



Original Article

Spectrum of lymphoma in Western Maharashtra: A tertiary care rural hospital study Study

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ABSTRACT

Background: There are very few studies to date focusing on the demography of lymphoma in the rural population of western Maharashtra. The distribution of different subtypes of lymphoma varies across different geographical locations. The present study aimed to find the distribution of various histopathological subtypes of lymphoma in the rural population of western Maharashtra.

Materials and Methods: The study is a retrospective, descriptive, cross-sectional study consisting of 134 cases of lymphoma detected at a tertiary care rural hospital in western Maharashtra between November 2010 and December 2024. Based on the morphology and immunohistochemistry, cases were diagnosed as Hodgkin lymphoma or Non-Hodgkin Lymphoma according to the 5th edition of the WHO Classification of Haematolymphoid Tumours.

Results: Out of the total 134 cases, 33/134 (24%) cases were diagnosed as Hodgkin lymphoma and 101/134 (75%) cases were diagnosed as Non-Hodgkin Lymphoma. 64% of cases were seen in males. The most common age group in Hodgkin lymphoma patients was 11 - 20 years with 09/33 (27%) cases, and the most common age group for Non-Hodgkin Lymphoma case was above 60 years with 34/101 (33%) cases. Among Hodgkin Lymphoma, mixed cellularity type was the most common, followed by Nodular sclerosis subtype of Hodgkin Lymphoma. Among Non-Hodgkin Lymphoma, Diffuse Large B-cell Lymphoma was the most common diagnosis, followed by Follicular Lymphoma.

Conclusions: Non-Hodgkin lymphoma was more common than Hodgkin lymphoma in the rural population of western Maharashtra as per present study. Diffuse large B-cell lymphoma and mixed cellularity Hodgkin lymphoma were the predominant subtypes.

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INTRODUCTION

Proliferations of white blood cells, typically lymphocytes, that usually present as discrete tissue masses are called lymphoma.¹ A large proportion of cancers (> 70%) are diagnosed in the low- and middle-income countries. The incidence of lymphomas is rising, significantly impacting environmental, social, and economic conditions worldwide.² The projected number of newly diagnosed lymphoma in India in 2020 was 11,230 for Hodgkin Lymphoma (HL) and 41,607 for Non-Hodgkin Lymphoma (NHL). The crude incidence rate of lymphoma in India in 2020 was 3.8 per 100000 population (0.8 for HL and 3 for NHL).² Mortality from lymphoma is high in low- and medium-

Human Development Index (HDI) countries such as India. The possible reasons include limited access to specialized tertiary cancer centers or lymphoma-specialized centers, a lack of trained histopathologists, and other socio-economic factors leading to treatment discontinuation and early loss to follow-up.³

HL has been classified separately because of its specific identifying cells, limited morphological spectrum, and distinctive clinical features. In contrast, the features of NHL are less distinct and more heterogeneous within any given subtype. The World Health Organization (WHO) Classification of Lymphoid Neoplasm encompasses not only HL and NHL, but also plasma cell neoplasms and lymphoid leukaemia, representing the solid and circulating phases of the same diseases. Lymphoma comprises only the solid phase of lymphoid neoplasms, which are included in the present study.⁴

Geographical variation, as suggested by various studies worldwide, indicates the influence of ethnicity, environmental factors, socio-economic status (including dietary habits), lifestyle, life span and exposure to carcinogens. The incidence is strongly dependent on the infectious etiology; for example, the Human Immunodeficiency Virus (HIV) epidemic has led to an increased prevalence of NHL in the United States. Increased Epstein-Barr virus (EBV) infection in Africa is associated with higher prevalence of Burkitt's lymphoma (BL), while increased *Helicobacter pylori* (*H. pylori*) infection in Japan is linked to higher prevalence of Extranodal Marginal Zone B-cell Lymphoma (MALToma). Western populations show an increased incidence of Chronic lymphocytic lymphoma/small lymphocytic lymphoma (CLL/SLL) and Follicular Lymphoma (FL), whereas the eastern populations (including Asian countries such as India) has predominance of Diffuse large B cell lymphoma (DLBCL), MALToma, Natural killer/T-cell lymphoma (NK/T cell lymphoma).⁵ Ramani et al.,⁶ Chakarborty et al.,⁷ Kim et al.,⁸ Yaqo et al.⁹ and Mondal et al.¹⁰ have described the clinicopathological spectrum of Lymphoma.

