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Original Research Article

Clinicopathological Assessment of Hodgkin and Non-Hodgkin Lymphomas in a Sample of Iraqi Patients

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Abstract: ***Background*:** Lymphomas are heterogeneous malignant neoplasms of lymphoid origin and represent the most common hematologic malignancies worldwide. They are broadly classified into Hodgkin lymphoma (HL) and non-Hodgkin lymphoma (NHL) based on morphologic and immunophenotypic criteria. Accurate subclassification using immunohistochemistry is essential for appropriate diagnosis and management. ***Aim*:** To perform a clinicopathological assessment of Hodgkin and non-Hodgkin lymphoma among Iraqi patients, evaluating frequency, age, sex, site distribution, and the diagnostic value of immunohistochemical markers. ***Methods*:** A retrospective descriptive study was conducted on 118 cases of malignant lymphoma diagnosed between January 2022 and December 2024. Cases were collected from multiple teaching laboratories and pathology departments. Clinical and pathological data, including age, sex, tumor site, size, biopsy type, and immunophenotype, were extracted from reports. Excisional biopsy was the most common diagnostic method. A panel of 32 immunohistochemical markers was used for classification. Cases with incomplete data or inadequate tissue were excluded. ***Results*:** Non-Hodgkin lymphoma predominated (71.2%) over Hodgkin lymphoma (28.8%). HL patients were younger (mean age 23.9 years), while NHL patients had a higher mean age (48.6 years). Classical HL accounted for 97.1% of HL cases, with mixed cellularity and nodular sclerosis as the main subtypes. B-cell lymphomas comprised 86.9% of NHL, with diffuse large B-cell lymphoma as the most frequent subtype (63%). Extranodal involvement was observed in 51.2% of NHL cases, whereas HL was predominantly nodal (88.2%). A male predominance (1.5:1) was noted overall. ***Conclusion*:** Distinct epidemiological and clinicopathological patterns exist between HL and NHL in this Iraqi cohort, highlighting the importance of regional data to support diagnostic accuracy and healthcare planning.

Keywords: Clinicopathological, Hodgkin, Non-Hodgkin, Lymphomas.

INTRODUCTION

Lymphomas are a heterogeneous group of malignant neoplasms arising from lymphoid tissues and constitute the most common hematologic malignancies worldwide. They are broadly categorized into Hodgkin lymphoma (HL) and non-Hodgkin lymphoma (NHL). Contemporary classification is based on the World Health Organization (WHO) framework and the 2022 International Consensus Classification (ICC), which integrate morphology, immunophenotype, genetic alterations, and clinical features. This integrated approach has major implications for diagnosis, risk stratification, and therapeutic decision-making [1]. The primary distinction between HL and NHL lies in the presence of Reed–Sternberg (RS) cells and their variants. HL typically shows contiguous nodal spread, whereas NHL demonstrates a more variable and often non-contiguous pattern of dissemination [2]. HL is a B-cell–derived malignancy characterized by RS cells within a rich inflammatory background composed of reactive lymphocytes, eosinophils, plasma cells, and histiocytes. Notably, the neoplastic cells usually represent a small fraction of the total tumor cellularity [3]. HL is subdivided into Classic Hodgkin Lymphoma (CHL), accounting for approximately 90–95% of cases, and Nodular Lymphocyte-Predominant Hodgkin Lymphoma (NLPHL). CHL includes four subtypes: nodular sclerosis, mixed cellularity, lymphocyte-rich, and lymphocyte-depleted [3]. RS cells in CHL typically express CD30 and CD15, show weak PAX5 positivity, and are usually negative for CD45 and CD20, although

variable CD20 expression may occur [4]. Increased PD-L1 and PD-L2 expression has therapeutic relevance in the era of immune checkpoint inhibitors [5]. In contrast, NLPHL is characterized by "popcorn" (lymphocyte-predominant) cells that strongly express B-cell markers such as CD20 and CD45 and lack CD15 and CD30 expression [6]. NHL comprises a biologically diverse group of lymphoid neoplasms arising from B cells (85–90%) or T/NK cells (10–15%) at different stages of differentiation [7]. Diffuse Large B-Cell Lymphoma (DLBCL) is the most common adult NHL and is classified into germinal center B-cell (GCB) and activated B-cell (ABC) subtypes with distinct prognostic implications [8]. Other major B-cell NHLs include follicular lymphoma with t(14;18) and BCL2 overexpression, mantle cell lymphoma with t(11;14) and cyclin D1 overexpression, marginal zone lymphoma, and Burkitt lymphoma characterized by MYC translocations and a very high proliferative index [4-9]. T-cell lymphomas include Peripheral T-Cell Lymphoma, NOS, and Anaplastic Large Cell Lymphoma, the latter subdivided into ALK-positive and ALK-negative variants [10]. Accurate subclassification requires comprehensive immunohistochemical panels, including lineage markers, germinal center markers, proliferation indices, and translocation-associated proteins, ensuring appropriate prognostication and therapeutic planning [4]. This study aims to perform a clinicopathological assessment of Hodgkin and non-Hodgkin lymphoma among Iraqi patients, analyzing frequency, demographic distribution, anatomical site, tumor size, and the diagnostic value of immunohistochemical markers in subtype identification.

