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Hodgkin Lymphoma in the Middle Euphrates Region of Iraq: Demographic and Histopathologic Insights

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ABSTRACT

Background: Hodgkin Lymphoma (HL) is among the top ten cancers affecting children and young adults in Iraq, yet epidemiologic and clinical data remain limited.
Objectives: To identify the epidemiologic and histopathologic trends of HL patients in the Middle Euphrates region of Iraq.
Materials and methods: Medical information of patients registered at the Middle Euphrates Cancer Centre from January 2020 to December 2024 was retrospectively collected and analysed. Demographic, histopathologic, and clinical staging data were extracted. The data were summarized, and correlations were assessed using 95% confidence interval and a significance level of < 0.05.
Results: A total of 293 HL cases were included with a median age of 28 years, and a male-to-female ratio of 1.22:1. Seventy percent of patients were younger than 40 years, with a dominant peak between 10 and 30 years. Nodular sclerosis (NS) and mixed cellularity (MC) were the dominant histologic subtypes (40.27% and 38.91%, respectively). NS subtype was significantly more likely to present in pediatric and younger age groups (P-value < 0.001) and at an earlier stage (P-value $= 0.018$). Conversely, MC showed a tendency to affect older adults (P-value $= 0.014$). Paediatric and young age groups had higher odds of presenting at an earlier stage than older adults (OR=3.56, P-value=0.031, 95%CI:1.12-11.36) and (OR=5.35, P-value=0.001, 95%CI:1.92-14.93), respectively.
Conclusion: HL mainly affects younger age groups, with NS and MC being the most prevalent subtypes. Younger age and NS subtype are significantly associated with earlier stage at presentation, suggesting the need for more age-specific diagnostic and management strategies in this patient population.
Keywords: Hodgkin lymphoma; Histologic subtypes; Stage; Middle Euphrates region.

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INTRODUCTION

Hodgkin lymphoma (HL), a malignant disease of the lymphoid system, is characterized by the presence of multinucleated Reed-Sternberg cells and their mononuclear counterparts within an inflammatory background [1]. HL comprises about 10% of lymphoma cases and less than 1% of all cancers worldwide, with over 82,000 new cases and over 22,000 deaths reported worldwide in 2022 [2]. According to GLOBOCAN reports, higher mortality rates are noticed in the underdeveloped and developing countries despite the lower incidence ratios, which is mainly attributed to disparities in health care access and health education in these regions [3]. HL is characterized by a bimodal age distribution, primarily affecting young people between 15 and 35 years, and another smaller peak in individuals over 50 years of age [4]. The disease is classified into two main histologic types: classical Hodgkin lymphoma (CHL), accounting for more than 90% of cases, and nodular lymphocyte-predominant Hodgkin lymphoma (NLPHL), which accounts for the remaining 5-10% [5]. The CHL is further classified into four main histologic subtypes: nodular sclerosis (NS), mixed cellularity (MC), lymphocyte-depleted (LD), and lymphocyte-rich (LR),. Each of these subtypes has its unique histologic features, age of presentation, and prognosis [6].

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HL has no specific aetiology, and multiple risk factors have been implicated in its pathogenesis. Those factors mainly include viral infections, genetic predisposition, and exposures to certain environmental factors like radiation, chemicals, drugs, smoking, and other occupational and childhood exposures [7]. Socioeconomic factors have also played a role in the disease distribution and presentation, with lower-income countries reporting a higher prevalence of MC and LD subtypes and advanced-stage disease at diagnosis [4].

Lugano classification, which is based on the earlier Ann Arbor classification system, is the primary staging system for HL patients, which is considered an important prognostic factor and a crucial requirement for treatment planning. Early-stage disease (stage I-II) generally carries a better prognosis, while advanced-stage (stage III-IV) disease is associated with a higher risk of relapse and lower survival rates, although the recent advances in treatment modalities have obviously improved the outcomes in those patients [8].

