

Long-Term Survival Patterns in Childhood B-Cell Non-Hodgkin Lymphoma in Resource-Constrained Countries

Irfana Ishaq Sindhu^{1,*}, Muneeba Jalil², Fatima Iqbal², Arooba Zafar², Afshan Khanum³, Najma Shaheen¹, Naeem Akram Butt¹, Aqeela Rashid¹

¹Department of Paediatric Oncology, Shaukat Khanum Memorial Cancer Hospital & Research Centre, Lahore, Pakistan

²Department of Paediatric Intensive care, Shaukat Khanum Memorial Cancer Hospital & Research Centre, Lahore, Pakistan

Abstract

Introduction

The B cell non-Hodgkin lymphomas (NHL) of childhood and adolescence are among the fifth most common pediatric malignancies worldwide. We conducted a retrospective study and evaluated risk factors influencing long-term survival outcomes in patients with B-cell NHL treated at a tertiary cancer care hospital.

Materials and Methods

This retrospective descriptive study was conducted at Shaukat Khanum Memorial Cancer Hospital and Research Center. This study included data of patients diagnosed with B-cell NHL from January 2016 to December 2020, following approval from the institutional review board. Statistical significance was defined as a two-tailed p-value < 0.05. Kaplan-Meier curves were generated in SPSS version 27 (IBM Corporation). Overall survival (OS) was defined as the time from diagnosis to death or last follow-up. Event-free survival (EFS) was defined as the time from diagnosis to death, progression, relapse, treatment abandonment, or last follow-up.

Results

A total of 276 patients with B-cell NHL were registered between January 2016 and December 2020. The median age of the patients was 5 years (IQR: 2). Baseline LDH was strongly associated with mortality, with a greater proportion of deaths occurring among patients with LDH $\geq 2 \times$ the upper limit of normal (54.1% vs 19.6%; $p < 0.01$). Advanced stage, tumor lysis syndrome, and poor reassessment response were significantly associated with mortality ($p < 0.001$). In multivariate analysis, patients with TLS had a 2.9-fold higher risk of death compared with those without TLS (2.86; 95% CI: 1.837-4.456; $p < 0.001$). The estimated 5-year overall survival rate was 63.7%, and the event-free survival rate was 62%.

Conclusion

Our study emphasized that the long-term survival outcome of pediatric B-cell NHL in LMIC is significantly inferior in comparison to developed countries due to high disease burden at presentation, along with tumor lysis syndrome, which led to complications such as sepsis. Sepsis was the major cause of death in our population.

Keywords

Paediatric Non-Hodgkin Lymphoma • Burkitt Lymphoma • Tumour Lysis Syndrome • Sepsis • Survival Analysis • Low- and middle-income countries

Introduction

B-cell non-Hodgkin lymphomas (NHL) in childhood and adolescence are the fifth most common pediatric malignancy worldwide (1). Among malignant lymphomas, B-cell NHL is the most common type, accounting for approximately 7% of all childhood cancers (2).

The cure rate for B-cell non-Hodgkin lymphoma in high-income countries exceeds 90%, largely due to robust supportive care and the addition of targeted therapy with dose-intense chemotherapy. However, in low- and middle-income countries (LMICs), survival outcomes remain below 50% because of inadequate supportive care and limited access to intensive chemotherapy and targeted therapies. Reported event-free

survival (EFS) rates for B-cell NHL from India and other LMICs range from 20% to 72% (3).

In LMICs such as Pakistan, pediatric B-cell non-Hodgkin lymphoma presents additional challenges because of limited diagnostic resources, inadequate supportive care, and high rates of treatment-related mortality (3,4). Furthermore, treatment at centers lacking the capacity to monitor and manage tumor lysis syndrome (TLS) has been associated with increased early mortality. Addressing these challenges requires optimized risk stratification, early intervention strategies, and improved access to essential supportive care measures.

*Corresponding author: Irfana Ishaq Sindhu

E-mail: irfanaishaq@skm.org.pk

We conducted a retrospective study and evaluated risk factors influencing long term survival outcomes in patients with B-cell non-Hodgkin lymphoma treated at a tertiary cancer care hospital.

Methods and Material

This retrospective descriptive study was conducted at Shaukat Khanum Memorial Cancer Hospital and Research Centre (SKMCH&RC), Lahore, Pakistan, and included data from patients aged 1–18 years, following approval from the institutional review board. Newly diagnosed patients with CD20-positive B-cell non-Hodgkin lymphoma—including Burkitt lymphoma (BL), high-grade B-cell non-Hodgkin lymphoma not otherwise specified (BNHL-NOS), and diffuse large B-cell lymphoma (DLBCL)—who were diagnosed between January 2016 and December 2020 were included. All patients had a five-year post-treatment follow-up period.