METHOD

This retrospective descriptive study was conducted between January and November 2025 and included 118 cases of malignant lymphoma diagnosed in Iraqi patients between January 2022 and December 2024. Cases were obtained from the Teaching Laboratory of Al-Imamain Al-Kadhimain (AS) Medical City, the Pathology Department of Ghazi Al-Hariri Surgical Specialties Teaching Hospital, the Teaching Laboratories of Medical City, and selected private histopathology laboratories. Clinical and pathological data were retrieved from archived pathology reports, including age, sex, presenting clinical features, anatomical site, gross findings (including tumor size), biopsy procedure, and immunohistochemical profile. Excisional biopsy was the predominant diagnostic procedure (100 cases), mainly from lymph nodes, followed by incisional biopsy (12 cases) and tru-cut biopsy (6 cases). Less frequent excisional procedures included thyroidectomy, tonsillectomy, and right hemicolectomy specimens. All available hematoxylin and eosin (H&E) slides and immunohistochemically stained sections were re-examined independently by two pathologists to confirm diagnosis and subtype classification according to WHO/ICC criteria. Immunohistochemical evaluation utilized a panel of 32 markers. B-cell markers (CD20, CD79a, CD10, BCL2, BCL6, Cyclin D1) and T-cell markers (CD3, CD4, CD5, CD7, CD8) were applied for lineage determination. Hodgkin lymphoma–associated markers (CD15, CD30, CD45, EMA, MUM1) supported differentiation between classical Hodgkin lymphoma and nodular lymphocyte-predominant Hodgkin lymphoma. Proliferation and oncogenic markers (Ki-67, MYC, ALK) and selected viral/lineage markers (EBV, MPO, CD99) were used for further subclassification and exclusion of mimickers. Inclusion criteria required adequate clinical data and sufficient tissue for complete reassessment and immunophenotypic analysis. Cases with incomplete information or poor tissue preservation were excluded. Data were analyzed using SPSS version 22. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. Comparative analyses employed t-test, ANOVA, Chi-square, or Fisher's exact test as appropriate, with $p \leq 0.05$ considered statistically significant. Ethical approval was obtained from the Institutional Review Board of the College of Medicine, Al-Nahrain University (IRB/54, 25 November 2025).

RESULTS

The age group most affected by lymphoma is individuals aged 51–60, accounting for 20.3% of cases. The mean age of cases is (41.47±22.04). Males (60.2%) have a higher incidence than females (39.8%). Table (1) illustrates that the disease is more frequently nodal (60.2%) than extranodal (39.8%). The preponderance of cases (71.2%) are non-Hodgkin lymphoma (NHL), while 28.8% are Hodgkin lymphoma (HL). Table (1) illustrates that the average size of all cases is 32.75 ±39.24.

Table 1: Clinicopathological parameters of Hodgkin and Non-Hodgkin Lymphoma Cases

		No.	%
Age (years) (mean ± SD)		**41.47±22.04**	
Age groups (years)	1-10	9	7.6
	11-20	23	19.5
	21-30	10	8.5
	31-40	8	6.8
	41-50	16	13.6
	51-60	24	20.3
	61-70	17	14.4
	71-80	9	7.6
	81-90	2	1.7
Sex	Male	71	60.2
	Female	47	39.8
Site	Nodal	71	60.2
	Extra nodal	47	39.8
Type	HL	34	28.8
	NHL	84	71.2
Size (mm) (mean ± SD)		32.75±39.24	

HL: *Hodgkin lymphoma, NHL: non-Hodgkin lymphoma*

The majority of cases were diagnosed in youthful individuals, as the mean age of patients

diagnosed with Hodgkin lymphoma was 23.88 ± 16.48 years. The second decade (11_20) was the most frequently affected age group, accounting for 44.1% of the cases. As illustrated in table (2), males were more frequently affected (58.8%) than females (41.2%) with respect to gender distribution, indicating a male predominance in the incidence of Hodgkin lymphoma.

The disease was predominantly nodal (88.2%) in terms of the site of involvement, while extra-nodal involvement was significantly less prevalent (11.8%). The classical Hodgkin lymphoma form was significantly more prevalent (97.1%) than the non-classical subtype (nodular lymphocyte predominant Hodgkin lymphoma) (2.9%) in terms of histological type. Table (2) illustrates that the mean lesion size was 29.85 ± 16.08 mm, with moderate variation among the cases examined.

Table 2: Clinicopathological parameters of Hodgkin Lymphoma Cases

		No.	%
Age (years) (mean ± SD)		**23.88±16.48**	
Age group (years	1-10	5	14.7
	11-20	15	44.1
	21-30	5	14.7
	31-40	3	8.8
	41-50	2	5.9
	51-60	3	8.8
	61-70	0	0
	71-80	0	0
	81-90	0	0
Sex	Male	20	58.8
	Female	14	41.2
Site	Nodal	30	88.2
	Extra nodal	4	11.8
Type	Classical	33	97.1
	Non - classical	1	2.9
Size (mm) (mean ± SD)		29.85±16.08	

The statistical analysis of non-Hodgkin lymphoma cases demonstrates that the most affected age group was 51–60 years (25%), following by 61–70 (19%). Males were more frequently affected (60.7%) than females (39.3%). Extranidal involvement was slightly predominant (51.2%) compared to nodal involvement (48.8%). The B-cell type represented the most common histological subtype (86.9%), while the T-cell type (13.1%); the mean size of NHL was 33.93 ± 45.42, as shown in table (3).

