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Profile of Acute Leukemia and Its Correlation with Morphological Diagnosis

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Abstract

Acute leukemia is a rapidly progressing hematological malignancy characterized by the uncontrolled proliferation of immature blood cells. It is broadly classified into two major subtypes: acute myeloid leukemia (AML) and acute lymphoblastic leukemia (ALL). The early and accurate diagnosis of acute leukemia is vital for initiating appropriate treatment and improving patient outcomes. Morphological diagnosis, through blood smears and bone marrow biopsies, remains the cornerstone of leukemia classification, although immunophenotyping, cytogenetic analysis, and molecular studies also play significant roles. This study aims to profile the clinical and morphological characteristics of acute leukemia and assess the correlation between the morphological features and definitive diagnosis. The study included a analysis of 100 patients diagnosed with acute leukemia at a tertiary care hospital, in department of pathology. The findings were categorized by cell lineage, morphology, and associated clinical features. A significant correlation was found between morphological characteristics such as blast count, cytoplasm appearance, and nuclear features with the subtypes of leukemia. This study emphasizes the role of morphological assessment as a fundamental tool in the diagnosis and classification of acute leukemia, providing a valuable adjunct to molecular and cytogenetic tests.

Keywords: Acute leukemia, morphological diagnosis, acute myeloid leukemia, acute lymphoblastic leukemia, blast cells, hematology.

Introduction

Acute leukemia is one of the most critical hematological conditions, and it is defined by the rapid accumulation of immature white blood cells, or blasts, in the bone marrow and peripheral blood. Acute leukemia typically presents with symptoms such as fatigue, fever, pallor, easy bruising, and recurrent infections, all of which are due to impaired hematopoiesis caused by the overwhelming expansion of leukemic cells.

The two major subtypes of acute leukemia are acute myeloid leukemia (AML) and acute lymphoblastic leukemia (ALL). AML arises from the malignant transformation of myeloid progenitor cells, while ALL results from the transformation of lymphoid progenitor cells. These subtypes exhibit significant differences in terms of cell lineage, morphology, and clinical presentation.

The diagnosis of acute leukemia relies heavily on morphology, which involves examining blood smears and bone marrow aspirates or biopsies. The examination reveals features such as the size of blasts, nuclear-to-cytoplasm ratio, nucleoli, and cytoplasmic granules that help differentiate between the subtypes of leukemia. Although molecular and cytogenetic studies have become more integral in leukemia diagnosis, morphology remains a valuable and cost-effective tool, particularly in resource-limited settings.

Morphological analysis of blood and bone marrow samples is crucial not only in diagnosing

leukemia but also in subclassifying the disease into specific types. For instance, the identification of Auer rods, a characteristic feature of AML, or the presence of distinct cytoplasmic markers in ALL, can provide insights into prognosis and treatment response. This study aims to analyze the profile of acute leukemia and correlate its morphological features with the definitive diagnosis.

Aim:

To assess the clinical profile of acute leukemia and explore the correlation between morphological features and definitive diagnosis.

Objectives:

1. To evaluate the clinical characteristics of patients with acute leukemia.
2. To correlate the morphological findings of acute leukemia with immunophenotypic and cytogenetic diagnoses.

Materials and Methods:

This is a cross-sectional study conducted over a period of 2 years, including 100 patients diagnosed with acute leukemia at a tertiary care hospital. Data was collected from patient records, including clinical presentation, laboratory results, and morphological examination findings from peripheral blood smears and bone marrow aspirates.

Inclusion Criteria:

- Patients with confirmed diagnosis of acute leukemia (AML or ALL).
- Patients who had undergone bone marrow aspiration and peripheral blood smear examination.
- Patients with adequate clinical and laboratory documentation for analysis.

Exclusion Criteria:

- Patients with chronic leukemia or other hematologic malignancies.
- Incomplete clinical or laboratory data.
- Patients who did not undergo bone marrow examination or peripheral blood smear analysis.

Morphological Examination: Peripheral blood smears and bone marrow aspirates were stained with Wright-Giemsa stain for initial examination. Key morphological features including blast cell percentage, nuclear and cytoplasmic characteristics, and presence of cytoplasmic granules or Auer rods (in AML) were documented. Additional tests, such as immunophenotyping and cytogenetic studies, were performed to confirm the diagnosis and further classify the leukemia.

Statistical Analysis: Data were analyzed using descriptive statistics to determine the frequency of various morphological features and their correlation with leukemia subtypes. Cross-tabulation and chi-square tests were used to assess the relationship between clinical presentation, morphological findings, and final diagnosis.

Results:

Table 1: Demographic Profile of Patients with Acute Leukemia

Parameter	Frequency (%)
Gender	
Male	60%
Female	40%
Age Group	
< 20 years	15%
20 - 40 years	25%

41 - 60 years	40%
> 60 years	20%
Type of Leukemia	
Acute Myeloid Leukemia (AML)	70%
Acute Lymphoblastic Leukemia (ALL)	30%

Description: The majority of the patients in this study were male (60%), with the most common age group being 41-60 years (40%). AML was more prevalent than ALL, with a ratio of 7:3.

Table 2: Morphological Features of Acute Leukemia

Feature	AML (%)	ALL (%)
Blasts in Peripheral Blood (%)	90%	85%
Nucleoli in Blasts (%)	80%	60%
Auer Rods (%)	40%	0%
Cytoplasmic Granules (%)	60%	20%
Infiltration of Bone Marrow (%)	100%	90%

Description: AML showed a higher incidence of Auer rods (40%) and cytoplasmic granules (60%), which were absent in ALL. The presence of nucleoli was more common in both subtypes but was more frequent in AML (80%).

Discussion:

Acute leukemia is characterized by the rapid proliferation of immature hematopoietic cells. The clinical presentation can be nonspecific, with symptoms such as fever, fatigue, pallor, and bleeding. Early diagnosis and differentiation between AML and ALL are crucial for appropriate management and prognosis.

Morphological examination plays a significant role in the initial classification of acute leukemia. In this study, 70% of the patients were diagnosed with AML, and 30% with ALL. The presence of blasts in peripheral blood and bone marrow was a common feature in both subtypes, although the morphology of the blasts varied between the two.

AML is typically associated with the presence of Auer rods, cytoplasmic granules, and a high blast count in peripheral blood. These features were evident in the majority of AML cases in our study, with 40% of cases exhibiting Auer rods and 60% showing cytoplasmic granules. On the other hand, ALL was characterized by lymphoblasts with a lower incidence of cytoplasmic granules, and no cases showed Auer rods. The nuclear features, such as nucleoli, were more prominent in AML than in ALL.

These findings emphasize the importance of detailed morphological examination, especially when ancillary tests such as immunophenotyping and cytogenetic analysis are not immediately available. In this study, the morphological diagnosis was consistent with the final immunophenotypic and cytogenetic diagnosis in most cases, highlighting the reliability of morphological examination in acute leukemia classification.

Conclusion:

The morphological features of acute leukemia, including the presence of Auer rods, cytoplasmic granules, and nucleolar characteristics, are essential in the initial diagnosis and differentiation of AML from ALL. While immunophenotyping and cytogenetic studies provide definitive classification, morphological analysis remains a valuable tool, especially in resource-limited settings. Early and accurate

diagnosis through morphological features can help initiate appropriate treatment and improve patient outcomes in acute leukemia.

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