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The pattern of Leukemia among adult Patients in Oncology center at AlJumhori Hospital, Sana'a city ,Yemen (2021)

This research for achieving requirements of community medicine department

21 September University of Medical & Applied Sciences

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Dedication:

With best regards, this work has been done for our beloved country Yemen.
We hope that we have succeeded in this work and benefit from it .

List of Contents

AML	*Acute myeloid leukemia*
CML	*Chronic myelogenous leukemia*
ALL	*Acute lymphoblastic leukemia*
CLL	*Chronic lymphocytic leukemia*
MENA	*Middle-East and Northern Africa*
BCR	*Breakpoint cluster region*
ACS	*American Cancer Society*
US	*United States*
IgM	*Immunoglobulin M*
IgD	*Immunoglobulin D*
CBC	*Complete blood count*
DALY	Disability Adjusted Life Year

Abstract

Background : Leukemia is a heterogeneous group of hematological disorders that is made up of several diverse and biologically distinct subgroups. Leukemia is the twelfth most common cause of cancer morbidity and mortality worldwide . There is insufficient data on the epidemiology of leukemia in Yemen .This cross-sectional study aims to determine the epidemiologic pattern of adult leukemia in Yemen

General objective : To determine the pattern of Leukemia in adult Patients in Oncology center at AlJumhori Hospital, Sana'a city-Yemen.

Methods: The research is a retrospectively analyzed a hospital - based medical records study. We analyzed the data of 295 adult patients with leukaemia, who were newly diagnosed in 2021 at the Oncology center at Al-Jomhori Hospital, according to type of leukaemia, age, sex and geographic distribution .

Results: Chronic Myeloid Leukaemia (CML) was found to be the most common (34.9%) followed by acute myeloid leukemia (AML) (27.8 %), Acute Lymphoid Leukaemia (ALL) (25.1%) and Chronic Lymphoid Leukaemia (CLL) (12.2%), respectively.55.3 were males and 44.7 were females.

A significant variation in geographic pattern showed that the highest percentage 13.2% in Ibb city, while the lowest percentage 0.3 in Aden city.

Conclusions: The pattern of adult leukemia in this study is different from the past studies, which could be attributed to different environmental exposure. The geographic pattern indicates a possible role of certain environmental factors that warrant further investigations.

Chapter 1:

Introduction and Literature review

Introduction

Background:

Leukemia is a malignant neoplasm of hematopoietic origin, characterized by diffuse replacement of bone marrow and peripheral blood with neoplastic cells [1].Although, many subtypes of leukemia were known, four main subtypes were frequently seen in diagnosis such as: Acute Myeloid Leukemia (AML), Chronic Myeloid Leukemia (CML), Acute Lymphoblastic Leukemia (ALL) and Chronic Lymphocytic Leukemia (CLL). Globally, between 1990 to 2018, the number of leukemia cases markedly ncreased from 297,000 to 437, 033 [2]. Thus, according to GLOBOCAN report in 2018, leukemia was ranked the 13th among cancers worldwide, while leukemia deaths increased by 16.5% in the same year. Despite the increased incidence of leukemia over the time, causes of leukemia are still not clear. Both genetic and environmental risk factors such as exposure to ionizing radiation, infection, or chemical substances contribute heavily to the development of leukemia [3]. Consequently, such wide range of risk factors affects prognosis, treatment plans and overall survival [4]. According to the reported data from the GLOBOCAN for region of Middle-East and Northern Africa (MENA), the estimated crude incidence is 5.3 per 100.000 among male population and 4.0 per 100,000 females [5]. Moreover, Gulf Cooperation Council report on cancer, ranked leukemia as the 4th among the most common cancers in the area [6].