In Iraq, lymphoma is one of the top ten malignancies in both sexes, with HL constituting about one third of lymphoma cases, particularly among the young population. Based on the last reports of the Iraqi cancer registry (https://storage.moh.gov.iq/2024/11/24/2024_11_24_12127028949_4299728097670824.pdf), 723 new HL cases were registered in 2023, accounting for approximately 1.68% of all malignancies diagnosed that year. The disease affects both sexes nearly equally, with a slight male predominance and a notable incidence among individuals aged 15-44 years, with male-to-female ratio of 1.27:1. While it ranks among the top five cancers among children (0-14 years) with 7.5% incidence ratio. Regarding the Middle Euphrates region, which includes the provinces of Najaf, Babylon, Karbala, Al-Qadisiyah, and Al-Muthanna, there are inadequate studies available regarding on the real figures and patients' characteristics. Although regional cancer centres data and reports suggest variable incidence and presentation, HL tend to present among the most common haematological malignancies seen in oncology referral centres [9]. Notably, there is a predominance of classical subtypes, particularly MC and NS, with about 50% of the cases present in the advanced stage (stage III-IV), highlighting the need for improved early detection and diagnostic infrastructure to improve outcomes in the HL patients population [9].

The current study aims to describe the epidemiological characteristics, histological subtypes, and clinical staging of HL patients admitted to Middle Euphrates Cancer Centre (MECC) between January 2020 and December 2024, providing updated insights into the disease profile in this region.

MATERIALS AND METHODS

This retrospective observational study analysed data from patients with HLregistered at the MECC in Iraq. MECC maintained a hybrid cancer registry consisting of both electronic and paper-based records. Registry data are routinely updated by oncology staff and preserved through systematic archiving and secure file storage. Data collection was conducted between March 15, 2025, and June 30, 2025. The dataset included all patients who were registered and diagnosed with HL between January 1st, 2020, and December 31st, 2024.

All confirmed HL cases diagnosed during the study period were screened, and patients with complete demographic and clinical information were included in the final analysis. Suspected or unconfirmed cases and cases with missing primary variables were excluded. As this was a retrospective registry-based study, the sample size was determined by the total number of eligible confirmed HL cases recorded during the defined period. No prospective sample size calculation was required.

Demographic variables, including age, sex, residence (urban or rural), and province were obtained from each patient. Age was divided into 4 groups (pediatric < 15, young-adults 15-30, middle-aged adults 40-59, and old adults ≥ 60). This categorization is consistent with the National Cancer Institute definitions for the Adolescents and Young Adults (AYA) population [10] and adjusts for age-specific sequences in the elderly. Clinical variables included histopathologic subtype and stage at presentation. Histopathological classification followed the World Health Organization (WHO) classification of lymphoid neoplasms. This classification system categorizes HL to NLPHL and CHL, which are further sub-grouped into NS, MC, LR, and LD subtypes [6]. CHL not otherwise specified (CHL-NOS) is a generic term used by pathologists to describe cases of CHL with ambiguous morphology or limited tissue sampling, which are still classified as CHL while acknowledging the inability to specify a subtype [11]. Staging was recorded according to the Ann Arbor system at the time of diagnosis. Ann Arbor staging system classifies HL cases into four stages, with stage I and II representing limited-stage disease, while stage III and IV are classified as advanced-stage disease [8]. All variables were extracted from the original patient files and cross-verified with registry entries.

Ethical approval was obtained from the MECC and the Najaf Health Directorate in accordance with institutional regulations under form number 9695 dated March 13, 2025. All patient data were de-identified and processed in accordance with ethical standards to ensure confidentiality and privacy.

Data were analysed using the statistical package for the social sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). The normality of continuous variables was tested using the Shapiro-Wilk test and skewness/kurtosis analysis. Because of the non-normal distribution, it was presented as the median and interquartile range (IQR). Demographic and clinical characteristics were summarized using descriptive statistics. Associations between categorical variables by Chi-square and Fisher's Exact tests. Multivariate logistic regression was applied, and independent predictors were presented in the form of ORs and 95% confidence intervals (CI). For analytical purposes, patients classified as 'Children' (n=41) were excluded from the analysis of educational level. The remaining study population was re-categorized into three groups: Low (including illiterate, primary, and intermediate education), intermediate (including secondary and diploma), and high (including bachelor's and postgraduate degrees). Statistical significance was set at P-value < 0.05.

RESULTS

A total of 293 HL patients were included in this study. Of all, 161 (54.9%) were males with a male-to-female ratio of 1.22:1. The median age at diagnosis was 28 years (IQR 19-43), and approximately 70% of patients were younger than 40 years. NS was the dominant histopathological subtype in 40.27% of patients. Other subtypes, including NLPHL, LR, LD, and CHL-NOS, accounted for a minority of cases. Most patients presented with early-stage disease (Stage I–II), accounting for 58.37% of cases. Other baseline characteristics of the enrolled patients are summarized in Table 1.

