Original article

Non-Hodgkin lymphoma in childhood and adolescence: frequency and distribution of immunomorphological types from a tertiary care center in South India

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Background: **There is a dearth of published literature on the frequency and distribution of pediatric and adolescent non-Hodgkin lymphoma (NHL) in India according to the 2001 WHO classification. The aim of this study was to record the distribution of the different subtypes, analyze the major subtypes, and compare it with the published data from other countries. A review of pediatric NHL statistics from population-based cancer registries was included in this study.**

Methods: **The study was conducted using information retrieved from the files of our institution. A total of 467 patients with lymphoma (excluding mycosis fungoides) were recorded in the under 20 years group over a period of 6 years, of which 252 patients suffered from NHL. The demographic characteristics, frequency and distribution of different subtypes were noted and compared with published reports from other parts of the world.**

Results: **T-lymphoblastic lymphoma/leukemia constituted the majority (32.1%) of all NHLs in children and adolescents in our study. The other major subgroups were Burkitt's lymphoma, anaplastic large cell lymphoma, and diffuse large B cell lymphoma. Burkitt's lymphoma in this study had clinical presentations similar to those seen in western countries.**

Conclusions: **The distribution of different subtypes of lymphoma in pediatric and adolescent NHL in India differs considerably from that in western countries and other eastern countries.**

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anaplastic large cell lymphoma;
Burkitt's lymphoma;
children;
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Introduction

Lymphomas are frequently seen in adolescents in industrialized countries in the northern hemisphere and in the Middle East.[1] They are the third most common group of malignancies in children and adolescents in the USA and non-Hodgkin lymphoma (NHL) accounts for approximately 7% of newly diagnosed cancers.[2] NHL constitutes 6%-10% of all pediatric malignancies in different parts of the world.[3,4]

A recent study of childhood cancer in the under 15 years group over a period of 10 years in India revealed that lymphomas were the second most common malignancy after leukemia and constituted 20.3% of all childhood malignancies, whereas NHL constituted 8.4%.[5] Earlier studies from India on childhood cancers showed that lymphomas are the third most common malignancy in Indian children,[6,7] constituting about 10% of all childhood malignancies.[8] The histological spectrum of NHL in children is considerably narrower than in adults.[2] They are highly aggressive lymphomas of diffuse type and involve extranodal sites more commonly than adult lymphomas.[9]

Little information has been available on the spectrum of pediatric and adolescent NHL in India according to the WHO classification. This study was undertaken to record the frequency and distribution of the types of NHL in children and adolescents in South India and to compare these with the published

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reports from other countries. The major subtypes of pediatric and adolescent NHL in India were compared and analyzed. A review of population-based data on pediatric NHL from different countries was also included. There is only one other large published series on the distribution of pediatric and adolescent NHL in India according to the WHO classification.[10] The earlier reports on pediatric NHL from India were based on earlier lymphoma classifications and did not include immunohistochemical analysis.[11,12]

Methods

This study was done using the information retrieved from the records available in the department of pathology and the electronic clinical records at Christian Medical College and Hospital. The hospital information system has oracle based software programs and databases, into which clinical, radiological and pathological information is put. The information was retrieved using keyword search. A total of 467 patients with lymphoma (excluding mycosis fungoides) were diagnosed in the under 20 years group during the period of 2002-2007. All patients with acute lymphoblastic leukemia but no lymph node or other tissues biopsies apart from bone marrow examination were excluded from the study. Of the 467 patients with lymphoma, 54% had NHL (252 patients) and the rest (46%) had Hodgkin lymphoma (HL). Clinical information included age, gender and main anatomic sites of involvement. The patients were reviewed according to the WHO classification. The samples included needle biopsies as well as excision biopsies. The biopsy samples were embedded in paraffin, routinely processed, cut into 3 micron sections and stained with hematoxylin and eosin. Immunohistochemical staining was done with avidin biotin using Dako antibodies. CD3, CD20, mindbomb homolog 1 (MIB-1) antibody for proliferation index, CD30, and CD15 were done routinely. Immunohistochemical staining with ALK-1, Tdt, CD79a, CD7, CD5, CD10, bcl-2 and CD56 was done in appropriate cases. Specialist opinion was sought for 2 patients who were difficult to diagnose.