Patients with T-cell lymphoblastic lymphoma (TCL), precursor B-cell lymphoblastic lymphoma, anaplastic large cell lymphoma (ALCL), and those with missing data were excluded. Data were retrieved from the electronic database. The diagnosis of B-cell non-Hodgkin lymphoma was confirmed by tissue biopsy, histopathological examination, and immunohistochemistry.

Data were collected for age, gender, residence, diagnosis, site, stage, lactate dehydrogenase levels, treatment group, tumor lysis syndrome, diagnostic procedure (biopsy vs laparotomy), and outcomes. Staging was performed according to the St. Jude classification, using computed tomography (CT) scans, bone marrow aspiration and biopsy, and cell count and cytology of cerebrospinal fluid (5). MRI of the spine was performed in some patients to evaluate spinal cord involvement. Risk stratification and the treatment protocol used at the center were based on the United Kingdom Children's Cancer Study Group (UKCCSG) NHL 2003, which follows the FAB/LMB (French-American-British/Lymphome Malins De Burkitt) protocol (6).

In our study, tumor lysis syndrome was identified based on laboratory abnormalities, including elevated serum potassium, uric acid, creatinine, calcium, and phosphate levels.

Group A treatment consisted of cyclophosphamide 250 mg/m² every 12 hours for the first 3 days, vincristine 2 mg/m² on days 1 and 6, prednisolone 60 mg/m² in two divided doses for 5 days (then tapered over 3 days), and doxorubicin 60 mg/m² (COPAD regimen).

Groups B and C received initial cytoreductive chemotherapy with vincristine 1 mg/m², cyclophosphamide 300 mg/m², prednisolone 60 mg/m² in two divided doses for 5 days, and intrathecal chemotherapy with methotrexate (MTX) and hydrocortisone (COP regimen).

Group B patients received two cycles of induction chemotherapy: cyclophosphamide 250 mg/m² every 12 hours

for 3 days, vincristine 2 mg/m² on day 1, prednisolone 60 mg/m² in two divided doses for 5 days (then tapered over 3 days), methotrexate (MTX) 3 g/m² on day 1 with folinic acid rescue, doxorubicin 60 mg/m² on day 1, and two doses of intrathecal MTX and hydrocortisone (COPADM regimen). This was followed by two cycles of consolidation chemotherapy: cytarabine 100 mg/m² as a 24-hour infusion for 5 days, high-dose MTX 3 g/m² with folinic acid rescue, and intrathecal MTX, hydrocortisone, and cytarabine for 2 days (CYM regimen).

Group C patients received very high-dose MTX 8,000 mg/m² on day 1 followed by folinic acid rescue and cyclophosphamide 1,000 mg/m²/day for 3 days during induction, along with vincristine, doxorubicin, and prednisolone. In the consolidation phase, they received high-dose cytarabine 3,000 mg/m²/day for 4 days and etoposide 200 mg/m²/day for 4 days (CYVE regimen). CNS-positive patients also received high-dose MTX 8,000 mg/m² with folinic acid rescue and intrathecal methotrexate, followed by four cycles of maintenance chemotherapy. Rituximab was introduced in January 2020 for patients with stage IV disease; it was not available earlier due to resource limitations.

Response criteria on reassessment imaging followed the United Kingdom Children's Cancer Study Group (UKCCSG) NHL 2003 guidelines. Complete remission was defined as the disappearance of all measurable or evaluable lesions, with no L3 blast cells in the CSF or bone marrow. Partial response was defined as the existence of histologically proven residual disease.

Disease progression was defined as an increase of more than 25% in the product of the two largest diameters of measurable lesions, the appearance of new lesions, or the reappearance of L3 blasts in the bone marrow or cerebrospinal fluid. Disease response was also assessed at the end of therapy. Patients were followed for five years after completing therapy.

Reassessment CT scans for treatment group B were performed after the first cycle of CYM chemotherapy. If histologically proven residual disease was present, chemotherapy was intensified from Group B to Group C. No centralized radiology review was available at our center.

Statistical analysis was performed using SPSS software (version 26.0; SPSS, Chicago, IL, USA). Continuous variables were presented as mean ± SD, and categorical variables were summarized as frequencies and percentages. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate.

Continuous variables were compared using the independent t-test. A multivariable logistic regression (MLR) model was used to identify independent risk factors associated with mortality. Statistical significance was defined as a two-tailed p-value < 0.05. Overall survival (OS) and event-free survival (EFS) were calculated using the Kaplan-Meier method. EFS was calculated from the date of diagnosis until the first event, including death from any cause, disease progression, relapse, second

malignancy, or abandonment of treatment. OS was calculated as the percentage of patients alive at last follow-up.

