ISSN 2822-2032 (Print) 2822-2040 (Online)

Medical Journal of Eastern Nepal

Volume 04, Number 01, Issue 07, January-June 2025, 22-27

Original Article

PROFILE OF HEMATOLOGICAL ONCOLOGY PATIENTS AT PURBANCHAL CANCER HOSPITAL, NEPAL: A RETROSPECTIVE STUDY

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Submitted:27th-March-2025 Revised:17th -April- 2025 Accepted:24th-April-2025

DOI: https://doi.org/10.3126/mjen.v4i01.80701

ABSTRACT

Background

Hematological malignancies, including leukemias, lymphomas, and multiple myeloma, pose a growing burden in developing countries like Nepal, yet regional data remain scarce. This study profiles patients with hematological malignancies at Purbanchal Cancer Hospital, a referral center in eastern Nepal, to inform clinical practice and research.

Methods

A retrospective analysis was conducted on 249 patients diagnosed with haematological malignancies at Purbanchal Cancer Hospital from January 1, 2022, to December 31, 2024. Data on age, sex, diagnosis, geographical origin, relapse status, and genetic mutations were extracted from medical records. Descriptive statistics were used to analyze frequency distributions, age-sex patterns, and notable trends.

Results

Out of 249 patients (age 2–99 years), 55.4% were male. Multiple myeloma (MM) was the most frequent diagnosis (18.9%), followed by non-Hodgkin lymphoma (NHL, 17.7%) and acute myeloid leukemia (AML, 17.3%). Acute lymphoblastic leukemia (ALL) predominated in children (71.8% of 0–18 years), while MM and AML were frequent in adults (19–60 years) and the elderly (61+ years). AML showed a high relapse rate (23.3%), with FLT3-ITD (6 cases) and NPM1 (5 cases) noted. ALL included BCR-ABL-positive cases (3), and myeloproliferative neoplasms featured JAK2 mutations (11). Most patients (59.4%) were from Jhapa district.

Conclusion

MM emerged as the leading hematological malignancy at Purbanchal Cancer Hospital, contrasting with prior Nepalese studies that reported AML as most prevalent—possibly due to referral patterns. The high relapse rate in AML and the presence of actionable mutations highlight the need for expanded molecular testing and improved therapeutic strategies. Future research should include survival data and population-based studies to refine regional cancer strategies.

Keywords: Acute Myeloid Leukemia, Hematological Malignancies, Multiple Myeloma, Nepal, Retrospective Study

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Citation
Man Singh I, Rattan R, Yadav BK, Profile of Hematological Oncology Patients at Purbanchal Cancer Hospital, Nepal: a Retrospective Study, MJEN. 2025 June; 4(1):22-27.

INTRODUCTION

Hematological malignancies encompass a category of cancers impacting the blood, bone marrow, and lymphatic system, which includes leukemias, lymphomas, multiple myeloma, and associated disorders. These cancers represent notable factors in the global cancer burden, constituting around 6.3% of all new cancer cases and 7.0% of all cancer-related deaths in 2020[1]. Recent years have witnessed a rising trend in their incidence, especially in developing countries, attributed to factors including aging populations, enhanced diagnostic capabilities, and evolving environmental and lifestyle influences.

Nepal, a low-resource country in South Asia, has witnessed an increasing burden of cancer, including hematological malignancies. A study published in 2020 estimated that cancer contributed to 10% of total deaths in Nepal in 2017, with an age-standardized incidence rate of 101.8 per 100,000 population [2]. While national data often focus on common solid tumors like breast and lung cancer, specific insights into hematological cancers from regional hospitals are limited. Previous hospital-based studies, such as one conducted in 2012 at a tertiary care hospital in Nepal, reported 155 cases over 11 years, with acute myeloid leukemia (AML) being the commonest leukemia. It was followed by chronic myeloid leukemia (CML), acute lymphoblastic leukemia (ALL), and chronic lymphocytic leukemia (CLL), and 23 cases of multiple myeloma [3]. Another study from 2019 focused on distress screening among patients with hematological malignancies, highlighting the psychosocial burden but not the epidemiological profile [4]. These studies highlight a gap in recent, comprehensive data, particularly from eastern Nepal, where this study was conducted at Purbanchal Cancer Hospital.