The present study was aimed to know the distribution pattern of various histopathological subtypes of lymphoma in the rural population of western Maharashtra, according to WHO classification of hematolymphoid neoplasms 5th edition 2022 guidelines (WHO HAEM5).¹¹

MATERIALS AND METHODS

This retrospective, descriptive, cross-sectional study included 134 cases of Lymphoma diagnosed over a period

of 14 years at a tertiary care rural hospital from Western Maharashtra, India from November 2010 to December 2024. The study was conducted after acquiring approval from institutional ethical committee. (Registration Approval No. DR/RMC/UG-PG/2025/107; Dated 12/04/2025).

Both incisional biopsy and excision specimens were included in the study. Cases confirmed by histomorphology and/or immunohistochemistry were considered. Autolysed and improperly fixed specimens were excluded in the study. Relevant clinical details, including demographic and clinical findings, were obtained from medical records.

Tissue specimens were processed using the HistoCore PEARL automated tissue processor (Leica). Sections were stained with Hematoxylin and Eosin (H&E) using a linear slide stainer (Automated stainer by Medimeas). Immunohistochemistry (IHC) was performed using polymer horseradish peroxidase (HRP) manual method with the EnVision FLEX Link (Dako) kit and diaminobenzidine as chromogen. The antibody panel included CD45, CD19, CD79a, CD3, CD5, CyclinD1, TdT, BCL2, Pax-5, CD38, CD15, CD30, CD20, CD10, BCL6, MUM1, Ki67 and ALK, applied as required for the diagnosis.

Final diagnoses were established based on morphology and/or immunohistochemistry findings according to the WHO HAEM5.¹¹ Cases of DLBCL were further classified using the Hans-algorithm into germinal center B-cell (GCB) subtypes, which show a favorable response to standard chemotherapy, and non-germinal center B-cell subtypes (Non-GCB) with an aggressive course. This classification was based on immunohistochemical expression of CD10, BCL6, and MUM1, with a cutoff value of more than 30% positivity for each marker. Data were analyzed using OpenEpi software.

RESULTS

A total of 134 cases of malignant lymphoma were studied in the present study from November 2010 to December 2024. Out of the total 134 cases, 33/134 (25%) cases were diagnosed as Hodgkin Lymphoma (HL) and 101/134 (75%) cases were diagnosed as Non-Hodgkin Lymphoma (NHL). The majority of the cases, 87/134 (64.92%) were males. Among HL cases, 22/33 (66.66%) were males, with the highest number of cases observed in the 11-20 year age group (9/33, 27.27%). Among NHL cases, the highest frequency was observed in patients aged >60 years (34/101, 33.66%) (Table 1). In the present study, the most common presenting symptom of the patient was fever, followed by fatigue, neck swelling, and weight loss (Table 2).

Table 1: Age and gender distribution of Hodgkin Lymphoma and Non-Hodgkin Lymphoma

Lymphoma	n (%)	Age distribution (years)							M:F ratio
		0 - 10	11 - 20	21-30	31-40	41-50	51-60	> 60	
HL	33 (24.63)	4	9	6	3	5	3	3	2.0
NHL	101 (75.37)	10	6	5	8	15	23	34	1.80
Total	134 (100)	14	15	11	11	20	26	37	1.85
HL: Hodgkin Lymphoma; NHL: Non- Hodgkin Lymphoma; M/F: Male: Female									

Table 2: Clinical symptoms at presentation

Symptoms	No. of patients
Neck swelling	43
Weight loss	33
Fatigue	44
Anorexia	17
Fever	63

The present study classified HL cases into 4 categories according to WHO HAEM5. The present study found 25/33 (75.75%) cases of the Mixed Cellularity type of HL as the commonest type, followed by 6/33 (18.18%) cases of the Nodular Sclerosis type of HL, and 1/33 (3.03%) case each of the Nodular Lymphocyte Predominant type and the Lymphocyte-rich type of HL. The present study did not find any case of the Lymphocyte-depleted type. The most common site involved was the cervical lymph node, with 16/33 (48.48%) cases, followed by the axillary and inguinal lymph nodes, with 6/33 (18.18%) cases each (Table 3).

