

Clinical Profile of Lymphoproliferative Disorders

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Abstract: *Lymphoproliferative disorders are a set of disorders characterized by the abnormal proliferation of lymphocytes into a monoclonal lymphocytosis. It is observed due to varied clinical picture, many patients are misdiagnosed or treated as a disease like tuberculosis, systemic lupus erythematosus, etc for a long time before coming to correct diagnosis. Also, there is a lack of literature from India and paucity of published studies on lymphoproliferative disorders from India. Hence, this study was undertaken to evaluate the clinical profile and subtypes of lymphoproliferative disorders in cross-section of histologically proven lymphoma patients at a tertiary care center and to subtype various lymphoproliferative disorders using advanced techniques like ImmunoHistoChemistry (IHC) and Flow cytometry (FC)¹.*

Keywords: Lymphoproliferative disorders, ALL, Hodgkins, Non-Hodgkins lymphoma in India, Multiple myelomas, DLBCL, Follicular lymphoma, Burkitt's Lymphoma, Mantle cell Lymphoma, CLL

1. Introduction

Lymphoproliferative disorders (LPDs) refer to several conditions in which lymphocytes are produced in excessive quantities. They typically occur in people who have a compromised immune system hence sometimes equated with "immunoproliferative disorders", but technically lymphoproliferative disorders are a subset of immunoproliferative disorders, along with hypergammaglobulinemia and paraproteinemias. The two major types of lymphocytes are B cells and T cells, which are derived from pluripotent hematopoietic stem cells in the bone marrow. Individuals having dysfunction in their immune system are susceptible to develop a lymphoproliferative disorder due to dysfunction of numerous control points or immunodeficiency or deregulation of lymphocytes. There are several inherited gene mutations that have been identified to cause lymphoproliferative disorders; however, there are also acquired and iatrogenic causes². Lymphoproliferative disorders are malignant disorders of cells residing in lymphoid tissues and are classified mainly into following types: Hodgkin's lymphoma (HL), Non-Hodgkin's lymphomas (NHL), Acute Lymphoblastic Leukemia (ALL) and Multiple Myeloma (MM). Lymphoproliferative disorders can occur at any age hence has a bimodal presentation with one peak in early years of life and others after middle age. Patients with lymphoproliferative disorders usually present with constitutional symptoms of weight loss, fever, night sweats, and enlarged lymph nodes. Symptoms may also develop due to the pressure effect of lymph nodes on the surrounding structures or due to involvement of extranodal sites such as gastrointestinal tract, central nervous system, liver, kidney or bone leading to atypical presentations³. Initiating treatment prior to an accurate diagnosis, especially with steroids, can be counterproductive to patient care. This clinical scenario is commonly seen in young patients presenting with a mediastinal mass and dyspnoea. Steroid therapy given prior to an accurate diagnosis can confound the results of a biopsy as it is capable of partially treating the disease leading to an erroneous diagnosis or no diagnosis at all. Sometimes

benign disorders including ordinary infections and other non-neoplastic conditions may be interpreted as malignant lymphoma and unnecessarily subjected to surgery and/or chemotherapy⁴. The diagnosis of Lymphoproliferative disorders involves histopathological findings on biopsy of an enlarged lymph node from a relevant site, aided further by invasive or non-invasive procedures to confirm the extent of the disease and to formulate a proper therapeutic plan. Primary to the diagnosis of Hodgkin's Lymphoma is the presence of malignant Reed-Sternberg cells in an appropriate cellular background. The NHLs and HLs are the most commonly occurring hematologic malignancies. They now represent 4% to 5% of all new cancer cases and are the fifth leading cause of cancer death worldwide. NHL is the most common form and accounts for 88% of lymphoid tumors and HL accounts for 12% of cases⁵. Most cases of NHL are derived from the malignant transformation of B-Lymphocytes in lymph nodes. B-Cell lymphomas represent more than 85% of NHL. Follicular and Diffuse Large B Cell lymphomas (DLBCL) are the most frequent forms, each comprising around 30% of total cases. T-cell lymphomas account for less than 15% of NHL. Lymphoproliferative disorders are treatable and frequently curable malignancies, however, proper staging and evaluation are required to categorize them into different stages so as to follow a definitive therapeutic plan, prognosis and follow up⁶. The Ann-Arbor staging system assigns an anatomic stage to the lymphoma by focusing on the number of tumor sites (nodal and extranodal), locations and the presence or absence of constitutional symptoms.

