation was found between ANA status and molecular subtypes or histology.

Conclusion: While ANA and RF may be positive in malignancy due to immune dysregulation, these findings are largely non-specific. In the absence of clinical rheumatic symptoms, extensive autoantibody screening does not provide additional diagnostic or prognostic value and should neither prompt a diagnosis of a rheumatic disease nor alter the oncological treatment plan.

Keywords: Autoantibodies; Neoplasms; Lymphoma; Rheumatoid factor

INTRODUCTION

Cancer is associated with complex alterations in immune system regulation. The bidirectional interaction between malignancies and immune dysregulation¹, highlights an association between autoimmune disorders, rheumatic diseases, and malignancies. In particular, patients with conditions such as rheumatoid arthritis (RA) may be at an increased risk of developing lung cancer or

lymphoma, as chronic inflammation induces DNA damage and malignant transformation². Conversely, malignancies can trigger paraneoplastic rheumatic syndromes, presenting as inflammatory musculoskeletal manifestations. They may precede clinical cancer³.

Paraneoplastic syndromes arise from immune-mediated cross-reactivity, where antibodies or T

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cells targeting tumor antigens erroneously attack healthy tissues⁴. While ANA and RF are hallmark markers of rheumatic disease, their presence in some patients (particularly those hospitalized)⁴ may signal an occult malignancy. Consequently, in the context of suspected paraneoplastic phenomena, ANA or RF positivity warrants further investigation to exclude an underlying cancer^{5,6}.

Rheumatologic autoantibodies are frequently detected in a variety of malignancies, including colorectal cancer⁷, lymphomas⁸, and breast cancer⁹, even in the absence of clinical manifestations of paraneoplastic rheumatic syndromes. Mechanisms for this subclinical loss of self-tolerance include the expression of B7 molecules by non-Hodgkin lymphomas (enabling them to function as antigen-presenting cells (APCs))¹⁰ and Fas death receptor mutations that impair the apoptosis of autoreactive B and T lymphocytes¹¹.

Additional mechanisms for lymphoma-associated autoantibodies include B-cell tolerance defects, chronic antigenic stimulation, cytokine-mediated activation, dysregulation of NOTCH signaling pathways, and autonomous antibody production by malignant cells^{12,13}. Notably, autoantibody prevalence varies by malignancy subtype. One study reported that ANA positivity is significantly more frequent in patients with DLBCL compared with other lymphoma subtypes¹⁴.

In view of the inconsistent evidence and the fact that many prior studies have focused solely on a single cancer type or narrowly defined populations, further research involving more diverse patient groups was warranted. Accordingly, this study evaluates the autoantibody profile in treatment-naïve patients with three major malignancies (lymphoma, breast, and gastrointestinal cancers) to elucidate the relationship between autoantibodies and cancer. The aim of this study is to evaluate the usefulness of these markers in predicting tumor type, disease progression, and the progression-free survival of patients. The findings of this investigation may contribute to a better understanding of the relationship between cancer and autoimmunity.

MATERIALS AND METHODS

Study Design and Participants

This analytical case-control study at Hazrat-e Rasool Hospital aimed to evaluate the clinical significance of rheumatologic autoantibodies in lymphoma, breast, and gastrointestinal (GI) malignancies. Participants (n=300) included 150 treatment-naïve patients (50

per cancer subgroup) and 150 age- and sex-matched healthy controls. Inclusion required pathologically confirmed malignancy without prior immunomodulatory or immunosuppressive therapy. Healthy controls had no history of malignancy, rheumatologic disease, chronic infections, or family history of autoimmune disorders. Individuals currently taking immunosuppressive or immunomodulatory medications were also excluded.

Data collection

Data were collected using a researcher-designed checklist that included age, sex, type of malignancy, cancer stage determined by AJCC 8th edition/BCLC/TNM (GI/breast), and Ann Arbor/Rai systems (lymphoma), histological subtypes of breast cancer, and the results of rheumatologic autoantibody assessments.

