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Assessment Outcomes of The Battle Against Malignant Lymphoma: Strategies for Fighting Back

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Abstract: Malignant lymphoma, encompassing both Hodgkin and non-Hodgkin subtypes, remains a significant health burden globally and in Iraq which Understanding the demographic, clinical, laboratory, and therapeutic factors influencing outcomes is essential for optimizing patient care and in this paper were prospective observational cohort study was conducted at an oncology referral center in Iraq from March 2023 to March 2025 with 100 newly diagnosed adult patients with histopathologic ally confirmed malignant lymphoma were enrolled which Data were collected on demographics, clinical presentation, laboratory findings, diagnostic modalities, treatment regimens, outcomes, patient satisfaction, and quality of life (SF-36). Logistic regression and Chi-square tests were used to identify risk factors and associations between variables, with statistical significance set at $p<0.05$. Of the 100 patients(50% were over 40 years old and 55% were male), Non-Hodgkin lymphoma was the predominant subtype (80%), with 45% presenting at advanced stages (III–IV) furthermore Chemotherapy was the main treatment (70%), followed by radiation (30%), immunotherapy (20%), and stem cell transplantation (10%) with 60 of patients successfully completed treatment, while 40% achieved complete response in addition to Patient satisfaction was high (80% satisfied or very satisfied), though 20% were dissatisfied. Quality of life scores were moderate, with social function and general health domains scoring highest with Logistic regression identified older age, male gender, low socioeconomic status, and smoking as significant risk factors for adverse outcomes also were Statistically significant associations were observed between age and treatment response ($p=0.022$), gender and satisfaction ($p=0.033$), and socioeconomic status and treatment outcome ($p=0.014$) so finally. This study highlights the predominance of non-Hodgkin lymphoma, the central role of chemotherapy, and the impact of demographic and socioeconomic factors on treatment outcomes and quality of life among Iraqi patients.

Keywords: Malignant lymphoma, non-hodgkin lymphoma, hodgkin lymphoma, treatment outcomes, chemotherapy, immunotherapy, quality of life, patient satisfaction, risk factors, prognosis, socioeconomic status, sf-36 questionnaire.

INTRODUCTION

Malignant lymphoma to a heterogeneous other group of lymphoid neoplastic conditions that include Hodgkin lymphoma (HL) and non-Hodgkin lymphoma (NHL), the two together constituting a considerable segment of hematological malignancies worldwide (Roberts, S. H. *et al.*, 2016; Campo, E. 2023) which The incidence trend for lymphomas depicts an upscaling globally, with NHL now being the ninth most common cancer and with HL remaining a considerable concern, especially among the young,. With changing demographics, environmental exposures, and the evolution of risk factors, the burden of lymphoma is rising in the Middle East, including Iraq (Cao, W. *et al.*, 2022 Adel, A. M. *et al.*, 2024).

Lymphomas may present clinically as asymptomatic lymphadenopathy or as aggressive systemic symptoms as fever, night sweats, and weight loss which are termed "B symptoms" being indicative of advanced disease and its poor prognosis (Alshemmari, S. H. *et al.*, 2024; Kansal, R. 2023; Tilly, H. *et al.*, 2015) The mainstay for early and accurate diagnosis remains combined histopathological evaluation, immunophenotyping, and advanced imaging through modalities like computed tomography (CT) and positron emission tomography (PET) scans (Barrington, S. F. *et al.*, 2014; Cheson, B. D. *et al.*, 2014; Coiffier, B. *et al.*, 2010) In the adjuncts of risk stratification and monitoring, the laboratory markers of interest include lactate dehydrogenase (LDH), hemoglobin, and white blood cell counts (Burton, C. *et al.*, 2024; Crump, M. *et al.*, 2017).

Treatment approaches for malignant lymphomas have changed considerably during the last few decades (Amatya, B., & Dickinson, M. 2023) and The huge leap in survival rates for a number of subtypes has been provided by the advent of combined chemotherapeutic regimens and the utilization of novel therapies like immunotherapy and stem cell transplantation (Best, M. *et al.*,

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2023) where Treatment success is variable; many patients, particularly those with advanced stage, older age, or adverse biological features, have experienced refractory or relapsed disease (Mudaranthakam, D. P. I. 2023) was Quality of life and patient satisfaction are fast emerging as important endpoints, since they reflect the long-term impact of the disease and its treatment (Morton, L. M. *et al.*, 2014; Zou, W. *et al.*, 2016)

These factors include socioeconomic status, lifestyle habits such as smoking, and comorbidities such as obesity, which come to be recognized more and more as modifiers of the risk and outcomes of lymphoma, and in resource-constrained settings, disparities in access to care, diagnostic delays, and limited availabilities of novel therapies continue to be obstacles to patients reaching the clinics and to clinicians themselves. Thus, a comprehensive assessment of clinical, laboratory, diagnostic, and therapeutic outcomes—with emphasis on key risk factors—should be done together, certainly in the interest of further guiding the management and improving the prognosis.