This study provided the spectrum of NHL of childhood and adolescence in South India, including the distribution of common subtypes and anatomic locations.

Results

Totally 467 patients with lymphoma were diagnosed in the under 20 years group in the period of 2002-2007. In those patients, 54% had NHL (252 patients), and the remaining 46% had HL.

The male to female (M/F) ratio

The M/F ratio was 2.70:1 in HL and 2.87:1 in NHL. The M/F ratios in the different NHL subtypes are shown in Table 1. Most of the NHL subtypes showed a marked male predominance except anaplastic large cell lymphoma (ALCL).

Relative frequencies of NHL subtypes

Lymphoblastic lymphoma/leukemia (LL) was the most common subtype of NHL in the under 20 years group in this study and comprised 109 (43.2%) patients. Fifty-six (22.2%) patients had Burkitt's lymphoma and 29 (11.5%) had ALCL. Diffuse large B cell lymphoma (DLBCL) constituted 22 (8.7%) patients. There were 6 (2.4%) patients with peripheral T cell lymphoma (PTCL), otherwise specified. Other rare lymphomas in this series included subcutaneous panniculitis like T cell lymphoma (SPTCL), T cell rich B cell lymphoma (TCRBCL), cutaneous marginal zone lymphoma, angioimmunoblastic T cell lymphoma, and mediastinal large B cell lymphoma (Table 1). Approximately 7.6% of the patients could not be classified further and were categorized as having high grade B cell NHL and high grade T cell NHL.

Distribution of NHL in different age groups

In this study we enrolled the children and adolescents under 20 years of age. The distribution of the cases in the different age groups were as follows: 12.3% of

Table 1. Diagnoses and gender distribution of the NHL patients

Diagnosis	*n* (%)	Male	Female
Lymphoblastic (T, B, unclassified)	109 (43.3)	82	27
Burkitt's lymphoma	56 (22.2)	44	12
ALCL	29 (11.5)	16	13
DLBCL	22 (8.7)	19	3
TCRBCL	2 (0.8)	2	0
MBCL	1 (0.4)	0	1
B-NHL high grade (unclassified)	12 (4.8)	9	3
Marginal zone lymphoma (cutaneous)	1 (0.4)	1	0
PTCL(nos)	6 (2.4)	4	2
SPTCL	4 (1.6)	1	3
AITCL	1 (0.4)	1	0
NK-T cell	2 (0.8)	1	1
T-NHL (unclassified)	5 (2.0)	5	0
NHL (unclassified)	2 (0.8)	2	0

NHL: non-Hodgkin lymphoma; ALCL: anaplastic large cell lymphoma; DLBCL: diffuse large B cell lymphoma; TCRBCL: T cell rich B cell lymphoma; MBCL: mediastinal large B cell lymphoma; PTCL: peripheral T cell lymphoma; SPTCL: subcutaneous panniculitis like T cell lymphoma; AITCL: angioimmunoblastic T cell lymphoma; NK: natural killer cell lymphoma.

the cases were in the 0-4 years, 27.78% in 5-9 years, 28.57% in 10-14 years, and 31.35% in 15-19 years age groups. The distribution of the major subtypes varied in the different age groups (Fig. 1). LL was the most common lymphoma in all the 4 age groups. Burkitt's lymphoma was seen predominantly in the under 10 years group. ALCL and DLBCL were seen mainly in the over 10 years group. The age range of each of the major subtypes is illustrated in Fig. 2.

Sites of involvement

The data on the main sites of involvement were obtained from the biopsy and electronic clinical records available. Peripheral lymph nodes were the site of involvement in 48% of the patients, whereas mediastinal and pleural involvement was seen in 13.9%. Gastrointestinal tract involvement was seen in 9.1% of the patients and intraabdominal or retroperitoneal mass in 9.1%. Cutaneous involvement was the presenting manifestation in 5.1% of the patients. Waldeyer's ring involvement was seen in 4% of the patients, and primary bone lymphoma in 2.4%. Rare anatomic sites included the kidneys, brain, palate, gonads, eyelids, parotid, soft tissue, and pancreas, which together accounted for 7.2% of the patients. The sites of involvement in the major subtypes of NHL are shown in Table 2.

