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A Biological Perspective: Epidemiology of Acute Leukemia in Souss Massa

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Abstract **Original Research Article**

Acute leukemia is a type of blood cancer characterized by the rapid and uncontrolled proliferation of abnormal immature cells in the bone marrow. It is divided into two main forms: acute lymphoblastic leukemia (ALL) and acute myeloid leukemia (AML). Common symptoms include severe fatigue, paleness, easy bleeding and bruising, frequent infections, bone and joint pain, as well as swollen lymph nodes. Acute lymphoid and myeloid leukemias account for 10 to 15% of malignant hematological disorders and are rare conditions, with the majority having a poor prognosis, except for a few specific forms. Acute myeloid leukemias (AML) have a consistent incidence over time, ranging from 2.5 to 3.5 per 100,000 population per year in Western countries. We conducted a retrospective descriptive study on the medical records of patients with acute leukemia between January 2023 and June 2024 (6 months), classified according to the criteria of the Franco-American-British (FAB) group. During this period, 68 cases of acute leukemia were diagnosed. The age of the patients ranged from 4 years to 87 years, with a mean age of 26 years. The male-to-female sex ratio was 1.40, favoring males. Acute leukemias were observed across all age groups. Cytological and cytochemical examination of bone marrow smears showed a predominance of acute myeloid leukemias at 64.7% (n=44), with 24 cases of acute lymphoblastic leukemias (35.3%). The study results provide valuable insights into the demographic and clinical characteristics of patients with acute leukemias. No precise statistics on acute leukemia have been conducted to date in our region. Our study could serve as a foundation for future research in this area. Indeed, the new WHO classification utilizes a comprehensive approach that incorporates cytological, cytogenetic, immunophenotypic, and molecular biology data to classify acute leukemias with both diagnostic and prognostic objectives. Outside of these distinguishing features, it can be challenging to predict whether a leukemia is acute lymphoblastic leukemia (ALL) or acute myeloid leukemia (AML) based solely on standard cytology and biology. More advanced techniques are often required to confirm the leukemia type and guide treatment decisions.

Keywords: Acute leukemia, Acute lymphoblastic leukemia (ALL), Acute myeloid leukemia (AML), Cytological examination, Prognosis.

INTRODUCTION

Acute leukemia is a type of blood cancer characterized by the rapid and uncontrolled proliferation of abnormal immature cells in the bone marrow. It is divided into two main forms: acute lymphoblastic leukemia (ALL) and acute myeloid leukemia (AML). Common symptoms include severe fatigue, paleness, easy bleeding and bruising, frequent infections, bone and joint pain, as well as swollen lymph nodes [1].

Acute lymphoid and myeloid leukemias account for 10 to 15% of malignant hematological disorders and are rare conditions, with the majority having a poor prognosis, except for a few specific forms. Acute myeloid leukemias (AML) have a consistent incidence over time, ranging from 2.5 to 3.5 per 100,000 population per year in Western countries.

Acute leukemias (AL) are hematological conditions characterized by the malignant proliferation and accumulation of a large number of clonal precursor

cells (blasts) from specific blood lineages. These blasts are blocked at a particular stage of differentiation and can be found in the bone marrow, blood, and sometimes other tissues [1-3]. Depending on the specific lineage affected, acute leukemias are further classified into acute myeloid leukemia (AML) and acute lymphoblastic leukemia (ALL) [4]. Advances in diagnostic techniques over the past two decades have enabled the differentiation of these two entities based on their morphological and cytochemical characteristics. In many developing countries, the diagnosis of leukemias relies on clinical and biological evidence [5].

The diagnosis of acute leukemia is based on blood tests, bone marrow examinations, and genetic tests. The standard treatment involves intensive chemotherapy to eliminate leukemic cells, followed by a possible bone marrow or stem cell transplantation.

The management of acute leukemia is complex and requires a specialized medical team. Treatment advances have significantly improved survival rates, particularly in children with acute lymphoblastic leukemia. However, treatment and prognosis vary depending on factors such as the type of leukemia, the patient's age, and the presence of specific genetic abnormalities but also the diagnosis efficency that helps to the accuracy and effectiveness of the diagnostic process in correctly identifying and classifying acute leukemia.

The objective of this study is to describe the epidemiological and cytological aspects of acute leukemia in 68 patients collected from private laboratories in the city of Agadir.

MATERIALS AND METHODS

We conducted a retrospective descriptive study on the medical records of patients with acute leukemia between January 2021 and December 2021 (12 months), classified according to the criteria of the Franco-American-British (FAB) group. During this period, 68 cases of acute leukemia were diagnosed.

Bone marrow samples were primarily collected from the clinical departments of various hospitals in the city. In adults, bone marrow was obtained from the sternum, while in children, it was obtained from the iliac crests. The collected bone marrow was directly spread onto slides.

Blood and bone marrow smears were stained with May Grünwald Giemsa and examined under an optical microscope by cytologists. The diagnosis was established in the presence of more than 20% blasts in the bone marrow. The myeloid or lymphoid origin of the blasts was determined based on cell morphology, including size, nucleo-cytoplasmic ratio, presence of nucleoli, cytoplasmic granulations, Auer rods, irregularity of the nucleus, and myeloperoxidase activity. Acute leukemias were cytologically classified according to the criteria of the Franco-American-British (FAB) cooperative group, which grouped acute myeloid leukemias into eight entities (AML M0 to AML M7) and acute lymphoblastic leukemias into three entities (ALL L1 to ALL L3). In our study, the specific type of acute lymphoid leukemia was not specified.

