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Original Research Article

An autopsy study of hematolymphoid malignancies

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ABSTRACT

Background: Hematolymphoid malignancies (HLM) are primary cancers of blood, bone marrow and lymphoid organs associated with high mortality. Clinically undetected cases, diagnosed primarily at autopsy, are common.
Methods: Cases of HLMs at autopsy performed in our hospital from 1st January 2009 to 30th June 2017 were analysed. Gross and microscopic findings at autopsy along with clinical parameters were studied. Special stains and immunohistochemistry (IHC) were performed wherever possible.
Results: There were 49 cases of HLMs (0.98 %) among 4971 autopsies conducted during the study period, occurring predominantly in males (70 %). Fifteen (30.61 %) were primarily diagnosed at autopsy. There were 26 lymphomas and 19 leukemias; three patients had multiple myeloma and one patient had Langherhan cell histiocytosis. Non-Hodgkin's lymphoma was the commonest (24 patients). Nine were diffuse large B-cell lymphoma; rare sub-types included angiotrophic lymphoma, post-renal lymphoproliferative disorder and hepatosplenic gamma-delta T-cell lymphoma. Among the 19 leukemias, majority were acute (13 cases) with seven cases of myeloid and six of lymphoid types. IHC was performed in 21 cases which aided the diagnosis. The commonest symptoms were fever (43%) and dyspnoea (37%). Splenomegaly (67%), hepatomegaly (61.2%) and lymphadenopathy (57.1%) were the most common autopsy findings. Infiltrations were seen in various organs; an acute myeloid leukemia (M6) had infiltration of the atrio-ventricular node.
Conclusions: One-third cases in the present study were diagnosed at autopsy without any prior clinical suspicion thereby emphasizing on the relevance of autopsy in the current practice of pathology and further studies to improve accuracy of ante-mortem diagnosis.

Keywords: Autopsy, Hematolymphoid malignancies, Leukemia, Lymphoma

INTRODUCTION

Hematolymphoid malignancies (HLM) are primary cancers of blood, bone marrow (BM) and lymphoid organs. They can be derived from either of the two major blood cell lineages i.e. myeloid and lymphoid cell lines. Lymphomas, lymphocytic leukemia, myelomas and other plasma cell dyscrasias arise from lymphoid cell lines while acute myeloid leukemia (AML), chronic myeloid leukemia (CML), myelodysplastic syndromes (MDS) and other myeloproliferative disorders (MPD) are myeloid in origin. Hematolymphoid malignancies constitute a special group of diseases due to their high mortality, complex diagnostic steps that are required for their care and for the need of aggressive therapeutic methods.[1] These patients are at a risk of complications from the neoplasm as well as from the treatment. Infiltration of the organs by the tumour is one of the most important cause of morbidity in patients with hematolymphoid malignancies.[2] However, asymptomatic tumour infiltration diagnosed at autopsy is more common than

symptomatic organ dysfunction during life. Organ infiltration from leukemia lymphoma, myeloma and related conditions is in general less likely to be symptomatic than organ infiltration from carcinoma.

Thus, autopsies are important in not only determining the immediate cause of death but also provide the best possible data about the underlying and contributory causes of death. By comparing the clinical history, laboratory and autopsy findings of patients with ante mortem and post-mortem diagnoses of a hematolymphoid malignancy, the awareness of a hematological malignancy in a patient with an acute illness can be increased.[3] Against this background, the present study was planned to evaluate nature and extent of the HLM cases from autopsies performed.

METHODS

The present study was an observational record-based study. All cases of hematolymphoid malignancies at autopsy performed in Department of Pathology at a tertiary-care hospital from 1st January 2009 to 30th June 2017 were included in the study. The subject details were collected in a preformed structured proforma. Details of demographic data, clinical presentation, gross and microscopic pathology, hematological investigations like complete blood count with peripheral blood smear findings, bone marrow examination wherever performed, and cause of death were retrieved from the autopsy records of the department and analysed. Prior approval was taken from Institutional Ethics Committee before commencing the study. Permission was taken to access the autopsy reports.

Gross morphological findings of the various organs at autopsy were analysed. Blocks and slides from the various organs like brain, heart, lungs, liver, spleen, lymph nodes, bone marrow, gastrointestinal tract and kidney obtained at autopsy were retrieved and stained by haematoxylin and eosin staining and reviewed. Special stains and immunohistochemistry (IHC) were performed wherever possible.

Inclusion criteria

- All autopsy cases of hematolymphoid malignancies performed at our institute from 1st January 2009 to 30th June 2017.

Exclusion criteria

- All other autopsies were excluded.

Statistical analysis

All the categorical and quantitative data was presented as frequency and proportion. Analysis of data was done using Microsoft Excel® 2010.

RESULTS

Incidence of autopsies with a diagnosis of HLM

In the present study, out of 4971 autopsy records, 49 (0.9%). Records were with hematolymphoid malignancies.