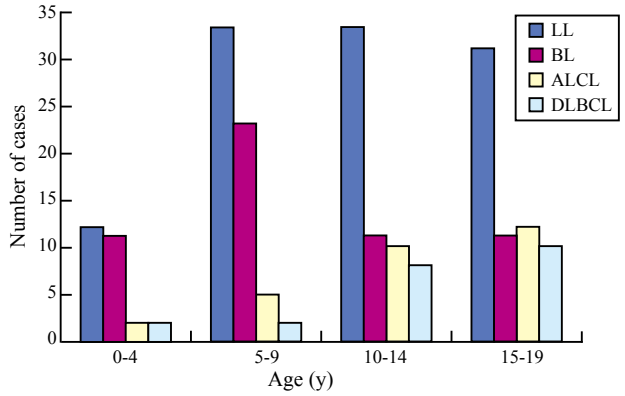

Fig. 1. Distribution of major non-Hodgkin lymphoma subtypes across different age groups. LL: lymphoblastic lymphoma; BL: Burkitt's lymphoma; ALCL: anaplastic large cell lymphoma; DLBCL: diffuse large B cell lymphoma.

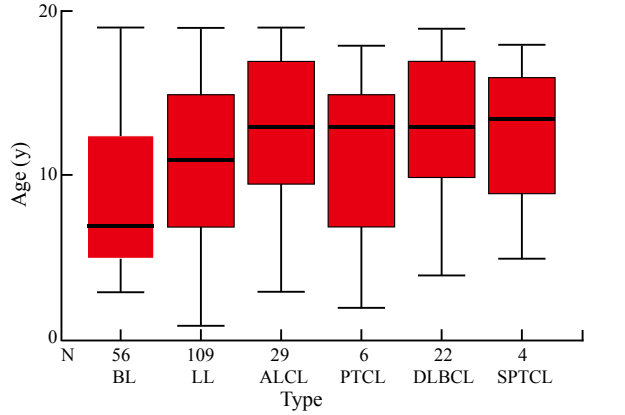

Fig. 2. Age range of each non-Hodgkin lymphoma subtype. LL: lymphoblastic lymphoma; BL: Burkitt's lymphoma; ALCL: anaplastic large cell lymphoma; PTCL: peripheral T cell lymphoma; DLBCL: diffuse large B cell lymphoma; SPTCL: subcutaneous panniculitis like T cell lymphoma.

Subtypes

Lymphoblastic lymphoma (LL)

LL or leukemia was the most common NHL subtype in this series. The mean age of LL patients was 10.8 years with a range of 1-19 years and an M/F ratio of 3.04:1. Of the 109 patients, 81 (74.3%) had T cell, 24 (22.0%) had B cell, and 4 (3.7%) were unclassified. Twenty-five of the 81 (30.9%) T-LL and 14 of the 24 (58.33%) B-LL patients were found to have leukemic involvement of the marrow by trephine biopsy.

Of the 81 T-LL patients, 50 (61.7%) had an involvement of peripheral lymph nodes and 27 (33.3%) had an involvement of the mediastinum. In the 24 B-LL patients, 70.8% had an involvement of peripheral lymph node. There was no B-LL patient with mediastinal involvement. Other principal sites involved by LL were adenoids (2 patients with T-LL), testis (2 patients with T-LL and 1 patient with B-LL), bone (2 patients with B-LL), skin, kidney, and oral cavity (1 patient with B-LL each). Four patients were categorized as having lymphoblastic lymphoma unclassified, when lack of tissue sections impeded further immunohistochemical analysis.