Aim

To study the clinical profile of Lymphoproliferative disorders.

2. Materials and Methods

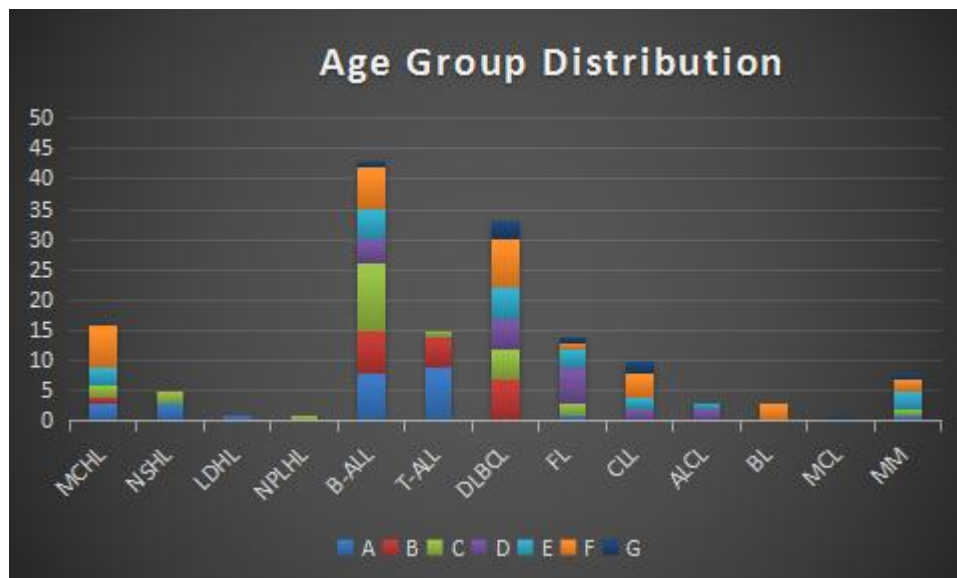
The sample size of 153 patients, cross-sectional study. The study duration is of 2 years. Inclusion criteria are the selection of all cases of lymphoproliferative disorders above 12 years admitted at the tertiary care center. Exclusion

criteria are patients with myeloproliferative disorders, post-transplant lymphoproliferative disorders, drug-induced lymphoproliferative disorders and those who do not give consent for the study.

3. Results

We distributed subjects into 7 age groups A=12-20, B=21-30, C=31-40, D=41-50, E=51-60, F=61-70, G=>70. Most (7) subjects of **HL (Hodgkin's Lymphoma)** were of 12-20 age group. The other 7 subjects of HL were from 61-70 age group. It shows HL has bimodal age distribution. Among HL, MCHL (Mixed Cellularity Hodgkin's Lymphoma) was found most commonly (7 subjects) in 61-70 age group. NSHL (Nodular Sclerosing Hodgkin's Lymphoma) was mostly (3 subjects) found in 12-20 age group. Single-subject of LDHL (Lymphocyte Depleted Hodgkin's Lymphoma) was in 12-20 age group and single subject of NLPHL (Nodular Lymphocyte Predominant Hodgkin's Lymphoma) was found in 31-40 age group. Furthermore, **ALL (Acute**