Table 3: Clinicopathological parameters of non-Hodgkin lymphoma cases

		No.	%
Age (years) (mean ± SD)		**48.6±19.97**	
Age group (years	1-10	4	4.8
	11-20	8	9.5
	21-30	5	6
	31-40	5	6
	41-50	14	16.7
	51-60	21	25
	61-70	16	19
	71-80	9	10.7
	81-90	2	2.4
Sex	Male	51	60.7
	Female	33	39.3
Site	Nodal	41	48.8
	Extra nodal	43	51.2
Type	B- cell	73	86.9
	T- cell	11	13.1
Size (mm) (mean ± SD)		33.93±45.42	

The analysis of B-cell non-Hodgkin lymphoma cases shows the most affected age group falls within the sixth and seventh decades of life, specifically individuals aged 51–60 years and 61–70 years, each contributing 26% and 19.2%, respectively. Males are more commonly affected than females, comprising 58.9% of the reported cases, compared to 41.1% among females. Among the various histological subtypes observed, DLBCL emerged as the most frequent, representing 63% of the B-cell cases, followed by SLL/CLL, representing 21.9%. The mean size of B-cell NHL was 32.9 ± 47.69, as shown in Table 4.

Table 4: Clinicopathological parameters of B cell non-Hodgkin lymphoma

		No.	%
Age (years) (mean ± SD)		**50.4±19.46**	
Age group (years	1-10	4	5.5
	11-20	4	5.5
	21-30	5	6.8
	31-40	2	2.7
	41-50	14	19.2
	51-60	19	26
	61-70	14	19.2
	71-80	9	12.3
	81-90	2	2.7
Sex	Male	43	58.9
	Female	30	41.1
Type	Marginal zone	3	4.2
	Follicular	1	1.4

	Burkitt lymphoma	5	6.8
	DLBCL	46	63
	Mantle cell	2	2.7
	SLL/CLL	16	21.9
Size (mm) (mean ± SD)		32.9±47.69	

MALT = *Mucosa-Associated Lymphoid Tissue, DLBCL = Diffuse Large B-Cell Lymphoma*
SLL / CLL = *Small Lymphocytic Lymphoma / Chronic Lymphocytic Leukaemia.*

The most affected age group for Hodgkin lymphoma (HL) was the second decade of life (≤20 years), while for non-Hodgkin lymphoma (NHL) it was the fifth and sixth decades (50–60 years). Both types showed a male predominance. The predominant site of involvement in HL was nodal (25.4%), whereas in NHL it was extra nodal (36.4%). The mean tumor size was slightly higher in NHL (33.93 ± 45.42 mm) compared to HL (29.85 ± 16.08 mm). Statistically significant differences were observed in age and site of involvement (P = 0.000), while sex and tumor size showed no significant difference (P = 0.505 and 0.176, respectively). As shown in table 5.

Table 5: Statistical comparison Between Hodgkin lymphoma and non-Hodgkin lymphoma

		HL (%)	NHL (%)	P value
Age (years) (mean ± SD)		**23.88±16.48**	**48.6±19.97**	**0.000***
Age groups (years)	-10	5 (4.2)	4 (3.4)	0.000*
	-20	15 (12.7)	8 (6.8)	
	-30	5 (4.2)	5 (4.2)	
	-40	3 (2.5)	5 (4.2)	
	-50	2 (1.7)	14 (11.9)	
	-60	3 (2.5)	21 (17.8)	
	-70	1 (0.8)	16 (13.6)	
	-80	0 (0)	9 (7.6)	
	-90	0 (0)	2 (1.7)	
Sex	Male	20 (16.9)	51 (43.2)	0.505
	Female	14 (11.9)	33 (28)	
Site	Nodal	30 (25.4)	41 (34.7)	0.000*
	Extra nodal	4 (3.4)	43 (36.4)	
Size (mm) (mean ± SD)		29.85±16.08	33.93±45.42	0.176

(*): statistically significant, HL: Hodgkin lymphoma, NHL: Non-Hodgkin lymphoma

A comparative analysis of B-cell and T-cell non-Hodgkin lymphoma (NHL) patients revealed significant differences in age and site of involvement. The mean age of B-cell NHL patients was 50.4 ± 19.46 years, significantly higher than T-cell patients (35.55 ± 20.03 years, P = 0.031). Sex distribution showed no significant difference between the two groups (P = 0.295), as shown in table (6). Regarding anatomical sites, B-cell NHL predominantly involved nodal sites (46.4%), whereas T-cell NHL showed relatively more extranodal involvement (10.7%), with this difference being statistically significant (P = 0.025). Mean tumor size did not differ significantly between B-cell (32.94 ± 7.69 mm) and T-cell (40.73 ± 26.24 mm) NHL (P = 0.597) as shown in table (6).

Table 6: Comparison between B cell and T cell non-Hodgkin lymphoma

		B- cell (%)	T- cell (%)	P value
Age (years) (mean ± SD)		**50.41±19.46**	**36.55±20.03**	**0.031***
Age groups (years)	1-10	4 (4.8)	0 (0)	0.005*
	11-20	4 (4.8)	4 (4.8)	
	21-30	5 (6)	0 (0)	
	31-40	2 (2.4)	3 (3.6)	
	41-50	14 (16.7)	0 (0)	
	51-60	19 (22.6)	2 (2.4)	
	61-70	14 (16.7)	2 (2.4)	
	71-80	9 (10.7)	0 (0)	
	81-90	2 (2.4)	0 (0)	
Sex	Male	43 (51.2)	8 (9.5)	0.299
	Female	30 (35.7)	3 (3.6)	
Site	Nodal	39 (46.4)	2 (2.4)	0.029*