Age wise distribution of HLM cases

Maximum number of HLM, i.e. 9 cases (18%) each were seen in the first and fifth decade of life followed by 4th decade (8) and least (2) in the eighth decade. Cases in the age group less than 10 years were with a preponderance of ALL (4 cases out of 9). Also, in nine cases of HLM seen between 41-50 yrs. age, Non-Hodgkin lymphoma (NHL) was the most common diagnosis. Mean age for the study population was 36 years. Age wise distribution of cases is shown in (Figure1).

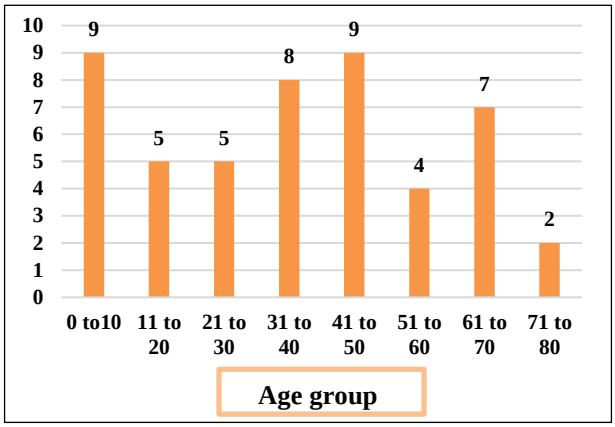

Figure 1: Age wise distribution of HLM cases.

Gender wise distribution of HLM cases

In the present study, 34 patients (69%) were males and 15 patients (31%) were females. Male preponderance was seen in the types of cases. Gender wise distribution of cases is given in (Figure 2).

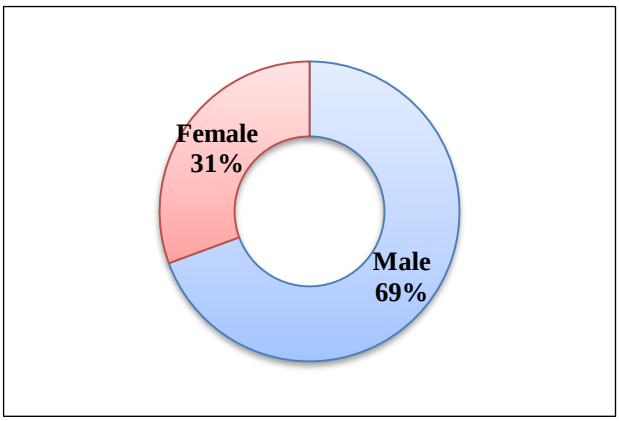

Figure 2: Gender wise distribution of HLM cases.

Types of HLM cases at autopsy

Out of the 49 autopsies of HLM cases, 26 cases were of lymphomas of which 24 cases were of Non-Hodgkin Lymphoma (NHL) and two were Hodgkin lymphoma (HL).

There were 19 cases of leukemia, 7 cases were acute myeloid leukemia (AML), 6 cases were acute lymphoid leukemia (ALL), and 5 cases were chronic myeloproliferative disorder (CMPD) and rest 1 case was chronic lymphoid leukemia (CLL). Types of HLM cases at autopsy are presented in (Table 1).

Table 1: Types of HLM cases at autopsy.

Types of HLM	Number	Percent
Lymphoma	26	53.06
Non -Hodgkin Lymphoma (NHL)	24	48.98
Hodgkin Lymphoma (HL)	02	4.08
Leukemia	19	38.7
Acute lymphoid leukaemia (ALL)	06	12.24
Acute myeloid leukaemia (AML)	07	14.24
Chronic myeloproliferative disorder (CMPD)	05	6.12
Chronic Lymphoid Leukaemia (CLL)	01	2.04
Others	04	8.16
Multiple myeloma (MM)	03	6.12
Langerhans cell histiocytosis (LCH)	01	2.04
Total	49	100.00

Distribution of lymphoma cases

Out of the total 26 lymphoma cases, two cases were of Hodgkin lymphoma, both were clinically suspected/diagnosed (Figure 3).

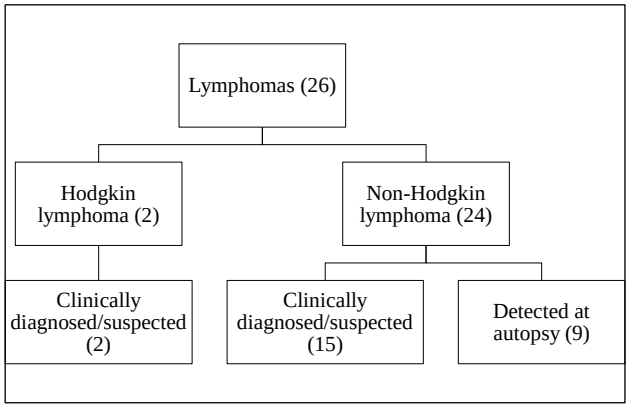

Figure 3: Distribution of lymphoma cases.