Purbanchal Cancer Hospital, situated in the Jhapa district, serves as a critical referral center for hematological oncology patients in the eastern region. This retrospective study aims to provide a comprehensive profile of these patients, focusing on demographic characteristics, types of malignancies, and notable patterns, to inform clinical practice and future research. The primary objectives of this study are to:

- Determine the frequency distribution of different types of hematological malignancies.
- Analyze the age and sex distribution of patients.
- Identify any notable patterns or trends in the patient population, such as relapsed cases or specific genetic mutations.
- Provide a geographical distribution of patients to understand the hospital's catchment area.

This research presents a retrospective analysis of patient data collected from January 1, 2022, to December 31, 2024, at Purbanchal Cancer Hospital. Data were obtained from medical records, and descriptive statistics were employed to summarize the findings. By providing a detailed analysis of hematological oncology patients at Purbanchal Cancer Hospital, this study aims to contribute valuable data that can help in understanding the epidemiology of these diseases in eastern Nepal and guide future research and clinical practices.

METHODS

This study adopted a retrospective design, analyzing data from all patients with hematological malignancies treated at Purbanchal Cancer Hospital from January 1, 2022, to December 31, 2024.The two-year study period (2022–2024) was selected based on the availability of complete patient records and to ensure a representative sample. Data were extracted from the hospital's medical records, encompassing patient demographics such as age, sex, address, and diagnosis. The dataset included 249 patients, providing a substantial sample for analysis.

Descriptive statistics were utilized to summarize the data. Frequency distributions were determined for categorical variables including sex, diagnosis, and geographical origin. Measures of central tendency (mean, median) and dispersion (range) were calculated for continuous variables such as age. Patients were categorized into three age groups: pediatric (0–18 years), adults (19–60 years), and elderly (>61 years) to enable age-specific analysis. Diagnoses were classified into primary categories (e.g., multiple myeloma, acute leukemias, lymphomas) according to clinical significance, with supplementary information regarding relapsed cases and genetic mutations recorded when accessible. Data analysis was performed using standard statistical software, though specific tools were not detailed in the records, assuming manual tabulation and basic spreadsheet functions for frequency counts.

RESULTS

The study included 249 patients, with a broad age range from 2 to 99 years, reflecting the diverse demographic served by the hospital. The distribution across age groups was as follows: pediatric (0–18 years, 39 patients, 15.7%), adults (19–60 years, 108 patients, 43.4%), and elderly (61+ years, 102 patients, 41.0%). This distribution underscores the significant burden of hematological malignancies across all age groups, particularly in adults and the elderly.

Frequency Distribution of Hematological Malignancies

Multiple myeloma (MM) was the most prevalent diagnosis (47 cases, 18.9%), followed by non-Hodgkin lymphoma (NHL, 44 cases, 17.7%) and

acute myeloid leukemia (AML, 43 cases, 17.3%). Acute lymphoblastic leukemia (ALL) accounted for 39 cases (15.7%), while chronic myeloid leukemia (CML) had 27 cases (10.8%). Other diagnoses included chronic lymphocytic leukemia (CLL, 8 cases, 3.2%), myeloproliferative neoplasms (MPN, 20 cases, 8.0%), myelodysplastic syndrome (MDS, 9 cases, 3.6%), myelodysplastic/myeloproliferative neoplasms (MDS/MPN, 2 cases, 0.8%), Hodgkin lymphoma (HL, 7 cases, 2.8%), and other rare hematological malignancies (3 cases, 1.2%). This distribution is summarized in **Table: 1** below:

Table 1: Distribution of Hematological Malignancies

Diagnosis	Number of Cases	Percentage (%)
Multiple Myeloma (MM)	47	18.9
Non-Hodgkin Lymphoma (NHL)	44	17.7
Acute Myeloid Leukemia (AML)	43	17.3
Acute Lymphoblastic Leukemia (ALL)	39	15.7
Chronic Myeloid Leukemia (CML)	27	10.8
Chronic Lymphocytic Leukemia (CLL)	8	3.2
Myeloproliferative Neoplasms (MPN)	20	8.0
Myelodysplastic Syndrome (MDS)	9	3.6
MDS/MPN	2	0.8
Hodgkin Lymphoma (HL)	7	2.8
Other Hematological Malignancies	3	1.2
Total	**249**	**100.0**

Age-specific patterns revealed distinct trends. In the pediatric group (0–18 years, 39 patients), ALL were the most common, with 28 cases (71.8% of pediatric cases), followed by AML (4 cases, 10.3%), CML (2 cases, 5.1%), NHL (2 cases, 5.1%), and other rare diagnoses (3 cases, 7.7%). This aligns with global trends where ALL predominates in childhood.

For adults (19–60 years, 110 patients), the distribution was more diverse, with MM (23 cases, 21.3%), AML (24 cases, 22.2%), and NHL (24 cases, 22.2%) being the most frequent, followed by ALL (10 cases, 9.3%), CML (15 cases, 13.9%), and MPN (14 cases, 13.0%). This reflects the broad spectrum of hematological malignancies in working-age adults.

In the elderly (>61 years, 100 patients), MM remained prominent (24 cases, 23.5%), alongside AML (15 cases, 14.7%), NHL (18 cases, 17.6%), CML (10 cases, 9.8%), CLL (7 cases, 6.9%), MDS (8 cases, 7.8%), and MPN (6 cases, 5.9%). This age group showed a higher prevalence of MM and MDS, consistent with age-related increases in these conditions.

Table 2: Distribution of Hematological Malignancies by Age Group

Diagnosis	Pediatric (0–18 yrs)	Adult (19–60 yrs)	Elderly (>61 yrs)
ALL	28 (71.8%)	10 (9.3%)	1
AML	4 (10.3%)	24 (22.2%)	15 (15%)
CML	2 (5.1%)	15 (13.9%)	10 (10%)
NHL	2 (5.1%)	24 (22.2%)	18 (18%)
MM	–	23 (21.3%)	24 (24%)
CLL	–	–	8 (8%)
MDS	–	–	9 (9%)
MPN	–	14 (13.0%)	6 (6%)
MDS/MPN	–	–	2(2%)
HL	–	–	7(7%)
Other	3 (7.7%)	–	–

Sex Distribution

The sex distribution showed a slight male predominance, with 138 males (55.4%) and 111 females (44.6%), yielding a male-to-female ratio of 1.24:1. By diagnosis, males were more represented in MM (28 males, 59.6%), AML (22 males, 51.2%), ALL (23 males, 59.0%), CML (18 males, 66.7%), and NHL (27 males, 61.4%), while AML showed a near-equal distribution (21 females, 48.8%).

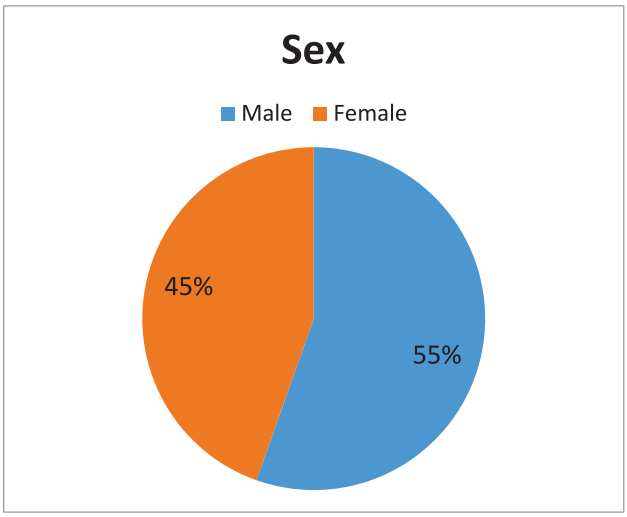


Table 3: Sex Distribution of Hematological Malignancies by Diagnosis

Diagnosis	Male (n, %)	Female (n, %)
MM	28 (59.6%)	19 (40.4%)
AML	22 (51.2%)	21 (48.8%)
ALL	23 (59.0%)	16 (41.0%)
CML	18 (66.7%)	9 (33.3%)
NHL	27 (61.4%)	17 (38.6%)

