ORIGINAL ARTICLE

Patterns of the Leukemia Records that were Referred to the Regional Laboratory in Makkah, Saudi Arabia

Mamdouh Allahyani [1], Khalid Kedwa [2], Sami Sahl [2], Mohammed Alhashmi [2], Hayaa M. Alhuthali [1], Mazen Almehmadi [1], Meshari A. Alsuwat [1], Ayman S. Alhazmi [1], Tariq Elmissbah [1]

[1] *Department of Clinical Laboratory Sciences, College of Applied Medical Sciences, Taif University, Saudi Arabia*
[2] *Department of Hematology, the Regional Laboratory, Makkah, Saudi Arabia*

SUMMARY

Background: **Leukemia is the fifth most common cancer in Saudi Arabia. The aim of this study was to assess the various patterns of leukemia associated with age, gender, and nationality in this region.**
Methods: **This cross-sectional study was conducted at the regional laboratory in Makkah, Saudi Arabia, from April to November 2023. Descriptive statistics were presented as frequencies and percentages by using the Graph-Pad Prism software.**
Results: **This study included 107 patients, and the results showed that leukemia cases were higher in males than females and more prevalent in older patients (above 50 years of age). Overall, acute myeloid leukemia (AML) and acute lymphocytic leukemia (ALL) were the most common types of leukemia among Saudi patients. In addition, AML was the most prevalent type of leukemia in males and females, followed by ALL. Data also revealed that ALL was the most common type in the younger population, whereas AML was highly prevalent in older patients.**
Conclusions: **In conclusion, this study provides valuable information about the patterns of leukemia reported at the regional laboratory in Makkah and will help in designing management and preventive approaches for these patients. This epidemiological investigation is also valuable for establishing proper medical databases.**
(Clin. Lab. 2024;70:xx-xx. DOI: 10.7754/Clin.Lab.2024.240210)

Correspondence:
Dr. Mamdouh Allahyani
Department of Clinical Laboratory Sciences
College of Applied Medical Sciences
Taif University
Taif 21944
P.O. Box 11099
Saudi Arabia
Phone: +966 500881380
Email: m.allahyani@tu.edu.sa
ORCID ID: 0000-0001-7929-7748

KEYWORDS

INTRODUCTION

Leukemia refers to a group of blood malignancies characterized by an uncontrolled proliferation of white blood cells (WBCs) from the bone marrow into the circulatory system. While leukemia can be classified into many subtypes, the main ones include acute myeloid leukemia (AML), chronic myeloid leukemia (CML), acute lymphocytic leukemia (ALL), and chronic lymphocytic leukemia (CLL) [1].

There are several risk factors for leukemia, including smoking, exposure to chemicals and radiation, and genetic abnormalities [2,3]. Leukemia is a major concern worldwide and is the 11th most common cause of cancer-associated mortality [4]. Globally, there are variable

trends in leukemia, as it is highly dependent on age, gender, and geographical location [2]. Leukemia can be detected in both sexes and in all age groups, but the distribution of the disease generally depends on the type [3]. Overall, leukemia is ranked as the 15th most common cancer diagnosed worldwide [3].

In Saudi Arabia, leukemia is the fifth most common cancer [5]. More specifically, leukemia was reported to be the most common cancer in males in Saudi Arabia between 2001 and 2014 [6]. A study, conducted between 2001 and 2008 to determine the pattern of leukemia in Saudi Arabia, included a total of 3,852 leukemia cases and found that the disease is especially prevalent in Riyadh, the Eastern region, and the Northern region of the Kingdom [7]. Another study found a steady increase in leukemia cases from 5.2% in 1999 to 7.9% in 2013 [8]. The majority of the leukemia cases included in the latter study was from the central area of the Kingdom (33.6%) [8].

Given the variability in the incidence of leukemia according to region and population, more epidemiological studies of leukemia in Saudi Arabia are needed to determine proper medical databases. Although region-specific reports have been conducted to examine the prevalence of leukemia in Saudi Arabia, limited information is available about the patterns in the Western region of the Kingdom, particularly in Makkah. Thus, the aim of this study was to assess the patterns of leukemia at the regional laboratory in Makkah, Saudi Arabia, between January 2017 and December 2021. We also determined the age and gender groups most affected by leukemia.

MATERIALS AND METHODS

Patients and study design

This was a cross-sectional study conducted between April and November 2023, that included all patients whose samples from various hospitals were sent to the regional laboratory in Makkah with a confirmed diagnosis of any leukemia type between January 2017 and December 2021. Diagnosis was made via flow cytometry by using standard protocols and a panel of antibodies. The patients' data were collected from their electronic records at the regional laboratory in Makkah. The sample size was 107 patients, and ethical approval was obtained from the institutional review board (IRB) of the directorate of Health Affairs in Makkah (H-02-K-076-1222-861).

Inclusion and exclusion criteria

All patients with a confirmed diagnosis of any type of leukemia were included in the study. All age groups and both genders were included. Any patient with missing information (diagnosis, age, gender, leukemia type, or nationality) was excluded from the study.