	Extra nodal	34 (40.5)	9 (10.7)	
Size (mm) (mean ± SD)		32.9±47.69	40.73±26.24	0.597

(*): statistically significant

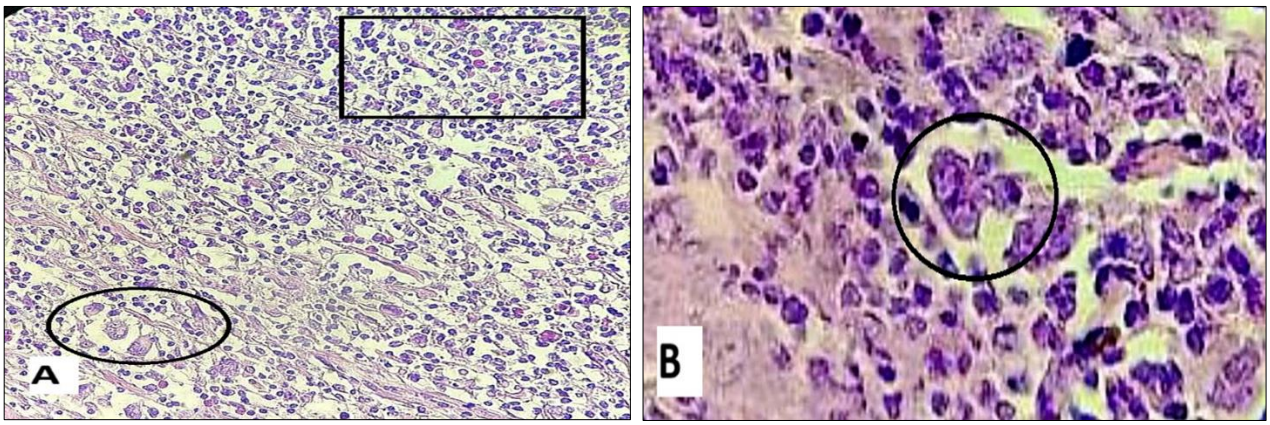

Figure 1: Photomicrographs of classical Hodgkin lymphoma, mixed cellularity subtype in cervical lymph node, (H&E) stain: (A) showing the mixed inflammatory microenvironment (black square) with the presence of Reed–Sternberg cells (indicated by black circles) at (10x), (B): High power magnification demonstrating classic Reed–Sternberg cells (black circles)(40X).

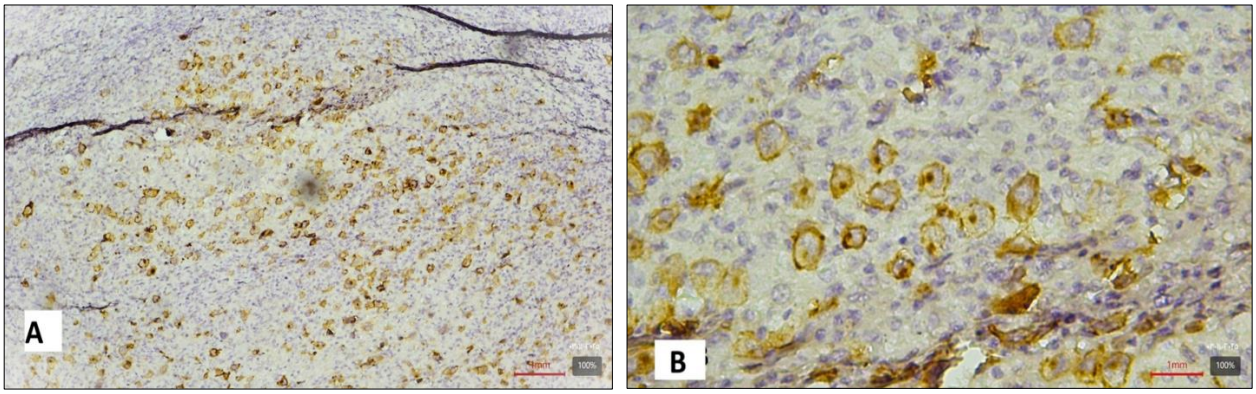

Figure 2: Photomicrograph of Mixed Cellularity Hodgkin Lymphoma in cervical lymph node stained for CD30, (A) Reed-Sternberg cells show strong membranes positivity(10x), (B): section shows membranes and distinctive perinuclear Golgi region staining as a dot-like pattern, within mixed inflammatory background at (40x).