Relapsed and Refractory Cases

Relapsed or refractory cases were noted, particularly in AML (10 cases, 23.3% of AML cases), ALL (5 cases, 12.8% of ALL cases), MM (2 cases, 4.3% of MM cases), NHL (3 cases, 6.8% of NHL cases), and HL (1 refractory case, 14.3% of HL cases). The high relapse rate in AML is a notable finding, suggesting challenges in achieving durable remissions.

Table 4: Distribution of Relapsed and Refractory Cases by Diagnosis

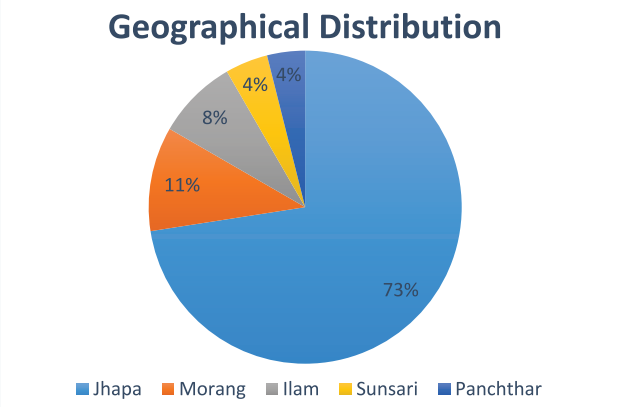
Disease	Number of Relapsed/ Refractory Cases	Percentage of Total Cases (%)
AML	10	23.3
ALL	5	12.8
MM	2	4.3
NHL	3	6.8
HL	1	14.3

Genetic Mutations and Prognostic Markers

The dataset included details on genetic mutations and prognostic markers, critical for personalized treatment. In AML, FLT3-ITD was noted in 6 cases, NPM1 in 5 cases, t (8;21) in 2 cases, and inv (16) in 1 case. For ALL, BCR-ABL was identified in 3 cases, and Philadelphia chromosome-positive (Ph+ve) in 2 cases, suggesting potential benefits from tyrosine kinase inhibitors. In MPN, JAK2 mutations were present in 11 cases, and CALR mutations in 4 cases, while MDS had one case with deletions (5q, 7q, 20q). These findings underscore the importance of molecular testing for prognosis and therapy selection.

Geographical Distribution

Geographical analysis revealed that most of the patients were from the Jhapa district (148 cases, 59.4%), reflecting the hospital's primary catchment area. Other significant contributors included Morang (22 cases, 8.8%), Ilam (17 cases, 6.8%), Sunsari (9 cases, 3.6%), and Panchthar (8 cases, 3.2%), with smaller numbers from districts like Saptari, Taplejung, and Bhojpur. This distribution aligns with the hospital's regional focus in eastern Nepal.



DISCUSSION

This retrospective study provides a comprehensive profile of hematological oncology patients at Purbanchal Cancer Hospital, offering valuable insights into the epidemiology of these malignancies in eastern Nepal. The predominance of multiple myeloma (MM) as the most common diagnosis (18.9%), followed closely by non-Hodgkin lymphoma (NHL, 17.7%) and acute myeloid leukemia (AML, 17.3%), represents a distinct pattern compared to earlier Nepalese studies. For instance, a study conducted over 10 years at a tertiary care hospital in western Nepal reported AML as the most frequent hematological malignancy, with MM constituting only 15% of cases[5]. This discrepancy could stem from regional variations, evolving disease incidence, or the hospital's specialized referral role, potentially attracting more MM cases due to enhanced diagnostic and treatment capabilities for plasma cell disorders. Nationally, solid tumors like breast and lung cancer dominate cancer statistics[6], suggesting that the high prevalence of hematological malignancies in this cohort may be influenced by referral bias rather than a true population-based trend. A recent study on cancer epidemiology in South Asia further highlights the underrepresentation of hematological malignancies in national registries, often due to limited diagnostic facilities in rural areas[11].