Results

A total of 276 patients with B-cell non-Hodgkin lymphoma were registered between January 2016 and December 2020. The median age was 5 years (IQR: 2), with a male predominance (76.8%). Most patients were from Khyber Pakhtunkhwa (57.2%), followed by Punjab (23.2%). Burkitt lymphoma was the most common diagnosis (89.1%), and the diagnosis was mainly established by biopsy (54.3%). Most children presented with advanced disease (stage III–IV: 95.3%), and the abdomen was the most common primary site (83.7%). Tumor lysis syndrome occurred in 24.6% of patients. On reassessment scan, complete response was achieved in 63%, while 3.3% had a partial response (Table 1). The median follow-up duration was 53 months. At the end of treatment, 93 patients died (30 [28.5%] due to disease burden and 63 [60%] due to sepsis), 7 (6.5%) had disease progression, 2 (2%) relapsed, and 3 (2%) were lost to follow-up.

Of the 276 patients, 176 (63.7%) were alive (censored) and 100 (36.3%) died. Gender was not significantly associated with outcome ($p=0.182$). Baseline LDH was strongly associated with mortality, with a greater proportion of deaths occurring in patients with LDH $\geq 2\times$ the upper limit of normal (54.1% vs 19.6%; $p<0.01$). Advanced stage, tumor lysis syndrome, and poor reassessment response were also significantly associated with mortality ($p<0.001$) (Table 2).

In univariate regression analysis, patients with baseline LDH $>2\times$ normal had significantly higher odds of death (OR: 3.31, 95% CI: 2.13–5.13; $p<0.001$). Patients with tumor lysis syndrome had a fourfold higher risk of mortality (OR: 4.04, 95% CI: 2.71–6.02; $p<0.001$). Biopsy was associated with lower odds of death (OR: 0.50, 95% CI: 0.33–0.77; $p=0.002$). In multivariate analysis, patients with LDH $>2\times$ normal had a twofold higher risk of death compared to those with LDH $<2\times$ normal (OR: 2.03, 95% CI: 1.25–3.31; $p=0.004$), indicating that elevated LDH is independently associated with worse survival. Patients with tumor lysis syndrome had a 2.9-fold higher risk of death compared to those without TLS (OR: 2.86, 95% CI: 1.84–4.46; $p<0.001$) (Table 3).

Discussion

B-cell non-Hodgkin lymphoma is a highly curable disease in high-income countries with an intensive chemotherapy regimen based on LMB89 and BFM backbone (7). Survival outcome has been improved with the incorporation of Rituximab in the intensive chemotherapy regimen. Radhakrishnan et al. study

Table 1. Baseline Demographic and Clinicopathological Characteristics of Children with B-Cell Non-Hodgkin's Lymphoma.

Variables	Characteristics	Frequency n (%)
Age (years)	Median (IQR)	5.0 (2.0)
Gender	Male	212 (76.8)
	Female	64 (23.2)
Area of Residence	Punjab	64 (23.2)
	Khyber Pakhtunkhwa	158 (57.2)
	Afghanistan	39 (14.1)
	Balochistan	13 (4.7)
	Sindh	1 (0.4)
	Others	3 (1.1)
Diagnosis	Burkitt's lymphoma	246 (89.1)
	DLBCL	26 (9.4)
	B-cell NHL, NOS	4 (1.4)
Diagnostic Procedure	Biopsy	150 (54.3)
	Laparotomy	126 (45.7)
Tumor Lysis Syndrome	Yes	68 (24.6)
	No	208 (75.4)
Clinical Stage	Low stage (I–II)	13 (4.7)
	Advanced stage (III–IV)	263 (95.3)
Primary Site of Disease	Abdomen	231 (83.7)
	Face	28 (10.1)
	Neck	6 (2.2)
	Paraspinal	8 (2.9)
	Others	3 (1.1)
Stage IV Disease	None	203 (73.6)
	Bone marrow involvement	28 (10.1)
	CNS disease (cranial mass or nerve palsy)	28 (10.1)
	CSF positive	3 (1.1)
	Both BM & CNS involvement	14 (5.1)
Reassessment Scan	Not done	88 (31.9)
	Complete response	174 (63.0)
	Partial treatment response	9 (3.3)
	Disease progression	5 (1.8)

showed that in Low- middle countries, survival outcome of B-cell non-Hodgkin lymphoma has been improved to 92% by reduction of 25% chemotherapy dose along with incorporation of Rituximab in advanced stage disease (3). However, our study showed that the long-term survival outcome is still less than 65%, and advanced stage IV disease has an OS of 38%. Due to inferior long-term survival in advanced-stage disease,

Table 2. Association of Baseline Clinical Characteristics with Mortality Among Children with B-cell Non-Hodgkin's Lymphoma.

