



Original Article

Diagnostic significance of Peripheral Blood Smear in the Initial evaluation of Various Leukemias

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ABSTRACT

Background: Peripheral blood smear (PBS) examination mainly used in the initial evaluation of hematological disorders. PBS continues to provide rapid and valuable microscopic findings, especially in limited resource.

Aim: To assess the diagnostic utility of peripheral blood smear examination in the early detection and classification of different types of leukemia.

Materials and Methods: A retrospective observational study was conducted on 60 cases of leukemia at Sir T Hospital Bhavnagar, between 1st January 2025 to 15 September 2026 to assess the morphological subtypes, gender distribution, age at diagnosis, laboratory parameters, and clinical features of leukemia.

Results: Chronic Myeloid Leukemia (33.33%) was the most common subtype followed by Acute Myeloid Leukemia (31.6%). Weakness was the most frequent presenting feature. Peripheral blood smear findings, including the presence of blasts, smudge cells, and basophilia, played a significant role in the initial diagnosis of leukemia.

Conclusion: Peripheral blood smear examination is a rapid, cost-effective, and accessible diagnostic modality that plays an important role in the early detection and morphological classification of leukemia.

Keywords: Peripheral blood smear; Leukemia; Blast, Basophilia.

INTRODUCTION

Leukemia comprises a group of clonal hematopoietic malignancies characterized by abnormal proliferation of white blood cells in the bone marrow and peripheral circulation. Leukemias are broadly classified into acute and chronic forms, which differ in their clinical presentation, disease progression, prognosis, and therapeutic management. Acute leukemias—require urgent intervention. Peripheral blood smear (PBS) examination remains an important initial diagnostic investigation in the evaluation of leukemia. It provides valuable morphological information, including the identification of blast cells, assessment of lineage, and recognition of characteristic findings such as Auer rods, smudge cells, and basophilia. In addition, PBS findings facilitate correlation with clinical and hematological parameters, help guide further diagnostic investigations, and may support early initiation of appropriate management. Advances in flow cytometry, cytogenetic analysis, and molecular diagnostics have substantially enhanced the classification and prognostic assessment of leukemias.

The present study aimed to evaluate the diagnostic utility of peripheral blood smear examination in various types of leukemia and to assess the association between morphological findings and relevant clinical and demographic parameters.

MATERIALS AND METHODS

Study Design: Retrospective descriptive observational study. Study Setting: Tertiary care center, Sir T Hospital Bhavnagar

Study Duration: 1st January 2025 to 15 September 2026.

Study Population: 60 cases of leukemia.

Data Collection

- Age and gender

- Clinical presentation
- Hematological parameters
- Peripheral smear findings

Peripheral Smear Examination

- Blood samples were collected in EDTA vials.
- Peripheral blood smears were prepared using standard procedures.
- Smears were stained with Giemsa stain and Field stain.
- Smears were examined under light microscopy.

RESULTS

A total of 60 cases were analyzed.

Table 1: Distribution of leukemia according to types

Diagnosis	No. of Cases	Percentage
Acute Myeloid Leukemia	19	31.6%
Acute Lymphoid Leukemia	08	13.3%
Chronic Myeloid Leukemia	20	33.3%
Chronic Lymphoid Leukemia	05	8.3%
Acute Leukemia(Unclassified)	08	13.3%
Total	60	100%

The most common leukemia observed was CML (33.3%), followed by AML (31.6%).

Table 2: Distribution of various leukemia according to gender

Diagnosis	Male	Female	Total
Acute Myeloid Leukemia	11	08	19
Acute Lymphoid Leukemia	04	04	08
Chronic Myeloid Leukemia	17	03	20
Chronic Lymphoid Leukemia	05	00	05
Acute Leukemia(Unclassified)	05	03	08
Total	42	18	60

There was a male predominance (70%) compared to females (30%). This trend across leukemia subtypes may reflect gender-related susceptibility or differences in healthcare access.