Statistical analysis

Information about the leukemic patients (including age, gender, diagnosis, and nationality) were entered into an Excel spreadsheet and arranged in columns, according to the variables in the study. Descriptive statistics were presented as frequencies and percentages in all comparisons.

RESULTS

Table 1 shows that leukemia cases were slightly higher in males (60 cases, 56.1%) than in females (47 cases, 43.9%). Leukemia was also more prevalent in older patients (above 50 years of age; 45 cases) than in other age groups, followed by the 1 - 19 years group (31 cases). We found only eight cases each among the age groups of 20 - 29 and 40 - 50 years. Furthermore, the number of leukemia cases was more common among Saudis (66 cases, 61.6%) than non-Saudis (41 cases, 38.4%).

In this study, we found that acute leukemia (AML and ALL) was the most prevalent type, with 43 cases (40.2%) and 37 cases (34.5%), respectively. CLL was constituted of 10 cases (9.4%), and CML was found in 7 cases (6.5%). A total of 10 cases (9.4%) was reported as unspecified leukemia (Table 2).

AML was the most common type of leukemia in males (41.7%), followed by ALL (33.3%). In contrast, CML was the least prevalent type (6.7%). Similarly, AML and ALL were also prevalent in females at rates of 18 cases (38.3%) and 17 cases (36.1%), respectively (Table 3).

ALL was the most common type in the younger (1 - 19 and 20 - 29 years) age groups (19 and three cases, respectively). AML and CLL were more common in the 30 - 39 age group (six cases each). AML and CML were more common in the 40 - 49 age group, with three cases being reported each. In older patients (above 50 years), we found that AML was highly prevalent, with 26 cases reported (Table 4).

The most common types of leukemia among Saudi patients were AML and ALL (28 and 23 cases, respectively). In a similar manner, both types were also prevalent in non-Saudi patients (Table 5).

DISCUSSION

Leukemia is a serious health issue in Saudi Arabia and is associated with a high mortality. There are variable trends in leukemia, as it is dependent on age, gender, and geographical location [2]. Thus, epidemiological investigation is important to establish proper medical databases. Overall, leukemia is a major health issue and is ranked as the 15th most common cancer diagnosed worldwide [3]. As stated in the introduction, in Saudi Arabia, leukemia is the fifth most common cancer [5]. However, no specific study has been conducted on the

Table 1. Demographic data for all patients.

Variable	Categories	Number	%
Gender	Male	60	56.1
	Female	47	43.9
	Total	107	100
Age	1 -19	31	28.9
	20 - 29	8	7.5
	30 - 39	15	14.0
	40 - 50	8	7.5
	Above 50	45	42.1
	Total	107	100
Nationality	Saudi	66	61.6
	Non-Saudi	41	38.4
	Total	107	100

Table 2. Distribution of patients based on their type of hematological malignancy.

Variable	n	%
Acute myeloid leukemia (AML)	43	40.2
Acute lymphoid leukemia (ALL)	37	34.5
Chronic myeloid leukemia (CML)	7	6.5
Chronic lymphoid leukemia (CLL)	10	9.4
Unspecified leukemia	10	9.4
Total	107	100

Table 3. Type of malignancy and gender.

Variable	Male	%	Female	%
Acute myeloid leukemia (AML)	25	41.7	18	38.3
Acute lymphoid leukemia (ALL)	20	33.3	17	36.1
Chronic myeloid leukemia (CML)	4	6.7	3	6.4
Chronic lymphoid leukemia (CLL)	6	10	4	8.5
Unspecified leukemia	5	8.3	5	10.7
Total	60	100	47	100

Table 4. Type of malignancy and age.

Variable	Categories	AML	ALL	CML	CLL	Unspecified leukemia
Age	1 - 19	8	19	0	0	4
	20 - 29	0	3	0	2	3
	30 - 39	6	0	3	6	0
	40 - 49	3	2	3	0	0
	Above 50	26	13	1	2	3

Table 5. Type of malignancy and nationality.

Variable	AML	ALL	CML	CLL	Unspecified leukemia
Saudi	28	23	4	6	5
Non-Saudi	15	14	3	4	5

trends of leukemia cases in Makkah. Thus, we aimed to study the patterns of leukemia in association with age, gender, and nationality at the regional laboratory in Makkah. It should be noted that previous studies on the patterns of leukemia in Saudi Arabia are limited and mostly include old data [5-8]. In this study, we analyzed leukemia records from January 2017 to December 2021 at a regional laboratory in Makkah. A total of 107 patients were included in the study.

We found that leukemia cases were more frequently reported in males, compared with females, and more prevalent in older patients (above 50 years). This is consistent with another study conducted in Saudi Arabia in 2014 with similar findings [5], as well as a later study with comparable data [8]. Another study has shown that in Saudi Arabia, leukemia is the most prevalent cancer in males, followed by colorectal cancer [6].