Variables	Characteristics	Alive: n (%)	Death: n (%)	P-value
Sex	Male	140 (66.0)	72 (34.0)	0.182
	Female	36 (56.3)	28 (43.8)	
Baseline LDH	≤2× upper limit of normal	115 (80.4)	28 (19.6)	<0.001
	>2× upper limit of normal	61 (45.9)	72 (54.1)	
Primary Disease Site	Abdomen	151 (65.4)	80 (34.6)	0.051
	Face	15 (53.6)	13 (46.4)	
	Paraspinal	2 (25.0)	6 (75.0)	
Clinical Stage	Low stage (I–II)	12 (92.0)	1 (8.0)	<0.001
	Advanced stage (III–IV)	163 (63.0)	99 (37.0)	
Surgery Type at Diagnosis	Biopsy	82 (54.7)	68 (45.3)	<0.001
	Laparotomy	94 (74.6)	32 (25.4)	
Tumour Lysis Syndrome	No	157 (75.5)	51 (24.5)	<0.001
	Yes	19 (27.9)	49 (72.1)	
Reassessment Scan	Complete response	165 (94.8)	9 (5.2)	<0.001
	Partial response	7 (77.8)	2 (22.2)	
	Disease progression	1 (20.0)	4 (80.0)	

Table 3. Predictors of Mortality in B-cell Non-Hodgkin Lymphoma (Unadjusted and Adjusted).

Analysis	Variables	Characteristics	Unadjusted OR (95% CI)	p-Value
Univariate	Gender	Male	Reference	0.216
		Female	1.31 (0.85–2.04)	
	Baseline LDH	<2× upper limit of normal	Reference	<0.001
		>2× upper limit of normal	3.31 (2.13–5.13)	
	Tumor Lysis Syndrome	No	Reference	<0.001
		Yes	4.04 (2.71–6.02)	
	Surgery at Diagnosis	Laparotomy	Reference	0.002
		Biopsy	0.50 (0.33–0.77)	
Multivariate	Gender	Male	Reference	0.120
		Female	1.41 (0.91–2.20)	
	Baseline LDH	<2× upper limit of normal	Reference	0.004
		>2× upper limit of normal	2.03 (1.24–3.30)	
	Tumour Lysis Syndrome	No	Reference	<0.001
		Yes	2.86 (1.83–4.45)	
	Surgery at Diagnosis	Laparotomy	Reference	0.530
		Biopsy	0.86 (0.54–1.37)	

Figure 1. Kaplan–Meier Curve of Overall Survival in Patients with B-cell Non-Hodgkin Lymphoma.

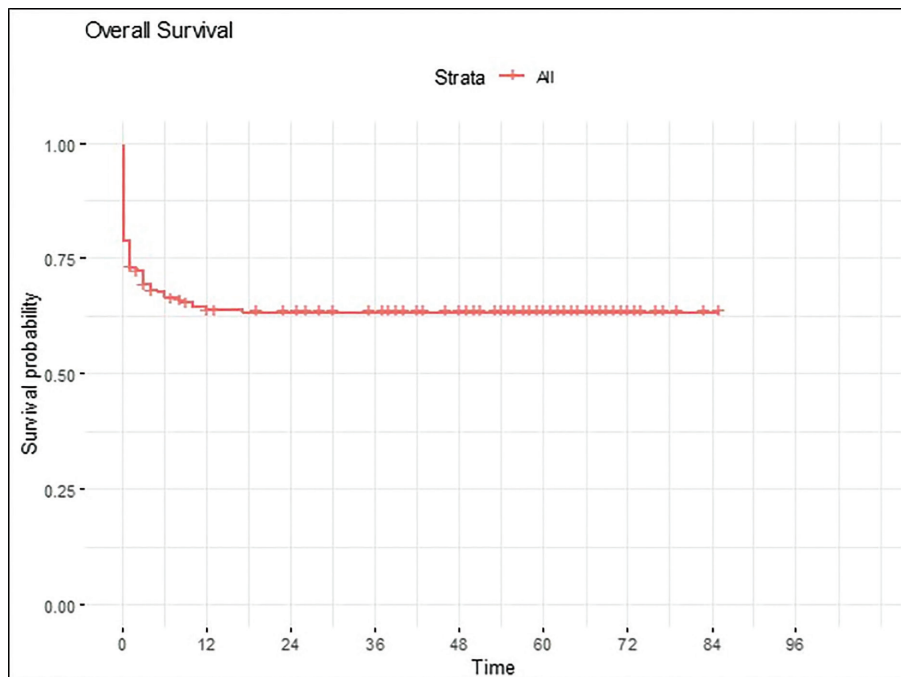


Figure 2. Kaplan–Meier Curve of Overall Survival Stratified by Clinical Stage in Patients with B-cell Non-Hodgkin Lymphoma.

