

# Clinicohaematological Study of Leukaemias at a Tertiary Care Centre, Vindhya Region of India: A Cross-sectional Study

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## ABSTRACT

**Introduction:** Leukaemia is characterised by widespread proliferation of leucocytes and their precursors in the body tissues and is usually associated with qualitative and quantitative changes in circulating white blood cells. The global burden of leukaemia is increasing.

**Aim:** To study the morphology of leukaemia from Peripheral Blood Smears (PBS) and/or bone marrow smears and evaluate the clinical and haematological profile of leukaemia patients.

**Materials and Methods:** This prospective observational study was conducted in a Tertiary Care Centre of the Vindhya region, in the Department of Pathology at Shyam Shah Medical College, Rewa, Madhya Pradesh, India. The study was carried out over a period of one year, from June 2019 to June 2020. A total of 90 newly diagnosed cases of all types of leukaemia during the study period. Detailed history, physical examination, complete blood counts, and bone marrow examinations were performed to confirm the diagnosis. Cytochemistry was used for the diagnosis and classification of acute leukaemia according to the French-American-British (FAB) classification. The data was compiled and analysed using appropriate statistical methods,

and the mean was described with Standard Deviation (SD). Statistical significance was assessed using Analysis of Variance (ANOVA) test conducted with Statistical Package for Social Sciences (SPSS) version 22.0.

**Results:** The study included 90 cases of all types of leukaemia, with a mean age of 36.5±22.5 years. There was a male preponderance in the study, with 65 (72.2%) males and 25 (27.8%) females, resulting in a male-to-female ratio of 2.6:1. Chronic Myeloid Leukaemia (CML) was the most common malignancy, accounting for total 40 (44.4%) cases. Non specific symptoms such as fever in 50 (55.6%), weight loss 49 (54.4%), and loss of appetite 42 (46.7%) cases were the most common symptoms across all types of leukaemia. Acute leukaemia also presented with leukopenia and normal leucocyte counts, while chronic leukaemia mostly showed markedly elevated Total Leucocyte Count (TLC) with a mean count of 1,30,912±63,792 per mm<sup>3</sup>.

**Conclusion:** Light microscopic features of peripheral smear and bone marrow examination still play an important role in the diagnosis of leukaemia, especially in resource-poor health centres lacking immunotyping and cytogenetics.

**Keywords:** Acute leukaemia, Chronic leukaemia, Lymphoid, Myeloid

## INTRODUCTION

Rudolf Virchow coined the term "leukaemia" in 1847. It is characterised by widespread proliferation of leucocytes and their precursors in the body tissues and is usually associated with qualitative and quantitative changes in circulating White Blood Cells (WBC) [1]. According to the Global Burden of Disease (GBD) study, the incidence of leukaemia increased by 26% from 2006 to 2016. In 2016, there were 467,000 new cases of leukaemia diagnosed and 310,000 reported deaths [2]. The most common acute leukaemia in the adult population is Acute Myeloid Leukaemia (AML) [3]. The incidence of AML is approximately 1.3 per 100,000 population for adults under 65 years of age, which increases to 12.2 per 100,000 for adults over 65 years. Prognosis has significantly improved for younger patients due to advancements in treatment options. However, prognosis for the elderly population remains poor [4].

Chronic leukaemias are more commonly observed in older adults. Patients may be incidentally diagnosed due to an increased WBC count found during a Complete Blood Count (CBC) performed for unrelated reasons. Approximately 50% of CML patients and 20% of Chronic Lymphocytic Leukaemia (CLL) patients are asymptomatic. Bleeding and bruising are less common in chronic leukaemias [5,6]. The present study emphasised the importance of light microscopic examination of peripheral smear and bone marrow in the diagnosis of leukaemia, particularly in resource-poor settings lacking immunotyping, cytogenetics, and other advanced molecular methods for leukaemia evaluation. Hence, the present study aimed

to study the morphology of leukaemia from PBS and/or bone marrow smears and to evaluate the clinical and haematological findings in these patients.

## MATERIALS AND METHODS

The present study was a prospective observational study conducted at a Tertiary Care Centre in the Vindhya region, specifically in the Department of Pathology at Shyam Shah Medical College, Rewa, Madhya Pradesh, India. The study included 90 cases of all types of leukaemia, which were diagnosed over a period of one year, from June 2019 to June 2020. Institutional Ethical Clearance was obtained (No: 9440/SS/PG/MC/2019).