Out of 24 NHL cases, nine were detected at autopsy. Out of 24 NHL cases, nine were of diffuse large B cell lymphoma (DLBCL) followed by lymphoblastic lymphoma (5 cases). Distribution of lymphoma cases is presented in (Table 2).

Table 2: Types of NHL cases.

Types of NHL	No. of cases	Percentage
Diffuse large B cell lymphoma (DLBCL)	09	37.5
Lymphoblastic lymphoma	05	20.8
Burkitt lymphoma	03	12.5
Angiotrophic lymphoma	02	8.3
Anaplastic Large B cell lymphoma (ALCL)	01	4.2
Post renal transplant lymphoproliferative disorder (PTLD)	01	4.2
Lymphoplasmacytic lymphoma	01	4.2
Diffuse Low-grade B cell lymphoma	01	4.2
Hepatosplenic T cell lymphoma	01	4.2
Total	24	100

Distribution of leukemia cases

Of the 19 leukemia cases, 13 were of acute while six were of chronic leukemia. Of these 19 cases, five (one ALL, two AML and two CMPD) were diagnosed after autopsy (Figure 4).

Detection of the HLM cases post autopsy

In present study, in total 15 (31%) cases were detected after autopsy was performed. These cases were not clinically suspected or diagnosed ante-mortem. Nine cases of NHL, 5 cases of leukemia and one case of MM were detected after autopsy.

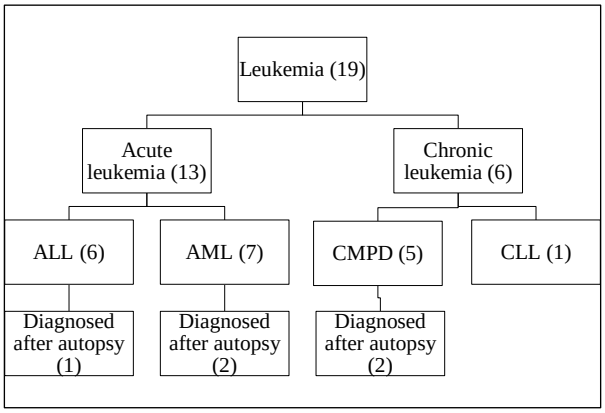

Figure 4: Distribution of leukemia cases.

Table 3: Symptoms seen in HLM cases.

Symptoms	Number	Percent
Fever	21	43
Dyspnoea /cough	18	37
Loss of appetite/ loss of weight	17	35
Abdominal Pain/distension	11	22
Bleeding Manifestations/ulcers	06	12
Lymphadenopathy	05	10

Clinical parameters (symptoms, signs) of HLM cases

In the present study, fever was the most common presenting symptom seen in 21(43%) patients followed by cough and dyspnoea (18 patients (37%)). Bleeding manifestations and oral ulcers were present in 6 patients (12%). Lymphadenopathy was present in 5 patients (10%). List of symptoms with their frequency is presented in (Table 3).

In the present study, 41 patients (84%) were found to have hepatomegaly and splenomegaly on clinical examination followed by pallor in 27 (55%) patients. Lymphadenopathy was present in 9 cases (18%). Signs seen in HLM cases are depicted in (Table 4).

Complete blood count (CBC) of HLM cases

CBC were available for 45/49 cases only. In the present study, low haemoglobin was a common finding. The mean haemoglobin was 8.9 gm%. Fifteen patients presented with total WBC count between 11,000/cmm-50,000/cmm. Nine patients presented with a count higher than 50,000 of which maximum i.e. Eight patients were of leukaemia and 1 patient of lymphoma. Blasts in the peripheral blood were seen in 9/19 cases of leukemia (Figure 5 a, b and c). The mean platelets were 1.2 lac/cmm. Platelet count <20,000/cmm was present in 12 cases.

Table 4: Signs seen in HLM cases.

Signs	Number	Percent
Hepatomegaly	41	84
Splenomegaly	41	84
Pallor	27	55
Lymphadenopathy	09	18