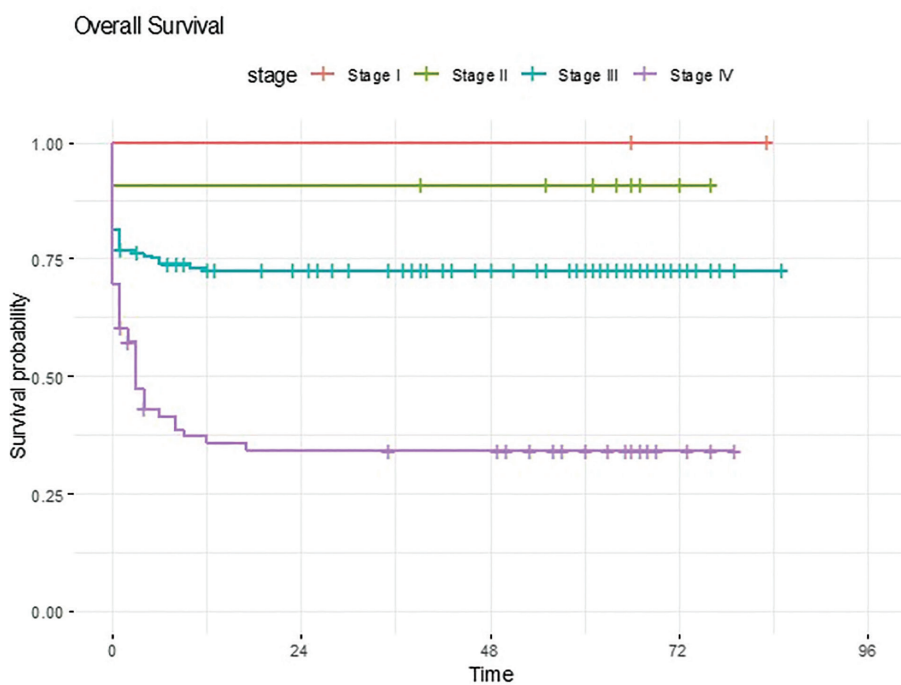


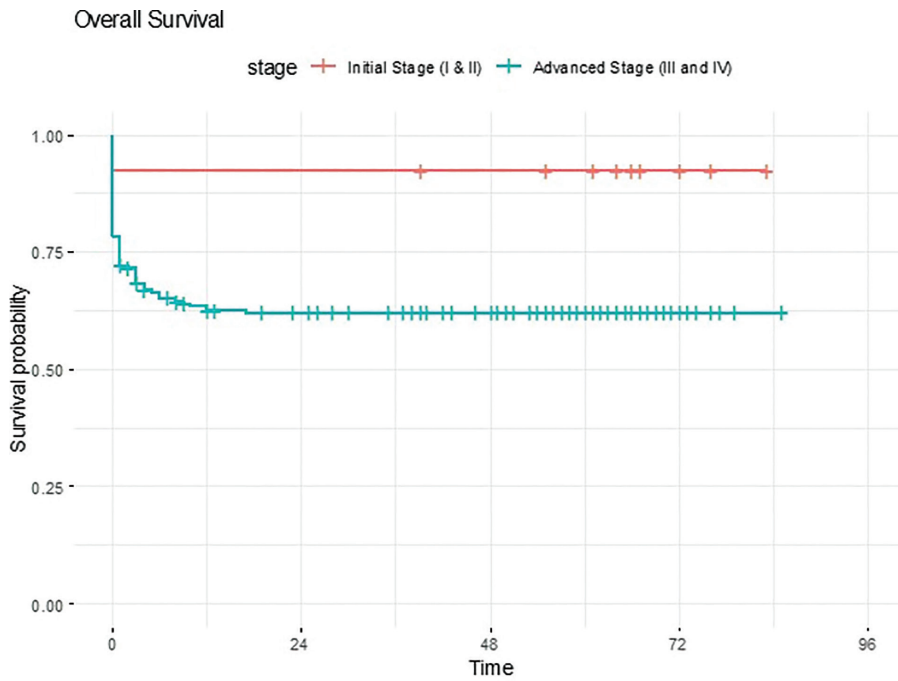
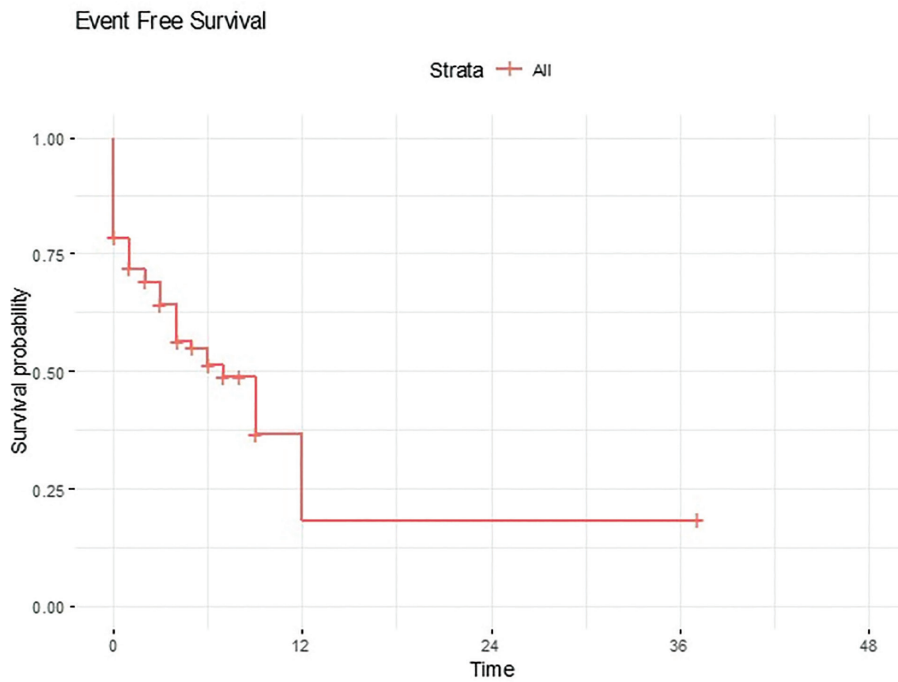
Figure 3. Kaplan–Meier Curve of Overall Survival Stratified by Disease Burden in Patients with B-cell Non-Hodgkin Lymphoma.**Figure 4.** Kaplan–Meier Curve of Event-Free Survival in Patients with B-cell Non-Hodgkin Lymphoma.

