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Original Article

Role of Age and Sex on the Incidence of Leukemia in a Sample of Iraqi Patients

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Abstract

Background: Leukemia accounts for 8% of the total cancers in the population and is known as the world's fifth most common type. Leukemia is not just a pediatric disease as most people assume. The disease consists of four main types and several sub-types, and only some are more common among children. Leukemic cells affect the other types of blood cells produced by the bone marrow, including red blood cells and platelets. Leukemia is typically caused by certain genetic defects that cannot be changed. **Objectives:** To find if there is a correlation between sex and age with the incidence of leukemia. However, the majority of epidemiologic studies have shown links between leukemia incidence and potential risk factors, including ionizing radiation exposure and chemicals. They have also shown that some of these factors, like smoking, infections, and family history of cancer, are simply modifiable. Understanding pertinent risk factors may therefore be important for leukemia prevention and mitigation. **Materials and Methods:** The current study was conducted on 100 patients with leukemia of all kinds, who visited Baghdad Teaching Hospital in the Medical City complex in Bagdad, Iraq, from January to September 2022. The diagnosis was confirmed based on bone marrow aspiration, blood film, flow cytometry analysis of cells, and genetic analysis using PCR. **Results:** In the current study, the results showed that acute lymphocytic leukemia has the high-test prevalence (42%) among cases followed by acute myelogenous leukemia (30%), chronic lymphocytic leukemia (9%), chronic myelogenous leukemia (7%), hairy cell leukemia (5%), natural killer cell leukemia (4%), and mast cell leukemia (3%). There was a significant association between sex and leukemia incidence ($P = 0.009$). Also, there was a significant correlation between age and the incidence of leukemia ($P = 0.013$). **Conclusion:** There is a correlation between sex and age with the incidence of leukemia.

Keywords: ALL, AML, correlation, leukemia, risk factors

Introduction

Leukemia is estimated to account for 8% of all cancers in the world and is the world's fifth most common form of cancer. Cancers of the hematopoietic system include lymphatic system and bone marrow cancers, which develop from lymphocytes and other white blood cells (WBCs). WBCs normally grow and divide in an orderly and controlled manner in accordance with the needs of the body. However, leukemia disrupts this pattern, causing blood cell growth to spiral out of control. In acute leukemia, the bone marrow creates an abnormally large number of premature WBCs, and normal WBC production is brought to a halt, resulting in the reduction of the body's ability to fight the disease.[1,2]

Leukemic cells also affect the other types of blood cells produced by the bone marrow, including red blood cells and platelets. Leukemia is not just a pediatric disease, as most people assume. The disease consists of four main types and several sub-types, some of which are more common among children. Treatment of leukemia is very complicated and depends on age, health status, type of leukemia, and its spread rate.[3,4]

The most common type of leukemia in both adults and children is acute myelogenous leukemia (AML). Acute lymphocytic leukemia (ALL; the most common type of leukemia in children, accounting for nearly 80% of all

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children's leukemia), and chronic myelogenous leukemia (CML; usually develops in adults). Chronic lymphocytic leukemia (CLL; is the most common type of adult leukemia in which the patient may survive for years without treatment due to a Philadelphia chromosome abnormality that produces an abnormal gene called BCR-ABL). Such a kind of leukemia is more common in Russian and Eastern European Jews. According to global statistics, the above type of leukemia does not develop in children) and other chronic bone marrow disorders (these groups of diseases, like CML, develop chronic leukemia by producing very low or very high bone marrow cells). Chronic bone marrow disorders that result in acute bone marrow leukemia are bone marrow dysplasia and disorders associated with bone marrow tissue proliferation.[5,6]

Leukemia is typically caused by certain genetic defects that cannot be changed.[7] However, the majority of epidemiologic studies have shown links between leukemia incidence and potential risk factors, including ionizing radiation exposure and chemicals including hydrocarbons and pesticides. They have also shown that some of these factors, like smoking, infections, and family history of cancer, are also modifiable. Additionally, it appears that these potentially etiologic exposures affect clinical outcomes. Understanding risk factors may therefore be especially important for leukemia prevention and mitigation. Additionally, it should be noted that this could affect clinical management.[8,9]

Furthermore, several research studies have been done to investigate the possibility of synergistic interactions between genes, adverse outcomes, and external conditions with the incidence of leukemia in both adulthood and childhood. It appears that understanding leukemia etiology can be improved by examining the possible impact of several lifestyle and environmental factors such as diabetes, alcohol exposure, and environmental toxins, as well as maternal factors, such as age at pregnancy and birth weight, on genetic abnormalities.[6,8,9] The study's aim was to investigate the role of sex and age on leukemia incidence in Iraqi patients.