The evaluated rheumatologic autoantibodies and laboratory markers in all participants included ANA, anti-dsDNA, RF, anti-CCP, complement levels (C3, C4, and CH50), P-ANCA, C-ANCA, anti-SSA, anti-SSB, ACE level, anti-Scl-70 antibody, anti-centromere antibody, antiphospholipid antibodies (anticardiolipin and anti-β₂ glycoprotein I [IgG/IgM]), and lupus anticoagulant. Autoantibody evaluations were performed in all patients prior to the first chemotherapy session. ANA testing was conducted using ELISA. An index value > 1.1 was considered positive, while values < 0.9 were considered negative. Results in the equivocal range (0.9–1.1) were considered negative for statistical analysis. Similarly, RF positivity was defined as values >20 IU/mL. Positive RF results were further categorized into low-titer (1–3 × the upper limit of normal [ULN]) and high-titer (>3 × ULN) categories.

A rheumatologist screened all patients for signs and symptoms suggestive of rheumatic diseases. These manifestations included arthritis, arthralgia, skin rash, Raynaud's phenomenon, sicca symptoms (dry eyes and dry mouth), muscle weakness, and oral ulcers. Clinical findings were documented whenever present. Clinical outcomes were assessed during a 2-year follow-up period. Progression-free survival (PFS) was defined as the time from initiation of chemotherapy to the first documented event, defined as disease progression, relapse, or death from any cause. Healthy controls had no history of malignancy or rheumatologic disease. The study protocol was approved by the institutional Ethics Committee.

Statistical analysis

Data were analyzed using IBM SPSS (version 26). The Fisher exact test and Chi-square test were used for comparison of categorical variables, and the independent-samples t-test was applied for continuous variables. $P < 0.05$ was considered significant.

RESULT

Patient characteristics

A total of 300 participants were enrolled in this study, with a mean age of 59.05 ± 12.46 years. No

significant differences were observed in age or sex between the cancer groups and their corresponding controls ($P > 0.05$), confirming appropriate matching (Table 1). Sex distribution was comparable between groups ($P > 0.05$). Males predominated in gastrointestinal cancer (60%) and lymphoma (62%), while all breast cancer participants were female (Table 2). The mean age was 66.54 ± 8.98 years in gastrointestinal cancers, 57.96 ± 15.10 years in lymphoma, and 53.66 ± 8.27 years in breast cancer (Table 1).

Table 1: Age distribution of study participants in case and matched control groups

Malignancy type	Patients (years) Mean $\pm$ SD	Matched controls (years) Mean $\pm$ SD	P
Gastrointestinal cancers	66.54 ± 8.98	66.22 ± 8.66	0.856
Breast cancer	53.66 ± 8.27	53.22 ± 8.29	0.791
Lymphoma	57.96 ± 15.10	56.72 ± 15.66	0.688
P (between patient groups)†	<0.001	–	

† Independent samples t-test

‡ One-way ANOVA

Table 2: Sex distribution of study participants in case and matched control groups

Malignancy type	Patients		Controls		P
	Male n (%)	Female n (%)	Male n (%)	Female n (%)	
Gastrointestinal cancers	30 (60%)	20 (40%)	30 (60%)	20 (40%)	1.000
Breast cancer	0 (0%)	50 (100%)	0 (0%)	50 (100%)	–
Lymphoma	31 (62%)	19 (38%)	31 (62%)	19 (38%)	1.000
P (between patient groups)	<0.001				

Chi-square test

Based on the AJCC/ BCLC/TNM system and the Ann Arbor/Rai criteria, early-stage disease (I–II) predominated in breast cancer (58%), whereas advanced stages (III–IV) were more common in lymphoma (60%) and gastrointestinal cancers (66%)

(Figure 1). All patients were evaluated by a rheumatology subspecialist and had no clinical features suggestive of systemic rheumatologic disease.