Despite those similarities, we found that AML was the most common type of leukemia, followed by ALL, which is inconsistent with various studies conducted in Saudi Arabia, in which opposite findings were reported, as ALL was the most common type [5,9]. According to the Saudi registry, ALL accounts for 31% of all childhood cancers in Saudi Arabia [10]. It should be noted that there are different subtypes of ALL and AML, that should be defined in future studies to provide a more accurate prognosis and diagnosis [11]. For example, the management approach and outcomes for a rare form of AML, called acute promyelocytic leukemia (APL), remain challenging [12]. In another study, many subtypes of AML were analyzed, and M1 was found to be the most common type, according to the French-American-British (FAB) classification [13].

While we have shown that AML is more prevalent in older patients, ALL is seen frequently in younger patients. It has been estimated that a quarter of leukemia cases are diagnosed with AML [13]. In agreement with our findings, older patients (above 50 years) were the most affected age group by AML [5]. These data are important for predicting the course of the disease, as older patients diagnosed with AML are associated with poor prognoses [11]. Accordingly, AML is considered an age-related disorder, as patients diagnosed with this disease are, in most cases, at the age of 60 years or above [13].

CONCLUSION

In conclusion, this study provides valuable information about the patterns of leukemia at the regional laboratory in Makkah and will help in designing better management and preventive approaches for these patients. Overall, this epidemiological investigation is important for establishing proper medical databases in the Makkah region.

Declaration of Interest:
The authors have no conflicts of interest to declare, and the work was not supported or funded by any drug company. The work was not previously presented in any conference.

References:

1. Baeker Bispo JA, Pinheiro PS, Kobetz EK. Epidemiology and etiology of leukemia and lymphoma. Cold Spring Harb Perspect Med 2020;10(6):a034819. (PMID: 31727680)

2. Huang J, Chan SC, Ngai CH, et al. Disease Burden, Risk Factors, and Trends of Leukaemia: A Global Analysis. Front Oncol 2022; 12:904292. (PMID: 35936709)

3. Tebbi CK. Etiology of acute leukemia: A review. Cancers (Basel) 2021;13(9):2256. (PMID: 34066700)

4. Du M, Chen W, Liu K, et al. The Global Burden of Leukemia and Its Attributable Factors in 204 Countries and Territories: Findings from the Global Burden of Disease 2019 Study and Projections to 2030. J Oncol 2022;2022:1612702. (PMID: 35509847)

5. AlBakr RB, Khojah OT. Incidence Trend of the Leukemia Reported Cases in the Kingdom of Saudi Arabia, Observational Descriptive Statistic from Saudi Cancer Registry. Int J Biomed Res 2014;5(8):522–4. https://ssjournals.com/ijbr/article/view/1058

6. Chaudhri E, Fathi W, Hussain F, Hashmi SK. The increasing trends in cases of the most common cancers in Saudi Arabia. J Epidemiol Glob Health 2020;10(4):258-62. (PMID: 32959621)

7. Alghamdi IG, Hussain II, Alghamdi MS, Dohal AA, El-Sheemy MA. The incidence of Leukemia in Saudi Arabia: Descriptive epidemiological analysis of data from the Saudi cancer registry 2001 - 2008. Saudi Med J 2014;35(7):674-83. (PMID: 25028223)

8. Bawazir A, Al-Zamel N, Amen A, Akiel MA, Alhawiti NM, Alshehri A. The burden of leukemia in the Kingdom of Saudi Arabia: 15 years period (1999 - 2013). BMC Cancer 2019;19(1): 703. (PMID: 31315607)

9. Mohamed Elasbali A, Hussain Alharbi H, Al-Onzi Z, et al. Epidemiology and Patterns of Leukemia in Northern Saudi Arabia. Int J Med Res Health Sci 2019;8(1):160-6.
https://www.ijmrhs.com/abstract/epidemiology-and-patterns-of-leukemia-in-northern-saudi-arabia-15516.html

10. Ahmed AM, Al-Trabolsi H, Bayoumy M, Abosoudah I, Yassin F. Improved outcomes of childhood acute lymphoblastic leukemia: A retrospective single center study in Saudi Arabia. Asian Pac J Cancer Prev 2019;20(11):3391-8. (PMID: 31759364)

11. Alahmari B, Alzahrani M, Shehry NA, et al. Management Approach to Acute Myeloid Leukemia Leveraging the Available Resources in View of the Latest Evidence: Consensus of the Saudi Society of Blood and Marrow Transplantation. JCO Glob Oncol 2021;7:1220-32. (PMID: 34343012)

12. Jastaniah W, Alsultan A, Al Daama S, et al. Clinical characteristics and outcome of childhood acute promyelocitic leukemia (APL) in Saudi Arabia: a multicenter SAPHOS leukemia group study. Hematology 2018;23(6):316-23. (PMID: 29212418)

13. Alzahrani M, Al-Quozi A, Alaskar A, AlFaleh A. Clinical features and outcome of acute myeloid leukemia, a single institution experience in Saudi Arabia. J Appl Hematol 2015;6(1):6.
https://www.researchgate.net/publication/275235251_Clinical_features_and_outcome_of_acute_myeloid_leukemia_a_single_institution_experience_in_Saudi_Arabia