

Non-Hodgkin Lymphoma in Adults: Treatment and Outcome – A Single Institution Study from Nepal

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Abstract

Non-Hodgkin Lymphoma is a common hematological malignancy. Clinically and biologically a diverse group of disease ranging from indolent to aggressive clinical course. Diffuse large B cell variant is clinically aggressive course while follicular, Marginal zone lymphoma are indolent. Individual risk categorization based on immunohistochemistry, molecular study and nuclear image-based response criteria has resulted in increased response and survival in last two decades. Our objective was to study clinical profile, treatment and outcome of patients diagnosed as Non-Hodgkin Lymphoma at our center. Retrospective chart review of patients diagnosed as Non-Hodgkin lymphoma and got treated were enrolled in the study from January 2018 to December 2023 and followed up them up to June 2025. Demographic, clinical profile, treatment and outcome were analyzed for event free survival (EFS) and overall survival (OS). Total of 55 adult patients were enrolled in the study. From January 2018 to December 2023, fifty-five cases were registered with Non-Hodgkin lymphoma. Mean age of presentation was 45.3 years (range 19-76 years). Male: female ratio was 1.75:1. Majority (42%) belonged to age group of 40-60 years and 76% patients had duration of symptoms between 1-3 months. B symptoms were documented in 24%. Nodal presentation (56%) was more common than Extra nodal (44%). B-cell disease (94.5%) was more common than T cell (5.5%). DLBCL was the most common histological subtype (71%) followed by Mantle cell, Follicular, Splenic Marginal Zone, MALT lymphoma. Among T cell histology, ALK positive T cell, Peripheral T cell and NK/T cell were common. Staging and response evaluation was done by CECT in 89% while PET CT was done in 11%. Majority 58% belonged to stage 2 disease while one third 33% belonged to advanced stage. CHOP (Cyclophosphamide, Vincristine, Doxorubicin, Prednisolone) based regimen was adopted in 74.5%, Bendamustine (B-R) based in 18%, CVP (Cyclophosphamide, Vincristine, Prednisolone) in 5% and one patient was treated by SMILE protocol. Rituximab was used in 53% and three (5.4%) received Radiotherapy as well. Outcome analysis revealed 37(67%) were alive during follow-up and 18 (33%) relapsed. Those who relapsed 7(13%) died due to relapse/refractory or progressive disease. Mean duration of follow up since first diagnosis was 66.8 months (range: 8 – 96 months). Non-Hodgkin Lymphoma presents in fourth decade of life in majority. B cell lymphoma is the most common and DLBCL histology predominates. Financial restriction influences in adopting advanced investigation and treatment modalities. Almost one third had relapse. Relapse poses significant challenges in resource poor country.

Keywords: B Cell Lymphoma, Non-Hodgkin Lymphoma, Radiotherapy, Mantle Cell, Follicular, Splenic Marginal Zone, MALT Lymphoma, T Cell Histology, ALK Positive T Cell, Flow Cytometry, Cytogenetics, Molecular Diagnostics, Positron Emission Tomography-Computed Tomography

1. Introduction

Non-Hodgkin lymphoma (NHL) is a heterogeneous group of lymphoid malignancies arising from B lymphocytes, T lymphocytes, or natural killer (NK) cells. It represents one of the

most common hematological cancers worldwide and comprises more than 80 distinct clinicopathological entities according to the World Health Organization (WHO) classification. The biological behavior of NHL ranges from indolent lymphomas, which may

remain stable for years without treatment, to highly aggressive subtypes that require prompt diagnosis and intensive therapy. Among these, diffuse large B-cell lymphoma (DLBCL) is the most common subtype in adults, accounting for approximately 30–40% of all NHL cases globally [1-4].

Globally, the incidence of NHL has increased steadily over the past several decades, making it one of the leading causes of cancer-related morbidity and mortality. According to GLOBOCAN 2022 estimates, NHL accounts for more than half a million new cases and over a quarter of a million deaths annually worldwide (4). Improvements in diagnostic techniques, including immunophenotyping, immunohistochemistry, flow cytometry, cytogenetics, molecular diagnostics, and positron emission tomography-computed tomography (PET-CT), have substantially improved disease classification, risk stratification, and treatment planning [1-3,8]. The incorporation of targeted therapies, particularly rituximab for CD20-positive B-cell lymphomas, has significantly improved survival outcomes in patients with aggressive B-cell lymphomas [6,7,9,10].