Figure 5. Kaplan–Meier Curve of Event Free Survival Stratified by Clinical Stage in Patients with B-cell Non-Hodgkin Lymphoma

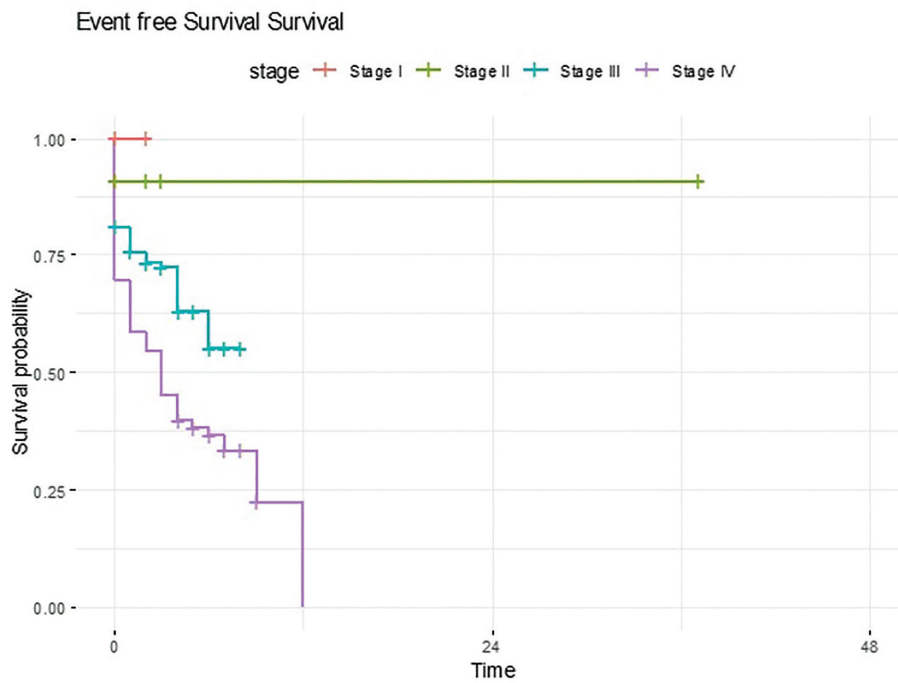
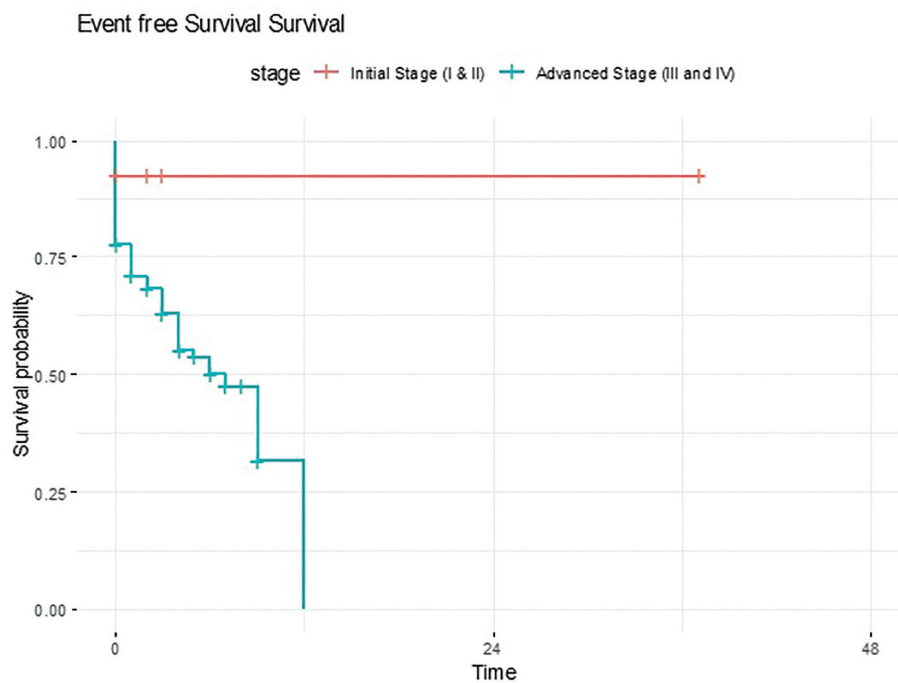