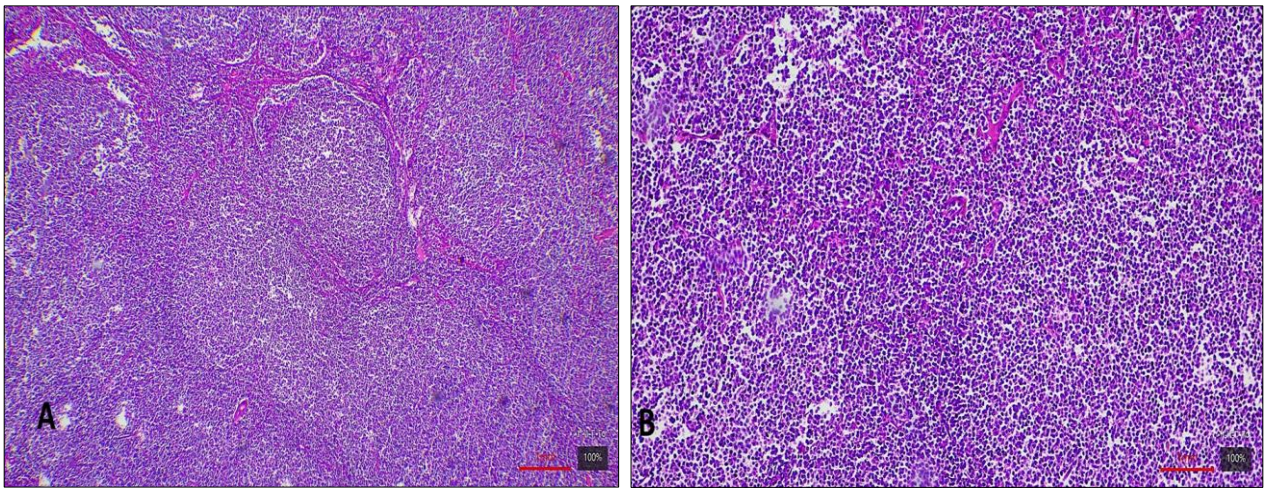

Figure 3: Photomicrograph of mantel cell non-Hodgkin lymphoma of lymph node (H&E) stain, (A): nodular mantle zone growth patterns (4x), (B): monotonous population of small lymphoid cells; in the background of hyalinized blood vessels (10x)

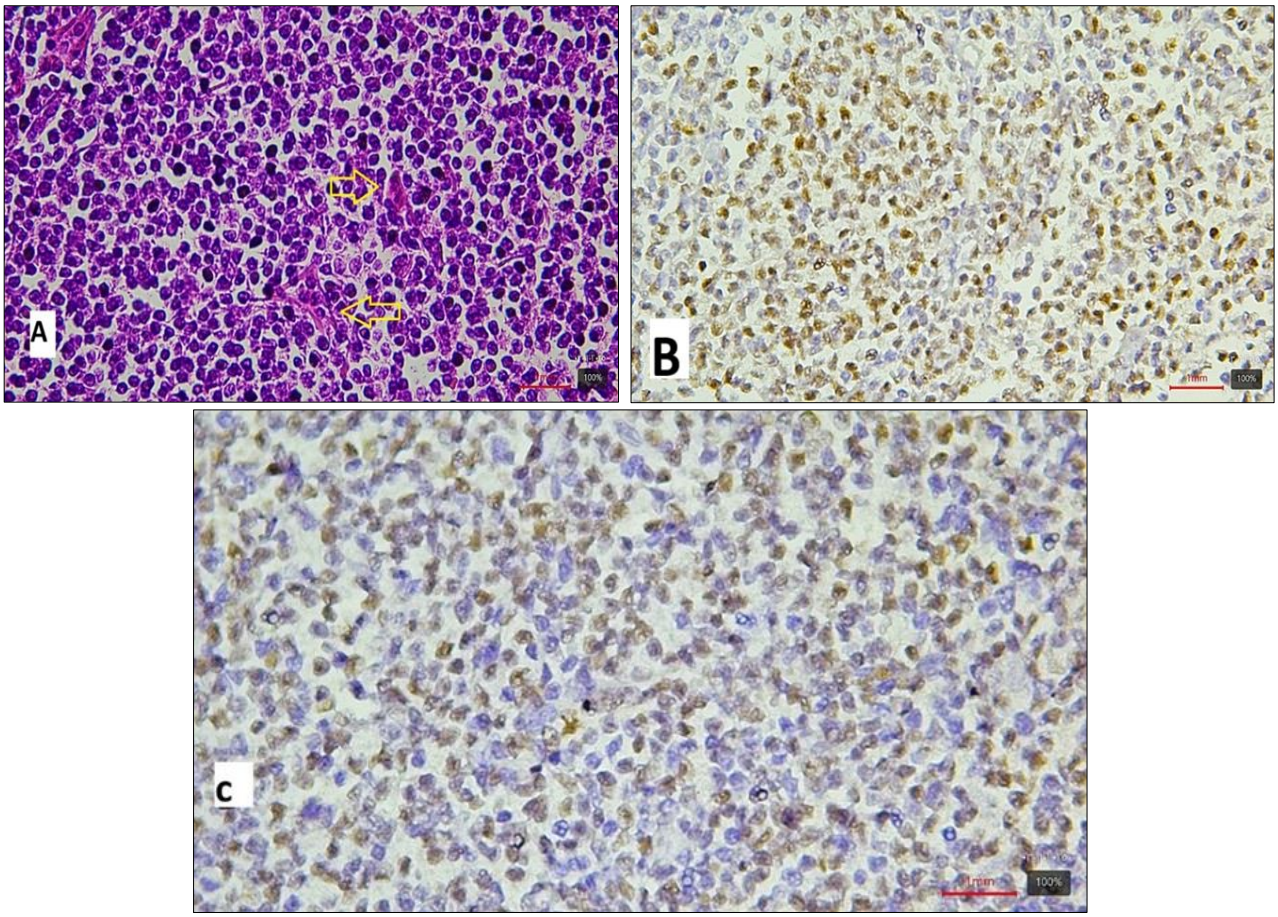

Figure 4: Photomicrograph of mantel cell non-Hodgkin lymphoma in lymph node, (A) shown Small to medium monomorphic lymphoid neoplasm, Irregular nuclear border, clumped chromatin and inconspicuous nucleoli and hyalinized blood vessels (arrows), no proliferation centres seen, (H&E ,40x), (B) shown positive nuclear staining of SOX11 at (40x),(C)shown positive nuclear staining of cyclin D1 at (40x).