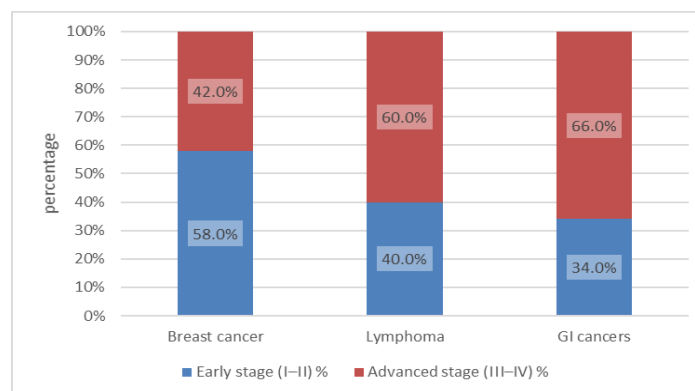


Figure 1. Classification of Patients by Malignancy Stage

RF positivity was observed in 10% of gastrointestinal cancer patients, 12% of breast cancer patients, and 16% of lymphoma patients, compared with 2% in all control groups. The difference was not statistically significant for gastrointestinal or breast cancers ($P > 0.05$). However, lymphoma patients showed a significantly higher RF positivity than controls ($P = 0.031$; OR = 9.33, 95% CI: 1.12–77.70). No significant difference in RF positivity was found among the three malignancy groups ($P = 0.656$) (Table 3). Notably, all positive RF cases across both groups were classified as low-titer ($\leq 3 \times$ ULN), and no high-titer ($> 3 \times$ ULN) cases were detected. Similarly, all ANA-positive results consistently fell within the low index range (1.1–3.0), categorized as low-titer positive.

ANA positivity was 14% in gastrointestinal cancers, 24% in breast cancers, and 22% in the lymphoma group, compared with 2%, 8%, and 4% in controls,

respectively. This difference was significant for breast cancer ($P=0.029$; OR=3.63) and lymphoma ($P=0.007$; OR=6.77), and reached borderline significance in gastrointestinal cancers ($P= 0.059$). No significant differences were observed among malignancy groups ($P= 0.417$)

Other autoantibodies, including P-ANCA and antiphospholipid antibody, were identified exclusively in lymphoma patients. No positivity for these markers was observed in breast or gastrointestinal cancer groups. At least one rheumatologic autoantibody was detected in 24% of gastrointestinal cancer, 32% of breast cancer, and 30% of lymphoma patients, compared with 4%, 10%, and 6% in corresponding controls. These differences were significant across all malignancy groups (all $P < 0.01$; Table 3), with no significant variation between the three cancer types ($P = 0.655$) (Table 3).

Table 3: Association between Rheumatologic Autoantibodies and Type of Malignancy

Type of Malignancy	Positive autoantibody	Patients (n, %)	Controls (n, %)	OR (95% CI)	P
Gastrointestinal cancer	RF	5 (10%)	1 (2%)	44.5 (0.61–48.40)	0.204
	ANA	7 (14%)	1 (2%)	7.98 (0.94–67.45)	0.059†
	Any rheumatologic autoantibody	12 (24%)	2 (4%)	7.57 (1.60–35.93)	0.004‡
Breast cancer	RF	6 (12%)	1 (2%)	6.68 (0.77–57.70)	0.112
	ANA	12 (24%)	4 (8%)	3.63 (1.08–12.18)	0.029‡
	Any rheumatologic autoantibody	16 (32%)	5 (10%)	4.24 (1.41–12.71)	0.007‡
Lymphoma	RF	8 (16%)	1 (2%)	9.33 (1.12–77.70)	0.031‡
	ANA	11 (22%)	2 (4%)	6.77 (1.42–32.37)	0.007‡
	Any rheumatologic autoantibody	15 (30%)	3 (6%)	6.71 (1.80–25.00)	0.002‡
P(between patient groups)		RF: 0.656	ANA: 0.417	Any autoantibody: 0.655	

† Fisher's exact test; ‡ Chi-square test

Clinical Correlations and Outcomes

Lymphoma subgroup analysis showed varying autoantibody frequencies. The highest rates were observed in DLBCL (RF 23.8%, ANA 33.3%) and Hodgkin lymphoma (RF 20%, ANA 30%). Marginal zone lymphoma also demonstrated relatively high positivity (RF and ANA 33.3%). Follicular lymphoma showed isolated autoantibody positivity in 33.3% of

cases. Other subtypes including Burkitt lymphoma, mantle cell lymphoma, CLL/SLL, and T-cell lymphoma showed no detectable autoantibodies. However, these differences were not statistically significant ($P > 0.05$) (Figure 2).