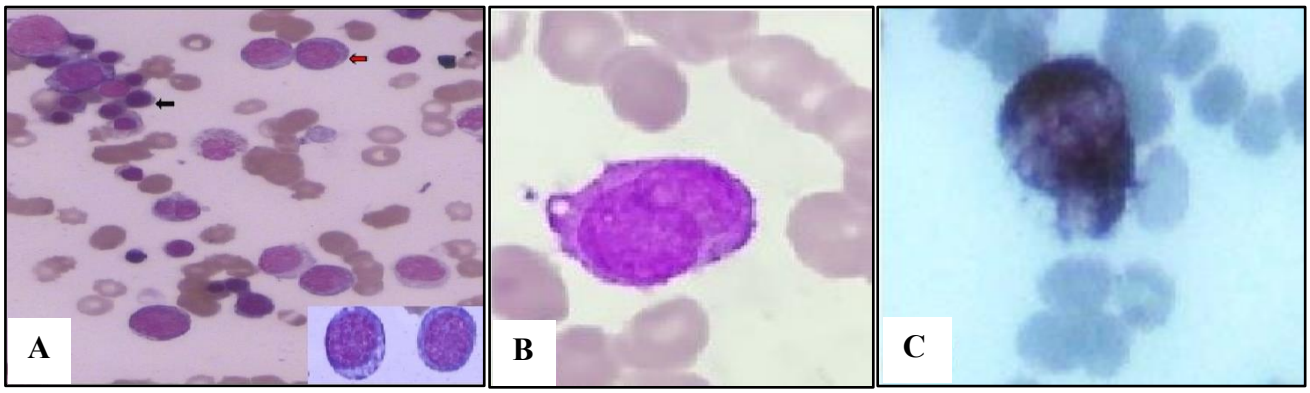

Figure 5: Peripheral Blood Smear showing myeloblasts and erythroid precursors in AML M6, inset shows erythroblasts (a). Peripheral Blood Smear shows myeloblasts in AML M3 (b) along with MPO stain showing positivity (c).

Salient gross findings in HLM cases

In in the present study, leukemic deposits in brain was seen in 1 case of ALL. Petechial hemorrhages were seen in sub-endocardial region of left ventricle in AML M6 (Figure 6). Enlarged liver was a consistent finding seen in 30 cases (61%). Splenomegaly was seen in 33 cases (67%). In GIT, tumour masses and deposits were seen in 14 cases (Figure 7).

Enlarged peripancreatic and mesenteric lymph nodes were found in 9 cases each. Hilar and paratracheal lymph nodes were enlarged in 7 cases and paraortic lymph nodes were enlarged in 3 cases. In 1 case of NHL (lymphoblastic type) receiving chemotherapy (CHOP regimen) enlarged fleshy red paraortic and mediastinal lymph nodes were present, the red colour was probably due to chemotherapy (Figure 8). Mediastinal masses were found in 4 cases (18%) of NHL which were soft, fleshy yellowish white. Hepatosplenomegaly was present in all three cases of myeloma. There was one case of LCH which showed hepatosplenomegaly, with nodules in liver and intestine and enlarged hemorrhagic lymph nodes at portahepatis. Salient gross findings in HLM cases in various organs are presented in Table 5.

Microscopic infiltration of various organs in HLM cases

In the present study, lymph nodes were available in 18 cases out of which 15 showed infiltrates (83%). Liver, spleen, lung, kidney, heart, CNS, stomach, intestine adrenals and pancreas were involved in 34, 32, 27, 26, 18, 17, 11, 17, 11 and 10 cases respectively. Lymph node infiltration was seen in 3 cases of AML and 3 cases of ALL. One case of CMPD, CLL, HL and LCH in our study showed infiltrates. Five cases of NHL showed lymph node infiltrates with total effacement of architecture with diffuse infiltration by tumour cells was seen.

There were 4 cases of ALL, 13 cases of NHL, all 7 cases of AML, 4 cases of CMPD and 1 case of CLL which showed liver infiltrates. 1 case of HL and all 3 cases of multiple myeloma and LCH were involved by infiltrates. The infiltrates were sinusoidal in 15 cases, periportal in 8 cases, both sinusoidal and portal in 7 cases and nodular aggregates in the parenchyma was seen in 4 cases. Spleen infiltration was seen in 7 cases of AML, 4 cases of ALL, 5 cases of CMPD and 1 case of CLL, 11 cases of NHL showed infiltrates; both our HL cases showed splenic infiltrates. 1 case of MM showed splenic infiltrates. There were 5 cases of AML, 4 cases of ALL and 9 cases of NHL which showed lung infiltrates. 3 cases of CMPD and 1 of CLL in our study showed infiltrates in lung. 2 cases of MM and 1 case of HL and LCH showed lung infiltrates. There were 6 cases of AML, 3 cases of ALL and 5 cases of NHL which showed infiltrates in heart. 3 cases of CMPD and 1 case of MM showed cardiac infiltrates. The infiltrates in heart were seen in the myocardium and epicardium. In 1 case of AML (M6) the AV node was involved leading to conduction pathway abnormality. In 1 case of PTLD there was lymphomatous extension in the interatrial septum, interventricular septum, AV valves and ventricular myocardium. Renal infiltrates were seen in 6 cases of AML, 4 cases of ALL, 9 cases of NHL, 3 cases of Multiple Myeloma, 4 cases of CMPD. Infiltrates in brain were seen in 5 cases of AML, 3 cases of ALL, 7 cases of NHL and 2 cases of CMPD. The CNS infiltrates were mainly seen in the parenchymal, meningeal vessels and in the Virchow Robin space.