Table 3: Distribution of various leukemia according to age

Age (Years)	AML	ALL	CML	CLL	Acute Leukemia(Unclassified)	Total
<10	02	07	00	00	01	10
11–20	01	02	01	00	00	04
21–30	03	02	04	00	02	12
31–40	03	00	03	00	00	06
41–50	01	01	08	00	00	10
51–60	04	00	01	03	00	08
61–70	00	00	02	01	00	03
>70	00	00	02	02	01	05

CML appeared more frequent among young to middle-aged adults, while CLL was predominantly observed in older individuals. ALL was more commonly observed in children under 10 years, whereas AML showed a broader age distribution. These findings represent patterns observed in the study population and were broadly consistent with previously described age-related distributions of leukemia.

Table 4: Clinical manifestation

Presenting Feature	AML	ALL	CML	CLL	Acute Leukemia (Unclassified)	Total
Fever	04	04	04	00	04	13
Weakness	06	06	10	01	01	24
Pallor	03	02	03	00	01	09
Bleeding	02	00	00	00	00	02
Splenomegaly	01	00	09	00	00	01
Lymphadenopathy	02	01	00	08	00	03

Abdominal pain	01	01	03	01	02	08
Total	19	14	29	10	08	60

Weakness was the most frequently reported presenting complaint (40%) in the study population. Lymphadenopathy noted more frequently in CLL and splenomegaly in CML. Bleeding manifestations were less commonly reported but remained clinically relevant findings.

Table 5: CML cases distribution according to phase

CML Phase	No. of Cases	Percentage
Chronic Phase	19	90%
Accelerated Phase	00	00%
Blast Crisis Phase	01	10%
Total	10	100%

The majority of CML cases (80%) were diagnosed in the chronic phase. This finding may indicate that a substantial proportion of patients were identified before progression to advanced disease. The presence of blast crisis in a subset of cases, however, suggests that some patients may present at a more advanced stage of disease.

Table 6: AML subclassification

AML Subclass	No. of Cases
Acute Promyelocytic Leukemia	02
Acute Leukemia	15
AML M5	01
AML M3	01
Total	19

Acute Leukemia was the most commonly seen. Presence of APML cases is clinically significant due to its distinct treatment and prognosis.

Table 7: Peripheral smear findings

Key Peripheral Smear Finding	No. of Cases
Blast	48
Auer rods	02
Smudge cells	05
Left shift	01
Basophilia	04
Eosinophilia	05
Schistocytes	05
Total	70

Blasts were the most frequent finding (48 cases), confirming their central role in diagnosing acute leukemias. Smudge cells were characteristic of CLL, while basophilia was strongly associated with CML. Auer rods, though less frequent, provided evidence of myeloid lineage.

Table 8: Frequency of laboratory indices in various leukemia

Parameter	Range	No of cases	%
Total WBC count/mm ³	<4000	7	11.6
	4000-11000	4	6.6
	11000-50000	16	26.6
	50000-100000	10	16.6
	100000-200000	12	20
	>200000	11	18.3
Hemoglobin (g/dl)	<6	17	28.3
	6.1-10	28	46.6
	10.1-12	15	25
Platelet count/mm ³	<20000	32	53.3
	20000-100000	16	26.6
	>100000	12	20
Blast % on peripheral smear	<20	15	25
	21-89	28	46.6

	90 or above	17	28.3
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Cases (11.6%) had leucopenia. Anemia was detected in leukemia patients. Severe degree of anemia in 28.3% of cases (hemoglobin < 6 g/dL), and 46.6% had moderate degree of anemia (hemoglobin: 6.1–10 g/dL), while 25% cases had mild anemia.

A total of 12 patients (20%) showed platelets count more than 100,000/mm³, 16 cases (26.6%) showed 20,000 and 100,000/mm³, 32 cases (53.3%) showed platelets count less than 20,000/mm³. Fifteen cases (25%) showed blasts less than 20%, 28 cases (46.6%) showed blasts between 21 and 89%, and 17 cases (28.3%) showed blasts more than 90%.