Table 3: Distribution of Hodgkin Lymphoma according to site

Site	Number of cases n (%)
Cervical lymph node	16 (48.4)
Axillary lymph node	06 (18.18)
Inguinal lymph node	06 (18.1)
Lung	03 (9.09)
Liver	01 (3.03)
Bone marrow biopsy	01 (3.03)
Total	33 (100)

Out of a total of 101 cases of NHL, 50/101 (49.50%) were classified as DLBCL, of which 31/50 (62%) were of the germinal center B-cell type and 19/50 (38%) were the non-germinal center B-cell type, according to Hans's algorithm. Follicular lymphoma, with 15/101 (14.85%) cases, was the second most common type of NHL, found in the present study, followed by chronic lymphocytic leukemia/small lymphocytic lymphoma, with 12/101 (11.88%) cases (Table 4).

Table 4: Relative frequency of histologic subtypes of Non-Hodgkin Lymphoma

Histopathological classification	n (%)
Diffuse large B cell Lymphoma	50 (49.50)
Follicular Lymphoma	15 (14.85)
Chronic lymphocytic leukemia/ Small lymphocytic lymphoma	12 (11.88)
T-cell lymphoma	06 (5.94)

Burkitt Lymphoma	05 (4.95)
Mantle cell lymphoma	03 (2.97)
Anaplastic large-cell lymphoma	03 (2.97)
Plasmablastic lymphoma	02 (1.98)
Marginal zone lymphoma	02 (1.98)
Lymphoblastic lymphoma	02 (1.98)
Mucosa-associated lymphoid tissue lymphoma	01 (0.9)
Total	101 (100)

Out of 38 cases of extranodal NHL, 7/38 (18.42%) cases arose from the oral cavity, 5/38 (13.15%) cases arose from the head and neck and intestinal regions, respectively, and 4/38 (10.52%) cases arose from various soft tissue sites such as the gluteal region, upper arm, scapula, and perianal region (Table 5).

Table 5: Extranodal Non-Hodgkin Lymphoma distribution according to primary site

Site	n (%)
Oral cavity	07 (18.42)
Intestine	05 (13.15)
Head and neck	05 (13.15)
Soft tissue	04 (10.52)
Breast	02 (5.26)
Stomach	02 (5.26)
Spleen	02 (5.26)
Testis	02 (5.26)
Bone marrow	02 (5.26)
Brain	02 (5.26)
Lung	01 (2.63)
Liver	01 (2.63)
Thoracic vertebral	01 (2.63)
Kidney	01 (2.63)
Pancreas	01 (2.63)
Total	38 (100)

Out of 63 cases of nodal NHL, 29/63 (46.03%) cases arose from the cervical lymph nodes, followed by the inguinal and axillary lymph nodes, with 16/63 (25.39%) and 11/63 (17.46%) cases, respectively (Table 6).

Table 6: Site distribution of nodal Non-Hodgkin Lymphoma

Nodal Site	n (%)
Cervical lymph node	29 (46.05)
Inguinal lymph node	16 (25.39)
Axillary lymph node	11 (17.46)
Mesentric lymph node	03 (4.76)
Retroperitoneal lymph node	02 (3.17)
Mediastinal lymph node	01 (1.58)
Para-aortic lymph node	01 (1.58)
Total	63 (100)

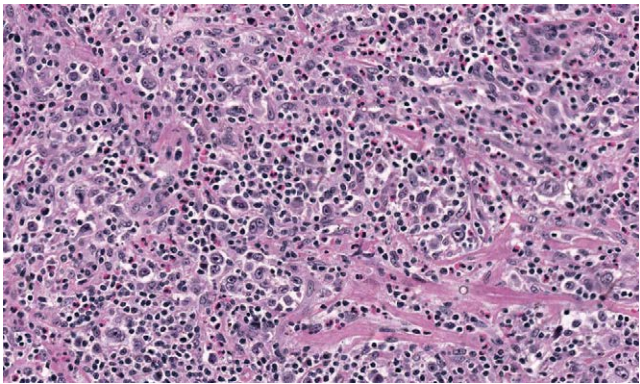


Figure 1: Hodgkin Lymphoma. Large binucleated neoplastic cells showing owl-eye appearance [HE stain, 400x]