Stomach infiltration was seen in 2 cases of AML, 2 cases of ALL, 1 case of CMPD, and 1 case HL showed infiltrates. In our study stomach in 5 cases of NHL. Small and large intestine infiltration was seen in 3 cases of AML, 3 cases of ALL and 1 case of CMPD. 9 cases of NHL shows infiltrates in small and large intestine. And 1 case of LCH in our study showed extensive large intestine involvement. BM sections were available in 39 cases. Out of the bone marrow sections which were available for study all cases of leukemia showed involvement of the bone marrow by leukemic cells. Both cases of HL had marrow involvement and all 3 cases of MM showed marrow involvement by plasma cells. In 17 cases of NHL, where BM was available, 14 showed infiltrates by lymphoma cells.

Final cause of death in HLM cases

In the present study, disseminated malignancy was the most common cause of death (51%) followed by acute respiratory distress syndrome (ARDS) with pulmonary oedema (14%). Infection, increased intra-cranial tension (ICT) with cerebral oedema constitute 10% cases each. Shock due to gastro-intestinal (GI) bleed and hemoperitoneum constituted 4%. Congenital heart diseases and thromboembolism constituted 4% each while conduction abnormality was seen in 2% cases. Various causes of death in HLM cases are presented in Table 6.

Table 5: Salient gross findings in HLM cases in various organs.

Organ	Gross findings	AML (n=7)	ALL (n =6)	CMPD (n=5)	CLL (n=1)	HL (n=2)	NHL (n=24)
CNS	Parenchymal deposits	_	01	_	_	_	_
Heart	Petechial hemorrhages	01	01	_	_	_	_
	Thrombus	_	_	01	_	_	_
	Deposits	_	_	_	_	_	02
Lungs	Thrombus	_	_	_	01	_	_
	Hemorrhage	01	02	_	_	_	07
	Bronchopneumonia	01	_	_	_	01	04
	Tumour mass(deposits)	_	_	_	_	_	02
Liver	Enlarged	06	01	03	_	02	14
	Deposits, mass	_	_	01	_	01	04
Spleen	Enlarged	06	03	03	_	02	16
	Infarction/ nodules/mass	01	01	_	_	02	03
Kidney	Enlarged/Swollen	03	01	01	_	_	02
	Deposits/mass	_	_	01	_	02	04
GI Tract	Deposits/masses	02	02	_	_	02	08
	Ulcers/hemorrhages	05	02	_	01	_	12

Special stains and immunohistochemistry

IHC was done in 15 cases of NHL. CD20 was positive in 7 cases (Figure 9). CD 5 was positive in 2 cases, CD 3, CD7, and CD 8 were positive in one case each. Tdt was positive in 1 case. MIB 1>99.1% was seen in 1 case of Burkitt Lymphoma (Figure 10). In both cases of HL, IHC was done and LCA, CD3, CD20, CD30 were positive. In case of LCH, CD1a and S100 were found to be positive. Myeloperoxidase stain was done in cases of leukemia and was positive in cases of AML.

Table 6: Final cause of death in HLM cases.

Final cause of death	Number	Percent
Disseminated malignancy	25	51
ARDS/pulmonary oedema	07	14
Infections	05	10
Increased ICT and cerebral oedema	05	10
Shock (GI bleed/hemoperitoneum)	02	4
Congenital heart diseases	02	4
Thromboembolism	02	4
Conduction abnormality	01	2

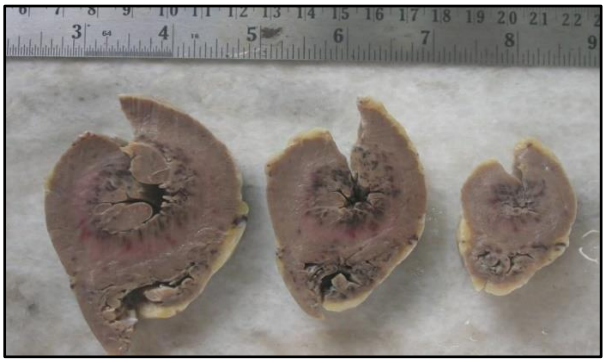

Figure 6: Left ventricle showing petechial hemorrhages in subendocardial region in AML M6.

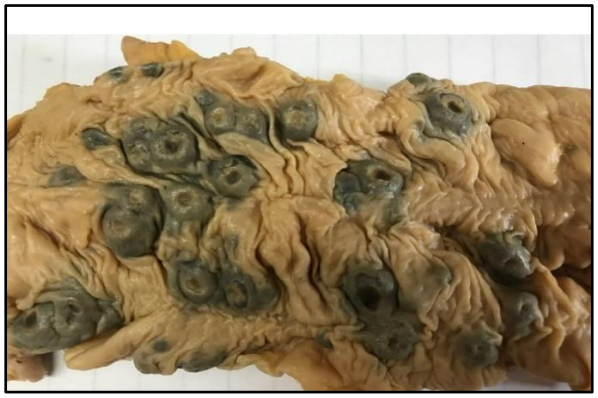

Figure 7: Large intestine showing multiple hemorrhagic ulcerated discrete nodules in AML M3.