The clinical presentation of NHL is highly variable. Patients commonly present with painless lymphadenopathy, constitutional "B symptoms" (fever, night sweats, and weight loss), extra nodal involvement, or organ-specific manifestations depending on the site of disease [11-17]. Accurate staging, commonly performed using the Ann Arbor staging system together with imaging modalities such as contrast-enhanced computed tomography (CECT) or PET-CT, plays an essential role in determining prognosis and selecting appropriate treatment strategies [8]. Standard first-line treatment for aggressive B-cell NHL generally consists of rituximab combined with cyclophosphamide, doxorubicin, vincristine, and prednisolone (R-CHOP), whereas treatment for indolent lymphomas may vary according to disease burden, symptoms, and patient characteristics [6,7,9,10].

Despite remarkable advances in lymphoma management in high-income countries, diagnosis and treatment remain challenging in low- and middle-income countries such as Nepal. Limited availability of advanced diagnostic facilities, restricted access to PET-CT imaging, high costs of immunohistochemistry and molecular testing, and financial barriers to receiving targeted therapies such as rituximab often influence treatment decisions and patient outcomes [8-10]. Consequently, many patients receive conventional chemotherapy regimens without complete biological characterization of the disease, potentially affecting long-term survival and relapse rates [10–12]. Published data describing the clinical characteristics, treatment patterns, and outcomes of NHL patients from Nepal remain limited. Most available evidence originates from small institutional experiences, and comprehensive long-term outcome data are scarce. Understanding the demographic profile, histological spectrum, stage distribution, treatment approaches, and survival outcomes in Nepalese patients is essential for improving clinical practice, guiding resource allocation, and informing future national lymphoma management

strategies [13,14,17,18].

Therefore, this retrospective single-center study aimed to evaluate the demographic characteristics, clinicopathological features, treatment modalities, and clinical outcomes of adult patients diagnosed with Non-Hodgkin lymphoma and treated at Vayodha Hospital, Nepal, between January 2018 and December 2023, with follow-up until June 2025. The findings are expected to provide valuable real-world evidence on NHL management in a resource-limited setting and identify areas for improving lymphoma care in Nepal.

2. Objective

To study the clinical profile, treatment modalities and outcomes of adult patients diagnosed with Non-Hodgkin lymphoma.

3. Materials and Methods

3.1 Study Design and Setting

This retrospective observational study was conducted at the Department of Hematology and Medical Oncology, Vayodha Hospital, Kathmandu, Nepal, a tertiary care referral center providing comprehensive diagnostic and treatment services for patients with hematological malignancies. The study evaluated the clinicopathological characteristics, treatment patterns, and clinical outcomes of adult patients diagnosed with Non-Hodgkin lymphoma (NHL) over a six-year period.

3.2 Study Population

Adult patients (≥ 18 years) with a histopathologically confirmed diagnosis of Non-Hodgkin lymphoma who received treatment at Vayodha Hospital between **January 2018 and December 2023** were included in the study. Patients were followed until **June 2025** to evaluate treatment response, relapse, event-free survival (EFS), and overall survival (OS). A total of **55 patients** fulfilled the study eligibility criteria and were included in the final analysis.

3.3 Inclusion Criteria

Patients were included if they met the following criteria:

- Age 18 years or older.
- Histopathologically confirmed diagnosis of Non-Hodgkin lymphoma.
- Received definitive treatment at Vayodha Hospital.
- Had complete clinical records with follow-up information available until June 2025.

3.4 Exclusion Criteria

Patients were excluded if they:

- Were younger than 18 years.
- Had Hodgkin lymphoma or other hematological malignancies.
- Received only diagnostic evaluation without treatment at the study center.
- Had incomplete medical records or were lost to follow-up immediately after diagnosis.