Table 1. Demographic characteristics of Hodgkin lymphoma patients (n=293)*.

Variables	n (%)
Sex	
Male	161 (54.95)
Female	132 (45.05)
Age	
Pediatric (<15 years)	41 (13.99)
Young Adults (15–39 years)	164 (55.97)
Middle-aged Adults (40–59 years)	64 (21.84)
Older Adults (≥ 60 years)	24 (8.19)
Education Level	
Child (<15 years)	41 (13.99)
Illiterate	50 (17.06)
Primary	80 (27.30)
Intermediate	45 (15.36)
Secondary	35 (11.95)
Diploma	10 (3.41)
Bachelor	31 (10.58)
Postgraduate	1 (0.34)
Histopathology*	
NS	118 (40.27)
MC	114 (38.91)
NLPHL	22 (7.51)
LD	13 (4.44)
LR	5 (1.71)
CHL-NOS	21 (7.17)
Year	
2020	62 (21.16)
2021	58 (19.80)
2022	65 (22.18)
2023	62 (21.16)
2024	46 (15.70)
Province	
Najaf	140 (47.78)
Muthanna	35 (11.95)
Thi-Qar	9 (3.07)
Baghdad	6 (2.05)
Babil	31 (10.58)
Karbala	9 (3.07)
Al-Qadisiyah	56 (19.11)
Karkook	1 (0.34)
Basrah	1 (0.34)
Wasit	5 (1.71)
Residence	
Urban	199 (67.92)
Rural	94 (32.08)
Stage	
I	38 (14.13)
II	119 (44.24)
III	70 (26.02)
IV	42 (15.61)

* CHL-NOS: Classical Hodgkin lymphoma-not otherwise specified, LD: Lymphocyte-depleted, LR: Lymphocyte-rich, MC: Mixed cellularity, NLPHL: Nodular lymphocyte-predominant Hodgkin lymphoma, NS: Nodular sclerosis.

A prominent peak was observed between 11-30 years, with a smaller secondary peak in the 51-60-year age group (Figure 1).

Stage II was observed in approximately 51% of NS and 40% of MC cases. Patients with LD were more likely to be present with stage IV disease (69% of the cases), as shown in Figure 2.

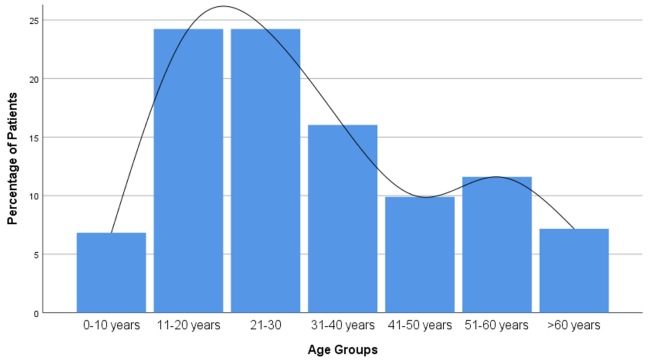

Figure 1. Proportional distribution of 293 Hodgkin lymphoma cases by age group.

Univariate analysis showed a significant association between histologic subtype and both age and stage at diagnosis (P-value = 0.001 and P-value = 0.018, respectively), as shown in Table 2.

In multivariate analysis of factors associated with disease stage (early vs. advanced), age remained a significant predictor. Paediatric patients had higher odds of presenting with early-stage disease compared with older adults (OR 3.56; 95% CI: 1.12–11.36; P-value = 0.031), and young adults were over five times more likely to present with early-stage disease (OR 5.35; 95% CI: 1.92–14.93; P-value = 0.001) as shown in Figure 3.

After adjustment for covariates, NS showed a borderline association with early-stage disease (OR 2.83; 95% CI: 1.00–8.07; P-value = 0.051), while MC was not significantly associated with stage (OR 2.08; 95% CI: 0.72–5.99; P-value = 0.18). NLPHL was significantly associated with early-stage presen-