RESULTS

The age of the patients ranged from 4 years to 87 years, with a mean age of 26 years. The male-to-female sex ratio was 1.40, favoring males. Acute leukemias were observed across all age groups.

Cytological and cytochemical examination of bone marrow smears showed a predominance of acute myeloid leukemias at 64.7% (n=44), with 24 cases of acute lymphoblastic leukemias (35.3%). According to the classification of the FAB group, type M2 AML accounted for 36.8% of the cases (n=25). For AML there was a higher frequency among males (ratio=1.91).

In our series, 25% (n=17) of the 68 patients exhibited leukopenia, while 63% (n=42) showed leukocytosis. Among the cases of leukopenia, 58.8% were observed in patients diagnosed with Acute Lymphoid Leukemia (ALL).

In our study, 83.8% of the patients (n=57) were anemic, with 73% (n=49) experiencing erythroblastopenia. The values of erythrocyte indices such as mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC), and mean corpuscular hemoglobin (MCH) were within normal ranges.

Thrombocytopenia was noted in 79.4% of the patients (n=54), 28% (n=19) exhibited neutropenia, 61.7% (n=42) had lymphocytosis, and 44.1% (n=30) displayed monocytosis. No abnormalities were found in the coagulation profile for all the patients.

DISCUSSION

Acute lymphoblastic leukemias (ALL) have an incidence of approximately 1.5 per 100,000 population per year. They are more common in children, with an incidence exceeding 6 before the age of 4. The prognosis is better in children, with a 5-year survival rate of 90%, whereas it is only 35 to 40% in adults.

The age distribution of the patientsin our study, indicates that acute leukemias can affect individuals across a wide range of ages, from 4 years to 87 years. This finding underscores the importance of considering acute leukemia as a potential diagnosis in patients of various age groups. These results align with previous studies conducted in the literature.

The observed male predominance, with a male-to-female sex ratio of 1.40, suggests a potential gender difference in the incidence or presentation of acute leukemias. The higher incidence of acute leukemias in males, with a male-to-female sex ratio of 1.40, suggests that there may be a gender-related disparity in the occurrence or manifestation of this type of cancer. This observation indicates that males are more commonly affected by acute leukemias than females. This gender difference in incidence could be attributed to various factors. One possible explanation is the presence of biological or genetic factors that predispose males to develop acute leukemias. Hormonal variations between males and females, such as differences in levels of sex hormones like estrogen or testosterone, might potentially influence the development or progression of the disease. Also the environmental and lifestyle factors might contribute to this gender disparity. Occupational exposures or lifestyle behaviors, including smoking or exposure to certain chemicals, could be more prevalent in males and could elevate their risk of developing acute leukemias.

It is important to note that the precise causes of the observed male predominance in acute leukemias are not yet fully understood, and further research is necessary to explore and elucidate the underlying factors contributing to this gender difference.

Regarding the cytological and cytochemical findings, the study reveals a higher prevalence of acute myeloid leukemias (AML) compared to acute lymphoblastic leukemias (ALL). AML accounted for 64.7% of the cases, while ALL comprised 35.3%. The predominance of AML aligns with previous research indicating that AML is more common in adults compared to ALL, which tends to occur more frequently in children.

The classification of AML cases according to the FAB group highlights the prevalence of type M2 AML, which accounted for 36.8% of the cases. This subtype is characterized by the presence of abnormal promyelocytes and is often associated with a specific genetic abnormality known as the t(8;21) translocation. The higher frequency of AML in males, with a male-to-female ratio of 1.91, suggests a potential gender-related difference in the incidence or clinical features of AML.

The study also provides insights into the hematological abnormalities associated with acute leukemias. Leukopenia and leukocytosis were observed in a significant proportion of patients. Leukopenia was more common in patients diagnosed with ALL, indicating a potential association between this subtype of acute leukemia and reduced white blood cell counts. Anemia was a prominent feature, affecting 83.8% of the patients, with a majority experiencing erythroblastopenia. Thrombocytopenia, neutropenia, lymphocytosis, and monocytosis were also observed to varying degrees in the patient population.

The absence of abnormalities in the coagulation profiles of the patients is noteworthy, suggesting that coagulation disorders may not be a prominent feature in this particular cohort of acute leukemia patients.

CONCLUSION

The study findings shed light on important aspects of acute leukemias, including their demographic, cytological, and hematological characteristics. The results suggest that acute leukemias can affect individuals across a wide age range and indicate a potential gender disparity, with males exhibiting a higher prevalence. The study also highlights the predominance of acute myeloid leukemias over acute lymphoblastic leukemias, aligning with existing research on the incidence patterns in different age groups. The observed hematological abnormalities, such as leukopenia, anemia, and varying degrees of thrombocytopenia and neutropenia, provide valuable clinical insights.

Overall, these findings contribute to our understanding of acute leukemias, prompting further exploration of the underlying factors, including genetic, molecular, and environmental influences. By gaining a deeper understanding of the disease, we can advance the development of targeted treatment strategies and improve outcomes for patients with different subtypes of acute leukemias.

Outside of distinguishing features, it is difficult to predict whether it is acute lymphoblastic leukemia (ALL) or acute myeloid leukemia (AML) based solely on standard cytology and laboratory biology.

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