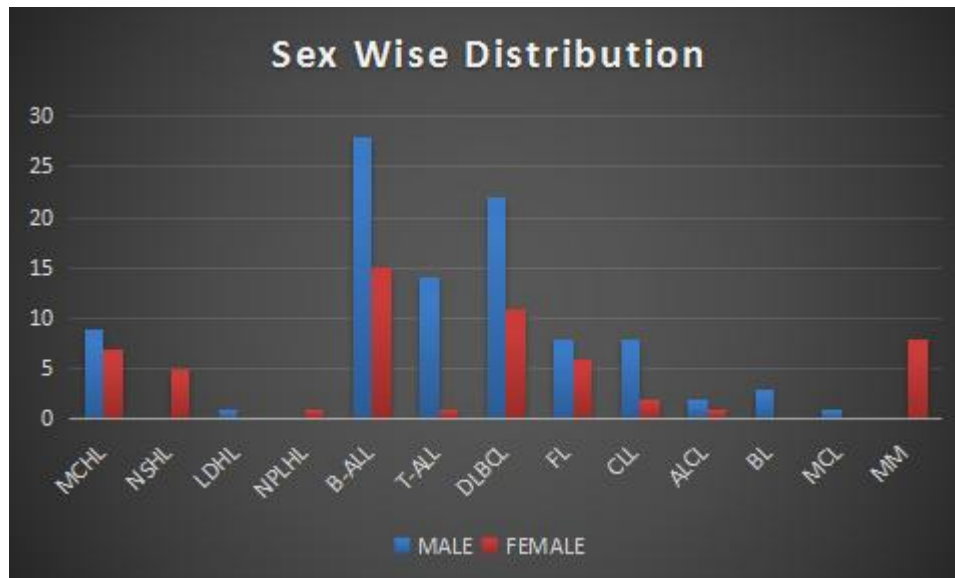
Lymphoblastic Leukemia) was found most commonly in 12-20 age group (17 subjects), But B-ALL, a subtype of ALL was found mostly in 31-40 age group (11 subjects), while T-ALL, other subtypes of ALL, was mostly found in 12-20 age group (9 subjects). **NHL (Non-Hodgkin's Lymphoma)** was mostly found in the 41-50 age group (15 subjects). Among NHL, most common age group of DLBCL (Diffuse Large B Cell Lymphoma) was 61-70 (8 subjects), Follicular lymphoma was 41-50 (6 subjects), CLL (Chronic Lymphoblastic Leukemia) was 61-70 (4 subjects), ALCL (Anaplastic Large Cell Lymphoma) was 41-50 (2 subjects), Burkitts was 61-70 (3 subjects), & single case of Mantle cell lymphoma belonged to above 70 age group. Out of 8, 3 subjects of **MM (Multiple Myeloma)** were found in the 51-60 age group. The mean age of presentation of LPD was 44.01 years. The mean age of HL (23 subjects) was 41.7 years. The mean age of ALL (58 subjects) was 34.1 years. The mean age of the NHL (64 subjects) was 52.5 years. The mean age of MM (8 subjects) was 54 years.



Graph 1: Age distribution of LPD's

Out of 153 subjects of LPD, 96 subjects of LPDs were male and 57 were female. M: F ratio was 1.68. Out of 23 total HL subjects, 10 were male and 13 were female (M: F=0.76). Among that **HL**, we found 9 male & 7 female in MCHL (M: F=1.28), all 5 subjects of NSHL were female, 1 male in LDHL, 1 female in NLPHL. Out of 58 subjects of **ALL**, 42 subjects were male and 16 subjects were female (M: F=2.62). 28 male & 15 female in B-ALL (M:F=1.86), 14

male and 1 female in T-ALL (M:F=14). Out of 64 subjects of **NHL**, 44 were male and 20 were female (M:F=2.2). 22 male and 11 female in DLBCL (M:F=2), 8 male and 6 female in Follicular (M:F=1.33), 8 male and 2 female in CLL (M:F=4), 2 male and 1 female in ALCL (M:F=2), all 3 subjects of BL were male, only subject of MCL was male. All 8 subjects of **MM** were female.