Problem statment: In developing countries, and especially in Yemen, there is little information about the prevalence and patterns of haematological malignancies, especially leukemia. In previous study of leukaemia in Yemen. A total number of 702 cases of leukaemia were evaluated over the ten-year period (October 2nd 1999 to October 1st 2009). AML was most common followed by CML and ALL respectively and CLL was the least common constituting only 10.7% of the total number of leukaemia cases [7]. This pattern is similar to that seen in Southeast Asia showing higher incidence of the myeloid leukaemia (AML and CML) and CLL is the least common [8,9,10]. However, it is different from that seen in USA and other Western countries where CLL is the most common form of leukaemia [9,10]. This may indicate a different exposure to certain etiologic factors.

Rationales of the study: In recent years, Yemen has witnessed war and difficult situations, and there is little research related to leukemia , so we aim through this research to know the pattern of leukemia in patients coming to the Oncology Center at Al-Jumhouri Hospital.

Literature review

Definition of leukemia:

. Leukemia is a malignant neoplasm of hematopoietic origin, characterized by diffuse replacement of bone marrow and peripheral blood with neoplastic cells [1]

-Leukemia is a blood-related malignancy characterized by transformed hematopoietic progenitors and by diffuse infiltration of bone marrow. It was the 11th leading cause of cancer-related mortality worldwide in *2018 [11].*

Etiology of leukemia:

etiology of leukaemia remains unknown but it may be the result of a complex interaction between host susceptibility factors and different environmental susceptibility agents (12). The incidence of particular subgroups of leukaemia varies with age and sex which may suggest differences in etiology. The most common types of leukaemia in adults are AML, CML and CLL. In contrast, chronic leukaemia is extremely rare in childhood and ALL is the most common type of childhood leukaemia. Similarly all types of leukaemia show male predominance (13, 14). Prior cancer chemotherapy and exposure to radiation and benzene are identified as risk factors for adult leukaemia, primarily AML (15). However these risk factors for adult leukaemia account for only a small proportion of all adult cases. Results of cytogenetic studies suggest that exposure to certain environmental agents may be associated with clonal chromosomal aberrations which may play a role in the activation of cellular oncogenes(16). Environmental risk factors that have been explored and have produced inconsistent association with leukaemia include farming, proximity to nuclear plants, hair dye, exposure to pesticides and petrol products, infections and alcohol consumption (15, 16). Life style factors including smoking, obesity and some dietary factors as risk for adult leukaemia have been assessed in several epidemiologic studies (17-18). Studies on the geographical distribution of leukaemia show higher number of patients of leukaemia who lived in rural areas which suggests that risk factors do exist in the rural environment (19-20).

Types of leukemia:

many subtypes of leukemia were known, four main subtypes were frequently seen in diagnosis such as: Acute Myeloid Leukemia (AML), Chronic Myeloid Leukemia (CML), Acute Lymphoblastic Leukemia (ALL) and Chronic Lymphocytic Leukemia (CLL) (2).

Acute Myeloid Leukemia:

Definition*:*

Acute myeloid leukemia (AML) is a malignant disease of the bone marrow in which hematopoietic precursors are arrested in an early stage of development. Most AML subtypes are distinguished from other related blood disorders by the presence of more than 20% blasts in the bone marrow.

Pathophysiology:

The underlying pathophysiology in AML consists of a maturational arrest of bone marrow cells in the earliest stages of development. The mechanism of this arrest is under study, but in many cases, it involves the activation or inactivation of genes through chromosomal translocations and other genetic and/or epigenetic abnormalities.(21)

Chronic myelogenous leukemia:

Definition:

Chronic myelogenous leukemia (CML), also known as chronic myeloid leukemia, is a myeloproliferative disorder characterized by increased proliferation of the granulocytic cell line without the loss of their capacity to differentiate. Consequently, the peripheral blood cell profile shows an increased number of granulocytes and their immature precursors, including occasional blast cells. CML accounts for 20% of all leukemias affecting adults.