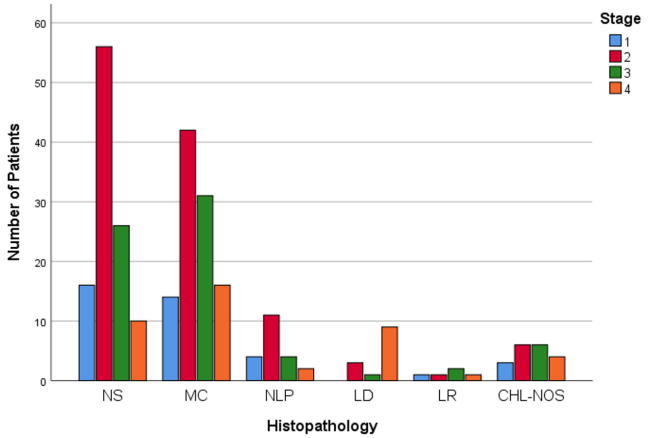

Figure 2. Distribution of histopathologic types of 293 Hodgkin lymphoma patients according to disease stage at diagnosis. CHL-NOS, Classical Hodgkin lymphoma-not otherwise specified; LD, Lymphocyte-depleted; LR, Lymphocyte-rich; MC, Mixed cellularity; NLP, Nodular lymphocyte-predominant; NS, Nodular sclerosis.

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Table 2. Characteristics of 293 Hodgkin lymphoma patients stratified by histological subtype.*

Characteristic	NS n (%)	MC n (%)	NLPHL n (%)	LD n (%)	LR n (%)	CHL-NOS n (%)	P-value
Year							
2020	27 (22.88)	24 (21.05)	4 (18.18)	2 (15.38)	2 (40.00)	3 (14.29)	
2021	27 (22.88)	19 (16.67)	7 (31.82)	1 (7.69)	0 (0.00)	4 (19.05)	
2022	25 (21.19)	30 (26.32)	3 (13.64)	5 (38.46)	1 (20.00)	1 (4.76)	0.656
2023	22 (18.64)	24 (21.05)	4 (18.18)	3 (23.08)	0 (0.00)	9 (42.86)	
2024	17 (14.41)	17 (14.91)	4 (18.18)	2 (15.38)	2 (20.00)	4 (19.05)	
Age Group							
Paediatric (<15 years)	18 (15.25)	12 (10.53)	0 (0.00)	2 (15.38)	1 (20.00)	8 (38.10)	
Young Adults (15–39)	80 (67.80)	57 (50.00)	12 (54.55)	4 (30.77)	4 (80.00)	7 (33.33)	0.001*
Middle-aged Adults (40–59)	18 (15.25)	31 (27.19)	9 (40.91)	4 (30.77)	0 (0.00)	2 (9.52)	
Older Adults (≥ 60)	2 (1.69)	14 (12.28)	1 (4.55)	3 (23.08)	0 (0.00)	4 (19.05)	
Sex							
Male	59 (50.00)	67 (58.77)	16 (72.73)	9 (69.23)	2 (40.00)	8 (38.10)	0.091
Female	59 (50.00)	47 (41.23)	6 (27.27)	4 (30.77)	3 (60.00)	13 (61.90)	
Education†							
Low	72 (72.00)	71 (68.93)	14 (63.64)	8 (72.72)	2 (50.00)	9 (69.23)	
Intermediate	18 (18.00)	17 (16.50)	3 (13.64)	2 (18.18)	1 (25.00)	4 (30.77)	0.730
High	10 (10.00)	15 (14.56)	5 (22.72)	1 (9.09)	1 (25.00)	0 (0.00)	
Residence							
Urban	80 (67.80)	80 (70.18)	12 (54.55)	8 (61.54)	5 (100.00)	14 (66.67)	0.560
Rural	38 (32.20)	34 (29.82)	10 (45.45)	5 (38.46)	0 (0.00)	7 (33.33)	
Stage							
Early (I–II)	72 (66.67)	56 (54.37)	15 (71.43)	3 (23.08)	2 (40.00)	9 (47.37)	0.018*
Advanced (III–IV)	36 (33.33)	47 (45.63)	6 (28.57)	10 (76.92)	3 (60.00)	10 (52.63)	

* Significant P-value < 0.05. †Paediatric patients (n=41) were excluded. Education categories reclassified as: Low (illiterate/primary/intermediate), Intermediate (secondary/diploma), High (bachelor/postgraduate). CHL-NOS; Classical Hodgkin lymphoma-not otherwise specified, LD; Lymphocyte-depleted, LR; Lymphocyte-rich, MC; mixed cellularity, NLPHL; Nodular lymphocyte-predominant Hodgkin lymphoma, NS; Nodular sclerosis.