Graph 2: Sex wise distribution of LPD's

The study population was divided into urban and rural communities from where they belong. 89 subjects of all LPDs were from the urban locality and 64 from rural locality (U/R=1.39). In **HL**, 15 were from urban and 8 were from rural areas (U/R=1.87). In subtypes of HL, we found that in MCHL there were 10 patients from urban and 6 patients from rural locality. In NSHL 3 patients from urban and 2 patients from rural, in LDHL 1 patient from urban, In NPLHL 1 patient from urban. In **ALL**, 31 were from urban and 27 were from rural areas (U/R=1.14). In B-ALL 22 patients from urban and 21 patients from rural, In TALL 9 patients from urban and 6 patients from rural areas. In **NHL**, 39 were from urban and 25 were from rural (U/R=1.56). In DLBCL 18 patients from urban and 15 patients from rural. In FL 10 patients from urban and 4 patients from rural while in CLL 6 patients from urban and 4 patients from rural. In ALCL 2 patients from urban and 1 patient from rural and that of in BL 2 patients from urban and 1 patient from rural locality. In MCL 1 patient from urban. In **MM** 4 patients from urban and 4 patients from rural communities (U/R=1). In the present study, most common LPD was NHL (n=64), followed by ALL (n=58), HL (n=23) and then MM (n=08). Among NHL, DLBCL subtype was most common (33 subjects). Among ALL, B-ALL was most common (43 subjects) and among HL, MCHL was found commonest variety (16 subjects). The most common LPD found was B-ALL (28.1%) and second most common was DLBCL (21.56%). There were 16 subjects of MCHL, 05 of NSHL, 01 of LDHL, 01 of NPLHL, 43 of B-ALL, 15 of T-ALL, 33 subjects of DLBCL, 14 of Follicular, 10 of CLL, 03 of ALCL, 03 of BL, 01 of MCL and 08 of MM. We found various symptoms in our subjects. We found fever, weight loss, night sweats, generalized weakness, backache, bone pain, bleeding manifestation, swelling over the body, and decreased appetite were among common symptoms. In HL, swelling over body was most common (23 subjects) symptom and generalized weakness (21 subjects) were second most common. In ALL, generalized weakness was most common (53 subjects) presenting symptom and fever was second most common (48 subjects) symptom. In NHL, swelling over the body was most common (57 subjects) symptom and generalized weakness were second most

common (53 subjects). Bone pain, generalized weakness, and backache were among the most common symptoms in MM. Overall in all LPDs, among common symptoms, fever was present in 100 subjects, weight loss was present in 48 subjects, night sweats was present in 38 subjects, generalized weakness was present in 134 subjects (most common symptom), backache was present in 18 subjects, bone pain was present in 23 subjects, bleeding manifestations were present in only 6 subjects, swelling over body was present in 80 subjects and decreased appetite was present in 30 subjects. We also found various signs in our study subjects. We found pallor, splenomegaly, hepatomegaly, ecchymosis/petechiae, pedal edema, mass per abdomen, sternal tenderness, CNS signs, GIT signs, skin nodules. In **HL**, pallor was found in 13 subjects (most common), hepatomegaly in 11 subjects, splenomegaly in 9 subjects, and hepatosplenomegaly was found 3 subjects. In **ALL**, pallor was found in 46 subjects (most common), hepatomegaly in 20 subjects, splenomegaly in 21 subjects, and hepatosplenomegaly was found 7 subjects. In **NHL**, pallor was found in 36 subjects (most common), hepatomegaly in 25 subjects, splenomegaly in 36 subjects, and hepatosplenomegaly was found 10 subjects. In **MM**, pallor in 6 patients, splenomegaly in 4, hepatomegaly in 4, hepatosplenomegaly in 1 subject, ecchymosis in 1, mass per abdomen in 1, sternal tenderness in 8, CNS signs in 2 and skin nodules in 2 subjects. Overall, in all LPDs, pallor was present in 101, splenomegaly was present in 70, hepatomegaly was present in 60, and hepatosplenomegaly was found in 21 subjects. Overall, Cervical lymphadenopathy was observed in 46 subjects, Axillary lymphadenopathy was observed in 34 subjects, Inguinal lymphadenopathy was observed in 28 subjects, Generalized lymphadenopathy was observed in 25 subjects and abdominal lymphadenopathy was observed only in 9 subjects. Out of 23 total subjects of HL, 13 had moderate to severe anemia (56.5%). Out of 58 total subjects of ALL, 46 had moderate to severe anemia (79.3%). Out of 64 total subjects of NHL, 37 had moderate to severe anemia (57.8%). Out of 8 total subjects of MM, 6 had moderate to severe anemia (75%). So overall moderate to severe anemia was found most commonly in ALL subjects, mostly in B-