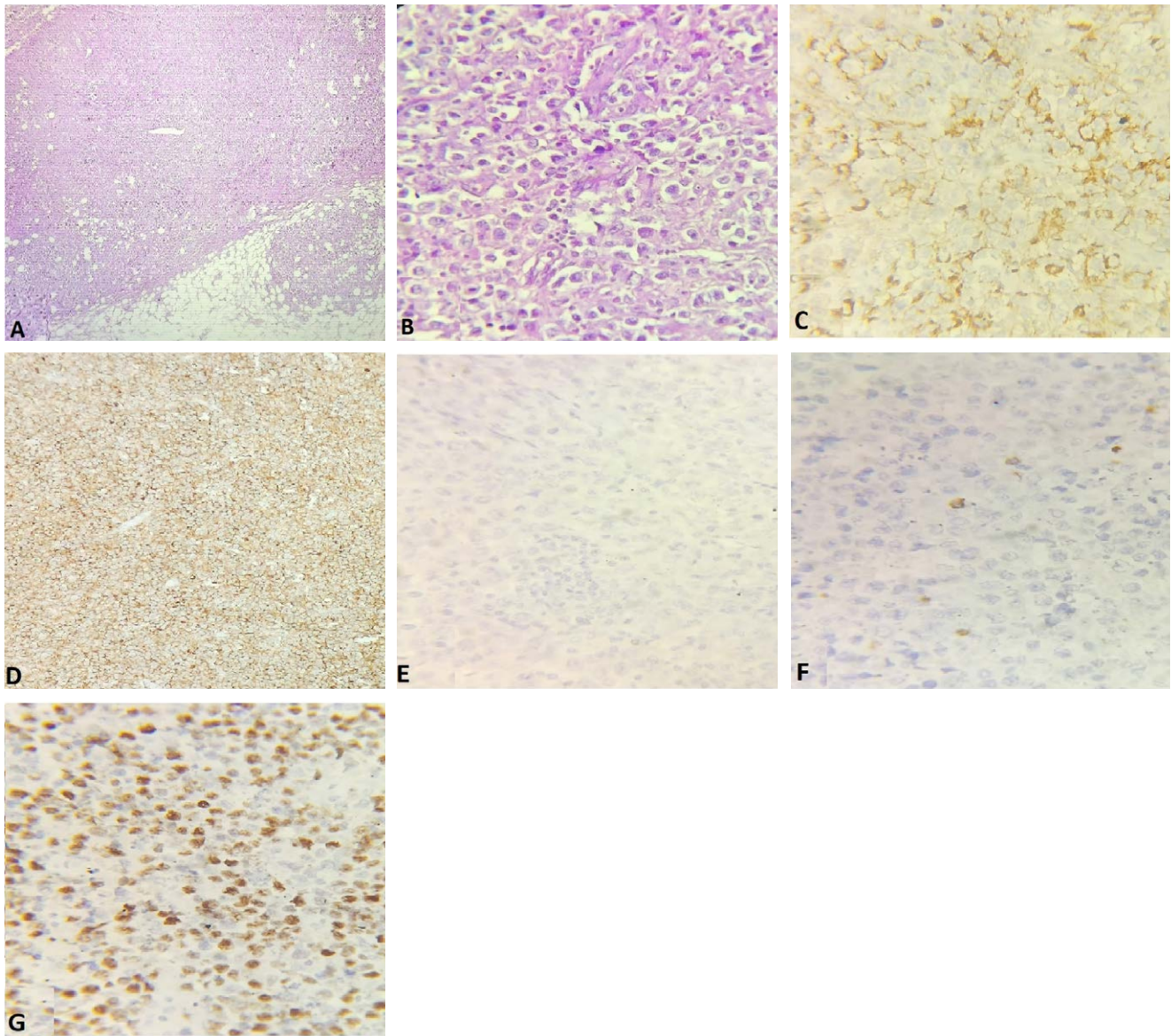


Figure 2: Diffuse large B-cell lymphoma. A) Extracapsular involvement [HE stain, 100x]. B) Large malignant lymphoid cells compared to small lymphocytes in background [HE stain, 400x]. C) CD20 positivity [IHC, 400x]. D) CD10 diffuse strong positivity confirming germinal centre B-cell type [IHC, 400x]. E) MUM1 negative [IHC, 400x]. F) CD5 negative [IHC, 400x]. G) Ki67 proliferation index of 70 to 80% [IHC, 400x].