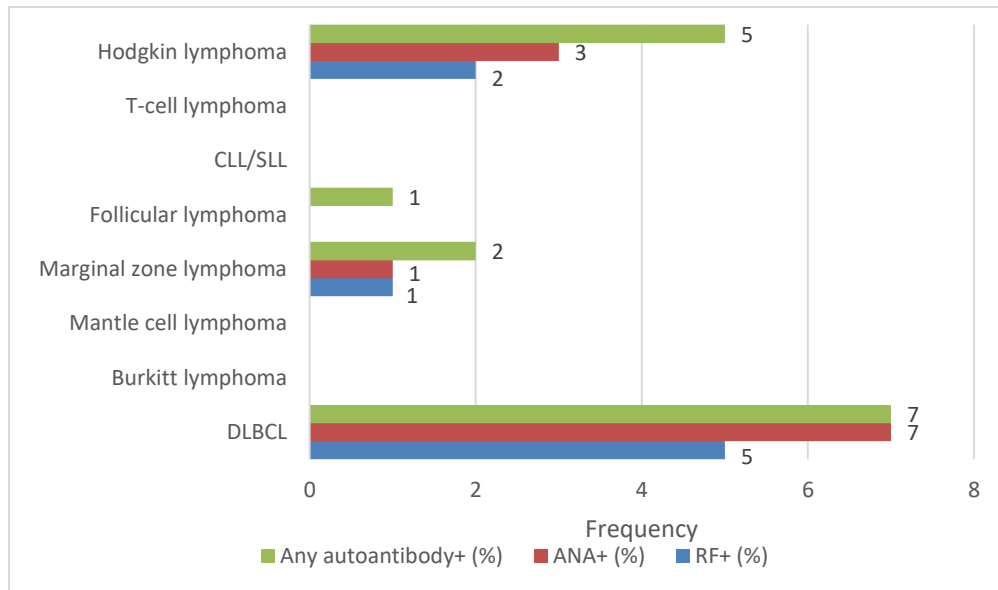


Figure 2. Distribution of Positive Rheumatologic Autoantibodies Across Different Lymphoma Types

When comparing aggressive lymphoma subtypes (DLBCL, BL, and MCL) and indolent forms (MZL, FL, and CLL/SLL), RF positivity was 20.8% vs. 10%, ANA positivity 29.2% vs. 10%, and overall autoantibody

positivity 29.2% vs. 30%, respectively. None of these differences reached statistical significance (Table 4).

Table 4: Association between rheumatologic autoantibodies and aggressiveness classification in B-cell non-Hodgkin lymphoma

Autoantibody		Indolent lymphoma (n = 10)	Aggressive lymphoma (n = 24)	P †
RF	Negative	9 (90.0%)	19 (79.2%)	0.644
	Positive	1 (10.0%)	5 (20.8%)	
ANA	Negative	9 (90.0%)	17 (70.8%)	0.385
	Positive	1 (10.0%)	7 (29.2%)	
Any autoantibody	Negative	7 (70.0%)	17 (70.8%)	0.961
	Positive	3 (30.0%)	7 (29.2%)	

† Fisher's exact test

No statistically significant association was observed between disease stage and RF or ANA positivity in any malignancy group ($P > 0.05$). However, in breast cancer, overall autoantibody positivity was

significantly higher in advanced stages compared with early stages (47.6% vs. 20.7%, $P = 0.044$) (Table 5).

Table 5. Association between rheumatologic autoantibodies and cancer stage in different malignancies

Cancer type	Autoantibody	Early-stage (I-II)	Advanced-stage (III-IV)	P
Breast cancer (n=50)	RF	1 (4.3%)	5 (23.8%)	0.070
	ANA	5 (17.2%)	7 (33.3%)	0.189†
	Any autoantibody	6 (20.7%)	10 (47.6%)	0.044‡
Lymphoma (n=50)	RF	3 (15%)	5 (16.7%)	1.000
	ANA	3 (15%)	8 (26.7%)	0.489
	Any autoantibody	5 (25%)	10 (33.3%)	0.754‡
Gastrointestinal cancers (n=50)	RF	1 (5.9%)	4 (12.1%)	0.650
	ANA	1 (5.9%)	6 (18.2%)	0.398
	Any autoantibody	2 (11.8%)	10 (30.3%)	0.181

† Fisher's exact test

‡ Chi-square test

In diffuse large B-cell lymphoma, no significant difference in 2-year progression-free survival (PFS) was observed between autoantibody-positive and autoantibody-negative patients ($P > 0.05$). Despite higher ANA and RF frequencies, autoantibody status

was not associated with disease progression or survival outcomes (Table 6).