FIGURE LEGENDS

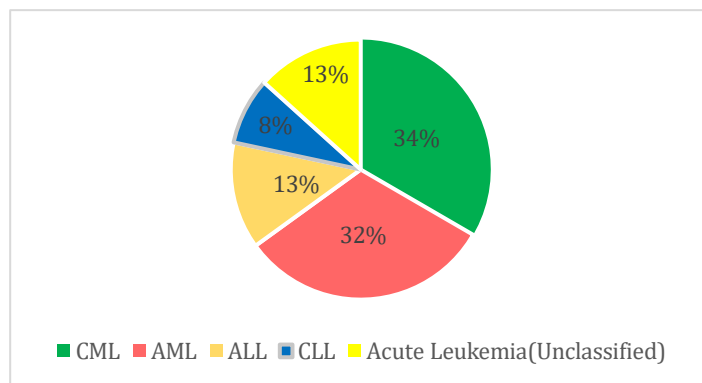


Figure 1: Various types of leukemia

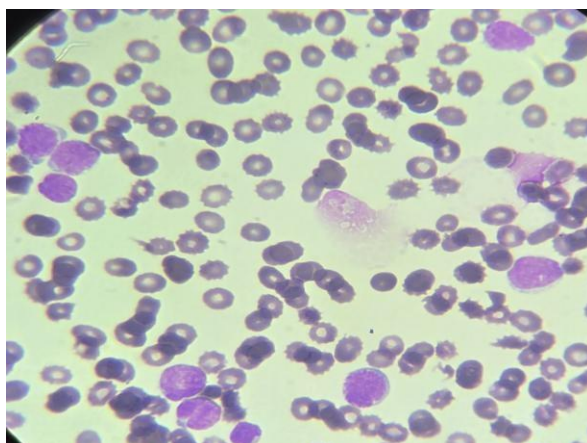


Figure 2: Acute lymphoblastic leukemia: Blasts having high N:C ratio. 1–2 inconspicuous nucleoli are seen. (Field stain, 100×10x)

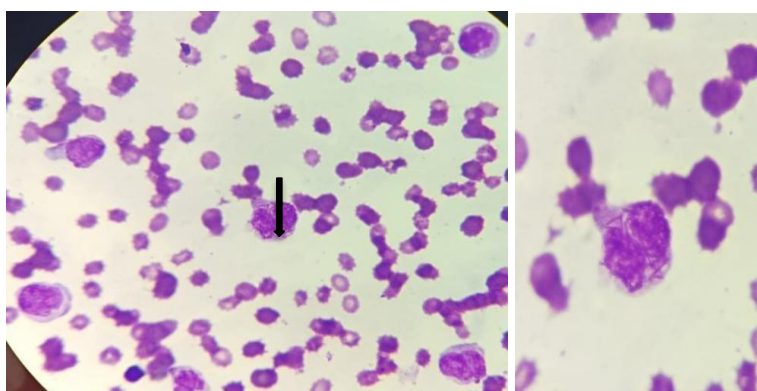


Figure 3: Acute promyelocytic leukemia: Promyelocytes with Auer rods are seen. Faggot cells are also seen. (Field stain, 100×10x)

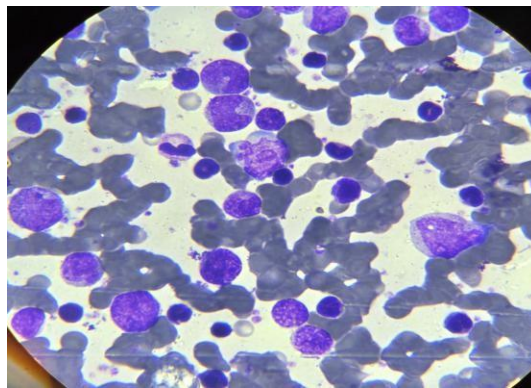


Figure 4: Chronic myeloid leukemia: Myelomonocytic bulge is seen. (Field stain, 100×10x)