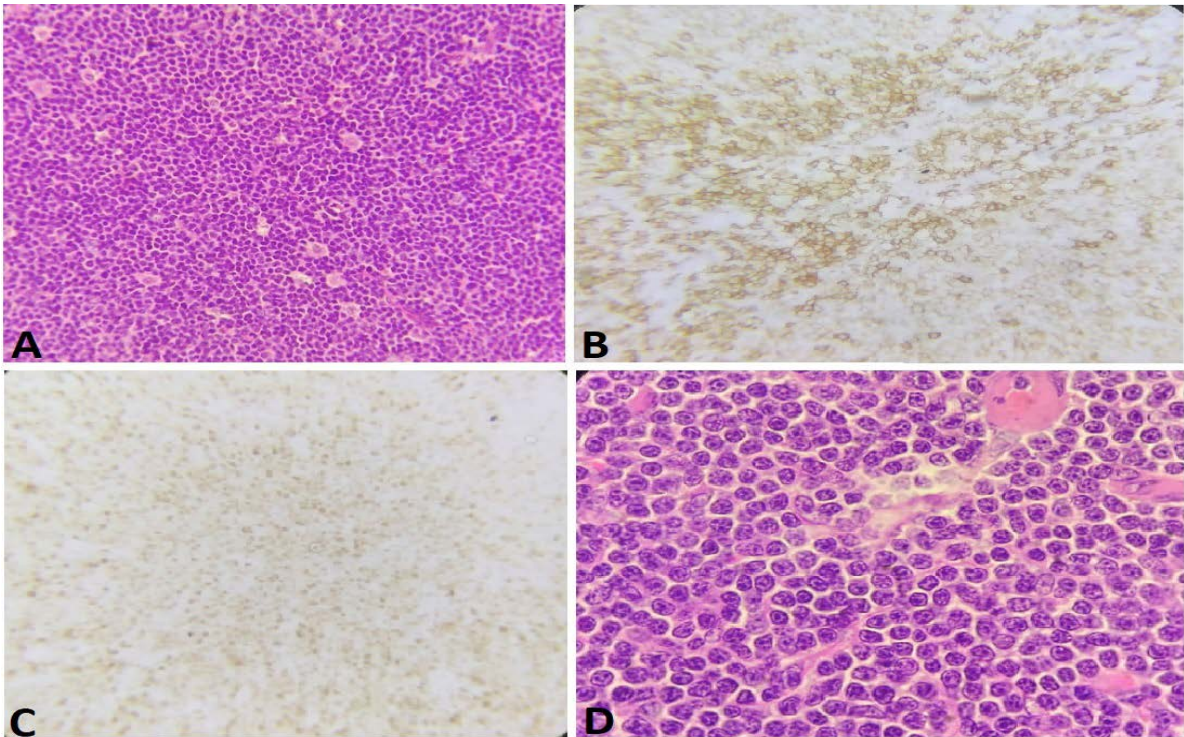


Figure 3: A-C. Mantle cell lymphoma. A) Proliferation of intermediate-sized atypical lymphoid cells [H&E, 40x]; B) CD5 positivity [IHC, 40x]; C) Cyclin D1 positivity in neoplastic cells [IHC, 40x]. D) Small cell lymphoma, proliferation of small sized atypical lymphoid cells [HE stain, 400x].

DISCUSSION

The present study attempts to cover cases of malignant lymphoma diagnosed at a rural hospital in western Maharashtra. The demographic data of the present study correlate with the findings of Mohapatra et al.⁵, Mondal et al.¹⁰ and Lalitkumar et al.³ as shown in (Table 7) for cases of HL and NHL. The WHO HAEM5 classification

for lymphoma provides a comprehensive framework for diagnosing and classifying lymphoma, combining morphological, genetic, and immunophenotypic data. It ensures a more precise understanding of lymphoma, which is crucial for developing targeted treatments and improving patient outcomes.⁴

Table 7: Frequency of lymphoma subtypes observed in various studies

Study	Lymphoma subtypes n (%)	
	Hodgkin lymphoma	Non-Hodgkin lymphoma
Mohapatra et al ⁵ (2020)	28/106 (26.41)	78/106 (73.58%)
Chakraborty et al. ⁷ (2010)	48/124 (38.70)	76/124 (61.29)
Mondal et al. ¹⁰ (2013)	108/455 (23.73)	347/455 (76.26)
Jin-Man Kim et al. ⁸ (2011)	191/3998 (4.77)	3807/3998 (95.22)
Lalitkumar et al. ³ (2022)	11230/52837 (21.25)	41607/52837 (78.74)
Present Study (2025)	33/134 (24.62)	101/134 (75.37)

The present study tries to classify the lymphoma according to the WHO HAEM5 classification for lymphoma wherever possible. Among HL cases, the majority of cases, 25/33 (75.75%), were of the mixed cellularity subtype, which correlates with findings by Mohapatra et al.⁵ and Mondal et al.¹⁰, with 16/28 (57.14%) and 36/108 (33.3%) cases, respectively. However, the study by Yaqo et al.⁹ found the nodular sclerosis subtype to be the most

common subtype of HL. The frequency of nodular lymphocyte predominant Hodgkin lymphoma in the present study, 1/33 (3.03%), correlates with findings by Mohapatra et al.⁵ and Yaqo et al.⁹, who observed 1/28 (3.57%) and 3/65 (4.61%) cases, respectively (Table 8).