Figure 6. Kaplan–Meier Curve of Event-Free Survival Stratified by Disease Burden in Patients with B-cell Non-Hodgkin Lymphoma.



institutional guidelines were made, and Rituximab was added as a frontline therapy in stage IV disease. However, only seven patients received rituximab, and the overall cohort was small; therefore, larger future studies are needed to evaluate its impact.

Our study showed that baseline LDH levels more than twice the normal value were an independent risk factor for poor prognosis. When combined with other risk factors such as tumor lysis syndrome, advanced stage, and specific disease sites, prognosis was even worse—findings consistent with numerous other studies (8). Patients who achieved a complete response on reassessment imaging after intensive induction chemotherapy (after the first CYM cycle in Group B and the second CYVE cycle in Group C) had an overall survival rate exceeding 90%. In contrast, nearly 80% of patients with progressive disease on reassessment imaging subsequently died. A study from University College London by Green K et al. suggested that scans at this point cause clinical uncertainty, as they do not always indicate residual disease or predict relapse (9).

A study by Burkhardt et al. from Germany examined the impact of age and gender on the biology, clinical features, and treatment outcomes of B-cell non-Hodgkin lymphoma. They found that more boys than girls were diagnosed, but there was no difference in long-term prognosis between the groups. In our study, over 75% of the patients were boys, and only 23% were girls; however, girls had a 4.0% higher hazard ratio compared to boys. The hazard ratio indicated that patients who underwent biopsy as a diagnostic procedure had a worse prognosis, possibly due to a higher disease burden. This finding was contrary to the study conducted by Vural et al. (11). This disparity highlights the importance of early monitoring of tumor lysis profiles and timely multidisciplinary intervention, especially in LMICs with a high incidence of B-cell non-Hodgkin lymphoma. Management of tumor lysis syndrome should include intensive care support, with pediatric intensivist involvement and CRRT when indicated, as also recommended in the study by Reiger et al. (12).

In LMICs, critical challenges include delays in diagnosis and referral to pediatric oncology centers, poor nutritional status, and advanced stage at the time of diagnosis. Due to these factors, our patients were at high risk for acute complications, serious infections, and sepsis (13). Sepsis was the leading cause of death in our study. Contributing factors included late presentation to the emergency department by families and the serious problem of resistant microorganisms.

One likely reason is poor tolerance to chemotherapy due to severe malnutrition, which results in prolonged and profound neutropenia and an inability to clear infections. Based on these results, there is a need to modify chemotherapy protocols with appropriate dose reductions to help prevent acute mortality and deaths from serious, life-threatening infections.

The European Intergroup and Children's Oncology Group study (Inter-B-NHL Ritux 2010) demonstrated that adding rituximab to the LMB chemotherapy backbone for patients with high-risk B-cell non-Hodgkin lymphoma (stage III with elevated LDH or stage IV) improved event-free survival (EFS) from 82.3% to 93.9% (14).

The primary limitations of this study are its single-center, retrospective, descriptive design, which evaluates 5-year long-term survival outcomes in relation to various risk factors. Our center is a charitable tertiary cancer care hospital that treated a limited number of patients due to resource constraints. Although multiple risk factors influencing survival were identified, many of these could potentially be modified to improve outcomes in patients presenting with advanced-stage disease.

Our study emphasizes that prognosis for B-cell non-Hodgkin lymphoma in LMICs is significantly inferior to that in developed countries, primarily due to high disease burden at initial presentation. The development of tumor lysis syndrome further contributed to severe complications, with sepsis identified as the predominant cause of mortality in our patient population.

Funding statement

No funding was obtained for this study.

Conflict of interest declaration

The authors declare that they have no conflicts of interest related to this study.

Author contributions

Conceived and designed the analysis: IIS, AR.

Data Collection: AZ, MJ, FI.

Contributed data or analysis tools: IIS.