Pathophysiology:

CML is an acquired abnormality that involves the hematopoietic stem cell. It is characterized by a cytogenetic aberration consisting of a reciprocal translocation between the long arms of chromosomes 22 and 9 [t(9;22)]. The translocation results in a shortened chromosome 22, an observation first described by Nowell and Hungerford and subsequently termed the Philadelphia (Ph1) chromosome after the city of discovery. This translocation relocates an oncogene called ABL from the long arm of chromosome 9 to a specific breakpoint cluster region (BCR) in the long arm of chromosome 22. The ABL oncogene encodes a tyrosine protein kinase. The resulting BCR/ABL fusion gene encodes a chimeric protein with strong tyrosine kinase

activity. The expression of this protein leads to the development of the CML phenotype, through processes that are not yet fully understood.(22)

Acute Lymphoblastic Leukemia:

Definition:

Acute lymphoblastic leukemia (acute lymphocytic leukemia, ALL) is a malignant (clonal) disease of the bone marrow in which early lymphoid precursors proliferate and replace the normal hematopoietic cells of the marrow. ALL is the most common type of cancer and leukemia in children in the United States.

Pathophysiology:

The malignant cells of acute lymphoblastic leukemia (ALL) are lymphoid precursor cells (ie, lymphoblasts) that are arrested in an early stage of development. This arrest is caused by an abnormal expression of genes, often as a result of chromosomal translocations or abnormalities of chromosome number. These aberrant lymphoblasts proliferate, reducing the number of the normal marrow elements that produce other blood cell lines (red blood cells, platelets, and neutrophils). Consequently, anemia, thrombocytopenia, and neutropenia occur, although typically to a lesser degree than is seen in acute myeloid leukemia. Lymphoblasts can also infiltrate outside the marrow, particularly in the liver, spleen, and lymph nodes, resulting in enlargement of the latter organs.

Chronic Lymphoblastic Leukemia:

Definition:

Chronic lymphocytic leukemia (chronic lymphoid leukemia, CLL) is a monoclonal disorder characterized by a progressive accumulation of functionally incompetent lymphocytes. CLL is the most common form of leukemia found in adults in Western countries.Some patients die rapidly, within 2-3 years of diagnosis, because of complications from CLL, but most patients survive for 5-10 years. (23)

Pathophysiology:

The cells of origin in most patients with CLL are clonal B cells arrested in the B-cell differentiation pathway, intermediate between pre-B cells and mature B cells. Morphologically, in the peripheral blood, these cells resemble mature lymphocytes. CLL B-lymphocytes typically show B-cell surface antigens, as

demonstrated by CD19, CD20dim, CD21, and CD23 monoclonal antibodies. In addition, they express CD5, which is more typically found on T cells. Because normal CD5+ B cells are present in the mantle zone of lymphoid follicles, B-cell CLL is most likely a malignancy of a mantle zone–based subpopulation of anergic self-reactive cells devoted to the production of polyreactive natural autoantibodies. CLL B-lymphocytes express extremely low levels of surface membrane immunoglobulin, most often immunoglobulin M (IgM) or IgM/IgD and IgD. Additionally, they also express extremely low levels of a single immunoglobulin light chain (kappa or lambda).(24)

Epidemiology of leukaemia:

Global aspect:

The total number of incident cases, deaths, and Disability Adjusted Life Year (DALYs) from leukemia in 2019 was 0.64, 0.33, and 11.66 million, respectively. Decreasing trends in age-standardized incidence rate (ASIR), the age-standardized death rate (ASDR), and age-standardized DALY rate were detected on a global level while increasing trends in ASIR were detected in the high-sociodemographic index (SDI) regions. The leukemia burden was heavier in males than in females. By cause, acute myeloid leukemia (AML), chronic myeloid leukemia (CML), and chronic lymphocytic leukemia (CLL) were more likely to impose a burden on the elderly, while acute lymphoblastic leukemia (ALL) showed a greater impact in the younger population. A significant positive correlation was observed between SDI and AAPC in ASIR, while SDI was negatively correlated with AAPCs in both ASDR and age-standardized DALY rate. Smoking remained the most significant risk factor associated with leukemia-related death and DALY, especially in males. Similar deaths and DALYs were caused by smoking and high body mass index (BMI) in females. Future projections through 2030 estimated that ASIR and ASDR will continue to increase, while the DALY rate is predicted to decline.2.5 [25]

regonal aspect:

The overall incidence of leukemia during the period (1999–2013) has steadily increased among both genders . However, it is more in males than females. In 2012, the peak among males was reported in the as 5.5 per 100,000 person per year in 2013, while in females it was reported as 4.3 per 100,000 person per year in the year 2011. This increase in 2012 was observed in young males of less than14 years of age . The peak of incidence in young males was 4.0 per 100,000 people per year, while it was 3.0 for young fe- males . In adults of more than 14 years of age, both males and females shown an incidence of 2.7 per 100,000 populations per year (year 1999), while females dropped to 1.8 per 100,000 per year in 2013 . The overall incidence during the period (2001–2013) among the elderly age group (more than 60 years of age-76). Both genders showed a steadily increased of leukemia with more trend in males than females. For ex- ample, the

peak was reported as the highest among male cases in the year 2006 (21.2 per 100,000 person-year), while highest incidence rate was found in the year 2006 in females (14.3 per 100,000 person-year) [26]

Local aspect (in YEMEN)

In total, 300 patients aged between18-80 years (mean age: 43.6 years) with a male:female ratio of 1.23:1 were diagnosed with malignant hematological disorders. NHL was the most common HM (37.66%), followed by HL (21.0%), AML (15.66 %), and ALL (7.66%). Among the chronic leukemia's, CML was more common than CLL (9.33% and 4.66%, respectively). In all, 12 patients had MM (4.0%). The 1-year relative survival rate was 87% in the HL patients, 75% in the CML patients, 72% in the CLL patients, 71% in the NHL patients, 35% in the ALL patients, and 18% in the AML patients. the most of the patients with AML (29.7%) were aged 18-50 years and 73.9% of the ALL patients were aged 18-30 years. 21.4% of CML patients were aged 31-50 years and 57.1% of CLL patients were aged 51-60 years. NHL occurred in 24.8% patients aged 61-70 years, followed by 20.4% of those aged 51-60 years, whereas 58.7% of HL patients were aged 18-30 years. [27]

Diagnosis of leukemia:[28]

If you're concerned you may have leukemia or are experiencing symptoms associated with leukemia, a physical exam is often the first method your doctor utilizes to see what's going on. The physical exam may be focused on looking or feeling for swelling in the lymph nodes, liver and spleen. Your eyes, mouth and skin may also be examined. Your doctor may also be on the lookout for signs of infection and bruises, as frequent infections, widespread bruises and easy bleeding are associated with some types of leukemia. A nervous system exam may also be performed, which often involves checking your balance, sensation (touching different areas of the body to make sure you have proper sensation) and reflexes (tapping certain body parts with a small rubber hammer).

Lab tests

Laboratory tests, and specifically blood tests, are among the most important diagnostic tools for leukemia. For some types of leukemia, such as chronic lymphocytic leukemia, blood tests may be the only test needed to confirm the diagnosis (but other tests may be used to find out more about the cancer). To officially diagnose other types, such as acute lymphocytic leukemia, blood tests are typically followed by bone marrow tests. Most of the time, blood tests, and specifically a test called a complete blood count, are the first step in the diagnostic process.

Complete blood count (CBC): This blood test measure the amount of red blood cells, white blood cells and platelets in the blood.

Differential: A differential, or diff, analyzes how many of each type of white blood cell are present in your blood.

Peripheral blood smear: This blood test requires just one drop of blood, which is smeared or spread out across a surface and then analyzed under a microscope. The laboratory technician looks at the appearance of the blood cells, as certain changes in the look of these cells may point toward leukemia. Leukemia blood test results The results of a CBC, diff and peripheral blood smear are an essential part of diagnosing leukemia and, if present, determining the type of leukemia. These blood tests tend to reveal different findings depending on the type of leukemia. The findings associated with some of the main leukemia types are summarized below.