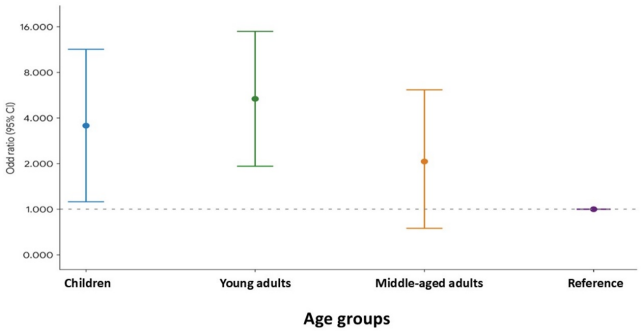

Figure 3. Odds ratios of early-stage disease in various age groups. The older adults group served as a reference (OR=1).

tation (OR 5.40; 95% CI: 1.33–21.74; P-value = 0.018). Sex, educational level, place of residence, and year of diagnosis were not significant predictors of stage at presentation (Table 3).

Multivariate analysis of histologic subtype confirmed a strong association between NS and younger age groups. Pediatric patients (OR 13.92; P-value = 0.015) and young adults (OR 18.17; P-value = 0.005) had significantly higher odds of NS than older adults. In contrast, MC was more prevalent among older adults, whereas pediatric and young adult patients showed reduced odds of this subtype (OR 0.24 and 0.30, respectively) as illustrated in Table 4. Other histologic variants were excluded from the multivariate models because of small sample sizes.

DISCUSSION

This study comprehensively characterizes the epidemiologic and clinicopathologic profile of patients with HL in the Middle Euphrates region of Iraq. The study highlights a distinct bimodal age distribution with a dominant early peak, a significant predilection for NS in younger populations, and a divergent pattern of MC and advanced stage in older adults. The study results would serve as a reference for an initial standardized approach to triage HL in this region and identify areas of weakness to guide future studies and health services.

Demographics and epidemiologic patterns

The bimodal age distribution pattern with a prominent peak noticed in patients aged 10-30 years has also been observed in other studies conducted in northern Iraq and nearby countries [12, 13]. However, in developed countries, this peak typically occurs in the third decade of life [3]. This pattern could be attributed to lower socioeconomic status, smoking habits, and poor sanitation [14], and higher and earlier incidence of Epstein-Barr virus (EBV) infection in the developing world [15]. The skewing of the population distribution towards the younger compartment versus the older one, which is noticeable in many developing

Table 3. Multivariate analysis of predictors of early-stage Hodgkin lymphoma.*

Characteristic	Early Stage (I-II)n(%)	Advanced Stage (III-IV)n(%)	Adjusted OR	95%CI (%)	P-value*
Year					
2020	29 (53.70)	25 (46.30)	0.783	0.343–1.786	0.562
2021	27 (61.36)	17 (38.64)	0.944	0.400–2.232	0.869
2022	37 (62.71)	22 (37.29)	1.047	0.459–2.387	0.912
2023	35 (60.34)	23 (39.66)	1.157	0.513–2.611	0.724
2024	25 (56.82)	19 (43.18)	Ref	- - - - - - -	- - - -
Age Group					
Paediatric (<15 years)	17 (60.71)	11 (39.29)	3.559	1.120–11.364	0.031*
Young Adults (15–39)	103 (69.13)	46 (30.87)	5.348	1.923–14.925	0.001*
Middle-aged Adults (40–59)	27 (45.00)	33 (55.00)	2.066	0.748–6.135	0.191
Older Adults (≥60)	6 (27.27)	16 (72.73)	Ref	- - - - - - -	- - - -
Sex					
Male	74 (54.41)	62 (45.59)	0.655	0.394–1.092	0.104
Female	79 (64.23)	44 (35.77)	Ref	- - - - - - -	- - - -
Education†					
Low	92 (58.23)	66 (41.77)	1.095	0.479–2.500	0.830
Intermediate	28 (65.12)	15 (34.88)	1.499	0.661–4.082	0.427
High	16 (53.33)	14 (46.67)	Ref	- - - - - - -	- - - -
Residence					
Urban	109 (61.58)	68 (38.42)	1.536	0.897–2.632	0.118
Rural	44 (53.66)	38 (46.34)	Ref	- - - - - - -	- - - -
Histopathology					
NS	72 (69.90)	31 (30.10)	2.833	0.998–8.065	0.051
MC	54 (54.00)	46 (46.00)	2.079	0.720–5.988	0.176
NLPHL	15 (71.43)	6 (28.57)	5.405	1.328–21.739	0.018*
LR	2 (40.00)	3 (60.00)	0.591	0.114–3.058	0.531
LD	3 (23.08)	10 (76.92)	0.638	0.080–5.076	0.672
CHL-NOS	7 (41.18)	10 (58.82)	Ref	- - - - - - -	- - - -