ALL. Out of 23 total subjects of HL, 18 had leukopenia (78.2%) and none had leukocytosis. Out of 58 total subjects of ALL, 20 had leukopenia (34.4%) and 16 had leukocytosis (27.5%). Out of 64 total subjects of NHL, 26 had leukopenia (40.6%) and 16 had leukocytosis (25%). Out of 8 total subjects of MM, 4 had leukopenia (50%) and single-subject had leukocytosis (12.5%). So overall leukopenia was found most commonly in HL subjects and leukocytosis was found mostly in ALL and subtypes of NHL including CLL, ALCL, and BL. In the subtypes of LPD, mostly thrombocytopenia was observed in ALL. In B-ALL, thrombocytopenia was present in 32 subjects. In most subjects of DLBCL, CLL and all subjects of BL thrombocytopenia were present. In 3 out of 8 subjects of MM, thrombocytopenia was seen. Thrombocytosis was present only in HL. In subtype of HL, thrombocytosis was seen in 3 subjects of MCHL. Deranged KFT was seen mostly in FL (8 subjects) followed by MM (5 subjects). Deranged LFT was seen in 3 subjects of B-ALL and 2 subjects of MCHL, DLBCL, and FL. Hypoglycemia was observed mostly in ALL and NHL. While hyperglycemia was seen in 2 subjects of B-ALL, single subject of DLBCL, FL, and MM which was secondary to Diabetes mellitus as these were diagnosed cases of DM.

4. Discussion

We studied 153 cases of lymphoproliferative disorders at the tertiary care center. We found cases of HL, ALL, NHL & MM and its various subtypes. In the present study, mean age of presentation of LPD was 44.01 years. The mean age of HL (23 subjects) was 41.7 years. The mean age of ALL (58 subjects) was 34.1 years. The mean age of the NHL (64 subjects) was 52.5 years. The mean age of MM (8 subjects) was 54 years. Out of 153 subjects of LPD, 96 subjects of LPDs were male and 57 were female. M: F ratio was 1.68. 89 subjects of all LPDs were from urban locality and 64 from rural locality (U/R=1.39). In the present study, most common LPD was NHL (n=64), followed by ALL (n=58) then HL (n=23) and then MM (n=08). The most common LPD found was B-ALL (28.1%) and the second most common was DLBCL (21.56%).

Nathan D. Montgomery et al⁷ studied a total of 85 pediatric and 82 adult patients received real-time LPD diagnoses in Malawi followed by final diagnoses in the United States. The male to female ratio was 1.9:1. They found that frequency of various types of LPD in study population was Burkitt lymphoma in 63, Intermediate to large lymphoma in 12, Classic Hodgkin lymphoma in 12, Peripheral T-cell lymphoma in 04, Diffuse large B-cell lymphoma in 37, High-grade B-cell lymphoma in 04, Multicentric Castleman disease in 12, Burkitt lymphoma in 04, Extranodal NK/T-cell lymphoma in 03, CLL in 03, lymphoblastic lymphoma in 01, mantle cell lymphoma in 01 study population. **Owen A et al**⁸ in their study of LPD found that out of 21 studied cases follicular in 09, mantle cell in 08, marginal zone lymphoma in 01, CLL in 03. They also found that there is a slight male predominance of LPD, with about 57% of all cases developing in males. The present study is consistent with male preponderance. In the study done by **Rahul N M et al**⁹ they found that a total of 301 patients were eligible for analysis. The median age of presentation was 36 years (range 19-75). There were a total