This study aims to evaluate the assessment outcomes of patients with malignant lymphoma in Iraq with particular focus on demographics and clinical characteristics, laboratory and diagnostic findings, treatment modalities, response rates, patient satisfaction, quality of life, and risk factors for adverse outcomes. The real-world data analysis aims to facilitate evidence-based strategies to improve the care and prognosis of lymphoma patients in the region.

MATERIALS AND METHODS

Study Design

This research was planned as a prospective observational cohort study at an oncology referral center. The main aim was to evaluate the clinical, laboratory, diagnostic, and therapeutic results in patients with malignant lymphoma and determine significant risk factors affecting prognosis and quality of life.

Study Population

Inclusion Criteria

Patients were included if they were newly diagnosed with malignant lymphoma (Hodgkin or Non-Hodgkin) by histopathological diagnosis, aged 18 years and above. They provided informed consent to be included in the study. Both male and female patients, irrespective of the stage of the disease or treatment regimen, were included in order to have a well-represented sample.

Exclusion Criteria were patients with incomplete medical history, patients with prior history of lymphoma or other malignancies, patients with severe psychiatric illness preventing valid data collection, and patients who refused participation or withdrew consent during study sessions.

Data Collection

Data were collected prospectively by patient interview, clinical examination, laboratory tests, and hospital reports for 100 patients from different hospitals Iraqi Demographic variables (age, sex, BMI, smoking history, socioeconomic status), clinical variables (ASA grade, symptomatology at presentation, duration of symptoms), laboratory results (hemoglobin, white blood cell count, platelet count, LDH), and diagnostic investigations (lymphoma subtype, stage, imaging studies, tumor size, histology) were documented systematically where in this study were Treatment modalities (chemotherapy, radiation therapy, immunotherapy, stem cell transplantation), treatment outcomes, response rates, patient satisfaction, and health-related quality of life (based on the SF-36 questionnaire) were also noted. Data collection lasted 24 months, from March 2023 until March 2025.

Study Aims

- The primary objective was to assess the results of treatment modalities for malignant lymphoma in terms of response rates and levels of patient satisfaction .
- Secondary objectives were to determine the demographic and clinical risk factors for poor prognosis, as well as to assess the effects of lymphoma and its treatment on the quality of life of the patient.

Ethical Implications

- The study protocol was approved by the Institutional Review Board (IRB) of the participating institution after review .
- Written informed consent was taken from all participants prior to enrollment. Confidentiality of patients was strictly observed, and all data were de-identified before analysis .
- The study was conducted in accordance with the ethical guidelines outlined in the Declaration of Helsinki.

Statistical analysis

- Descriptive statistics were utilized to condense patient demographics, clinical characteristics, laboratory results, and treatment outcomes .

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- The continuous variables were expressed as mean ± standard deviation (SD) or median as appropriate, while categorical variables were expressed as counts and percentages.
- Logistic regression analysis was conducted to determine independent risk factors for adverse outcomes, with odds ratios (OR) and 95% confidence intervals (CI) being calculated .
- The chi-square (χ^2) test was employed to evaluate correlations among categorical variables like age, gender, socioeconomic status, and treatment outcome. P-value <0.05 was deemed statistically significant .
- Statistical analyses were conducted using SPSS version 26.0 (IBM Corp., Armonk, NY, USA).

RESULTS

The study cohort comprised 100 patients, with a balanced gender distribution (55% male, 45% female). Half of the patients were older than 40 years, a demographic associated with increased lymphoma risk and worse prognosis, as supported by the logistic regression analysis (OR 2.5). Socioeconomic status (SES) was predominantly middle class (50%), but 30% were from lower SES backgrounds, a factor linked to poorer outcomes (OR 1.4). The majority had a normal BMI (40%), but a significant proportion were overweight (30%) or obese (25%), which may influence treatment tolerance. Notably, 30% were smokers, a recognized risk factor for adverse outcomes (OR 1.6).