3.5 Data Collection

Patient information was retrieved retrospectively from hospital medical records and electronic databases. The following variables were collected:

- Demographic characteristics (age and sex)
- Duration of symptoms before diagnosis
- Presence of constitutional (B) symptoms
- Site of disease (nodal or extra nodal)
- Histological subtype
- Immunophenotypic classification (B-cell or T-cell lymphoma)
- Disease stage at diagnosis
- Imaging modality used for staging (contrast-enhanced computed tomography (CECT) or positron emission tomography-computed tomography (PET-CT))
- Chemotherapy regimen administered
- Rituximab use
- Radiotherapy
- Treatment response
- Disease relapse
- Survival status at last follow-up.

3.6 Diagnosis and Disease Classification

The diagnosis of NHL was established by histopathological examination of lymph node or extra nodal tissue biopsy specimens. Histological classification was based on the World Health Organization (WHO) classification of lymphoid neoplasms. Immunohistochemistry was performed where indicated to differentiate B-cell and T-cell lymphomas and to identify specific lymphoma subtypes. Disease staging was performed according to the Ann Arbor staging system using contrast-enhanced computed tomography (CECT) in most patients, while PET-CT was used when clinically indicated and financially feasible.

4. Treatment

Treatment decisions were individualized according to lymphoma subtype, disease stage, patient performance status, and financial considerations. Most patients with aggressive B-cell lymphoma received CHOP (cyclophosphamide, doxorubicin, vincristine, and prednisolone)-based chemotherapy, with rituximab added for eligible CD20-positive patients whenever available. Patients with indolent lymphoma received bendamustine-based or CVP-based regimens according to disease characteristics. Selected patients also received involved-site radiotherapy as part of multimodality treatment. Patients with NK/T-cell lymphoma received the SMILE protocol.

4.1 Outcome Measures

The primary study outcomes were treatment response, relapse, event-free survival (EFS), and overall survival (OS). Event-free survival was defined as the time from diagnosis to disease progression, relapse, death, or last follow-up. Overall survival was defined as the time from diagnosis until death from any cause or the last recorded follow-up.

4.2 Statistical Analysis

Data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) software (IBM SPSS Statistics, version XX; IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean $\pm$ standard deviation or median with range, whereas categorical variables were summarized as frequencies and percentages. Survival outcomes were estimated using the Kaplan–Meier method. A two-sided P value of <0.05 was considered statistically significant.

5. Ethical Considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Approval was obtained from the Institutional Review Committee/Ethics Committee of Vayodha Hospital before commencement of the study. As this was a retrospective review of anonymized hospital records, the requirement for individual informed consent was waived by the ethics committee.

6. Results

A total of **55 adult patients** with histopathologically confirmed Non-Hodgkin lymphoma (NHL) were included in the study. Patients were diagnosed between **January 2018 and December 2023** and followed until **June 2025**, with a mean follow-up duration of **66.8 months** (range: 8–96 months).

6.1 Patient Demographic Characteristics

The mean age at diagnosis was **45.3 years** (range: 19–76 years). The majority of patients (42%) were between **40 and 60 years** of age. There was a male predominance, with **35 males and 20 females**, giving a male-to-female ratio of **1.75:1**. Most patients (76%) presented within **1–3 months** of symptom onset, whereas a smaller proportion presented after a longer duration. Constitutional (B) symptoms, including fever, weight loss, and night sweats, were documented in **24%** of patients.

Variable	Number (%)
Total patients	55
Mean age (years)	45.3 (19–76)
Age group 40–60 years	23 (42%)
Male	35 (63.6%)
Female	20 (36.4%)
Male: Female ratio	1.75:1
Duration of symptoms 1–3 months	42 (76%)
Presence of B symptoms	13 (24%)

Table 1: Baseline demographic and clinical characteristics of study participants (N = 55)

6.2 Clinical Presentation

Nodal lymphoma was the most common presentation, observed in 31 patients (56%), while 24 patients (44%) had extra nodal disease. The majority of lymphomas were of B-cell origin (94.5%), whereas T-cell lymphomas accounted for 5.5% of cases.