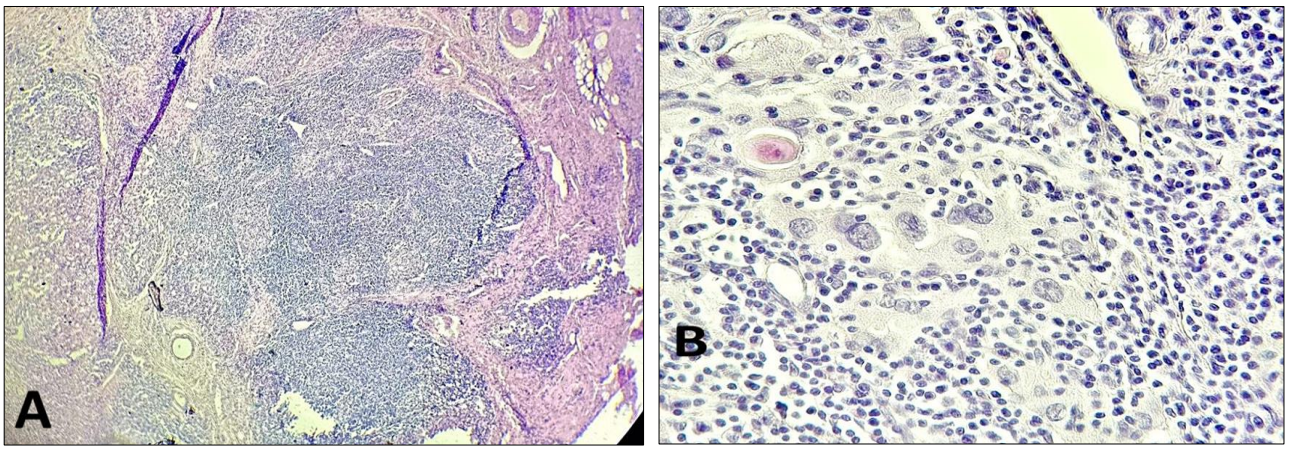

Figure 5: Photomicrograph of a thyroidectomy specimen showing Hashimoto thyroiditis with transformation to diffuse large B-cell lymphoma,(A) at low magnification ,the thyroid architecture is markedly disrupted ,there is diffuse effacement of the normal follicular pattern, with loss of colloid filled follicles ,the tissue shows dense lymphoid infelterasion forming confluent sheets(H&E,4x) ,(B) infiltration of large atypical B cells with vesicular chromatin ,prominent nucleoli and abundant amophlic cytoplasm with background features of hashimoto thyroiditis (H&E,40x).

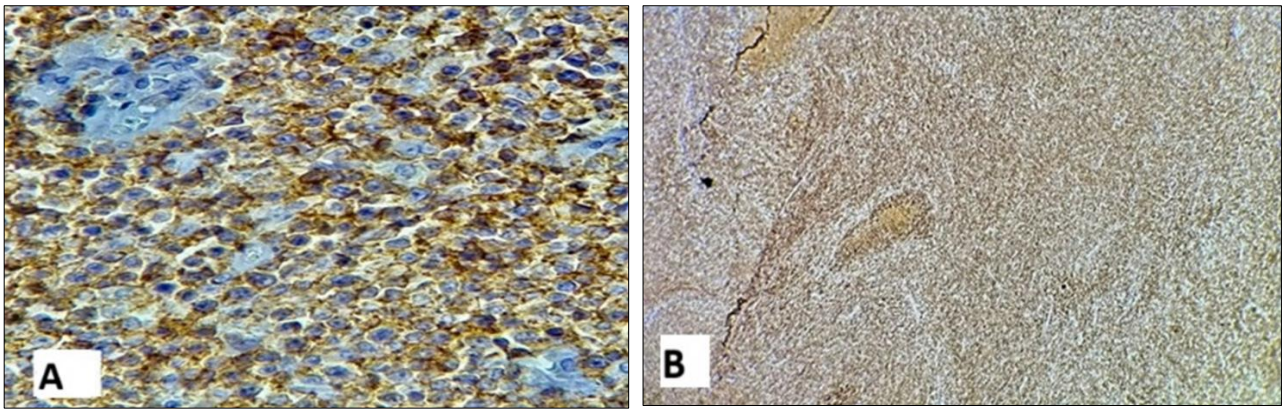

Figure 6: Photomicrograph of a thyroidectomy specimen showing Hashimoto thyroiditis with transformation to diffuse large B-cell lymphoma, (A) CD10 shows positive membranous staining at (40x), (B): Ki 67 demonstrates high proliferative activity with positive nuclear staining (80%) at (4x).