* Significant P-value < 0.05. †Paediatric patients (n=41) were excluded. Education categories reclassified as: Low (illiterate/primary/intermediate), Intermediate (secondary/diploma), and High (bachelor/postgraduate). CHL-NOS: Classical Hodgkin lymphoma-not otherwise specified, LD: Lymphocyte-depleted, LR: Lymphocyte-rich, MC: Mixed cellularity, NLPHL: Nodular lymphocyte-predominant Hodgkin lymphoma, NS: Nodular sclerosis, OR: Odds ratio.

Table 4. Multivariate analysis of the association between age and nodular sclerosis (NS) and mixed cellularity (MC) subtypes of Hodgkin lymphoma.*

Histological Subtype	Age Group (Years)	Adjusted OR	95%CI (%)	P-value
NS	Pediatric (<15 years)	13.922	1.674-115.759	0.015*
	Young Adult (15-39)	18.177	2.348-140.692	0.005*
	Middle-aged (40-59)	8.698	1.079-70.116	0.042*
	Older Adults (≥ 60)	Ref	- - - - - - - -	- - - -
MC	Pediatric (¡15 years)	0.242	0.078-0.751	0.014*
	Young Adult (15-39)	0.301	0.115-0.788	0.014*
	Middle-aged (40-59)	0.503	0.182-1.387	0.184
	Older Adults (≥ 60)	Ref	- - - - - - - -	- - - -

* Significant P-value < 0.05.

countries, could further explain the greater discrepancy between the first and the second peak [4]. The slight male predominance is comparable to data reported by the Iraqi cancer registry (https://storage.moh.gov.iq/2024/11/24/2024_11_24_12127028949_4299728097670824.pdf) and national registries [2]. While no studies have directly compared urban versus rural incidence of HL, most literature suggests an increased incidence of HL in populations with higher socioeconomic status [14]. The most frequently recorded educational level was primary education; this may be attributed to the higher incidence among the young age group and the involvement of patients from rural areas, where higher education levels may be less widespread.

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Histopathological characteristics

The predominance of NS (40.27%) and MC (38.91%) subtypes mirrors the histopathologic distribution of HL in northern Iraq [12], and in most Mediterranean basin countries [16]. Approximately 45% of patients presented with stage II disease; these results are comparable to those reported in a study at Al-Hussein Cancer Center in Karbala [9] and another on pediatric HL patients in northern Iraq [17]. The obvious male predominance associated with MC and NLPHL subtypes is comparable to worldwide figures, which show a 3:1 male to female ratios with a tendency to affect older patients [5, 18]. NLPHL accounted for 7.5% of all HL cases in the current study, an incidence considered comparable to nationally reported NLPHL counts ranging between 5-13% of all HL cases [18, 19]. Notably, multivariate analysis revealed a significant association between NLPHL and early-stage disease, a consistent with findings from a large-scale international study by the Global NLPHL One Working Group (GLOW) Consortium. In a series of more than 2,000 patients, about 73% of NLPHL cases were early-stage disease [20].

Clinical associations

Consistent with other national studies [21]. The NS subtype was more frequently associated with pediatric and young patients, whereas the MC subtype was more prevalent in the older patients. This was also noted in a study by Barret and Collins (2023), which showed that MC was the commonest subtype in elderly patients, representing about 57.4% of cases [22]. The shift toward MC in elderly patients was frequently associated with EBV reactivation and immunosenescence [3, 22]. These factors contribute to more aggressive clinicopathologic presentation and advanced-stage disease, along with upregulation of programmed death ligand-1 (PDL-1) expression [22]. These findings indicate the need for specified management strategies in these patients. Although histological type did not emerge as an independent predictor in the multivariate analysis, the association between NS and disease stage showed a notable trend toward significance (OR = 2.83). This suggests that the observed change after the adjustment for confounding variables may be attributed to the small sample size, which could further explain the wide 95% confidence intervals observed. A significant association between histological type and disease stage was reported by other researchers, where patients with the NS subtype presented more frequently with early-stage disease [23]. The strong association between patient age and stage at diagnosis can be inferred from studies focusing on elderly patients with HL, which found that patients older than 50 and 60 years have a greater incidence of advanced-stage disease [24].