6.3 Histopathological Characteristics

Diffuse large B-cell lymphoma (DLBCL) was the predominant

histological subtype, accounting for 71% of all NHL cases. Other B-cell lymphomas included mantle cell lymphoma, follicular lymphoma, splenic marginal zone lymphoma, and mucosa-associated lymphoid tissue (MALT) lymphoma. Among T-cell lymphomas, ALK-positive anaplastic large cell lymphoma, peripheral T-cell lymphoma, and NK/T-cell lymphoma were identified.

Histological subtype	Number (%)
Diffuse large B-cell lymphoma (DLBCL)	39 (71%)
Mantle cell lymphoma	Included among remaining cases
Follicular lymphoma	Included among remaining cases
Splenic marginal zone lymphoma	Included among remaining cases
MALT lymphoma	Included among remaining cases
ALK-positive T-cell lymphoma	Included among remaining cases
Peripheral T-cell lymphoma	Included among remaining cases
NK/T-cell lymphoma	Included among remaining cases

Table 2: Histological distribution of Non-Hodgkin lymphoma

6.4 Disease Staging

Initial disease staging was performed using **contrast-enhanced computed tomography (CECT)** in **89%** of patients, whereas **PET-CT** was performed in **11%**, primarily because of financial

limitations. Stage II disease was the most common stage at diagnosis, accounting for **58%** of patients, while 33% presented with advanced-stage disease (Stage III or IV).

Variable	Number (%)
CECT staging	49 (89%)
PET-CT staging	6 (11%)
Stage II disease	32 (58%)
Advanced stage (III–IV)	18 (33%)

Table 3: Disease staging and imaging modality

6.5 Treatment Characteristics

The most frequently administered chemotherapy regimen was **CHOP-based therapy**, used in **41 patients (74.5%)**. **Bendamustine plus Rituximab (B-R)** was administered to **10 patients (18%)**, while **CVP** chemotherapy was given to **3**

patients (5%). One patient with NK/T-cell lymphoma received the **SMILE protocol**. Rituximab was administered in **29 patients (53%)**, while **three patients (5.4%)** also received radiotherapy as part of their treatment.

Treatment	Number (%)
CHOP-based chemotherapy	41 (74.5%)
Bendamustine + Rituximab	10 (18%)
CVP chemotherapy	3 (5%)
SMILE protocol	1 (1.8%)
Rituximab administered	29 (53%)
Radiotherapy	3 (5.4%)

Table 4: Treatment modalities

6.6 Treatment Outcomes

At the end of the follow-up period, **37 patients (67%)** were alive. **Eighteen patients (33%)** experienced disease relapse during

follow-up. Among patients who relapsed, **seven (13%)** died due to relapsed, refractory, or progressive disease. The mean duration of follow-up from diagnosis was **66.8 months** (range: 8–96 months).

Outcome	Number (%)
Alive at last follow-up	37 (67%)
Relapsed disease	18 (33%)
Death due to relapse/progression	7 (13%)
Mean follow-up	66.8 months (8–96)

Table 5: Clinical outcomes

7. Summary of Findings

The present study demonstrated that adult NHL in Nepal predominantly affected middle-aged males and was largely composed of B-cell lymphomas, with DLBCL representing the most frequent histological subtype. Most patients presented with Stage II disease and received CHOP-based chemotherapy, although the use of PET-CT imaging and rituximab was limited. Despite favorable survival in approximately two-thirds of patients, one-third experienced relapse, highlighting the ongoing challenges in managing NHL in a resource-constrained healthcare setting.

8. Discussion

The present study provides a comprehensive overview of the demographic characteristics, clinicopathological features, treatment patterns, and outcomes of adult patients with Non-Hodgkin lymphoma (NHL) treated at a tertiary care center in Nepal. The findings demonstrate that diffuse large B-cell lymphoma (DLBCL) is the predominant histological subtype, with most patients presenting during the fourth and fifth decades of life. Although the majority of patients responded to first-line chemotherapy, relapse remained a significant clinical challenge, particularly in a resource-limited healthcare setting [10,13,17].

In the present study, the mean age at diagnosis was 45.3 years, which is considerably younger than that reported in Western populations, where the median age at diagnosis ranges from 60 to 70 years. Similar observations have been reported from several South Asian countries, including India, Pakistan, and Bangladesh, where NHL tends to occur approximately one to two decades earlier [13,14,17]. This younger age at presentation may reflect demographic differences, genetic susceptibility, environmental exposures, infectious risk factors, or differences in healthcare utilization and life expectancy. The relatively younger patient

population has important socioeconomic implications because lymphoma affects individuals during their most productive years, resulting in substantial financial and social burdens [14,17].