Acute myeloid leukemia (AML): Blood tests of people with AML tend to reveal high levels of immature white blood cells and low levels of red blood cells and platelets. Among the white blood cells, many are myeloblasts, a type of white blood cell that isn't normally found in healthy blood.

Chronic lymphocytic leukemia (CLL): The blood of people with CLL contains high levels of lymphocytes (a type of white blood cell). Under a microscope, these cells don't look like normal, healthy cells. The number of platelets and red blood cells may be low.

Chronic myeloid leukemia (CML): People with CML tend to have high levels of white blood cells, many of which are myeloblasts. The cells appear abnormal under a microscope. Red blood cells and platelet counts may be low.

Acute lymphocytic leukemia (ALL): Blood tests of people with ALL often reveal high levels of lymphoblasts (immature white blood cells) and low levels of red blood cells and platelets.

Flow cytometry

A flow cytometry test may provide valuable insight into whether the tumor cells contain a normal or abnormal amount of DNA, and the relative rate at which the tumor is growing.This test is a very accurate indicator in determining the patient's exact kind of lymphoma or leukemia. The test may be performed on bone marrow cells (taken during a biopsy) or blood cells (taken during a blood test). These cells are exposed to special antibodies (proteins), which will attach to specific proteins on the cells that match them. Cancer is suspected if the antibodies attach to most cells in the sample, as this indicates that the cells originated from one abnormal cell. Cancer is unlikely if different antibodies attach to different cells in the sample, as this means that there are a variety of cell types. The process may also reveal how much DNA is in cancer cells, which indicates whether the cancer is likely to grow quickly or slowly.

Biopsy

A biopsy is used to determine the type of leukemia, the growth rate of the tumor, and whether the disease has spread. Common biopsy procedures for leukemia include:

Bone marrow biopsy removes a sample of bone marrow. Since leukemia begins in bone marrow, examining these cells is an important part of diagnosing leukemias. There are two types of procedures used to extract a bone marrow sample, and they are often performed simultaneously.

- A bone marrow aspiration collects a sample of liquid bone marrow. In this procedure, you lie on a table. Your doctor uses a needle to inject a numbing medication into the area of bone being tested (usually your hip bone). Then, the doctor inserts a hollow needle into your bone and extracts a sample of liquid bone marrow from inside.

- A bone marrow biopsy collects a small piece of the bone and bone marrow. Typically performed after a bone marrow aspiration, a bone marrow biopsy is a procedure that removes a small sample of your bone and a little bone marrow. This procedure also involves inserting a needle into your bone, but the needle is slightly larger. The needle is twisted as it's inserted into your bone to help collect the sample.

- These procedures may come with brief pain or pressure in the area. However, the numbing medication helps minimize pain.

- For most types of leukemia—such as acute lymphocytic leukemia, acute myeloid leukemia and chronic myeloid leukemia—diagnosis typically requires the bone marrow to be tested. Other types, such as chronic lymphocytic leukemia, may be diagnosed using blood tests alone, but some patients with this cancer may still undergo a bone marrow biopsy to assess how advanced the cancer is before beginning treatment.

Lymph node biopsy removes all or part of a lymph node. This procedure is rarely needed to diagnose leukemia, as tests on the blood and bone marrow are much more important. When it's used, however, it's typically done because a lymph node has increased in size after diagnosis, raising concern that the cancer may have become more aggressive. There are two types of lymph node biopsies: excisional (to remove an entire lymph node) and incisional (to remove part of a lymph node). If you need to have a lymph node deep inside the body (or part of a lymph node) removed, you may be given general anesthesia for the procedure. To remove lymph nodes that are more easily accessible, you may only need local anesthetic to numb the area.