Table 2. Sites of involvement in major subtypes of non-Hodgkin lymphoma

Sites	BL (%)	LL (%)	ALCL (%)	DLBCL (%)
PLN	6 (10.7)	71 (65.1)	15 (51.7)	15 (68.2)
Mediastinum, pleura, lung	1 (1.8)	25 (22.9)	6 (20.5)	1 (4.5)
Gastrointestinal	16 (28.6)	0	0	2 (9.1)
Intraabdominal/ retroperitoneum	20 (35.7)	3 (2.8)	2 (6.9)	0
Skin	2 (3.6)	1 (0.9)	5 (17.2)	0
Bone	1 (1.8)	2 (1.8)	1 (3.4)	1 (4.5)
Maxilla	1 (1.8)	0	0	0
Parotid	1 (1.8)	0	0	0
Adenoids, nasopharynx	3 (5.3)	2 (1.8)	1 (3.4)	2 (9.1)
Kidney	2 (3.6)	1 (0.9)	0	0
Brain	1 (1.8)	0	0	1 (4.5)
Palate, gingival	1 (1.8)	1 (0.9)	0	0
Ovary	1 (1.8)	0	0	0
Testis	0	3 (2.7)	0	0

BL: Burkitt's lymphoma; LL: lymphoblastic lymphoma; ALCL: anaplastic large cell lymphoma; DLBCL: diffuse large B cell lymphoma; PLN: peripheral lymph nodes.

Burkitt's lymphoma

The mean age of patients with Burkitt's lymphoma was 8.9 years with a range of 3-19 years and a M/F ratio of 3.67:1. The common anatomic location of the tumor was intraabdominal or retroperitoneum (35.7%). Gastrointestinal involvement was seen in 28.6% of the patients. Peripheral lymph node enlargement was seen in 6 patients (10.7%) and jaw involvement (maxilla) in 1 (1.8%). Only one patient in this series was associated with human immunodeficiency virus infection.

ALCL

The mean age of 29 patients with ALCL was 12.66 years with a range of 3-19 years and an M/F ratio of 1.23:1. In this series, 15 (51.7%) patients had peripheral lymph node enlargement, 6 (20.5%) had mediastinal involvement along with peripheral lymph nodes, and 5 (17.2%) had cutaneous involvement. Intraabdominal/ retroperitoneal mass was seen in 2 patients (6.9%). ALK immunostaining was done in 27 of the 29 patients and 81.5% of the 27 patients showed ALK positivity.

DLBCL

The mean age of the 22 patients with DLBCL was 13.0 years with a range of 4 to 19 years and an M/F ratio of 6.33:1. In these patients, 15 (68.2%) had peripheral lymph node enlargement. Rare variants of DLBCL were observed in 2 patients with TCRBCL and 1 patient with primary mediastinal large B cell lymphoma. Other rare B NHL seen included a single case of cutaneous marginal zone lymphoma.

PTCL(nos)

There were 6 patients with PTCL(nos) with a mean age of 11.33 years (range: 2-18 years). Four patients had subcutaneous panniculitis like T cell lymphoma and one had angioimmunoblastic T cell lymphoma.

Bone marrow involvement in NHL

In 159 of the 252 patients, the results of bone marrow trephine biopsy were available. Fifty-seven patients (35.9%) had bone marrow involvement by lymphoma. The percentage of lymphoma cells in the marrow ranged from 10% to 90% with a mean of 50%. Bone marrow involvement was not seen in 102 (64.1%) patients. In 93 patients, the status of bone marrow was unknown.

Discussion

Lymphomas have been reported as the second or third most common childhood malignancy in India[5-7,13] and other countries.[14] In contrast to a NHL/HL ratio of 1.5:1 in Western countries, it is either equal or often reversed in India.[15] Our study showed a NHL/HL ratio of 1.2:1, but Swaminathan et al[5] reported a NHL/HL ratio of 0.89.

The M/F ratio for NHL was 2.87:1 in our study, similar to a ratio of 2.5:1 in the under 15 years group reported from India.[13] Wright et al[9] reported a M/F ratio of 2.7:1 and Pedrosa et al[16] reported a M/F ratio of 2.4:1. In our series, the highest M/F ratio was observed in DLBCL (6.33:1) and the lowest in ALCL (1.23:1).