Healthcare and policy implications

Although the figures are not yet comparable to those in the developed countries [15]. They are promising when compared to figures from earlier studies in Iraq [25]. There is a trend toward somewhat earlier diagnosis and fewer patients presenting with stage III or bulky disease. This could be partly explained by the noticeable increment in tertiary cancer centers, the availability of multiple oncology specialties for both adult and pediatric patients, and the improvement in diagnostic tools, especially with the recent introduction of positron emission tomography-computed tomography imaging in many Iraqi provinces, including the Middle Euphrates region. The study outcomes can inform investment in diagnostic facilities across regions of Iraq. Moreover, given the observed demographics, public health awareness programs in rural regions should concentrate on early symptoms of the disease and, in turn lower the numbers of those presenting with advanced disease. Additionally, although EBV status was not assessed in the current study, the observed predominance of the MC subtype among elderly patients strongly suggests a viral etiology. Thus, integrating EBV testing into the diagnostic workup for older patients may better characterize this association, improve risk stratification, and guide future management strategies involving novel immunotherapies.

The current study was limited by its retrospective design, and the exclusion of files with missing data. The single-center nature of the study may not fully reflect figures for the region. Additionally, the limited number of cases for less common histologic types precluded analysis of their independent associations with other variables. Furthermore, the lack of socioeconomic and environmental data, as well as detailed staging and survival outcomes in the patient files, limited the study scope. Lastly, diagnostic and staging variability over the study period should be considered, particularly given recent advancements.

CONCLUSION

HL in the Middle Euphrates region of Iraq displays a clear bimodal age distribution. Patient age is an important predictor of disease stage and behavior. NS and MC were the dominant histologic subtypes among HL patients. Younger patients were more likely to be present with early-stage disease and NS subtype, while older patients tended to present with MC subtype and advanced-stage disease. These unique age-stage-histology relationships would serve as a useful guide to improve local diagnostic work-up and treatment strategies for the patient population in this region.

ETHICAL DECLARATIONS

Acknowledgments

The authors acknowledge the registry team of the MECC for their invaluable efforts to facilitate the collection of data for this study.

Ethics Approval and Consent to Participate

Ethical approval for the study was obtained from the MECC and the Najaf Health Directorate. The approval was granted in accordance with institutional regulations under form number 9695, dated March 13, 2025. All patient data were anonymized and handled in accordance with ethical standards to ensure confidentiality and privacy. No patient consent was needed as the study involved data collected from patients' reports.

Consent for Publication

Not applicable as there is no need for participants' photos or personal information.

Availability of Data and Material

The datasets generated and analyzed in the current study are available from the corresponding author upon reasonable request, subject to ethical approval and data sharing agreements.

Competing Interests

The authors declare that there is no conflict of interest.

Funding

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Use of Artificial Intelligence

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Authors' Contributions

Research question and conception (Al-Musawi JM), Study design: (Al-Musawi JM, Mohsin ZA), Data collection and entry (Ibrahim SQ, Mohsin ZA), Literature search (Al-Khalidi RR, Mohsin ZA), Writing (Al-Musawi JM, Mohsin ZA), Supervision (Al-Khalidi RR, Al-Musawi JM), and Critical Review (All authors). All authors read and approved the final version of the manuscript.

REFERENCES

[1] A. Satou, T. Takahara, and S. Nakamura. An update on the pathology and molecular features of hodgkin lymphoma. *Cancers*, 14(11):2647, 2022.

[2] J. Ferlay et al. Cancer statistics for the year 2020: An overview. *International Journal of Cancer*, 149(4):778–789, 2021.

[3] M. L. Moleti, A. M. Testi, S. Al-Hadad, M. F. Al-Jadiry, and R. Foà. Pediatric hodgkin lymphoma in low- and middle-income countries (lmics). a narrative review. *Mediterranean Journal of Hematology and Infectious Diseases*, 16(1):e2024078, 2024.

[4] J. Chen et al. Global burden of hodgkin lymphoma among children and adolescents: a population-based study using gbd 2021. *Frontiers in Pediatrics*, 13:1629229, 2025.