of 224 males and 77 females (ratio 2.9:1). Two hundred and twenty-eight (75.7%) patients presented with B symptoms. Fifty-five (18.2%) patients had the bulky disease at initial presentation. The histopathological examination revealed mixed cellularity (MC) in 224/301 (74.4%) of patients, followed by nodular sclerosis (NS) in 42/301 (13.9%), lymphocyte rich in 8/301 (2.6%), lymphocyte depleted in 16/301 (5.3%). Eleven patients (3.6%) had nodular lymphocyte-predominant HL. The findings of this study are also consistent with our study. **Dubey AP et al**¹⁰ studied LPD and found that total of one hundred (100) patients were diagnosed as non-Hodgkin's lymphoma during the study period. Of them, 62 (62%) were male and 38 (38%) were female and male-female ratio was 1.63:1. The mean and median age of presentation was 45.36 years and 44 years respectively. The disease shows a bimodal onset with 24 (24%) cases occurring in the age group of 31-40 years and 25 (25%) cases occurring in the age group of >60 years. Most of the patients i.e. 43 (43%) patients have presented beyond the 5th decade. B-cell lymphoma highest number of patients are in the 5th and 6th decade and of T-cell lymphoma in the 3rd decade. Out of study population 34 (34%) patients gave history of fever, 59 (59%) patients gave history of anorexia whereas 58 (58%) of patients complained of fatigue at the time of presentation to the hospital. 35 (35%) patients had complained of neck swelling at the onset whereas 13 (13%) patients also complained of dyspnoea on presentation. 6 (6%) patients had compressive symptoms due to enlarged nodes causing hoarseness of voice and muscle weakness. 6 (6%) patients gave history of bleeding manifestations. 30 (30%) patients had significant weight loss of >10% of body weight. B Symptoms (type B symptoms: fever, and/or night sweats, and/or weight loss of more than 10% of body weight) were seen in 45 (45%) of patients. Among signs pallor was present in 25 (25%) patients, Icterus was seen in 7 (7%) patients. Hepatomegaly was found in 17 (17%) of cases and splenomegaly was detected in 9 (9%) patients. 44 (44%) of patients were found to have peripheral lymphadenopathy. Ascites was detected in 8 (8%) patients. Anemia (Hb of < 10 gm/dl for females and <12 gm/dl in males) was found in a total of 18 (18%) patients. Out of these 18 patients, 11 were males and 7 were females. The mean hemoglobin in the study group was 10.56 gm/dl. Deranged liver function tests were found in 17 (17%) patients, most of these comprised of raised Bilirubin and AST levels (Serum Bilirubin >1.2 mg/dl; AST>30 IU/L). Deranged renal parameters were seen in 8 (8%) of cases. (Creatinine > 1.2 mg/dl and BUN > 20 mg/dl). The most common site involved was GIT, seen in 20 (20%) patients followed by CNS involvement which was observed in 5 (5%) patients. On flowcytometric evaluation of various subtypes they found that B-cell lymphomas formed 89% of the NHLs, whereas T-cell lymphomas formed 11% of all Non-Hodgkin's lymphomas. Diffuse large B-cell lymphoma (DLBL) was the most common subtype, forming 56% of all NHLs. It was followed by follicular lymphoma which was seen in 17% of all patients. The third commonest was marginal zone B- Cell lymphoma seen in 8% of cases. Among T-Cell lymphoma anaplastic large cell lymphoma (6%) was the commonest. This study suggested a higher male to female ratio as compared to western literature (UK it was 1.2:1), but it commensurate with the results obtained in Indian studies which showed a ratio of 1.6:1 to 3:1. On the