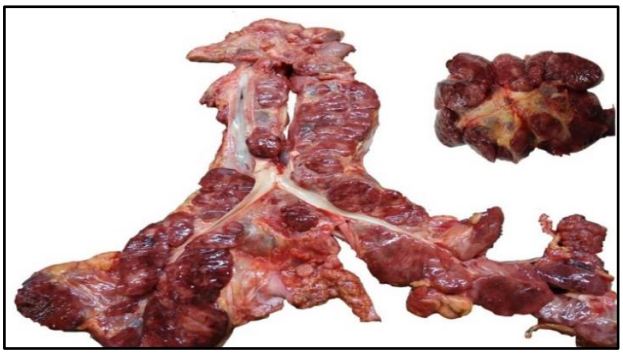

Figure 8: Large, multiple, matted, red and fleshy paraaortic lymphnodes in lymphoblastic lymphoma.

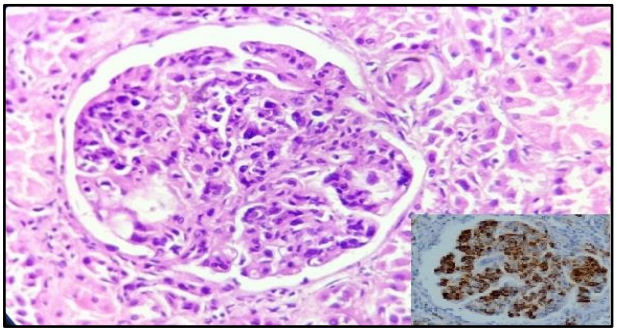

Figure 9: Kidney showing infiltration by large lymphoma cells within the glomerular capillaries in case of angiotropic lymphoma, inset shows CD 20 positivity.

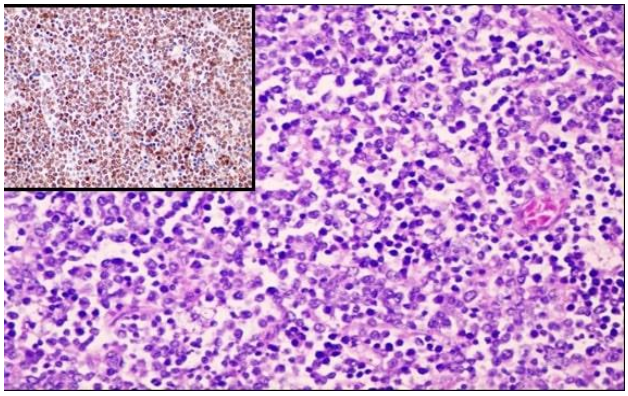

Figure 10: Lymph node in Burkitt lymphoma showing total effacement of architecture with diffuse infiltration by the lymphoma cells, inset shows MIB 1 > 99%.

DISCUSSION

Incidence of autopsies with a diagnosis of HLM

In the present study, out of 4971 autopsy records, 49 (0.9%) records were with hematolymphoid malignancies. This was in the coherence with findings of Saraf SR et al,

(48/4378 (1.09%)) and those by Dierksen et al, (30/1522 (2%)).[3,4] However, the time duration for the collection of cases was different for the above said studies. This difference was seen due to the different record databases used for pooling the cases.

Age wise distribution of HLM cases

The mean age in the present study was 36 years. This finding for the mean age from the study conducted by Xavier et al. was 46.5 years.[1] This can be attributed to the different pool for cases.

Gender wise distribution of HLM cases

In the present study, 34 patients (69%) were males and 15 patients (31%) were females. Male preponderance was seen in the types of cases. Similar findings were seen with the studies conducted by Saraf SR et al, (81.25% males) and Barcoset et al, (62% males).[4,5] This can be due to homogeneous pool from which cases were taken.

Types of HLM cases

At autopsy, out of the 49 autopsies of HLM cases, 26 cases were of lymphomas of which 24 cases were of Non-Hodgkin lymphoma (NHL) and two were Hodgkin lymphoma (HL). There were 19 cases of leukemia, 7 cases were acute myeloid leukemia (AML), 6 cases were acute lymphoid leukemia (ALL), 5 cases were chronic myeloproliferative disorder (CMPD) and rest 1 case was chronic lymphoid leukemia (CLL). This was in concordance with studies by Xavier et al and Dierksen et al, who also found NHL as the most common entity in HLM cases 18.6% (22 cases) and 63% (19 cases) respectively.[1,3] However, in a study by Saraf et al, had a contrasting finding having AML as the most common of HLM cases accounting for 21% (n=10) cases followed by NHL which was 16.6% (08 cases).[4]