The age-specific distribution of malignancies aligns with global patterns while revealing local nuances. In the pediatric group (0–18 years), acute lymphoblastic leukemia (ALL) dominated, constituting 71.8% of cases, which is consistent with international data where ALL is the most common childhood cancer, peaking between ages 2 and 5[7]. This finding corroborates observations from other South Asian studies, such as those in Pakistan, where ALL accounts for approximately 75% of pediatric leukemias[8]. In contrast, adults (19–60 years) exhibited a diverse spectrum, with AML (22.2%), NHL (22.2%), and MM (21.3%) being nearly equally prevalent. This broad distribution reflects the transitional age range where both acute leukemias and mature lymphoid/plasma cell disorders emerge, a pattern also observed in Indian cohorts where AML and NHL peak in middle age[12]. Among the elderly (61+ years), MM (24%) and NHL (18%) were prominent, alongside AML (15%) and myelodysplastic syndromes (MDS, 9%), aligning with age-related increases in clonal hematopoiesis and plasma cell dyscrasias reported globally[9]. The higher prevalence of MM in older adults at this hospital may indicate improved detection of this disease, possibly due to increased use of serum protein electrophoresis or bone marrow studies, though this requires further confirmation. A study in Bangladesh noted a similar trend, attributing the rise in MM diagnoses to better access to diagnostic tools in tertiary centers[13].

Sex distribution showed a slight male predominance (55.4%, male-to-female ratio 1.24:1), consistent with some hematological malignancies exhibiting a male bias. For example, CML (66.7% male) and NHL (61.4% male) in this study mirror global trends where males are disproportionately affected, potentially due to genetic, hormonal, or environmental factors[9]. However, AML displayed a near-equal sex distribution (51.2% male, 48.8% female), differing from some South Asian studies where a slight male predominance is typical[8]. This finding could suggest a unique risk profile in this population or simply reflect the sample size, warranting larger studies to clarify sex-specific incidence rates. Research in Sri Lanka has similarly reported a balanced sex distribution in AML, hypothesizing that environmental exposures might equalize risk across genders in certain regions[14].

A striking observation is the high relapse rate, particularly in AML, where 23.3% of cases (10 out of 43) were relapsed or refractory. This rate exceeds that reported in some Asian settings (e.g., 18% relapse within 2 years post-treatment in AML)[10], raising concerns about treatment efficacy, access to consolidation therapies (e.g., stem cell transplantation), or follow-up care in this region. The presence of adverse prognostic markers like FLT3-ITD (noted in 6 AML cases) likely contributes to this trend, as FLT3-ITD mutations are associated with higher relapse risk and poorer survival[10]. A study on AML outcomes in low-resource settings found that limited access to FLT3 inhibitors exacerbates relapse rates, with only 10% of patients receiving targeted therapies due to cost barriers[15]. Similarly, relapsed ALL cases (12.8%, 5 out of 39), including those with BCR-ABL positivity, highlight challenges in achieving durable remissions, particularly in Philadelphia chromosome-positive ALL, which requires tyrosine kinase inhibitors (TKIs) like imatinib or dasatinib alongside chemotherapy[7]. The lower relapse rates in MM (4.3%) and NHL (6.8%) may reflect better disease control with standard therapies (e.g., proteasome inhibitors for MM, rituximab-based regimens for NHL), though the small number of relapsed cases limits firm conclusions. A retrospective analysis in India reported similar relapse rates for MM (5%), attributing improved outcomes to the availability of bortezomib in urban centers[16].