**Inclusion criteria:** All age groups and newly diagnosed cases of leukaemia in the hospital were included in the study.

**Exclusion criteria:** Patients undergoing leukaemia treatment were excluded from the study.

## Study Procedure

Patients from Outpatient Departments (OPD) and Inpatient Departments (IPD) who met the inclusion criteria during the study period were enrolled in the study. The procedure and purpose of the study were explained to the patients in their language, and written informed consent was obtained. In the case of paediatric patients, consent was obtained from their legal guardian or parents. A complete clinical and haematological evaluation was conducted. Cases with suspicious clinical findings underwent peripheral smear

and bone marrow aspiration to confirm the diagnosis and were then included in the study. Cytochemistry was performed for cases provisionally diagnosed with acute leukaemia.

**Complete Blood Count (CBC):** The Sysmex autohaematology analyser (5 parts) was used for analysing the samples. The TLC was cross-verified using an improved Neubauer's chamber.

**Peripheral Blood Smear (PBS) examination:** Leishman-stained blood smears were examined under the microscope to confirm the haematological values provided by the automated analyser and to further study the morphology of cells. The Magnus MLX-B plus inclined binocular microscope was used in the present study.

**Bone marrow aspiration:** Bone marrow aspiration smears were stained with Leishman stain and examined under the microscope. After analysing peripheral blood/bone marrow smears, the diagnosis was made based on the World Health Organisation (WHO) criteria for blast percentage. Staging of CML was also performed based on WHO criteria [7]. Anaemia was classified by severity based on Haemoglobin (Hb) levels into mild (11.0 to 11.9 g/dL), moderate (8 to 10.9 g/dL), and severe anaemia (less than 8 g/dL) [8].

**Special stains:** Myeloperoxidase (MPO), Periodic Acid Schiff (PAS), Non specific Esterase (NSE), and acid phosphatase were used in cases of acute leukaemia. The FAB classification was used to subclassify Acute Lymphoblastic Leukaemia (ALL) and Acute Myeloid Leukaemia (AML) [9].

## STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS software version 22.0. The ANOVA test was used to determine statistical significance, and a p-value <0.05 was considered statistically significant with a 95% Confidence Interval (CI).

## RESULTS

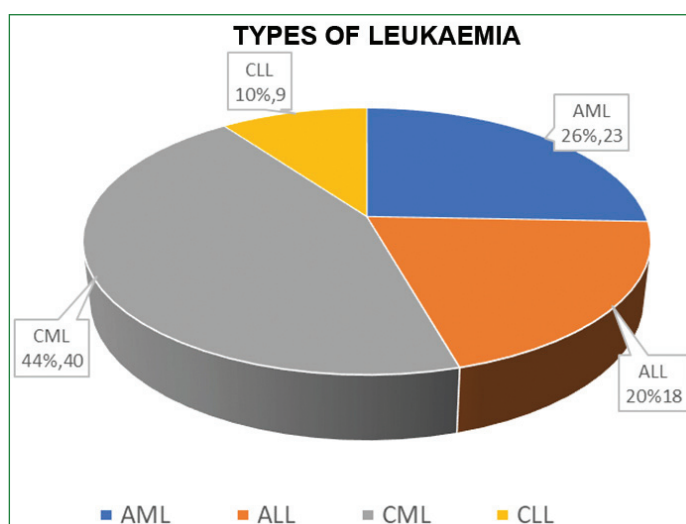
The present study was conducted on 90 newly diagnosed cases of leukaemia. The mean age of the study participants was 36.5±22.5 years. There was a male preponderance in the study, with 65 (72.2%) males and 25 (27.8%) females, resulting in a male:female ratio of 2.6:1. The age and gender distribution of various types of leukaemia are presented in [Table/Fig-1].