Distribution of lymphoma cases

Out of the total 26 lymphoma cases, two cases were of Hodgkin lymphoma, both were clinically suspected /diagnosed. Out of 24 NHL cases, nine were detected at autopsy. Out of 24 NHL cases, nine were of diffuse large B cell lymphoma (DLBCL) followed by lymphoblastic lymphoma (5 cases). This was in concordance with the autopsy studies by Dierksen et al, who also found DLBCL to be the largest among the NHL accounting to 47.3%.[3]

Distribution of leukemia cases

Leukemia was found to be the next common malignancy following the lymphoma cases, in the present study. Out of 19 cases of leukemia, 13 were of acute-6 ALL and 7 AML while 6 were chronic leukemia - 5 CMPD and 1 CLL. Of these 19 cases, 5 (1 ALL, 2 AML and 2 CMPD) were diagnosed after autopsy. However, in the study by Saraf et al. of the 24 leukemia cases there were 10 AML, 6 ALL, 7 CML and 1 CLL. Of these 24 cases, 9 cases (3 AML, 3 ALL and 3 CML) were detected at autopsy.[4] This finding cannot be generalized as the current study has got a very homogeneous pool of cases and they are very few in number.

Detection of the HLM cases post autopsy

In in present study, in total 15 (31%) cases were detected after autopsy was performed. These cases were not clinically suspected or diagnosed ante-mortem. This finding was similar to autopsy study by Saraf SR et al, where 16 cases (33.3%) out of 48 cases were diagnosed after post mortem examination.[4] In similar studies by Dierksen et al, also 14 out of 30 patients (47%) were detected at autopsy.[3]

Clinical parameters (symptoms, signs) of HLM cases

Fever was the most common presenting feature in present study seen in 43% patients. Saraf et al, also found fever to be the most common presenting symptom, although the incidence was higher (87.5%). In present study 84% patients were found to have hepatomegaly and splenomegaly on clinical examination followed by pallor (27 patients (55%)). This finding was in concordance with studies by Idris et al.[6]

Complete blood count (CBC) of HLM cases

CBC were available for 45/49 cases only. In the present study, low haemoglobin was a common finding. The mean haemoglobin was 8.9 gm%. Fifteen patients presented with total WBC count between 11,000/cmm-50,000/cmm. Nine patients presented with a count higher than 50,000 of which maximum i.e. 8 patients were of leukemia and 1 patient of lymphoma. Blasts in the peripheral blood were seen in 9/19 cases of leukemia. The mean platelets were 1.2 lac /cmm. Platelet count <20,000/cmm was present in 12 cases. Similar findings were also seen in studies by Dierksen et al.[3]

Organ involvement (both gross and microscopic infiltration) in HLM cases

Brain

CNS infiltrates on microscopy in present study were seen in 36% cases which was similar to autopsy studies by Bojsen-Moller et al, in which infiltrates in CNS were seen in 45% cases.[7]

Heart

In the present study, heart involvement was seen in 39% cases which is in concordance with studies by Johnson et al.[8] In the current study microscopic infiltration of cardiac tissue was seen in 5 cases of AML, 3 cases of ALL, 2 cases of CMPD. CLL in present study did not show

infiltrates in cardiac tissue which was comparable but higher with studies by Barcos et al, showing cardiac tissue infiltration in 15% AML, 21% ALL cases, 11% CML and 22% CLL.[5] Cardiac infiltration in 1 case of AML (M6) involving the AV node presented with conduction abnormality and cardiac failure which is a very rare phenomenon as described in studies by Johnson et al and Wierniket al.[8,9] In the present study 1 case of PTLD showed extensive lymphomatous extension in interatrial septum, summit of interventricular septum, atrioventricular valves and ventricular myocardium which is a rare phenomenon.

Liver

Hepatomegaly was seen in all cases of AML, CMPD, HL, 1 out of 6 cases of ALL and 4 out of 24 cases of NHL. Tumour nodule in the liver was seen in 1 case of CML and HL each, and 4 cases (18%) of NHL.

Liver infiltration was seen in 74% cases in the present study. 4 out of 6 cases of ALL, all cases of AML, CMPD and CLL showed liver infiltrates. This was concordant but slightly higher than autopsy studies by Barcos et al, in which liver was involved in 41% AML, 55% CML, and 63% ALL and 83% CLL. [5] In studies by Murakami et al, showed liver infiltration in 95% of ALL and up to 75% of AML.[10] One case out of 2 cases of HL and 13 cases out 24 cases of NHL had liver infiltrates. This was slightly higher than studies by Murakami et al, where liver infiltration was seen in 14% of HL and 16% to 43% of NHL.[10] All three cases of MM shows infiltration by plasma cells in the liver which was concordant with studies by Cohen et al, wherein it as seen in 45% of cases.[11]