LL comprised 43.2% of all pediatric and adolescent NHLs in our study with T-LL as the largest single subtype which constituted 32.1% of all the cases. Burkitt's lymphoma was the second most common lymphoma and constituted 22.2% of the cases. This is unlike the finding in childhood NHLs reported from other countries (Table 3). In UK, Burkitt's lymphoma was the most common NHL subtype in children (42.2%) and LL was the second.[9] In Brazil, Burkitt's lymphoma constituted the major share of NHL in young children (78.2%).[16] In Germany, the distribution was similar to that in UK, with Burkitt's lymphoma comprising 48.2% of the total and LL, 22.6% of all pediatric NHL cases.[17] In Korea, Burkitt's lymphoma was the most common NHL (although not as frequent as in Western countries) and constituted 23.4% of NHLs in the under 20 years group whereas LL constituted 17.8% of the cases.[18] In a study from Thailand, PTCL (25.8%), Burkitt's (23.6%) and T lymphoblastic lymphoma (22.4%) predominated in the under 10 years group, whereas DLBCL (26.1%), PTCL (22.5%) and T-LL (21.6%) were the major subtypes seen in the 11-20 years group.[19]

In the present series, only 12.30% of all patients under 20 years were seen in the under 5 years group. If only patients under 15 years were included, the under 5 years group would have constituted 17.91% of all NHLs in contrast to 48.2% of all NHLs under 15 years in the patients under 5 years reported in Brazil. Proportion of

Table 3. Comparison of the major subtypes of pediatric and adolescent NHL in different countries

Major subtypes	Present study (≤19 y)	India (≤19 y)[10]	Korea (≤19 y)[18]	Germany (≤18 y)[17]	UK (<16 y)[9]
Lymphoblastic lymphoma	109 (43.2%)	100 (34.6%)	19 (17.8%)	472 (22.6%)	84 (27.2%)
Burkitt's lymphoma	56 (22.2%)	31 (10.7%)	25 (23.4%)	1004 (48.2%)	130 (42.2%)
Anaplastic large cell lymphoma	29 (11.5%)	30 (10.4%)	22 (20.5%)	215 (10.3%)	46 (15%)
Diffuse large B cell lymphoma	22 (8.7%)	72 (24.9%)	14 (13.1%)	173 (8.3%)	10 (3.3%)
Peripheral T cell lymphoma	6 (2.4%)	4 (1.4%)	22 (8.9%)	-	4 (1.3%)

patients in the 10-14 years group is larger in our series (41.61% of all cases under 15) as compared with 18.2% reported by Pedrosa et al,[16] who proposed that the possibility of Epstein-Barr virus causing NHLs because the younger population in a low socioeconomic status are exposed to infectious agents earlier.[16] However, studies from other countries with similar socioeconomic status including ours did not reveal similar findings.

In our study, LL cases were distributed across all the age groups under 20. Burkitt's lymphoma mostly occurred in the under 10 years group and DLBCL and ALCL occurred in the above 10 years group. Wright et al[9] reported that LL was the common tumor in the under 5, Burkitt's lymphoma in the 5-10, and ALCL in the above 10 years groups. In the USA, Burkitt's or Burkitt like lymphoma predominated in the 5-14 years group and DLBCL was the most common subtype in 15-19 years group.[20]

Peripheral lymph node was the site of involvement only in 48% of cases. There was a high percentage of gastrointestinal tract involvement (9.1%) and intraabdominal/retroperitoneal masses constituted another 9.1%. The high percentage of extranodal involvement is well known in childhood NHLs.[2,9]