Age group (in years)	AML n (%)	ALL n (%)	CML n (%)	CLL n (%)	Total n (%)
0-18	8 (8.88)	16 (17.77)	1 (1.11)	0	25 (27.77)
19-60	13 (14.44)	2 (2.22)	30 (33.33)	6 (6.67)	51 (56.6)
>60	2 (2.22)	0	9 (10)	3 (3.33)	14 (15.55)
Total	23 (25.6)	18 (20)	40 (44.4)	9 (10)	90 (100)
Gender	AML	ALL	CML	CLL	Total
Male	16 (17.77)	12 (13.33)	30 (33.33)	7 (7.77)	65 (72.22)
Female	7 (7.77)	6 (6.66)	10 (11.11)	2 (2.22)	25 (27.77)

[Table/Fig-1]: Age and gender distribution of various leukaemias.

CML was the most common malignancy, accounting for 40 cases (44.4%). Overall, myeloid neoplasms were more common than lymphoid neoplasms, accounting for 63 cases (73%). Chronic leukaemias were slightly more prevalent than acute leukaemias, comprising 49 (54.4%) cases [Table/Fig-2]. The majority of the patients presented with complaints of fever 50 (55.6%) and weight loss in 49 (54.4%) cases. The most common clinical findings observed in the study group were pallor in 69 (76.7%) cases, followed by splenomegaly in 48 (53.3%) cases [Table/Fig-3]. Haematological profile of the various types of leukaemia found in the study as shown in [Table/Fig-4]. Detailed information regarding the types of leukaemia, along with their individual clinical and haematological findings, is described below.

Firstly, discussing AML, it accounted for approximately 23 (25.6%) cases. The mean age of patients was 31.6±19.14 years. The



[Table/Fig-2]: Distribution of various leukaemias.

Clinical features	AML n (%)	ALL n (%)	CML n (%)	CLL n (%)	Total n (%)
Fever	18 (78.2)	12 (66.67)	16 (40)	4 (44.4)	50 (55.6)
Weight loss	13 (56.5)	11 (61.1)	23 (57.5)	2 (22.22)	49 (54.4)
Loss of appetite	11 (47.8)	9 (50)	20 (50)	2 (22.22)	42 (46.7)
Bleeding tendencies	7 (30.4)	8 (44.4)	1 (2.5)	0	16 (17.8)
Pallor	23 (100)	18 (100)	24 (60)	4 (80)	69 (76.7)
Lymphadenopathy	6 (26.08)	9 (50)	13 (32.5)	2 (22.22)	30 (33.3)
Haepatomegaly	5 (21.7)	9 (50)	25 (62.5)	1 (11.1)	40 (44.4)
Splenomegaly	6 (26.08)	11 (61.1)	28 (70)	3 (33.3)	48 (53.3)
Sternal tenderness	0	4 (22.2)	15 (37.5)	0	19 (21.1)

[Table/Fig-3]: Frequency distribution of various presenting complaints and examination findings of leukaemic patients.

\*Percentages mentioned are with respect to that particular group

majority of the patients 51 (56.66%) were in the age group of 19-60 years [Table/Fig-1]. The most common subtypes were M3 and M4, each accounting for 7 (30.43%) cases. No cases belonged to the M0, M1, and M7 subtypes [Table/Fig-5]. The most frequent presenting complaints were fever in 18 (78.2%) cases, followed by weight loss in 13 (56.5%) cases. Some AML patients also exhibited lymphadenopathy in 7 (30.43%) cases, haepatomegaly 5 (21.7%), and splenomegaly in 6 (26.8%) cases upon examination [Table/Fig-2].

The Hb levels were below 8 g/dL in 13 cases (56.5%), resulting in pallor upon examination. The mean Hb level was 6.94±2.34 g/dL [Table/Fig-4]. A total of 2 (8.7%) cases of AML presented with leucopenia (TLC=<4000/mm<sup>3</sup>), and 12 patients (52.2%) had TLC levels above 50000/mm<sup>3</sup>. Since these patients also had anaemia and thrombocytopenia, it can be concluded that 8.7% of the patients presented with pancytopenia. A bone marrow aspirate smear of an AML-M2 patient, as shown in [Table/Fig-6], reveals blasts, promyelocytes, and band forms.

Of all the AML patients, 9% had normal leucocyte counts. For these patients, the diagnosis was made by examining the morphology of abnormal cells on peripheral smear and bone marrow smears. The majority of patients, nearly 82.6%, had elevated TLCs. Hyperleukocytosis, i.e., TLC >100,000/mm<sup>3</sup>, was observed in 4 (17.4%) patients. All these patients had low platelet counts, below 150,000/mm<sup>3</sup>. Approximately 50% of patients had platelet counts ranging from 20,000 to 50,000/mm<sup>3</sup> [Table/Fig-4].