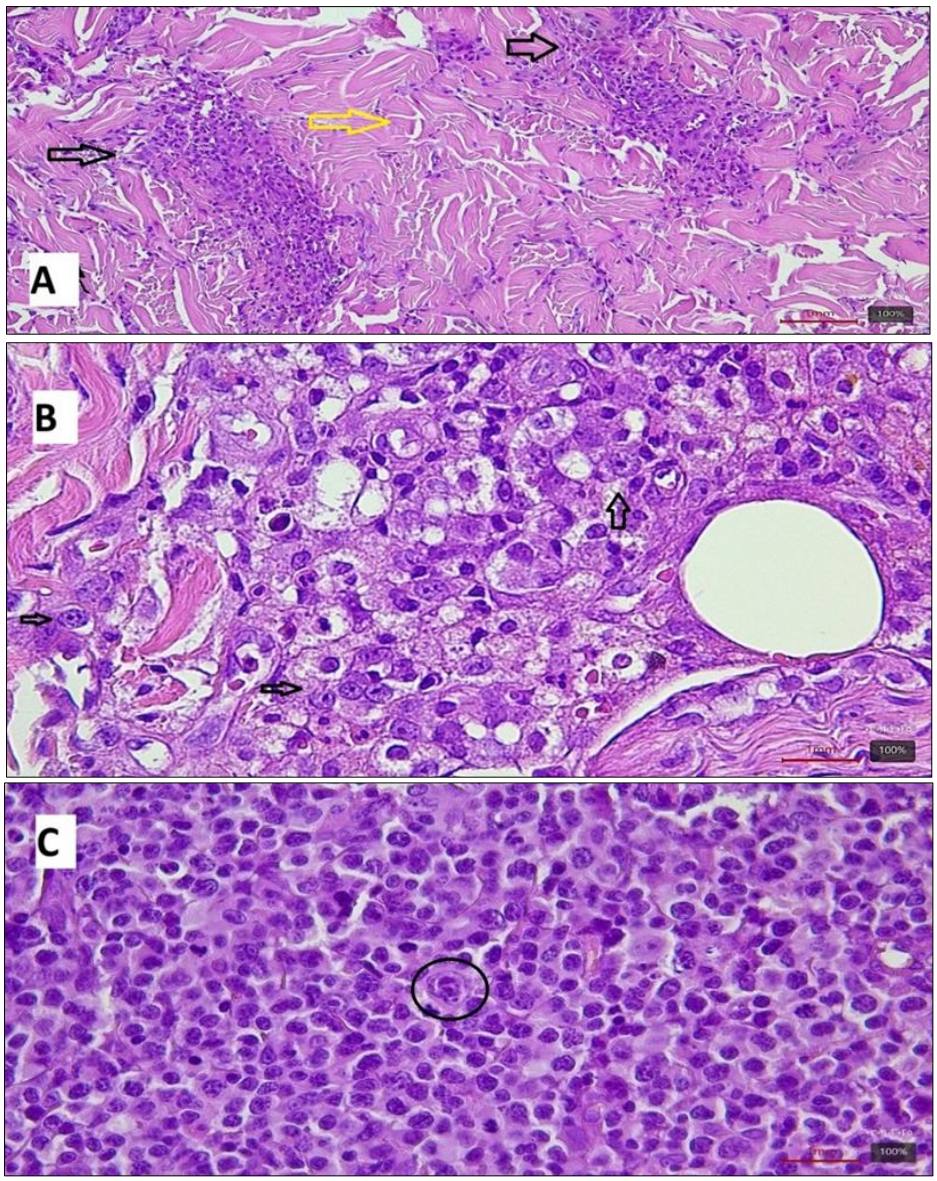

Figure 7: Photomicrograph of anaplastic T cell non-Hodgkin lymphoma in skin (H&E), (A): infiltration of neoplastic cell (black arrows) between collagen fibres (yellow arrows) at (4x),(B): The neoplastic cells are large, pleomorphic and show moderate amounts of cytoplasm, irregularly contoured nuclei, coarsely clumped / vesicular chromatin and prominent nucleoli, atypical mitotic figure are seen at(40x),(C) :large cells with folded ,curved