Table 6. Association between Rheumatologic Autoantibodies and Progression-Free Survival (PFS)

Variable	Group	N	Mean PFS (months) $\pm$ SD	p
ANA	Negative	14	16.57 $\pm$ 9.04	0.560
	Positive	7	13.43 $\pm$ 8.87	
RF	Negative	16	16.44 $\pm$ 8.97	0.413
	Positive	5	12.60 $\pm$ 8.88	
Any rheumatologic autoantibody	Negative	14	16.57 $\pm$ 9.04	0.560
	Positive	7	13.43 $\pm$ 8.87	

Mann–Whitney U test

In breast cancer, overall autoantibody positivity differed significantly across molecular subtypes ($P=0.039$), with the highest frequency in Luminal B and triple-negative breast cancer (TNBC). The results showed that RF was associated with the molecular subtype ($P=0.010$). However, ANA did not show such an association ($P=0.522$). No association was

observed between these markers and the histological type of the tumor. In gastrointestinal cancers, ANA positivity was more frequently observed in hepatobiliary tumors. However, this marker was not associated with the stage or severity of the disease (Table 7).

Table 7. Association between rheumatologic autoantibodies and tumor characteristics in breast and gastrointestinal cancers

		RF positive n (%)	P	ANA positive n (%)	P	Any autoantibody positive n (%)	P
Breast cancer	Molecular subtype	Luminal A (n = 24)	0.010	4 (16.7%)	0.522	4 (16.7%)	0.039
		Luminal B (n = 11)		4 (36.4%)		7 (63.6%)	
		Triple-negative (n = 12)		3 (25%)		4 (33.3%)	
		HER2-enriched (n = 3)		1 (33.3%)		1 (33.3%)	
	Histopathological type	IDC (n = 40)	1.000	10 (25%)	0.584	14 (35%)	0.457
		ILC (n = 6)		2 (33.3%)		2 (33.3%)	
		Other (n = 4)		0 (0%)		0 (0%)	
Gastrointestinal cancer type		Colorectal (n = 20)	1.000	3 (15%)	0.799	5 (25%)	0.758
		Gastric (n = 12)		1 (8.3%)		2 (16.7%)	
		Pancreatic (n = 10)		1 (10%)		2 (20%)	
		Hepatobiliary (n = 8)		2 (25%)		3 (37.5%)	

DISCUSSION

The interpretation of rheumatologic autoantibodies in patients with newly diagnosed cancer is not always straightforward. The presence of these markers may lead physicians to perform unnecessary evaluations for autoimmune diseases. This issue is of greater importance in lymphoma, breast cancer, and gastrointestinal cancers due to the relatively high prevalence of autoantibody positivity. However, this topic has not been well studied especially in

treatment-naïve patients. Therefore, in the present study, we evaluated the baseline frequency and clinical significance of these markers prior to the initiation of treatment.

The frequency of ANA and RF positivity was higher in all cancer groups than in the control group. However, because of the data distribution and sample variations, this difference was statistically significant

only for RF in lymphoma and ANA in lymphoma and breast cancer.

Subgroup analysis showed that the highest rates of autoantibody positivity occurred within the Luminal B and TNBC breast cancer subgroups. These markers were also more prevalent in advanced stages of the disease compared to early stages. However, no association was observed between disease stage and autoantibody presence in gastrointestinal cancers or lymphoma.

To avoid the influence of anticancer treatments on immune-related results, all patients were evaluated before the initiation of therapy. In addition, unlike many previous studies that assessed only a limited number of markers, this study employed a broad panel of autoantibodies. This approach allowed a more comprehensive evaluation of immune system dysregulation across different types of cancer.