Consistent with previous studies, males predominated in our cohort, with a male-to-female ratio of 1.75:1. Male predominance has been consistently observed in international lymphoma registries and may be related to hormonal influences, occupational exposures, environmental risk factors, and differences in immune regulation [13,17,18]. Similar sex distributions have been reported from neighboring countries and other low- and middle-income settings [14,17].

The majority of patients presented with nodal disease, although a substantial proportion (44%) had extra nodal involvement. Extra nodal NHL is relatively common in Asian countries and has been associated with chronic infections, autoimmune disorders, and environmental exposures [14,17]. The frequency of extra nodal disease observed in our study is comparable to reports from other regional studies and highlights the diverse clinical presentation of NHL. Clinicians should therefore maintain a high index of suspicion for lymphoma in patients presenting with extra nodal masses or organ-specific symptoms [14,17].

As expected, B-cell lymphoma accounted for the vast majority (94.5%) of cases, while DLBCL represented 71% of all NHL diagnoses, making it by far the most common histological subtype. This finding is consistent with international literature, where DLBCL constitutes approximately 30–40% of NHL cases and is recognized as the most common aggressive lymphoma worldwide [2,10,17]. The predominance of DLBCL has also been documented in studies from India, China, Pakistan, and other South Asian countries [13,14]. The high frequency of aggressive lymphoma in

our population underscores the importance of timely diagnosis and prompt initiation of treatment [9,10].

Disease staging plays a crucial role in determining prognosis and treatment strategy. In the present study, 58% of patients presented with Stage II disease, whereas one-third had advanced-stage disease. Although early-stage presentation may reflect increasing awareness and improved referral pathways, a considerable proportion of patients still presented with advanced disease, likely due to delayed healthcare seeking, limited access to specialized oncology services, and financial barriers. Early diagnosis through improved referral systems and greater public awareness may contribute to improved long-term outcomes [8,15].

One notable finding of our study was the limited use of PET-CT, which was performed in only 11% of patients. In contrast, CECT was used in 89% of cases for staging and response assessment. PET-CT has become the standard imaging modality for staging and treatment response evaluation in many lymphoma subtypes because of its superior sensitivity and prognostic value (8). However, the high cost and limited availability of PET-CT in Nepal restrict its routine use. Consequently, clinicians continue to rely primarily on CECT, which, although widely available, may underestimate disease burden and treatment response in some patients [8,9].

Treatment practices in our institution reflected both international recommendations and local resource constraints. CHOP-based chemotherapy remained the backbone of treatment and was administered to approximately three-quarters of patients. Rituximab was incorporated into treatment in only 53% of patients despite its established survival benefit in CD20-positive B-cell lymphomas. The relatively low utilization of rituximab in our cohort was primarily attributable to financial limitations rather than clinical indications. Previous studies have consistently demonstrated that the addition of rituximab to CHOP significantly improves complete remission rates, progression-free survival, and overall survival in patients with DLBCL [6,7,9,10]. Increasing affordability and access to biosimilar rituximab could substantially improve outcomes in resource-limited settings such as Nepal [6,10].

At a mean follow-up of 66.8 months, 67% of patients remained alive, while 33% experienced relapse. Furthermore, 13% died due to relapsed or progressive disease. Relapse remains one of the major challenges in lymphoma management, particularly where access to salvage chemotherapy, autologous stem cell transplantation, CAR-T cell therapy, and novel targeted agents is limited [11,12,16]. In high-income countries, patients with relapsed or refractory NHL increasingly benefit from advanced therapeutic options, whereas such treatments remain largely inaccessible in Nepal because of financial and infrastructural limitations [11,12]. These disparities highlight the urgent need to strengthen national oncology services and improve access to modern lymphoma therapies [11,12,16].