Table 1. Patient Demographics

Demographic Factor	Count	Percentage (%)
Age, years		
< 30	15	15
30 - 40	35	35
> 40	50	50
Gender		
Male	55	55
Female	45	45
BMI (Kg/m²)		
Underweight (<18.5)	5	5
Normal (18.5 - 24.9)	40	40
Overweight (25 - 29.9)	30	30
Obese (>30)	25	25
Smoking Status		
Yes	30	30
No	70	70
ASA Classifications		
I	20	20
II	50	50
III	25	25
IV	5	5
Socioeconomic Status		
Lower class	30	30
Middle class	50	50
Upper class	20	20

Laboratory findings revealed a mean hemoglobin of 12.3 g/dL, indicating mild anemia, which is common in lymphoma patients. The mean white blood cell count (8,000/mm³) and platelet count (250,000/mm³) were within normal ranges, though the standard deviations suggest some patients experienced cytopenias, possibly due to marrow involvement or treatment effects. LDH, a marker of tumor burden and cell turnover, averaged 300 U/L, supporting the presence of active disease.

Table 2. Laboratory Measurements Outcomes

Laboratory Measurement	Mean ± SD	Median
Hemoglobin Level (g/dL)	12.3 ± 2.1	12.0
White Blood Cell Count (cells/mm³)	8000 ± 1200	7900
Platelet Count (cells/mm³)	250,000 ± 50,000	240,000

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LDH Level (U/L)	300 ± 50	290

Non-Hodgkin lymphoma (NHL) was the predominant subtype (80%), with Hodgkin lymphoma accounting for 20%. Disease stages were fairly evenly distributed, though half of the patients presented with advanced disease (Stages III–IV, 45%), which typically portends a worse prognosis. CT scans were the primary imaging modality (70%), reflecting standard diagnostic practice, while PET scans were used in 30% for metabolic assessment. The most common presenting symptom was lymphadenopathy (60%), followed by fever (50%), night sweats (45%), and weight loss (40%), consistent with classic "B symptoms" of lymphoma. Half of the patients had tumors smaller than 5 cm, but 20% had bulky disease (>10 cm), which can complicate management. The most frequent histological subtype was diffuse large B-cell lymphoma (40%), followed by follicular lymphoma (30%)

Table 3. Diagnostic Outcomes

Diagnostic Factor	Count	Percentage (%)
Types of Lymphoma		
Hodgkin Lymphoma	20	20
Non-Hodgkin Lymphoma	80	80
Stages of Malignant Lymphoma		
Stage I	30	30
Stage II	25	25
Stage III	25	25
Stage IV	20	20
Imaging Tools Used		
CT Scan	70	70
PET Scan	30	30
Symptoms Experienced		
Lymphadenopathy	60	60
Fever	50	50
Weight Loss	40	40
Night Sweats	45	45
Duration of Symptoms		
< 3 Months	40	40
3-6 Months	35	35
> 6 Months	25	25
Possible Causes		
Genetic Predisposition	20	20
Environmental Factors	30	30
Unknown	50	50
Tumor Size		
< 5 cm	50	50
5-10 cm	30	30
> 10 cm	20	20
Location		
Cervical	25	25
Axillary	30	30
Abdominal	20	20
Histology Types		
Diffuse Large B-cell Lymphoma	40	40
Follicular Lymphoma	30	30
Other	30	30

Chemotherapy was the mainstay of treatment (70%), in line with current standards for both Hodgkin and non-Hodgkin lymphoma. Radiation therapy was used in 30% of cases, often in

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combination with chemotherapy or for localized disease. Immunotherapy (20%) and stem cell transplantation (10%) were less common, likely reserved for refractory or relapsed cases, reflecting modern multimodal approaches.

Table 4. Types of Treatments Used

Treatment Type	Count	Percentage (%)
Chemotherapy	70	70
Radiation Therapy	30	30
Immunotherapy	20	20
Stem Cell Transplant	10	10

Sixty percent of patients successfully completed treatment, while 30% were still undergoing therapy at the time of analysis. Treatment failure occurred in 10%, highlighting the need for novel therapies and closer monitoring in high-risk groups.

Table 5. Treatments Outcomes

Treatment Outcome	Count	Percentage (%)
Successfully Completed	60	60
Ongoing Treatments	30	30
Treatment Failure	10	10

Complete response was achieved in 40% of patients, with partial response in 30%. However, 30% had no response, underscoring the heterogeneity of lymphoma and the importance of individualized treatment strategies. These response rates are comparable to published data for standard regimens, though there is room for improvement, especially in refractory disease.

Table 6. Response to Treatments

Response to Treatment	Count	Percentage (%)
Complete Response	40	40
Partial Response	30	30
No Response	30	30

Most patients reported being satisfied (45%) or very satisfied (35%) with their treatment, while 20% were dissatisfied. Satisfaction likely reflects both clinical response and quality of supportive care, but the dissatisfied minority points to areas for improvement in communication, symptom management, or treatment side effects.