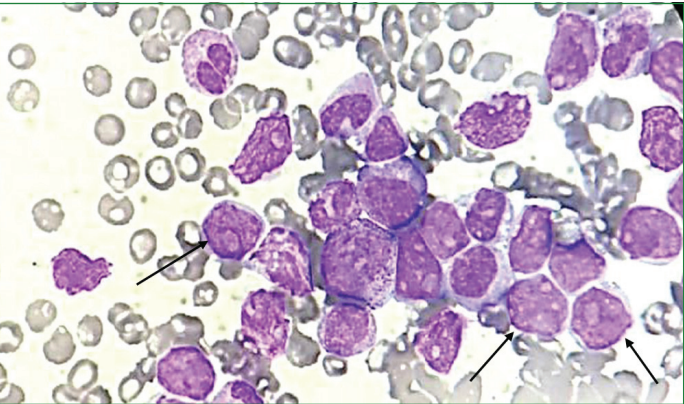
The ALL constituted 20% of all cases. The majority of the patients belonged to the paediatric age group. The mean age at diagnosis was 7.33±8.46 years [Table/Fig-1]. The male:female ratio was 2:1. Most of these patients exhibited blasts morphology of the L1 type [Table/Fig-7]. The most common presenting complaint was fever (66.67%), weight loss (61.1%), loss of appetite (50%), and bleeding

Haemogram	AML n (%)	ALL n (%)	CML n (%)	CLL n (%)	p-value*
Haemoglobin (Hb) (g/dL)					
11-11.9 (mild anaemia)	0	1 (5.5)	15 (37.5)	4 (44.4)	0.004
8-10.9 (moderate anaemia)	10 (43.5)	3 (16.7)	15 (37.5)	4 (44.4)	
<8 (severe anaemia)	13 (56.5)	14 (77.8)	10 (25)	1 (11.1)	
Total	23 (100)	18 (100)	25 (100)	9 (100)	
Mean haemoglobin±SD	6.94±2.34	6.58±2.29	9.64±2.26	10.2±2.43	
Total Leukocyte Count (TLC) (/mm³)					
<4000	2 (8.7)	8(44.4)	0	0	0.001
4000-12,000	2 (8.7)	0 (0)	0	0	
12,001-50,000	7 (30.4)	3 (16.7)	3 (7.5)	1 (11.1)	
50,001-1 lac	8 (34.8)	3 (16.7)	12 (30)	7 (77.8)	
>1 lac	4 (17.4)	4 (22.2)	25 (62.5)	1 (11.1)	
Total	23 (100)	18 (100)	40 (100)	9 (100)	
Mean TLC±SD	67473.91±61775	54910.67±64445	130912±63792	81840±50217	
Platelet count (/mm³)					
<20,000	3 (13.1)	3 (16.67)	0	0	0.001
20,000-50,000	11 (47.8)	6 (33.33)	4 (10)	2	
50,001-1,00,000	6 (26)	7 (38.9)	3 (7.5)	0	
1,00,001-1,50,000	3 (13.1)	2 (11.1)	8 (20)	1	
1,50,001-4,50,000	0	0	21 (52.5)	6	
>4,50,000	0	0	4 (10)	0	
Total	23 (100)	18 (100)	40 (100)	9 (100)	
Mean platelet count±SD	52000±36250	65111±61718	243200±228518	179556±98176	

[Table/Fig-4]: Haematological profile of leukaemia patients.  
\*Test of significance used is ANOVA test

S. No.	AML subtypes	No. of case s (n)	Percentage (%)
1.	M0	0	0
2.	M1	0	0
3.	M2	5	21.74
4.	M3	7	30.43
5.	M4	7	30.43
6.	M5	3	13.04
7.	M6	1	4.34
8.	M7	0	0
Total		23	100

[Table/Fig-5]: Distribution of morphological subtypes of AML (FAB criteria).