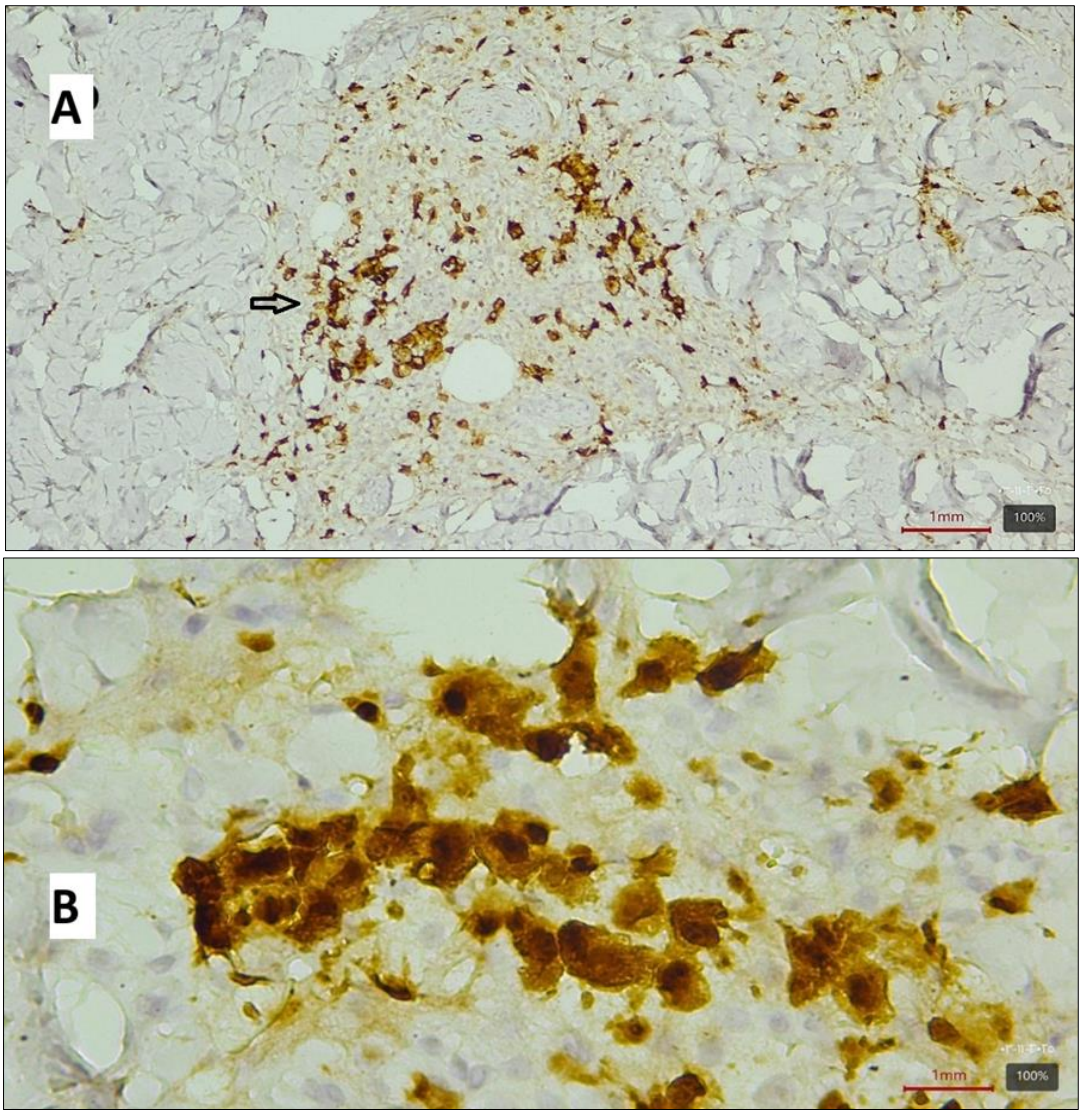

Figure 8: Photomicrograph of anaplastic T cell non-Hodgkin lymphoma in skin (A): the neoplastic cells are strongly and diffusely membranes positive staining of CD30 at (10x), (B): diffuse cytoplasmic positivity of ALK in neoplastic cells at (40x).

DISCUSSION

This study provides a comprehensive clinicopathological overview of 118 lymphoma cases and demonstrates patterns largely consistent with regional and global epidemiological data, while highlighting distinctive local features, particularly the high rate of extranodal non-Hodgkin lymphoma (NHL). NHL predominated (71.2%) over Hodgkin lymphoma (HL) (28.8%), reflecting global trends reported by GLOBOCAN 2020 and regional studies from Iraq and neighboring Middle Eastern countries [11–14]. The significant age difference between HL and NHL (P = 0.000) confirms their distinct epidemiological profiles. HL patients presented at a markedly younger mean age (23.9 years), with a prominent peak in the second decade. This truncated bimodal distribution, emphasizing younger patients, aligns with reports from Iraq and Gulf countries, where HL commonly affects adolescents and young adults [12], and differs somewhat from Western data that demonstrate a clearer second peak in older adults [15]. In contrast, NHL occurred predominantly in older individuals (mean 48.6 years), consistent with Iraqi and international data showing increasing incidence after the fifth decade [11-16]. Classical HL (CHL) constituted 97.1% of HL cases, consistent with international figures (~95%) [15]. Interestingly, mixed cellularity (48.5%) and nodular sclerosis (45.5%) showed near-equal distribution, differing from Western populations where nodular sclerosis predominates (>70%) [15]. The relatively high mixed cellularity frequency may reflect regional epidemiological factors, including socioeconomic influences and Epstein–Barr virus (EBV) association [12]. Among NHL cases, B-cell lymphomas dominated (86.9%), in agreement with Middle Eastern data (83–92%) [4]. Diffuse Large B-Cell Lymphoma (DLBCL) was the most frequent subtype (63%), consistent with its global predominance [7], though higher than some Iraqi reports [12-16], possibly reflecting referral bias toward aggressive cases. Small Lymphocytic Lymphoma/Chronic Lymphocytic

Leukemia also showed a relatively high frequency, suggesting potential regional variation. T-cell NHL comprised 13.1% of cases, aligning with regional estimates [12-14]. Mycosis fungoides was the most common T-cell subtype, consistent with its recognition as the most frequent cutaneous T-cell lymphoma worldwide [10]. A key finding was the high extranodal NHL rate (51.2%), contrasting with nodal predominance in HL (88.2%). Gastrointestinal involvement was prominent among B-cell lymphomas, particularly Burkitt and MALT types, consistent with established biological tropism [17, 18]. The significant site–subtype associations ($P < 0.05$) underscore the biological heterogeneity of lymphomas. Overall male predominance (1.5:1) aligns with global and regional data [11-15]. Limitations include single-center design and small subgroup sizes, particularly for T-cell lymphomas, which may limit generalizability. Larger multicenter studies are warranted to validate these findings.

CONCLUSION

This study demonstrates that Hodgkin lymphoma predominantly affects young patients with mainly nodal involvement, while non-Hodgkin lymphoma occurs more often in older adults and is largely of B-cell origin, especially DLBCL. A high frequency of extranodal NHL was observed. Male predominance was noted overall, except in nodular sclerosis HL. Mixed cellularity was the most common HL subtype, and mycosis fungoides was the leading T-cell NHL subtype. These findings provide important regional epidemiological insight for Iraq.

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