Materials and Methods

Study design and patients

The current study was conducted on patients with leukemia of different types, who visited Baghdad Teaching Hospital in Medical City Complex in Baghdad, Iraq, from January 2022 to September 2022. Patients' criterion of inclusion is a new diagnosis of leukemia by immunophenotype. Any patient with relapsed leukemia was excluded. All the necessary information was taken from each patient separately after being informed about the purpose of the study, and patients who did not agree were excluded. The study included 100 patients after applying the above criteria. The diagnosis was confirmed based on immunophenotype, bone marrow aspiration, blood film, and genetic analysis using PCR.[10]

The questionnaire included questions about age, sex, and a wide range of other characteristics that could pose risks, including personal medical and family history, history of aplastic anemia, Down syndrome, and mental illness like depression and anxiety. The blood smears were prepared and stained using Lishman and/or Giemsa stain in order to investigate the presence of transformed or abnormal cells in the studied cases.

Statistical analysis

The demographic data were presented as frequency and percentage, while the quantitative data were expressed as mean ± SD. Chi-square test was used to show the relation between qualitative and quantitative data. Statistical Package for the Social Sciences (SPSS) version 21.0 (SPSS, IBM Company, Chicago, IL, USA) and Microsoft Excel were used for statistical analysis of the study data. $P < 0.05$ was considered statistically significant.

Ethical approval

This study was approved by the Institutional Review Board of the College of Medicine at Ibn Sina University of Medical and Pharmaceutical Sciences, Baghdad, Iraq.

Results

In the current study, leukemia was classified into categories of "ALL, AML, CLL, CML, NK cell leukemia, mast cell leukemia, and HCL" in order to facilitate the statistical reporting and measurement form. The cases under study were diagnosed using several methods; however, the main step of diagnosis was the use of blood film that in turn revealed the presence of the transformed cells and the abnormal appearance of some blood elements that represent an indicator of leukemia [Figure 1].

The results showed that all had the highest prevalence (42%) followed by AML (30%), CLL (9%), CML (7%), hairy cell leukemia (HCL) (5%), natural killer (NK) cell leukemia (4%), and mast cell leukemia (3%). Table 1 shows the incidence of leukemia in the patients included in this study.

The results revealed a significant association between leukemia incidence and sex ($P = 0.009$) as the prevalence

Table 1: Incidence of leukemia in the patients included in the study

Type of leukemia	Frequency	%
ALL	42	42
AML	30	30
CLL	9	9
CML	7	7
HCL	5	5
NK cell L	4	4
Mast cell L	3	3

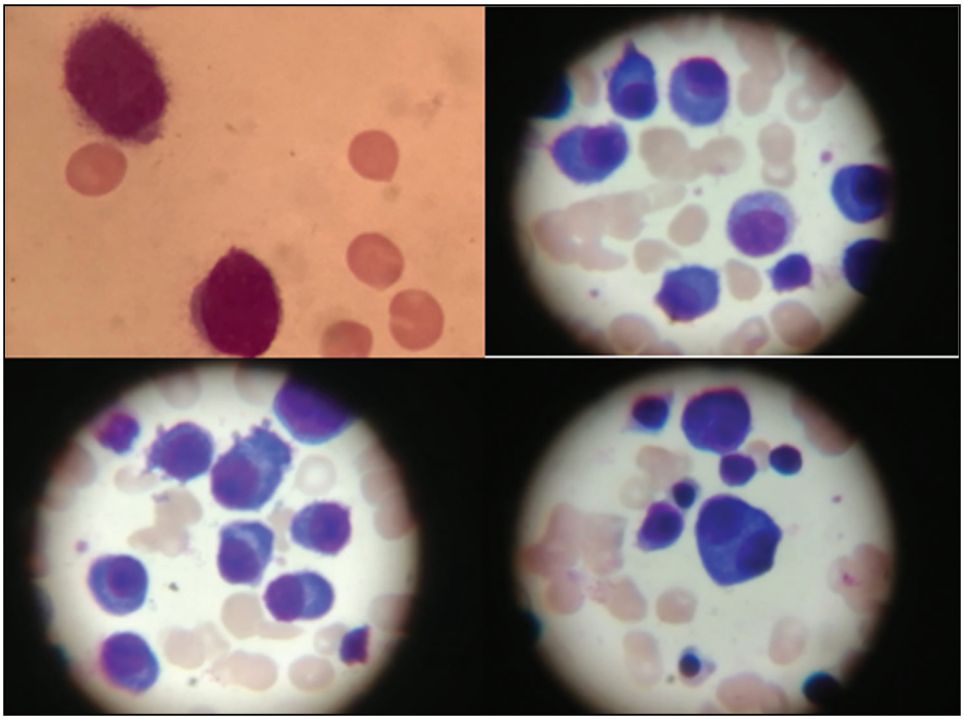

Figure 1: Blood film of the studied cases shows the hairy and transformed cells in the leukemic patients under study. Lishman stain × 400

Table 2: The relationship between sex and leukemia

Sex	Leukemia categories							Total	*P* value
	ALL%	AML%	CLL%	CML%	HCL%	NK%	Mast%		
Males	24	19	4	3	1	2	2	55	0.009
Females	18	11	5	4	4	2	1	45	
Total	42	30	9	7	5	4	3	100	