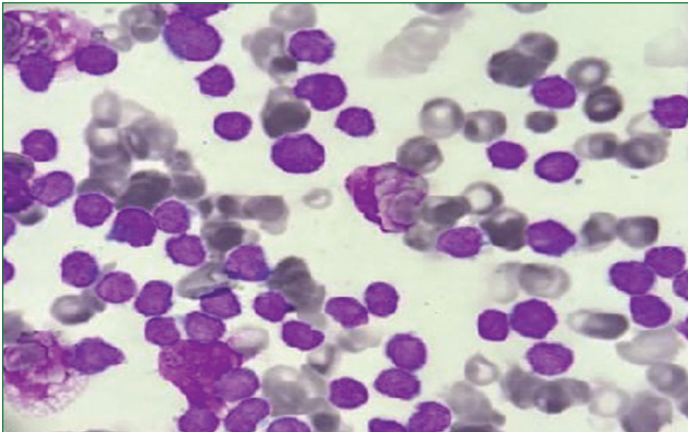
[Table/Fig-6]: Bone marrow aspirate smear in AML-M2 showing blasts (arrow), promyelocytes and band forms. Blasts show increased Nuclear: Cytoplasmic (N:C) ratio, round to oval, centrally placed nuclei and a thin rim of greyish blue cytoplasm. Nuclei show 2-3 prominent nucleoli (Leishman stain, 1000x).

tendencies (44.4%) in decreasing order. A total of 9 (50%) patients had haepatomegaly and lymphadenopathy, and 11 (60%) cases showed splenomegaly upon examination. Sternal tenderness was observed in 4 (22%) cases [Table/Fig-3]. Nearly 14 (78%) patients had Hb levels below 8 g/dL. The mean Hb was 6.58±2.29 g/dL.

All the patients exhibited pallor upon examination [Table/Fig-3]. Forty-five percent of patients had leucopenia. Hyperleukocytosis was observed in only 4 (22.2%) cases. The majority of the patients had platelet counts below 100,000/mm³ (n=7, 38.9%) [Table/Fig-4]. A peripheral blood smear picture of an ALL patient shows blasts with scant cytoplasm and delicate, finely stippled chromatin as shown in [Table/Fig-8].

S. No.	Subtype	No. of cases (n)	Percentage (%)
1.	L1	16	89
2.	L2	2	11
3.	L3	0	0
Total		18	100

[Table/Fig-7]: Morphological subtypes of ALL.



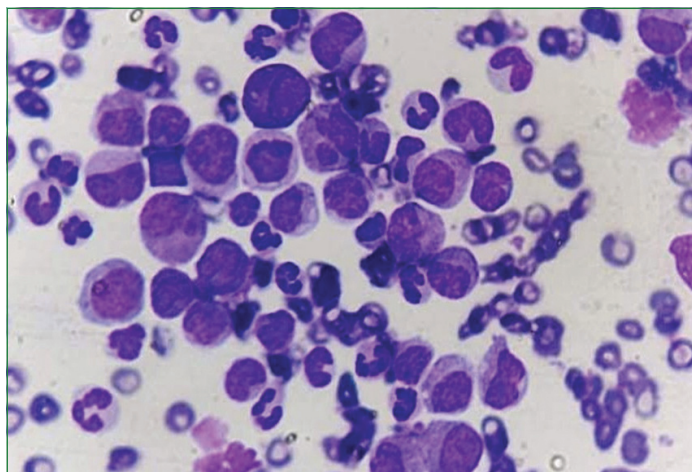
[Table/Fig-8]: Peripheral Blood Smear (PBS) in ALL-L1 showing blasts with scant cytoplasm and delicate, finely stippled chromatin. (Leishman stain, 1000x).

CML accounted for 40 (44.4%) cases, which was the most common type of leukaemia found in the present study. The mean age at diagnosis was 48.02±15.34 years [Table/Fig-1]. Most of the patients presented in the chronic phase 38 (95%), while 2 (5%)



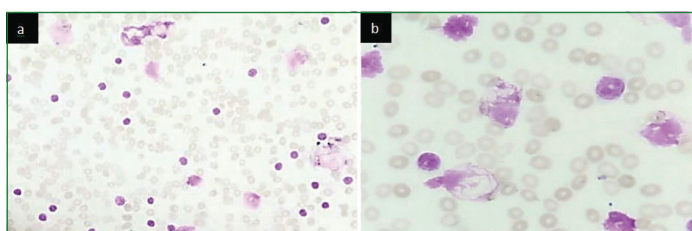
cases were in the accelerated phase, and no cases were observed in the blast crisis.