Rheumatologic autoantibodies were more frequently detected in patients with malignancies than in healthy controls, occurring in 24% of gastrointestinal cancers, 32% of breast cancers, and 30% of lymphomas. A study by Rugienė et al reported no difference in ANA prevalence between paraneoplastic arthritis and undifferentiated arthritis¹⁵, which is consistent with the absence of rheumatologic symptoms in the ANA- or RF-positive patients in our study. Therefore, ANA or RF positivity in cancer patients without clinical rheumatologic manifestations should not be interpreted as evidence of autoimmune disease or prompt unnecessary diagnostic investigations or changes in the patient's treatment plan. These antibodies likely reflect nonspecific tumor-associated immune dysregulation. Consistent with our findings, previous studies have reported a significantly higher prevalence of various rheumatologic markers in malignancy, particularly antiphospholipid antibodies such as anticardiolipin (aCL) and anti-β2 glycoprotein I (anti-β2-GPI)¹⁶.

Despite screening an extensive panel, only three cases beyond ANA and RF (specifically p-ANCA and anticardiolipin antibodies) were identified, all within the lymphoma group. This low prevalence of antiphospholipid antibodies (aPL) contrasts with some prior reports but aligns with a systematic review finding no significant aPL increase in breast cancer. These discrepancies likely arise from variations in the specific malignancy types included across studies¹⁷.

In the current study, RF positivity was 10%, 12%, and 16% in gastrointestinal cancer, breast cancer, and lymphoma patients, respectively, compared with 2%

in controls, reaching significance only in the lymphoma group. Our breast cancer findings align with Kim et al's study¹⁸, whereas Schattner et al. reported a higher RF rate in gastrointestinal cancers (19.3%), nearly double our observed rate¹⁹. This discrepancy may be explained by differences in study populations, cancer stage and subtype, laboratory methodologies, concomitant inflammatory or infectious conditions, and sample size. Consistent with our RF-lymphoma association, meta-analytic data show increased lymphoma risk but reduced gastrointestinal and breast cancer risk in RA patients²⁰. In lymphoproliferative disorders, RF is typically oligoclonal and originates from an unmutated germline gene²¹. Therefore, elevated RF in lymphoma signifies dysregulated clonal B-cell expansion rather than a classic autoimmune response observed in RA. Evidence suggests that chronic inflammation, indicated by markers like CXCL13, drives B-cell activation and may trigger lymphomagenesis. This highlights how unresolved inflammatory states in RA patients significantly increase the risk of developing lymphomas, particularly DLBCL²².

In the present study, ANA positivity was significantly higher in breast cancer (24% vs. 8%; OR=3.63) and lymphoma (22% vs. 4%; OR=6.77) than in controls, whereas the difference in gastrointestinal cancers (14% vs. 4%) was not statistically significant. Our findings align with the overall trend reported by Chen et al. (2025) in treatment-naïve cancer patients (20.1% vs. 10.5%)²³. However, the lack of subgroup analysis by tumor type in their study limits direct comparisons with our gastrointestinal cancer findings. In contrast to our findings, Liang et al. (2025) reported a significantly higher ANA prevalence in colorectal cancer (50%) and polyp group (46.5%), a discrepancy possibly due to their smaller, cancer-specific sample⁷. However, our results for breast cancer and lymphoma align with external data. Specifically, Nisihara et al. found 44.4% ANA positivity in breast cancer⁹; similarly studies on lymphoma reported ANA prevalence rates of 27% and 31.5%, supporting the trends observed in our case-control study^{8, 24}.

Consistent with previous reports, cancer stage showed no association with ANA or RF positivity in our study^{8, 25}. Some literature suggests a prognostic role for ANA^{26, 27}, particularly in DLBCL²⁸. However, our study found no significant difference in progression-free survival (PFS) between ANA-positive and ANA-negative DLBCL patients, aligning with Zou et al. (2015)²⁴. Therefore, our data suggest

that broad evaluation of autoantibodies may not be necessary for determining disease progression in malignancies.

Although Frost et al. (2023) reported no overall association between ANA and non-Hodgkin lymphoma, they reported a correlation with DLBCL in subgroup analysis¹⁴. While this may appear inconsistent with our statistical findings, it should be noted that 7 out of the 10 ANA-positive lymphoma cases in the present study occurred in patients with DLBCL. This suggests that the nonsignificant subgroup findings likely result from small sample sizes rather than biological inconsistency.

Autoantibodies in malignancy are generally classified into two categories²⁹. The first includes antibodies against non-tumoral antigens involved in cell-cycle regulation and mitosis, such as ANA. The second category comprises antibodies directed against tumor-associated antigens (TAAs), including oncoproteins like p53 and HER2³⁰. While immune responses against TAAs are thought to aid in eliminating premalignant lesions³¹, the clinical significance of ANA in this context remains a subject of debate^{24, 32}.