other hand, in north India the ratio was found to be 4.5:1. In Bangladesh it was 1.8:1 and in Pakistan it was observed to be 1.03:1. Though the general trend of male preponderance has been clearly found in the study. Male predominance was observed in all histological subtypes in the study which was similar to that of Elias (1979). A small study by **Sudipta et al**¹¹ on Hodgkin's and non-Hodgkin's lymphomas in rural India suggested neck swelling as the predominant symptom followed by weight loss, anorexia, and fatigue. **Naresh et al** and **Skarin, Dorfman, Laurini JA**¹² which revealed B cell lymphoma in 80% of the study cases of LPD. Diffuse large B-cell lymphoma (DLBL) was the most common subtype, forming 56% of all NHLs which is well in proportion as compared with other Indian studies where it's prevalence at presentation was noted to be 54.66%. It was followed by follicular lymphoma which was seen in 17% of all patients (17.66% as per Indian studies). Broadly the findings were similar to that of a study done by Naresh et al, 2000, hence elucidating DLBCL to be the largest subset of NHL. **Geetha P et al**¹³ found 142 cases of LPD in which it was observed that the youngest age reported in this study was 9 years and the oldest age of presentation was 77 years. There was a bimodal age distribution seen, the first peak occurring in the age group of 11-20 years and the second peak in the older age group more than 50 years. Overall males were predominantly involved with the percentage of 63% and females constitute 37%. B symptoms were present in 38 cases which constitutes 27%. Hepatomegaly was seen in 14 cases. Splenomegaly was seen in 17 cases (11.97%) of patients. Bone marrow infiltration was seen in 12 cases which accounts for 8.45%. Mixed cellularity was the most common subtype which accounts for 69% followed by Nodular sclerosis. Lymphocyte depleted was the least common subtype. The majority of cases of mixed cellularity subtype occurred in the age group of 15-35 years followed by 35-55 years. Mixed cellularity was most common in males and Nodular sclerosis was predominantly seen in females. **Khushboo Dewan et al**¹⁴ studied thirty untreated cases of CLPDs. Twenty-eight cases of B-CLPD were divided into two groups - chronic lymphocytic leukemia (CLL) (21 patients) and non-CLL (7 patients). Peripheral blood/bone marrow aspirate samples were analyzed by FCM using various panels of monoclonal antibodies. Immunohistochemical analysis of bone marrow biopsies obtained from these patients was also performed. They found that panel A of monoclonal antibodies comprising CD5, CD23, CD22, surface membrane immunoglobulin (SmIg), FMC7 and Panel B comprising CD5, CD23, CD22, SmIg, FMC7, CD79b were useful ($P < 0.01$ and < 0.001 respectively) while Panel C comprising CD5, CD23, SmIg, FMC7 and CD79b was not found to be useful in distinguishing CLL from non-CLL ($P > 0.05$). The concordance rate between FCM and IHC ranged from 80% to 100% for all comparable immunological markers. In all cases of CLPDs, we propose a screening panel comprising 9 markers including CD19, CD5, CD23, FMC7, CD10, CD20, CD3, kappa and lambda, which are important for specifying the lineage (B or T), to differentiate CLL from non-CLL group and for deciding the secondary panel. **Geraldo Barroso C et al**¹⁵ diagnosed LPD in 22 males and 20 females with the help of flow cytometry. The immunophenotyping showed that 35 cases were B-CLL, 3 B-PLL, and HCL and one patient was MCL. CD5