A male preponderance with an M:F ratio of 3:1 was observed. [Table/Fig-9] shows a PBS picture of CML. The most common presenting complaints were weight loss and loss of appetite, followed by fever and bony pains. Only 2% of the patients complained of bleeding diathesis. Lymphadenopathy was present in 32% of the patients. 60%-70% of the patients revealed hepatosplenomegaly [Table/Fig-3]. The mean Hb was higher than AML and ALL, i.e.,  $9.64 \pm 2.26$  g/dL. Only 25% of the patients had an Hb level below 8 g/dL. TLC count was above  $1 \text{ lac/mm}^3$  for most of the patients 25 (62.5%), unlike acute leukaemias. Platelet counts were also on the higher side, with the majority of the Patients ( $n=25$ , 62.5%)  $>1,50,000$  platelet/ $\text{mm}^3$  [Table/Fig-4].



**[Table/Fig-9]:** Peripheral Blood Smear (PBS) of CML in chronic phase showing premature cells of myeloid lineage, comprising mainly of myelocytes (myelocytic bulge), band forms and neutrophils. Leishman stain, 1000x.

Chronic lymphocytic leukaemia was the least common leukaemia in the present study, accounting for only 9 (10%) cases. The mean age at diagnosis was  $56.11 \pm 16.05$  years [Table/Fig-1]. The M:F ratio was 3.5:1. More than half of the patients were asymptomatic and were incidentally diagnosed after getting a CBC done for some other complaint/disease. Among the symptomatic ones, fever, weight loss, and loss of appetite were the common complaints. None of them presented with an abnormal bleeding history or bony pains. Hepatomegaly was seen in nearly 10% of cases, while splenomegaly was observed in 30%. Lymphadenopathy was observed in only 22% of cases [Table/Fig-3]. The mean Hb was  $10.20 \pm 2.43$  g/dL. Only one out of nine had severe anaemia. The majority of the patients 7 (77.8%) cases had TLC between 50,000 to  $1 \text{ lac/mm}^3$ . Platelet count was mostly above  $1,50,000/\text{mm}^3$  25 (62.5%) [Table/Fig-4]. A PBS picture of a CLL patient shows mature lymphocytes with abundant smudge cells [Table/Fig-10a,b].



**[Table/Fig-10]:** Peripheral Blood Smear (PBS) in CLL with predominantly mature lymphocytes (soccer ball lymphocytosis) and abundance of smudge cells (Leishman stain, 400x (a) and 1000x (b) respectively).

Bone marrow findings revealed a maximum blast count for acute leukaemias ranging anywhere from  $>20\%$  to 99% in peripheral blood/bone marrow. Chronic leukaemias revealed a blast cell count of  $<5\%$ , except in the accelerated phase of CML (where it was around 15%-19%).

## DISCUSSION

The study revealed CML as the most common malignancy, accounting for 40 (44.4%) cases. This could be due to the chronic nature of CML and earlier diagnosis facilitated by accurate and more affordable diagnostic tools, as well as increased physician awareness. Similar results were also found in studies conducted by Rathee R et al., (2014), Baviskar JB, (2016), and Ahirwar DR et al., (2018). Studies by Ahmad S et al., Kinjal B and Gautam C, and Priya J et al., also reported CML as the most common malignancy. However, studies by Khakhlari N et al., and Sansiya BS and Patel D showed AML as the most common malignancy in their study groups, with frequencies of 46.67% and 36.7%, respectively [Table/Fig-11] [10-17].

Other studies with place and duration of which data was analysed	No. of cases (n)	ALL (%)	AML (%)	CML (%)	CLL (%)
Rathee R et al., at Rohtak, India. 2008-2012 [10]	650	17.2	33.8	39	10
Baviskar JB at Maharashtra, India. 2006-2011* [11]	156	26.28	23.07	33.97	15.38
Ahirwar R et al., at Bhopal, India. 2013-2014† [12]	73	31.51	15.07	47.97	1.37
Ahmad S et al., at Lucknow, India. 2013-2015 [13]	286	6.30	40.60	43.80	9.8
Kinjal B and Gautam C at Bhavnagar, India. 2016‡ [14]	165	21.21	18.17	30.3	10.3
Priya J et al., at Ajmer, 2014-2016 [15]	132	32	23	35	10
Khakhlari N et al., Assam, India. 2017§ [16]	204	22.54	46.07	21.57	5.39
Sansiya BS and Patel D at Bhavnagar, India 2018-2020 [17]	98	20.5	36.7	30.6	12.2
Present study at Rewa, India. 2019-2020	90	20	25.6	44.4	10