Imaging and other tests for leukemia

Imaging tests

These procedures may provide information about the extent of leukemia in the body, and the presence of infections or other problems. The following imaging tests may be used to help formulate a leukemia diagnosis:

X-rays are used to produce images of the inside of your body. As with some leukemia patients, you may need regular X-rays of your chest to see whether you have a lung infection.

Computed tomography (CT) scans use X-rays to create more in-depth and detailed pictures of the body. CT scans help reveal swelling in the lymph nodes and organs. While these scans aren't typically necessary for diagnosing leukemia, doctors sometimes use them to find out whether there's cancer in an organ, such as the spleen.

A positron emission tomography (PET) scan may be used together with a CT scan to produce more precise images of where there is cancer in your body. Before a PET scan, the doctor injects a substance that disseminates in your body and lands in areas where there are cancer cells. These areas are highlighted in the images created by the scan, indicating where there may be

cancer. The images produced by the CT scan are more detailed than a PET scan alone, which is why they may be combined.

Magnetic resonance imaging (MRI) scans also create detailed pictures of your body. With leukemia, you may need an MRI scan if you're having symptoms that suggest the cancer has spread to the brain or spinal cord.

Ultrasounds bounce off organ the p A 2D used stand have echo

Chapter 2:

Subject and Methods

Objective Study

General objective

- To determine the pattern of Leukemia in adult Patients in Oncology center at AlJumhori Hospital, Sana'a city-Yemen.

Specific objectives

- To determine the distribution of leukemia according the government.
- To determine the distribution of leukemia in the government according the six
- To determine the association type of leukemia and six
- To determine the association type of leukemia and Age groups

Methodology

Study Sitting:

In oncology center at aljumhori hospital .

Study Design:

retrospectively analyzed a hospital - based medical records study.

Study Population:

The source population for this study was adult group people (above 15 years old) who had leukemia and admitted to oncology center at aljumhori hospital

Sample size:

The sample size was calculated for all patient's that had leukemia in period of 2021

Sampling and data collection Methods:

The data collected from patient's medical records in the Oncology center at AlJumhori hospital

. These data collected by medical records contained information about personal history , region , diagnosis.

Inclusion Criteria:

The research including:

All adult patients of either sex age 15 years or above (to exclude pediatric age group) diagnosed as Leukemia comes to oncology cancer at aljumhori hospital

Exclusion Criteria:

We excluded all patient's medical records that not completed .

We excluded all patient's medical records that the patient below age of 15 years old .

Operational Definition of Variables:

Dependent variables: variables *t*hat cannot be controlled are pattern of different types of leukemia (outcome).

Independent variables: variables that can be controlled by questionnaires; personal history and diagnosis.

Ethical approval [illegible] ity of 21 Septem [illegible] n the chosen hos[illegible]

Chapter 3:

Result

Results

The results which were obtained from the present study were analyzed, documented and presented in the following tables and figures:

Table 3.1. Characteristics of demographic data

Variables		Frequency	Percent %
Age Median (INQ)	37.0 (24.0- 55.0)		
Age groups (yrs)	< 24	75	25.4
	25-37	76	25.8
	38-55	85	28.8
	> 55	59	20.0
Sex	Male	163	55.3
	Female	132	44.7
Type of Leukemia	Acute myeloid leukemia	82	27.8
	Chronic lymphocytic leukemia	36	12.2

	Chronic myeloid leukemia	103	34.9
	Acute lymphoblastic leukemia	74	25.1

This table explained the characteristic of demographic data enrolled in this study.

The median age of the patients was 37.0(24.0-55.0) of the 295 patients studied, 25.4 % of the patients were found in the age group < 24 years, 25.8 % of the patients between 25-37, 28.8% of the patients were found in age groups 38-55, and 20.0% years of the patients were found in the age group > 55 years. 55.3 were males and 44.7 were females. 27.8 % of the patients have acute myeloid leukemia, 12.2% of the patients have chronic lymphocytic leukemia, 34.9% of the patients have chronic myeloid leukemia, and 25.1% of the patients have acute lymphoblastic leukemia.