The predominance of T-LL in our study (32.1% of all cases) was consistent with the finding of the previous study of pediatric and adolescent NHL in India, in which, T-LL cases contributed to 32% of cases.[10] The percentage of T-LL in childhood NHL series from UK and Germany was 19% and 16.1% respectively.[9,17] In a study on NHL from India including all age groups, T-LL constituted 7.2% of all cases, 56% of cases in the under 10 years group, 24% in the 11-20 years group, and 3% in the above 20 years group.[21] The overall frequency of 6%-7.2% for T-LL in India[21,22] was slightly higher than in other countries where it was less than 4% for NHL in all age groups.[21,23,24] It is worth noting that most of T-LL cases in India were seen in the below 20 years group. The reason for this high frequency in India is not certain. A report[25] of the international workshop on non-Hodgkin lymphoma in developing countries suggested the possible role of environmental and genetic factors for the high frequency of T-LL in India. A few centers in India have studied the possible association between T-LL in children and risk factors like Epstein-Barr virus infection,[26,27] methylene tetrahydrofolate reductase gene polymorphisms[28] and frequency of Tal-1 gene deletion.[29] These studies have not come up with conclusive proof for the high frequency of pediatric T-LL in India. While the percentage of T-LL in our study was similar to that reported by Srinivas et al,[10] the percentage of B-LL cases in our study (9.5% of all NHLs) was higher than that in their series, in which B-LL constituted 3.1% of all NHLs.

Burkitt's lymphoma was the second most common subtype in our study. Of the 3 clinical types described in the WHO classification,[30] two reports from India reported an intermediate pattern with almost equal frequencies of abdominal masses and jaw involvement.[31,32] In our series, intraabdominal/retroperitoneal masses and primary gastrointestinal tract involvement were the presenting symptoms in 60% of cases, and jaw involvement was seen only in one of the cases. This finding is similar to that of the studies from Brazil and USA,[16,20] as well as another study from India.[10]

Burkitt's lymphoma can sometimes be difficult to distinguish from high grade DLBCL histologically. A comparative immunohistochemical study on pediatric Burkitt's lymphoma and DLBCL suggested that c-myc, bcl-2 and mib-1 are the preferred markers to be used for distinguishing the two tumors.[33] Bcl-6 and CD10 are not of much use in pediatric cases because most of the pediatric DLBCLs are of germinal center origin. In our series, cases with classical morphology and 100% Mib-1 proliferation index were considered as cases of Burkitt's lymphoma. Bcl-2 and CD10 were used in some cases.

In our study ALCL was the third most common subtype and constituted 11.5% of all pediatric NHLs. This percentage was similar to 8%-16% reported in Western countries.[34] ALCLs accounted for 15% of pediatric NHLs in UK,[9] 10.3% in Germany,[17] and 20.5% in Korea.[18] A recent study of 75 cases of pediatric ALCLs from Italy revealed an ALK positivity in 90.7% of ALCL cases.[35] In our series the ALK positivity was seen in 81.5% of ALCL cases.

Diffuse large B cell lymphoma was the fourth most common subtype and constituted 8.7% of the cases of pediatric NHL. This finding is similar to that reported in the English literature. Burkhardt et al[17] found that DLBCLs constituted 13% of pediatric NHLs. Wright et al[9] reported that B cell NHL other than LL and Burkitt's lymphoma constituted 7.8% and comprised centroblastic lymphoma, B-NHL high grade not otherwise specified, TCRBCL, and primary mediastinal large B cell lymphoma. Pediatric DLBCLs have been studied extensively. They are considered biologically different from the adult type and found to have an excellent prognosis. The good prognosis is attributed to the fact that most of the pediatric DLBCLs are of the germinal center phenotype ($CD10^+$ or $CD10^-$/$BCL6^+$/$MUM\text{-}1^-$) and lack a (8:14) translocation.[36] The differential diagnoses of high grade pediatric DLBCLs have been discussed under Burkitt's lymphoma.