**[Table/Fig-11]:** Comparison of various studies in leukaemia and their frequency distribution in percentage [10-17].

\*Of the remaining 1.28%, 0.64% each was for Juvenile Myelomonocytic Leukaemia (JMML) and Chronic Myelomonocytic Leukaemia (CMML); †The remaining 4.11% of the cases were undiagnosed and referred to higher centre; ‡The remaining 20.60% belongs to that of acute leukaemia that cannot be typed; §The remaining 4.41% were of Mixed Phenotypic Acute Leukaemia (MPAL)

The increased incidence of all leukaemias in males seems to be due to increased exposure to occupational and environmental carcinogens, as suggested by Bhutani M et al., (2002) [18].

## Acute Myeloid Leukaemia (AML)

The majority of the patients (56.5%) in the present study were adults, with a mean age of presentation of  $31.6 \pm 19.14$  years. Similar results were also found in studies carried out by Preeti CR and Chang F et al., [19,20]. The present study showed that M3 and M4 were the most common subtypes of AML, while M0 and M7 were the less common subtypes. Preeti CR and Chang F et al., (2016) also reported findings that were consistent with the present study [19,20]. The most common presenting complaints were fever (78.2%) and weight loss (56.5%). Approximately 25% of patients had lymphadenopathy and organomegaly (enlarged spleen and liver) upon examination. Similar results were found in studies carried out by Rathee R et al., Asif N and Hassan K, and Hassan K et al., [10,21,22]. Pallor was observed in all patients upon examination. Preeti CR, Hassan K et al., and Ghosh S et al., also reported that the majority of their patients presented with pallor [19,22,23]. Leukocytosis was seen in 82% of AML patients in the present study. A study carried out by Chang F et al., showed leukocytosis in 84% of patients [20]. All patients in the present study had platelet counts below  $1,50,000/\text{mm}^3$ . Thrombocytopenia is an important finding in AML and has been well observed in previous studies on AML by Preeti CR, Chang F et al., and Asif N et al., [19-21].

### Acute Lymphoid Leukaemia (ALL)

Most of the ALL patients in this study presented in the first decade of life, as has also been reported by Van Steensel Moll NA et al., Monge P et al., and Clavel J et al., [24-26]. 50% of the patients in the present study had hepatomegaly and lymphadenopathy, while 60% revealed splenomegaly upon examination. Kulkarni KP and Marwaha RK observed similar results, with hepatomegaly in 49.54% of patients, lymphadenopathy in 45.04%, and splenomegaly in 50.45% [27]. Pallor (100%) and fever (66.67%) were the two most common presenting features in the present study, which was also reported by Nayyar A and Ahmed S (2013) [28]. In the present study, 44% of cases showed a TLC of less than 4000/mm<sup>3</sup>. A study carried out by Ahirwar R et al., (2018) showed 39% of ALL patients with leukopenia [12]. Acute leukaemia may often present with leukopenia and/or pancytopenia, thus requiring a careful examination of cell morphology on PBS and bone marrow aspiration smears. Most of the patients in the present study had a platelet count below 1,00,000/mm<sup>3</sup>, with nearly 17% of the patients showing platelet counts below 20,000/mm<sup>3</sup>. Studies by Ahirwar R et al., Nayyar A, and Ahmed S also reported similar results [12,28].

### Chronic Myeloid Leukaemia (CML)

The mean age in the present study was higher than in previous studies. This may be attributed to geographical and demographic variations. Most of the patients in this study presented in the chronic phase of CML. Chang F et al., also reported that the majority of patients presented in the chronic phase [29]. Weight loss (57.5%), loss of appetite (50%), and fever (40%) were common complaints in the present study. Millot F et al., also reported weight loss as a common finding in CML [30]. The common presentation of fever was confirmed by Sinha R et al., [31]. Nearly 70% of patients presented with abdominal discomfort and distension, and examination revealed hepatosplenomegaly. Chang F et al., (2015) reported that 84% of patients presented with symptoms due to splenomegaly, while Sinha R et al., (2019) observed that 85.9% of patients presented with splenomegaly [29,31]. Splenomegaly is, therefore, a common finding in all phases of CML.