The elevated ANA prevalence in lymphoma may stem from CD5+ B cells, a lineage that bridges lymphoproliferation and autoantibody production²⁸. Disease stage showed no significant association with autoantibody positivity across most malignancies, suggesting that ANA and RF presence reflects intrinsic immune dysregulation during carcinogenesis rather than tumor burden. In breast cancer, autoantibodies were more frequently observed in the Luminal B and TNBC subgroups. This finding may suggest the more active or distinct immune environment in these subgroups. Furthermore, these phenotypes are biologically more aggressive and are usually associated with higher Ki-67 expression and activation of inflammatory pathways such as NF- κ B and IL-6/JAK/STAT3. These pathways are directly involved in B-cell activation and the subsequent production of autoantibodies³³.

This study has some limitations. While indirect immunofluorescence (IFA) remains the gold standard for ANA assessment, our study relied on ELISA-based screening per the institutional protocols. This methodological constraint may have led to an overestimation of autoantibody positivity; therefore, future investigations should employ IFA for confirmatory analysis. Furthermore, the study was conducted at a single center and used convenience sampling; therefore, the results may

not be generalizable to all patients. The small number of samples in some subgroups may have reduced the study's ability to detect weaker associations. The two-year follow-up period may be insufficient to fully evaluate PFS; thus, studies with extended longitudinal monitoring are warranted. Finally, although each malignancy group was compared with its own age- and sex-matched control group, residual confounding related to age cannot be completely excluded.

CONCLUSION

In conclusion, the presence of malignancy may be associated with a mild but persistent increase in rheumatologic autoantibodies, particularly ANA and RF. However, no clear pattern of specific rheumatologic autoimmune diseases was observed in these patients. These findings may suggest that autoantibodies in cancer patients could reflect immune dysregulation rather than a true autoimmune disease. In addition, no clear association was observed between disease stage and autoantibody positivity. Moreover, ANA did not appear to have significant prognostic value in patients with DLBCL. Therefore, broad measurement of these autoantibodies in cancer patients may have limited clinical and prognostic utility. Larger, multicenter studies are needed to further clarify their role in tumor immunity.

CONFLICT OF INTERESTS

The authors declared that they have no conflict of interests.

Abbreviation	Full Term
ACE	Angiotensin-Converting Enzyme
AJCC	American Joint Committee on Cancer
ANA	Antinuclear Antibody
Anti- β 2-GPI	Anti- β 2 Glycoprotein I Antibody
Anti-CCP	Anti-Cyclic Citrullinated Peptide
Anti-dsDNA	Anti-Double-Stranded DNA
Anti-Scl-70	Anti-Topoisomerase I Antibody
aCL	Anticardiolipin Antibodies
APC	Antigen-Presenting Cell
BL	Burkitt Lymphoma
C-ANCA	Cytoplasmic Anti-Neutrophil Cytoplasmic Antibody
CLL/SLL	Chronic Lymphocytic Leukemia / Small Lymphocytic Lymphoma
DLBCL	Diffuse Large B-Cell Lymphoma
ELISA	Enzyme-Linked Immunosorbent Assay
FL	Follicular Lymphoma
GI	Gastrointestinal
HL	Hodgkin Lymphoma
IDC	Invasive Ductal Carcinoma
ILC	Invasive Lobular Carcinoma
MCL	Mantle Cell Lymphoma
MZL	Marginal Zone Lymphoma
NHL	Non-Hodgkin Lymphoma
OR	Odds Ratio
P-ANCA	Perinuclear Anti-Neutrophil Cytoplasmic Antibody
PFS	Progression-Free Survival
RA	Rheumatoid Arthritis
RF	Rheumatoid Factor
SSA (Ro)	Anti-Sjögren's-Syndrome-Related Antigen A
SSB (La)	Anti-Sjögren's-Syndrome-Related Antigen B
TAA	Tumor-Associated Antigen
TNBC	Triple-Negative Breast Cancer
TNM	Tumor, Node, Metastasis Classification System

BCLC: The Barcelona Clinic Liver Cancer (for hepatocellular carcinoma)

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