Data Analysis: AK.

Paper Writing: IIS, NJS, NAB, AR.

References

1. Gross TG, Biondi A. Paediatric non-Hodgkin lymphoma in low- and middle-income countries. *British Journal of Haematology*. 2016 May;173(4):651-4.
2. Mansoor R, Saeed H, Wali RM, Rehman P, Abubakar M. Malnutrition, sepsis, and tumour lysis syndrome are associated with increased rate of acute mortality in mature B cell non-Hodgkin lymphoma in a paediatric population-study from Tertiary Care Hospital in Pakistan. *Mediterranean Journal of Haematology and Infectious Diseases*. 2019 Jul 1;11(1): e2019043.
3. Radhakrishnan V, Kritthivasan V, Kothandan BT, Srinivasan P, Das G, Ramamurthy J. Reducing chemotherapy dose intensity by 25% and adding rituximab improves survival in paediatric mature B-cell non-Hodgkin lymphoma in LMIC setting. *paediatric Blood & Cancer*. 2023 Dec;70(12): e30694.

4. Jameel M, Wali R, Zaidi SM, Shaheen N, Sindhu II, Sindhu Jr II. Impact of Filgrastim on Mortality During Induction Chemotherapy in Childhood B-Cell Non-Hodgkin Lymphoma. *Cureus*. 2025 Jan 12;17(1).
5. Murphy SB, Fairclough DL, Hutchison RE, Berard CW. Non-Hodgkin's lymphomas of childhood: an analysis of the histology, staging, and response to treatment of 338 cases at a single institution. *Journal of Clinical Oncology*. 1989 Feb;7(2):186-93.
6. Patte C, Auperin A, Michon J, Behrendt H, Leverger G, Frappaz D, Lutz P, Coze C, Perel Y, Raphaël M, Terrier-Lacombe MJ. The Societe Francaise d'Oncologie Pediatrique LMB89 protocol: highly effective multiagent chemotherapy tailored to the tumor burden and initial response in 561 unselected children with B-cell lymphomas and L3 leukaemia. *Blood, The Journal of the American Society of Haematology*. 2001 Jun 1;97(11):3370-9.
7. Moleti ML, Testi AM, Foà R. Childhood aggressive B-cell non-Hodgkin lymphoma in low-middle-income countries. *British Journal of Haematology*. 2022 Feb;196(4):849-63.
8. Wang X, Ding L, Fang Y, Yan J, Gao J, Yang L, Liu A, Lu J, Wang J, Zhang A, Gao Y. The Prognostic and Risk Factors for Children with High-Risk Mature B-Cell Non-Hodgkin's Lymphoma: A Retrospective Multicenter Study. *Cancer Medicine*. 2024 Nov;13(21): e70309.
9. Green K, Pavasovic V, Ghorashian S, Ancliff P, Bartram J, Rao A, Samarasinghe S, Vora A, Cheng D, O'Connor D. Clinical Utility of Radiologic Disease Reassessment in the Management of Paediatric B-Cell Non-Hodgkin Lymphoma. *Journal of Paediatric Haematology/Oncology*. 2021 Apr 1;43(3): e380-4.
10. Burkhardt B, Zimmermann M, Oschlies I, Niggli F, Mann G, Parwaresch R, Riehm H, Schrappe M, Reiter A, BFM Group. The impact of age and gender on biology, clinical features and treatment outcome of non-Hodgkin lymphoma in childhood and adolescence. *British journal of haematology*. 2005 Oct;131(1):39-49.
11. Vural S, Baskin D, Dogan Ö, Polat N, Caliskan C, Urganci N, Karaman S. Diagnosis in childhood abdominal Burkitt's lymphoma. *Annals of Surgical Oncology*. 2010 Sep;17(9):2476-9.
12. Arnaud M, Loiselle M, Vaganay C, Pons S, Letavernier E, Demonchy J, Fodil S, Nouacer M, Placier S, Frère P, Arrii E. Tumour lysis syndrome and AKI: beyond crystal mechanisms. *Journal of the American Society of Nephrology*. 2022 Jun 1;33(6):1154-71.
13. Chauhan P, Gupta A, Mandelia A, Yadav S, Rahman K, Nityanand S. Clinical profile, outcome and challenges in the management of pediatric Burkitt lymphoma: a single center experience. *Pediatric Hematology and Oncology*. 2021 May 19;38(4):305-18.
14. Alexander S, Aupérin A, Bomken S, Csóka M, Kazanowska B, Chiang AK, Andres M, Uyttebroeck A, Burke GA, Zsiros J, Pillon M. Effect of rituximab on immune status in children with mature B-cell non-Hodgkin lymphoma: a prespecified secondary analysis of the Inter-B-NHL Ritux 2010 trial. *The Lancet Haematology*. 2023 Jun 1;10(6):e445-57.