The mean Hb in the present study was 9.64±2.26 gm/dL. This closely correlates with the studies carried out by Chang F et al., which reported a mean Hb of 9.5±2.9 g/dL, and Deb P et al., which reported a mean Hb of 10 g/dL [29,32]. The majority of patients in the present study (nearly 63%) had a TLC above 100,000/mm<sup>3</sup>. Studies by Sinha R et al., and Ahmed R et al., have also reported patients presenting with markedly elevated White Blood Cell (WBC) counts [31,33]. An elevated TLC count is, therefore, an important finding in CML and is more commonly seen than in acute leukaemia. The majority of patients (52.5%) had platelet counts within the normal range (150,000-450,000/mm<sup>3</sup>). Nearly 17.5% of patients had platelet counts below 100,000/mm<sup>3</sup>, and 10% presented with platelet counts above 450,000/mm<sup>3</sup>. CML can, therefore, present with normal platelet counts or with thrombocytopenia or thrombocytosis.

### Chronic Lymphocytic Leukaemia (CLL)

The mean age at diagnosis was 56.11±16.05 years. Zeeshan R et al., reported a mean age of 59.0±9.2 years [34]. The majority of the patients were above 55 years at the time of diagnosis. Agrawal N et al., also reported a similar finding [35]. Nearly 50% of the patients were asymptomatic and were incidentally diagnosed after a complete blood count (CBC) examination for some other ailment. The symptomatic patients presented with non-specific complaints such as fever, weight loss, and loss of appetite. These findings were also observed in studies by Zeeshan R et al., and Agrawal N et al., [34,35].

The mean Hb level was 10.20±2.43 g/dL. Zeeshan R et al., reported a mean Hb of 10.8±2.4 g/dL [34]. The mean Hb levels for chronic leukaemia were higher than those for acute leukaemia in the present

study. All the patients in this study had elevated WBC counts ranging from 48,600/mm<sup>3</sup> to 2,10,000/mm<sup>3</sup>. Zeeshan R et al., also observed a similar range for the Total Leucocyte Count (TLC) [34]. The majority of patients had platelet counts within the normal range. Platelet counts below 100,000/mm<sup>3</sup> were seen in 22% of the patients in the present study. Agrawal N et al., reported that 18% of patients had platelet counts below 100,000/mm<sup>3</sup> [35]. Acute leukaemia often presents with serious and life-threatening complications due to severe anaemia, thrombocytopenia, and leukopenia. Patients with acute leukaemia are more prone to serious infections and bleeding diathesis, and therefore warrant special attention. Chronic leukaemia, on the other hand, has a less worrisome presentation. Hence, a long-term cohort study with a sufficient sample size and evaluation using cytogenetic and molecular markers will provide a better understanding of leukaemias and guide further research.

### Limitation(s)

The sample size of the present study was small. Cytogenetic, karyotyping, or any other molecular studies could not be performed due to issues of unavailability and affordability at the Institution. Diagnosis is mainly based on morphological features and response to special stains.

### CONCLUSION(S)

In the present study, it was concluded that the distribution of different types of leukaemia in Rewa does not differ markedly from the rest of the Indian population. Chronic leukaemia was more common than acute leukaemia, with CML being the most common type overall as well as in adults. In the paediatric age group, ALL was found to be the most common, with L1 being the most common subtype. Male patients were found to be more affected. Fever, weight loss, and pallor were the common clinical features. CBC revealed a raised leucocyte count (>12,000/cumm) in chronic leukaemias, while acute leukaemias showed decreased Hb and platelet count. The TLC in acute leukaemias is lower compared to chronic leukaemias. The present study highlights that the light microscopic features of peripheral smear and bone marrow play an important role in the diagnosis of leukaemia, especially at resource-poor health centres lacking immunotyping and cytogenetics.

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#### PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Feb 20, 2023
- Manual Googling: May 18, 2023
- iThenticate Software: May 22, 2023 (9%)

#### ETYMOLOGY: Author Origin

#### EMENDATIONS: 7

#### AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: Feb 19, 2023

Date of Peer Review: Apr 15, 2023

Date of Acceptance: May 23, 2023

Date of Publishing: Oct 01, 2023