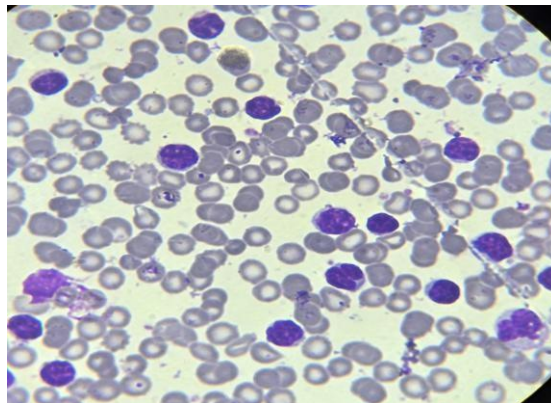


Figure 5: Chronic lymphocytic leukemia: Many mature lymphocytes are seen. (Field stain, 100×10x)

DISCUSSION

The present study highlights the diagnostic value of peripheral blood smear examination in the initial evaluation of leukemia. Peripheral blood smears provide a readily accessible means for direct morphological assessment of circulating blood cells, estimation of the hematological disease burden, and identification and characterization of abnormal or atypical cell populations. In this study, leukemia cases were analyzed according to morphological subtype, sex, age at diagnosis, seasonal variation, and geographic distribution.

One of the important challenges encountered in the present study was the accurate subtyping of acute leukemias based solely on peripheral blood smear findings. Although morphological examination provides valuable preliminary diagnostic information, definitive lineage assignment and classification often require correlation with flow cytometric immunophenotyping, cytogenetic analysis, and molecular investigations. Therefore, peripheral smear morphology should be regarded as an essential initial diagnostic tool, while integration with ancillary investigations is necessary for accurate classification and comprehensive characterization of acute leukemias.

The predominance of CML observed in this study followed by AML and ALL similar findings seen on Ahirwar R3, Jaya Bhaskar Baviskar⁴ contrast findings seen in Radha Rathee¹ and Pai, et al⁵. The high proportion of acute leukemia cases emphasizes the importance of timely diagnosis and prompt treatment to optimize patient outcomes. Male predominance noted in this study has been consistently reported in hematological malignancies. Similar gender distribution was observed in our study, which is consistent with the findings of Shridhar et al².

The age distribution observed in the present study was broadly consistent with the established epidemiological patterns of leukemia. ALL showed a predominance in the pediatric age group, whereas CLL was more frequently observed among elderly individuals. CML was observed in a relatively younger age group in the present study compared with the age distribution commonly reported in. This variation may reflect differences in demographic characteristics, disease presentation, referral patterns, and population-specific epidemiological factors.

Clinical presentation in leukemia is often nonspecific. In present study weakness being the most common complain reflects anemia due to marrow infiltration. Lymphadenopathy and splenomegaly are important clinical clues that help narrow the differential diagnosis the pattern of clinical presentation differed from that reported by Prachi Bhatt et al. Peripheral smear findings played a decisive role in diagnosis. Blasts enabled identification of acute leukemias. Auer rods confirmed myeloid origin. Smudge cells were highly suggestive of CLL. Basophilia strongly pointed toward CML. In our study, anemia is the most common hematological abnormality followed by thrombocytopenia and leucocytosis.

These morphological features not only aid in diagnosis but also help prioritize further confirmatory tests such as bone marrow examination and immunophenotyping.

In resource-limited settings, where advanced diagnostics may be delayed, PBS serves as an invaluable frontline tool. It enables early clinical decision-making and initiation of supportive therapy.

CONCLUSION

Peripheral blood smear examination continues to be an indispensable diagnostic modality in hematology. It is rapid, cost-effective, and widely accessible; provides crucial morphological insights; enables early diagnosis and classification of leukemias; and guides further diagnostic and therapeutic interventions.

Even in the era of advanced technologies, PBS remains a cornerstone in the initial evaluation of leukemia.

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