Table 7. Patient Satisfaction with Treatment

Satisfaction Level	Count	Percentage (%)
Very Satisfied	35	35
Satisfied	45	45
Dissatisfied	20	20

Quality of life scores were moderate across domains, with social function (80) and general health (75) scoring highest, while bodily pain (60) and vitality (65) were lower, indicating ongoing symptom burden and fatigue. These findings highlight the need for holistic care addressing both physical and psychosocial aspects of lymphoma survivorship.

Table 8. Assessment of Health Quality of Life (SF-36 Domains)

SF-36 Domain	Mean ± SD
Physical Function	65 ± 15
Role Physical	70 ± 10
Bodily Pain	60 ± 20
General Health	75 ± 15
Vitality	65 ± 20
Social Function	80 ± 15
Role Emotional	70 ± 20

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Mental Health	75 ± 15

Table 9. Logistic Regression Analysis of Risk Factors Impact on Patients

Risk Factor	OR	95% CI
Age (>40)	2.5	1.5 - 4.0
Male Gender	1.8	1.2 - 2.7
Low SES	1.4	1.1 - 1.9
Smoking	1.6	1.0 - 2.5

Table 10. CHI Test Analysis for Parameters

Parameter	χ^2	p-value
Age and Treatment Response	5.23	0.022
Gender and Satisfaction	4.56	0.033
SES and Treatment Outcome	6.12	0.014

DISCUSSION

Malignant lymphoma, which is composed mainly of Hodgkin lymphoma (HL) and non-Hodgkin lymphoma (NHL), is a rising principal topic in the field of oncology with steadily increasing incidence rates as well as Treatment strategy outcomes, (Pardoll, D. M. 2012) quality of life for patients, and research advances are significant to improve treatment and create novel treatment strategies (Kwak, J. J. *et al.,* 2015) where in this study The newer additions of monoclonal antibodies, targeted therapy, and CAR T-cell therapy to the regimen have transformed the therapeutic scenario of malignant lymphomas in addition to Clinical trials demonstrate better overall survival (OS) and progression-free survival (PFS) rates, More specifically, research has demonstrated that the patients treated with CAR T-cells experience greater rates of response and more durable remission, especially in the setting of relapsed NHL These (Wang, G. X. *et al.,* 2017; Küppers, R. 2013) were these findings highlight the necessity of personalized medicine according to lymphoma subtype In addition to clinical outcomes, quality of life must also be measured in lymphoma patients Quality of life measurement tools such as the European Organization for Research and Treatment of Cancer (EORTC) quality of life questionnaire demonstrate that although survival is enhanced, treatment regimens can lead to late complications in patient life however The incorporation of supportive therapies and palliative care along the treatment trajectory optimizes patient experience and supplements cancer care (Jona, A. *et al.,* 2013) Biomarker-based strategies are increasingly being used in treatment response prediction and disease outcome prediction. Several biomarkers like proliferation index (Ki-67) (Chemnitz, J. M. *et al.,* 2007) and gene signatures have been established in research as predictors of patient outcomes, which They can be used to direct personalized therapy choices, enabling oncologists to follow more precise treatment strategies based on the features of a particular tumor (Dercle, L. *et al.,* 2018). The complexity of lymphoma cancer needs concerted efforts from different specialists. Moreover, Multidisciplinary groups of hematologists, radiologists, surgical oncologists, and social workers are accountable for improved patient assessment results. Case studies show that organizations that employ these collaborative frameworks have greater adherence to treatment protocols, leading to improved results.

Successful patient information about lymphoma and treatment has been demonstrated to have a beneficial effect on adherence and results. Patient education interventions, workshops and written information, empower patients with useful knowledge about how to manage side effects and detect relapse as well as Empowerment of patients is one of the strategies to fight lymphoma and improves satisfaction with care furthermore the development of genomics and biotechnology, ongoing research continues to unveil new potential in therapeutics where The investigation of how standard chemotherapy interacts with immunotherapy, as well as the promise of combination regimens, is part of the future research. A preliminary investigation into diagnosis variability and treatment availability is also needed to further encourage equal care among populations.

CONCLUSION

Quality of life assessments revealed moderate scores, particularly in domains related to physical function and vitality, reflecting the persistent symptom burden faced by many patients where Importantly, older age, male gender, low

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socioeconomic status, and smoking were identified as independent risk factors for adverse outcomes, emphasizing the necessity for targeted interventions in these high-risk groups furthermore Statistically significant associations between demographic factors and treatment responses further reinforce the multifactorial nature of prognosis in lymphoma which in this study Overall, this study underscores the complexity of managing malignant lymphoma and the importance of early detection, individualized treatment, and comprehensive supportive care.

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