The present study found diffuse large B-cell lymphoma (DLBCL) as the most common type under the NHL category, with 50/101 (49.50%) cases, which correlates with the

findings of Mohapatra et al.⁵ and Yaqo et al.⁹, with 45/78 (57.69%) and 117/205 (57.07%) cases, respectively. The second most common type under the NHL category in the present study was follicular lymphoma, 15/101 (14.85%),

which correlates with the findings of Mondal et al.¹⁰, with 70/347 (20.17%) cases, followed by other types of NHL (Table 8).

Table 8: Comparison of frequency of various subtypes of lymphoma across studies

Histomorphological type		Present Study (2024)	Mohapatra et al. ⁵ (2020)	Mondal et al. ¹⁰ (2013)	Yaqo RT et al. ⁹ (2011)
Hodgkin lymphoma	Classical Hodgkin Lymphoma	n = 33 (%)	n = 28 (%)	n = 108 (%)	n = 65 (%)
	Mixed Cellularity type	25/33 (75.75)	16/28 (57.14)	36/108(33.3)	24/65 (36.92)
	Nodular sclerosis type	06/33 (18.18)	11/28 (39.28)	29/108 (26.89)	31/65 (47.69)
	Lymphocyte rich type	01/33 (3.03)	-	16/108 (24.8)	01/65 (1.53)
	Lymphocyte depleted	-	-	08/108 (7.4)	06/65 (9.23)
	Nodular lymphocyte predominant	01/33 (3.03)	01/28 (3.57)	08/108 (7.4)	03/65 (4.62)
Non-Hodgkin Lymphoma	Non Hodgkin lymphoma	n= 101 (%)	n = 78	n=347	n= 205
	Diffuse large B-cell lymphoma	50/101 (49.50)	45/78 (57.69)	129/347 (37.27)	117/205 (57.07)
	Follicular lymphoma	15/101 (14.85)	06/78 (7.69)	70/347(20.17)	06/205 (2.92)
	Chronic lymphocytic leukemia/ Small lymphocytic lymphoma type	12/101 (11.88)	04/78 (5.12)	20/347 (5.7)	14/205 (6.87)
	T-cell lymphoma	06/101 (5.94)	11/78 (14.10)	50/347 (14.50)	09/205 (4.39)
	Burkitt lymphoma	05/101 (4.95)	02/78 (2.56)	20/347 (5.7)	35/205 (17.07)
	Mantle cell lymphoma	03/101 (2.97)	02/78 (2.56)	09/347 (2.5)	04/205 (1.95)
	Anaplastic large cell lymphoma	03/101 (2.97)	04/78 (5.15)	42/347 (12.1)	05/205 (2.43)
	Plasmablastic lymphoma	02/101 (1.98)	02/78 (2.56)	-	01/205 (0.48)
	Marginal Zone lymphoma	02/101 (1.98)	-	-	01/205 (0.48)
	Lymphoblastic lymphoma	02/101 (1.98)	-	-	05/205 (2.43)
	Mucosa associated lymphoid tissue lymphoma	01/101 (0.99)	02/78 (2.56)	07/345 (2)	08/205 (3.90)

CONCLUSIONS

The present study addresses the knowledge gap by documenting lymphoma epidemiology in rural western Maharashtra, complementing existing data from urban Indian and other global populations. The findings align with the broader Asian epidemiological pattern characterized by diffuse large B-cell lymphoma (DLBCL) predominance and lower frequencies of follicular lymphoma and chronic lymphocytic leukemia/small lymphocytic lymphoma (CLL/SLL) compared to Western populations. By applying the WHO HAEM5 classification framework, this study contributes to the standardization of lymphoma diagnosis in resource-limited settings and adds to the foundation for future research into regional etiological factors. These observations may inform region-specific diagnostic algorithms, treatment strategies, and healthcare resource allocation, ultimately contributing to improved lymphoma outcomes in such populations.

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Conflict of interest: None

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