[5] S. M. Ansell. Hodgkin lymphoma: 2025 update on diagnosis, risk-stratification, and management. *American Journal of Hematology*, 99(12):2367–2378, 2024.

[6] R. Alaggio et al. The 5th edition of the world health organization classification of haematolymphoid tumours: lymphoid neoplasms. *Leukemia*, 36(7):1720–1748, 2022.

[7] A. Maggioncalda, N. Malik, P. Shenoy, M. Smith, R. Sinha, and C. R. Flowers. Clinical, molecular, and environmental risk factors for hodgkin lymphoma. *Advances in Hematology*, 2011(1):736261, 2011.

[8] T. Al-Juhaishi and S. Ahmed. Management of limited-stage hodgkin lymphoma. *Hematology*, 2023(1):500–509, 2023.

[9] A. Mjali, S. K. Abbas, A. F. Alwan, and S. K. Hamzah. Clinical and pathological pattern of hodgkin lymphoma in middle euphrates region of iraq. *Kerbala Journal of Medicine*, 13(2):2355, 2020.

[10] National Academies of Sciences, Engineering, and Medicine. *Childhood Cancer and Functional Impacts Across the Care Continuum*. National Academies Press, 2020. doi: 10.17226/25944.

[11] F. Fend. Classical hodgkin lymphoma and its differential diagnoses. *Diagnostic Histopathology*, 21(10):400–407, 2015.

[12] R. P. Shamoon, M. D. Ali, and N. P. Shabila. Overview and outcome of hodgkin's lymphoma: Experience of a single developing country's oncology centre. *PLoS One*, 13(4):e0195629, 2018.

[13] M. Alalawi et al. Clinical features and outcomes of newly diagnosed classical hodgkin lymphoma patients in saudi arabia: a multicenter cohort study. *Scientific Reports*, 15(1):18308, 2025.

[14] J. Huang et al. Incidence, mortality, risk factors, and trends for hodgkin lymphoma: a global data analysis. *Journal of Hematology & Oncology*, 15(1):57, 2022.

[15] D. M. Craven et al. Hodgkin lymphoma treatment patterns and outcome disparities in low-and middle-income countries. *Blood Global Hematology*, 1(3):100021, 2025.

[16] A. Moscona-Nissan, M. F. Mancilla-Osuna, A. Bardán-Duarte, and M. E. Rendón-Macías. Classical hodgkin lymphoma histologic subtypes distribution among geographical regions and correlation with human development index. *Health Sciences Review*, 9:100117, 2023.

[17] S. S. Abbas and R. H. Ali. Hodgkin disease in children. *Iraqi Journal of Medical Sciences*, 16(4):424–429, 2018.

[18] R. T. Salvaris, B. M. Allanson, G. Collins, and C. Y. Cheah. Nodular lymphocyte-predominant hodgkin lymphoma: advances in disease biology, risk stratification, and treatment. *Haematologica*, 109(11):3476, 2024.

[19] M. Sharma et al. Clinical and epidemiological profile of elderly hodgkin's lymphoma in india. *Cureus*, 14(7), 2022.

[20] M. S. Binkley et al. International prognostic score for nodular lymphocyte–predominant hodgkin lymphoma. *Journal of Clinical Oncology*, 42(19):2271–2280, 2024.

[21] A. Aslani, S. Morsali, S. E. Mousavi, S. Choupani, Z. Yekta, and S. A. Nejadghaderi. Adult hodgkin lymphoma incidence trends in the united states from 2000 to 2020. *Scientific Reports*, 14(1):20500, 2024.

[22] A. Barrett and G. P. Collins. Older patients with hodgkin lymphoma: Walking the tightrope of efficacy and toxicity. *Frontiers in Oncology*, 12:1017787, 2023.

[23] A. S. Harahap, S. Charles, M. F. Ham, and M. Ham. A decade of prevalence and clinicopathological insights into classical hodgkin lymphoma: A study from an indonesian tertiary hospital. *Cureus*, 16(11), 2024.

[24] S. Çokgezer et al. Treatment responses, toxicity, and survival in patients with classical hodgkin lymphoma aged $\geq$ 50 years: A single-center experience over two decades. *Cancer Management and Research*, pages 1911–1921, 2022. doi: 10.2147/CMAR.S363235.

[25] M. S. Abbas et al. Treatment of forty adult patients with hodgkin disease; baghdad teaching hospital experience. *Journal of the Faculty of Medicine Baghdad*, 57(2):129–133, 2015.

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