Table 3: The relationship between age and leukemia

Age year	Leukemia categories							Total	*P* value
	ALL%	AML%	CLL%	CML%	HCL%	NK%	Mast%		
0–15	11	6	3	0	0	0	0	20	0.013
16–30	11	13	0	0	1	0	2	27	
31–45	10	9	1	3	1	2	0	24	
46–60	4	0	2	3	2	1	0	12	
60–75	6	2	3	1	1	1	1	15	
Total (%)	42	30	9	7	5	4	3	100	

of leukemia among males was 55% compared with 45% for females. The prevalence of the disease was higher in males for ALL, AML, and mast cell leukemia; however, female incidence of leukemia was higher in females for CLL, CML, and HCL. The incidence of NK cell leukemia was equal in both genders [Table 2].

In relation to age, 16–30 years have the highest prevalence, followed by the age of 31–45 years with 24% and 20% for the age of 0–15 years. The age of 60–75 years was 15%, and the remaining 12% was for the age of 46–60 years. The Chi-square test revealed a significant correlation between aging and the incidence of leukemia ($P = 0.013$). Table 3 shows the incidence of leukemia in relation to age.

The association between leukemia and other conditions is presented in Table 4. The results revealed that 18% of the studied cases had a familial history, 2% had Down syndrome and had a previous prostate cancer incidence, and 2% had a breast cancer incidence.

Table 4: The relationship between other risk factors in clinical cases and leukemia

	Leukemia categories							Total
	ALL%	AML%	CLL%	CML%	HCL%	NK%	Mast cell%	
Family history	8	8	2	–	–	–	–	18
Downs syndrome	2	–	–	–	–	–	–	2
Prostate CA metastasis	2	–	–	–	–	–	–	2
Breast CA metastasis	–	–	–	2	–	–	–	2
No previous cases	32	22	7	5	5	4	3	76
Total (%)	42	30	9	7	5	4	3	100

Discussion

Leukemia and other hematological malignancies may be caused by a confluence of genetic defects and environmental risk factors.[8] Numerous epidemiological studies conducted across the world have shown that a number of potential risk factors, such as infections and environmental factors including ionizing radiation, smoking, a history of malignancies, and drug use are related to the prevalence of AML.[8-11]

Wong *et al.* reported only a modest and non-significant effect of a family history of cancer on leukemia in their case-control analysis, which is at odds with the results of the current study.[12] This study's findings are consistent with other research that has shown that having a family history of cancer increases the likelihood of developing leukemia and other neoplasms.[13,14] Nevertheless, the case-control research conducted in the United States did not support this finding.[15]

It is undeniable that aberrant gene expression, particularly that of tumor suppressors, contributes to the onset and spread of cancer. It appears that the acquisition of defective genes and the prevalence of cancer are higher in communities with a high proportion of consanguineous marriages because each allele for the manifestation of a trait is acquired from one of the parents. As a result, consanguineous marriage should be reconsidered in populations where leukemia and other tumors appear to be more prevalent.[16,17]

According to statistics previously published by the United States Statistics and Leukemia Treatment Institution, leukemia incidence is not equal in males and females. This proportion varies greatly between countries, with males being more involved, possibly because of differences in environmental factors, nourishment, and other factors. This study found that men are 1.5 times more likely than women to develop cancer, but statistics in Iraq show that females outnumber males by a large margin. As a result, the disparity in Iraq has allocated a higher proportion, and males are more susceptible to cancer as ALL cancers constitute the most prevalent in Iraq (63.4%) and AML (18.5%).[18]

Leukemia has a high incidence rate in the age range of 40–70 years (clearly omitting minors), although the highest incidence has been reported in the 15–45 years age group in this study, according to statistics from the US Organization of leukemia treatment in 2009. The majority of the population in Iraq is under 40 years old, and because there is a significant likelihood that this age range will be exposed to environmental elements like noise pollution, chemical pollution, etc., there is also a high likelihood that they will develop cancer.

Hejazi *et al.* have reported the highest rate of death and mortality associated with blood cancer to be in 15–25 years of age, but in this study due to the lack of hospitalization and treatment of leukemic children in the two studied wards, the age group of under 15 years old has a very low proportion.[19] Previous studies have shown no significant associations between congenital disorders, such as Down syndrome, and leukemia. There is some speculation about the possible effects of congenital disorders on leukemia. Although adults with Down syndrome show a decreased incidence rate of cancer, compared to healthy individuals, children with Down syndrome are at an increased risk of leukemia, especially AML.[20,21]

Conclusion

The study findings suggest that there is a significant association between gender and incidence of leukemia as males are more prone to have leukemia than females. Age is considered a risk factor as the incidence of leukemia increases in the age >20 years, and this incidence increases significantly with the presence of a previous family history.

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Conflicts of interest

There are no conflicts of interest.

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