The identification of genetic mutations and prognostic markers in this cohort—such as FLT3-ITD and NPM1 in AML, BCR-ABL in ALL, and JAK2 in MPN—underscores the importance of molecular diagnostics in modern hematology. Globally, these markers guide risk stratification and treatment decisions; for instance, FLT3 inhibitors improve outcomes in FLT3-mutated AML, while TKIs are standard for BCR-ABL-positive leukemias[10]. In this study, 14% of AML cases (6/43) had FLT3-ITD, and 7.7% of ALL cases (3/39) had BCR-ABL, proportions comparable to regional cohorts8. However, the extent to which these patients received targeted therapies remains unclear, as access to such drugs in Nepal is limited by cost and availability, a challenge also noted in other low-resource settings[6]. The frequent detection of JAK2 mutations in MPN (11/20 cases, 55%) aligns with its prevalence in polycythemia vera (PRV) and essential thrombocythemia (ET) globally (50–60%)9, suggesting that molecular testing for JAK2 is feasible at this center. A study in Pakistan emphasized the cost-effectiveness of JAK2 testing in MPN, advocating for its routine use in resource-limited settings to guide ruxolitinib therapy[17]. Expanding such capabilities to include routine cytogenetic and next-generation sequencing could enhance personalized treatment, though it requires investment in infrastructure and training. Research on molecular diagnostics in South Asia highlights the feasibility of implementing NGS in tertiary centers, with a 30% increase in actionable mutation detection[18].

Geographically, the concentration of patients from Jhapa (59.4%) reflects the hospital's location in Birtamode, with additional cases from Morang (8.8%), Ilam (6.8%), and Sunsari (3.6%) indicating a broad catchment area in eastern Nepal. This distribution likely represents referral patterns rather than true incidence, as patients from distant districts may seek care elsewhere or lack access to diagnosis, a common issue in Nepal due to limited healthcare infrastructure[6]. Population-adjusted incidence rates, unavailable in this study due to the lack of denominator data, would be necessary to confirm whether certain malignancies are genuinely more common in Jhapa or if this reflects diagnostic bias. A study on healthcare access in Nepal found that only 40% of rural cancer patients reach tertiary centers, underscoring the urban-rural diagnostic gap[19].

This research presents certain limitations. The retrospective design and dependence on hospital records may lead to selection bias, as only diagnosed and referred patients are included, potentially underrepresenting undiagnosed cases in rural areas, a known issue in Nepal[6]. The lack of survival data, treatment details, and socioeconomic variables limits analysis of outcomes and risk factors. The sample size (249 patients), while robust for a single center, and may not fully capture rare malignancies or regional variations. Additionally, the absence of standardized incidence rates prevents direct comparison with population-based studies. A study on cancer registries in low-income countries noted that incomplete data capture leads to a 20–30% underestimation of true incidence[20].

Future research should focus on prospective studies with longer follow-up to assess treatment responses, survival rates, and quality of life. This study reveals a distinct profile of hematological malignancies at

Purbanchal Cancer Hospital, with MM, NHL, and AML leading, and significant challenges posed by relapse rate and limited targeted therapy access. These findings contribute to the sparse literature on hematological cancers in Nepal, offering a foundation for improving care and guiding future investigations in this region.

CONCLUSION

This study identifies multiple myeloma (MM) as the predominant hematological malignancy at Purbanchal Cancer Hospital, while acute lymphoblastic leukemia (ALL) is the most frequent diagnosis in pediatric patients. Among adults and the elderly, MM and acute myeloid leukemia (AML) were the leading malignancies. The slight male predominance and high relapse rates, particularly in AML, underscore the need for improved management strategies. The presence of FLT3-ITD and BCR-ABL mutations underscores the need for routine molecular testing to guide targeted therapy selection. It is advisable to conduct future research utilizing larger sample sizes, extended follow-up periods, and survival data to gain insights into long-term outcomes and guide public health interventions.

ACKNOWLEDGMENTS

We express our gratitude to the administration and staff of the Purbanchal Cancer Hospital for granting access to the Health Management Information System (HMIS) data, which made this study possible. We thank the hospital's data management team for their assistance in facilitating data extraction.

Funding: None
Conflict of interest: None
Ethical approval: Yes

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