Different subtypes of peripheral T cell lymphoma constituted 5.2% of all NHLs. PTCL(nos) constituted 2.4%, SPTCL 1.6%, NK/T cell 0.8%, and angioimmunoblastic T lymphoma 0.4%. The frequency

of PTCL was lower in our series than in Thailand[19] but higher than in the UK where different subtypes of peripheral T cell lymphoma accounted for 1.6% of all NHLs in the under 14 years group.[37]

Other rare subtypes in our series included cutaneous marginal zone lymphoma in 1 patient, mediastinal B cell lymphoma in 1 and TCRBCL in 2. In their series of pediatric NHL, Wright et al[9] presented a patient with mediastinal B cell lymphoma and a patient with TCRBCL. Oschlies et al[36] reported 5 patients with TCRBCL in 134 children with DLBCLs. Pediatric low grade B-NHLs like follicular lymphoma and marginal zone lymphoma despite their rarity have been reported and their differences from the adult types were noted.[38] Marginal zone lymphoma also occurs in lymph nodes and extranodal sites like ocular adnexa, skin and salivary glands.[39]

We reviewed the data on pediatric NHL from population-based registries from other countries. In population based studies from Sweden, NHL constituted 6% of all malignancies in children under 15 years,[4] and in Nordic countries it was 5%[40] and in the USA, 3% of cancers in children less than 5 years old and 8%-9% in children of 5-19 years old.[20] In comparison, population-based cancer registries from two cities in India, NHL constituted 8.39%[5] and 12.80%[13] of all pediatric malignancies under 15 years.

In the Swedish pediatric population, T-LL (20.78%) and BL (20.78%) were the common subtypes.[4] Diffuse large B cell lymphoma (10.38%) and ALCL (7.79%) came next.[5] Except for that of T-LL, the frequencies of subtypes are similar to those in our study. In a 5-year population-based study from 5 Nordic countries, 42.95% of the patients were classified with B-NHL, 28.85% with T-NHL and 3.20% with Ki-1 positive NHL. In 25% of the patients, the immunophenotype was not known.[40] In a 10-year population-based study from Greece on NHL children of up to 14 years, 59.89% children were classified with B-NHL, 23.08% with T-NHL, and 15.93% with ALCL; 1.1% were unclassified.[41] In our series, 46.83% were classified with B-NHL, 39.28% with T-NHL, and 11.51% with ALCL but 2.38% were unclassified. In the population-based cancer registries from Indian cities, NHL was not classified further. In a population-based study from Abidjan in Western Africa, Burkitt's lymphoma constituted 89.09% of all NHL patients in the 0-14 years group.[42]

In the pediatric population of the USA, Burkitt's lymphoma was the predominant subtype in the under 5 years group and the 5-9 years age group (34.48% and 41.38% respectively) and LL was the second (22.41% and 18.39% respectively). In the 10-14 years group, 32.41% of patients had Burkitt's lymphoma, 17.59% had DLBL and 16.67% had LL. In the 15-19 years group, DLBL patients predominated (37.41%), followed by Burkitt's lymphoma (13.6%).[20] The review of the published data from population-based registries highlights the predominance of B-NHL in the pediatric age group in most of the Western populations and the overwhelming predominance of Burkitt's lymphoma in the study from Western Africa.

The clinical data in our study were limited since some of the patients were from other hospitals and only tissue or paraffin blocks were sent to our institution for histopathologic examination. The study included NHL patients under 20 years old (barring mycosis fungoides) diagnosed at our department in a specific period. However, our hospital is a tertiary care hospital, referral bias cannot be excluded. For instance, the urban/rural profile of the subjects under study was 2.24:1 which is not identical to that of the general population of India. Alternatively the finding could also indicate that urban children are more likely to suffer from lymphoma. However, further studies are necessary for such conclusions. The socioeconomic status of our series has not been compared to the general population of the same age because it is outside the scope of the study. Hence the results of the study cannot be generalized to the Indian population. In the absence of population-based studies on NHL from India, the results of this study are of significance as ours is one of the leading hematology centers with a high case load and referrals from different parts of the country.

In conclusion, we recorded the frequency and distribution of different NHL subtypes in children and adolescents in South India and compared them with the data from other countries. This is the second comprehensive study from India on pediatric lymphomas conducted according to the WHO classification. Similar to the study by Srinivas et al[10] this study also underscores the predominance of T-LL in the pediatric and adolescent groups in India in contrast to the reports from Western countries or from other Eastern countries. The proportion of B-LL in our study is higher than that in the previous studies in India. The predominant intrabdominal/retroperitoneal presentation of Burkitt's lymphoma in this study is similar to that reported in Western countries.

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