expression was present in all B-CLL and MCL. Low expression of CD5 was observed in one patient with B-PLL and negative in all cases of HCL. **Adhikarimayum AA et al**¹⁶ done study of LPD and stated that majority (43.0%) of the patients were in the age group of 41 and 60 years. The mean age was 54.01 ± 18.1 years. Male:female ratio was 1.2:1. The most common presenting symptom was neck swelling (57.0%), and peripheral lymphadenopathy (76.0%) was the most common sign. Primary site distribution was nodal (57.0%) and extra-nodal NHL (43.0%). The most common nodal site involved was cervical lymph nodes (65.0%), and gastrointestinal tract (17.0%) was the most common extranodal subsite. The majority of the patients were in stage II (36.0%) at the time of diagnosis. Bcell NHL accounts for 66.0% compared to T-cell lymphoma (23.0%). Diffuse large B-cell lymphoma was the most frequent B-cell lymphoma (45.0%), and anaplastic large cell lymphoma was the most common T-cell variant (15.0%). **Sadia S et al**¹⁷ in their study stated that there were 42 (67.7%) males and 20 females (32.2%) with male to female ratio of 2:1. Patient's age ranged between 15 and 76 years with the mean age of 29.7 ± 13.8 years and the median age of 30 years. B symptoms were present in 45 (72.5%) patients, out of whom fever was commonest, seen in 64.5%; drenching night sweats in 55% patients, while 37% patients had a history of weight loss. Lymphadenopathy was present in 53 (85.4%) cases. The most common lymph node palpable was cervical and axillary nodes. The splenomegaly and hepatomegaly were noted in 25.8% and 17.7% patients respectively. Histopathologically, mixed cellularity type constituted 62.9% ($n=39$) of cases, followed by nodular sclerosis in 16 (25.8%) patients, lymphocyte-predominant in 6 (9.6%) patients and lymphocyte depleted was in only single (1.6%) patient. Mean hemoglobin was 9.4 ± 1.9 g/dl (6.8-15.8g/dl). The mean total leukocyte count of $10.9 \pm 20.6 \times 10^9/l$ (1.5-22.9 $\times 10^9/l$); mean absolute neutrophils count of $3.8 \pm 3.0 \times 10^9/l$ and the mean platelets count were $241.6 \pm 150.1 \times 10^9/l$ (16-651 $\times 10^9/l$). Anemia ($Hb < 10$ gm/dl) was noted in 24.1% patients.

Most of the findings in the present study are consistent with the above-mentioned studies. There might be some differences in some results & this might be due to geographical variation, racial variation, and a difference in sample size.

5. Conclusion

In this study of 153 patients of lymphoproliferative disorders, over a period of two years, we found a mean age of presentation of LPD was 44.01 years. The mean age of HL was 41.7 years, of ALL was 34.1 years, of NHL was 52.5 years & of MM was 54 years. 96 subjects of LPDs were male and 57 were female. M:F ratio was 1.68. 89 subjects of all LPDs were from urban locality and 64 from rural locality (U/R=1.39). In the present study, most common LPD was NHL, followed by ALL then HL and then MM. The most common subtype of LPD was B-ALL (28.1%) and second most common was DLBCL (21.56%). Overall in all LPDs, generalized weakness, fever and swelling over body were most common symptoms. Among the signs observed in all LPDs, Lymphadenopathy was most common, mostly cervical whereas pallor was the second. Overall moderate to

severe anemia was found most commonly in ALL subjects, mostly in B-ALL. Leukopenia was found most commonly in HL subjects (78.2%) and leukocytosis was found mostly in ALL (27.5%). Thrombocytopenia was observed mostly in ALL. Pancytopenia was found most commonly in ALL, mostly in B-ALL. As such, there is much less impact on kidney and liver by these LPDs. Pancytopenia was found most commonly in ALL, mostly in B-ALL. As such, there is much less impact on kidney and liver by these LPDs. Flow cytometry is useful in determining the type of LPD and it helps to treat the disease. There is still much scope in the future to detect these LPD earlier on the basis of clinical findings and laboratory investigations. It will surely help to treat these LPDs earlier.

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