Kidney

Renal involvement in the present study was seen in 57% cases which was similar to studies by Luciano et al and Brewster et al, where renal infiltration was seen in 60-90% cases.[12] Tumour deposits and mass were seen in 1 case of CMPD, 2 cases of HL and 4 cases of NHL. In the present study, renal infiltration was seen in 5 cases of AML, 4 out of 6 cases of ALL. All cases of CMPD showed kidney infiltrates while CLL did not show infiltrates. Studies by Barcos et al, showed renal infiltration in 33% cases of AML, 54% of ALL cases, 34% CML and 63% CLL which was similar but slightly lower than in the present study cases of NHL showed infiltrates, and both our HL cases did not show renal infiltrates.[5,9] Autopsy studies by Richmond J et al, showed renal infiltrates to be present in 46% NHL and 13% HL.[13]

Lungs

Tumour deposits in the lung were seen in 2 cases of NHL. Lung infiltrates on microscopy in present study was seen in 59% cases. It was seen in 5 cases of AML, 4 cases of ALL. All cases of CMPD and CLL in present study showed infiltrates which was higher than studies by Barcos et al, which showed lung infiltration in 28% AML, 41% ALL, 29% CML and 41% CLL.[5]. 9 cases of NHL and 1 case of HL showed lung infiltrates which was in concordance with the studies by Richmond J et al. 2 cases of MM showed lung infiltrates also seen in autopsy studies by Oshima et al and Ravinet et al.[14,15]

Lymphoreticular system

In the present study, enlarged spleen was seen in 33 cases (67%). It was seen in all 7 cases of AML, 3 cases out of 6 cases of ALL, 16 cases out of 24 cases of NHL and all cases of HL and CMPD. Other findings were splenic nodules and mass seen in 1 case out of 7 cases of AML, 1 out of 6 cases of ALL, 3 out of 24 cases of NHL and both our cases of HL. In the present study spleen infiltration was seen in 70% cases which included AML, ALL, CMPD while CLL did not show any infiltrates. In studies by Barcos et al, splenic infiltration was seen in 58% cases of AML, 70% of ALL cases, 68% CML and 76% CLL.[5] 11 cases of NHL showed infiltrates; both our HL cases showed splenic infiltrates which was similar to studies by Richmond J et al, showing splenic infiltrates in 46% NHL and 71% HL.[13]

One case out of 3 cases of MM showed splenic infiltrates in the present study which was higher than studies by Oshima et al, where splenic infiltrates were seen in 30.8% cases.[14] Lymph Node involvement in present study was seen in 15 out 18 cases which included all cases of AML, 3 cases of ALL, 1 case of CMPD and CLL each. In studies by Barcos et al, lymph node infiltration was seen in 45% cases of AML, 55% of ALL cases, 59% CML and 76% CLL which was concordant with our studies.[5] Five cases of NHL and 1 case of HL showed lymph node infiltrates which was lower than studies by Richmond J et al, wherein lymph nodes were involved in 96% NHL and 99% HL.[13] LCH in the present study, splenic and lymph node involvement as seen in studies by Goyal et al and Haupt et al.[16,17]

GI tract

In the present study, tumour masses and deposits were seen in 2 cases of AML, 2 cases of ALL, 2 cases of HL and 8 cases of NHL. GI tract involvement in the present study was seen in 61% cases which was comparable to the autopsy studies by Kirshbaum JD et al, and Maher JA et al, wherein the infiltration varied between 13%-62%.[18,19] In the present study stomach infiltration was seen in 2 cases out of 7 cases of AML, 2 cases out of 6 cases of ALL, 1 case out of 5 cases of CMPD which was higher than studies by Barcos et al, showing infiltration in 11% AML, 17% ALL, 11% CML and CLL each.[5] Involvement of stomach was seen in 1 case of HL and 2 cases of NHL which was similar to autopsy studies by Richmond J et al.[13] Small and large intestine infiltration was seen in 3 cases out of 7 cases of AML, 3 cases out of

6 cases of ALL and 1 case out of 5 cases of CMPD which was higher than studies by Barcos et al, showing infiltration in 15% AML, 20 % ALL, 09% CML and 15% CLL.[5] Nine cases of NHL show infiltrates in small and large intestine which was concordant with studies by Herrmann et al[20]. LCH in the present study showed extensive large intestine involvement while the pancreas in present study was normal which was concordant with studies by Keeling et al and Harries et al.[21]

Final cause of death in HLM cases. In the present study, disseminated malignancy was the most common cause of death (51%) followed by acute respiratory distress syndrome (ARDS) with pulmonary oedema (14%). These findings were in concordance with the autopsy studies by Dierksen et al.[3] The present study was conducted in a single institute. Multicenter studies in similar context would shed more light on the subject. We have collected data from only one institute; therefore, population is relatively homogenous.

CONCLUSION

Present study highlights the spectrum of pathological changes seen in various organs in hematolymphoid malignancies. One third cases i.e. 31% cases in present study were diagnosed primarily at autopsy that were neither clinically suspected nor diagnosed ante-mortem, thereby emphasizing on the relevance of autopsy in the current practice of pathology, despite declining autopsy numbers.

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