The findings of this study have important implications for lymphoma care in Nepal. First, they provide valuable real-world evidence regarding the clinical spectrum and management of NHL in a tertiary referral center. Second, they emphasize the need for wider availability of advanced diagnostic techniques, including PET-CT, immunophenotyping, and molecular testing, to facilitate accurate diagnosis and risk stratification [1–3,8]. Third, improving access to targeted therapies and supportive care may help reduce relapse rates and improve long-term survival [6,7,10–12]. Finally, the establishment of a national lymphoma registry and multicenter collaborative studies would provide more representative epidemiological data and facilitate evidence-based healthcare planning [13,17,18].

This study has several strengths. It provides one of the few long-term institutional experiences describing adult NHL in Nepal, with a follow-up period extending to more than five years. The study also reflects routine clinical practice in a resource-constrained setting and therefore offers valuable information regarding real-world treatment patterns and outcomes.

However, several limitations should be acknowledged. The retrospective design introduces the possibility of selection and information bias. The study was conducted at a single institution with a relatively small sample size, limiting the generalizability of the findings. Complete molecular and cytogenetic profiling was not available for all patients because of financial and technical constraints. Additionally, PET-CT was performed in only a small proportion of patients, and detailed survival analyses according to stage, histological subtype, and treatment regimen could not be performed because of limited sample size. Despite these limitations, the study provides important baseline data on NHL management in Nepal and highlights areas requiring further multicenter prospective research [8,13,17].

Overall, our findings demonstrate that DLBCL remains the predominant NHL subtype in Nepal, with favorable survival achieved in many patients following CHOP-based chemotherapy. Nevertheless, financial barriers continue to influence access to optimal diagnostic investigations and immunotherapy, and relapse remains a major obstacle to improving long-term outcomes. Strengthening diagnostic capacity, expanding access to targeted therapies, and establishing national collaborative research networks will be essential to improving lymphoma care in Nepal [6–12,17].

8. Conclusion

This retrospective single-center study provides important insights into the clinical characteristics, treatment patterns, and outcomes of adult patients with Non-Hodgkin lymphoma (NHL) treated at a tertiary care centre in Nepal. The study demonstrated that NHL predominantly affected middle-aged adults, with a male predominance, and that B-cell lymphomas constituted the vast majority of cases. Diffuse large B-cell lymphoma (DLBCL) was the most common histological subtype, consistent with global epidemiological patterns. Most patients presented with Stage II

disease and were treated with CHOP-based chemotherapy, while the use of rituximab and PET-CT was limited by financial and resource constraints.

Although two-thirds of patients were alive at the end of follow-up, approximately one-third experienced disease relapse, and relapse-related mortality remained substantial. These findings highlight the ongoing challenges of managing NHL in resource-limited settings, where restricted access to advanced diagnostic modalities, targeted therapies, and salvage treatment options may adversely affect long-term outcomes.

Improving access to immunohistochemistry, molecular diagnostics, PET-CT imaging, and rituximab-based immunochemotherapy is essential for optimizing lymphoma management in Nepal. Furthermore, strengthening referral systems, establishing a national lymphoma registry, and conducting multicenter prospective studies will provide more representative epidemiological data and support evidence-based healthcare planning. Investment in modern diagnostic facilities and equitable access to novel therapies are likely to improve survival and reduce relapse among patients with NHL in Nepal.

Overall, this study contributes valuable real-world evidence on the management of Non-Hodgkin lymphoma in a resource-constrained setting and underscores the need for continued efforts to enhance diagnostic capacity, treatment accessibility, and long-term patient care.

Declarations

Ethics Approval

This retrospective study was reviewed and approved by the Institutional Review Committee (IRC), Vayodha Hospital, Kathmandu, Nepal Approval No.: 26-155. The study was conducted in accordance with the Declaration of Helsinki. Because the study used anonymized retrospective medical records, the requirement for written informed consent was waived by the Institutional Review Committee.

Consent to Participate

Not applicable., Written informed consent was waived by the Institutional Review Committee because this retrospective study used anonymized patient records without direct participant involvement.

Data Availability

The datasets generated and/or analyzed during the current study are not publicly available because they contain confidential patient information obtained from hospital medical records. However, anonymized data are available from the corresponding author upon reasonable request and with permission from Vayodha Hospital.

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Conflict of Interest

The authors declare that they have no competing interests.

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