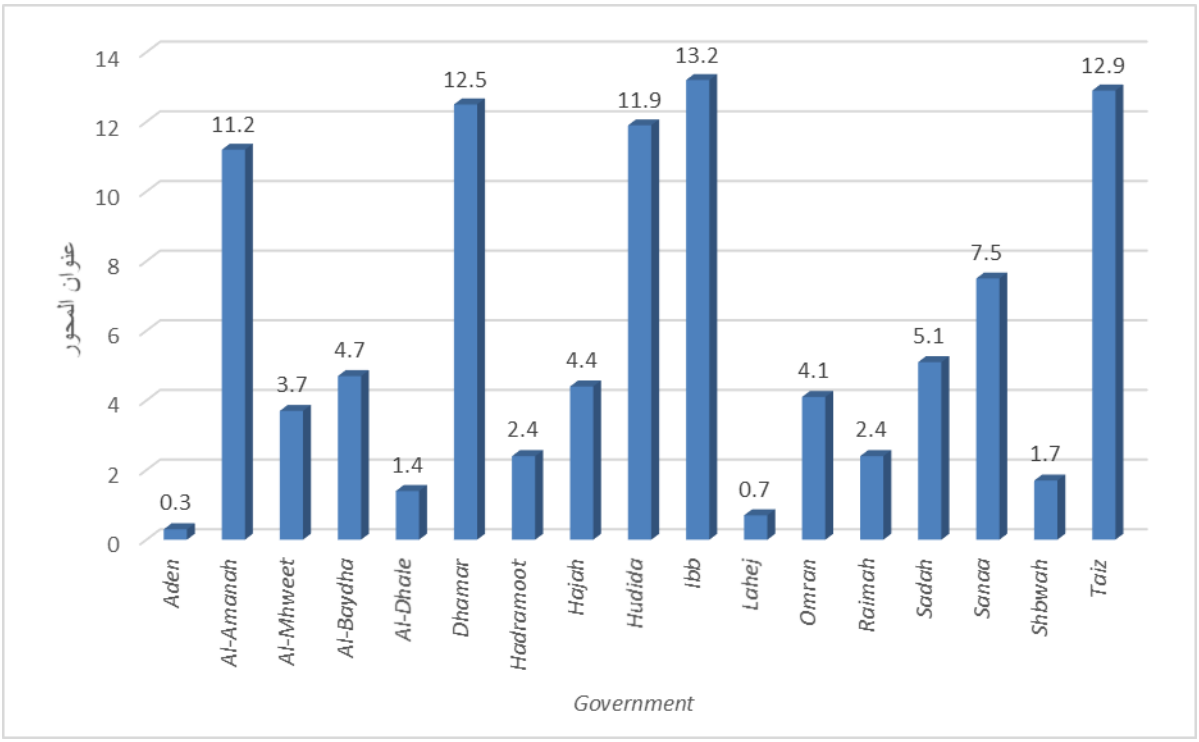

Figure 3.1. Distribution of Leukaemia according the government

This figure explained that, the highest percentage 13.2% in Ibb city, while the lowest percentage 0.3 in Aden city.

Table 3.2. Characteristics of demographic data according six

Variables		Male n=163		Female n=132	
		Frequency	%	Frequency	%
Age Median (INQ)		35.0 (21.0-52.0)		40.0(26.3-55.0)	
Age groups (yrs)	< 24	53	32.5	22	16.7
	25-37	36	22.1	40	30.3
	38-55	43	26.4	42	31.8
	> 55	31	19.0	28	21.2
Type of Leukemia	Acute myeloid leukemia	46	28.2	36	27.3
	Chronic lymphocytic leukemia	21	12.9	15	11.4
	Chronic myeloid leukemia	50	30.7	53	40.2
	Acute lymphoblastic leukemia	46	28.2	28	21.2

This table explained the characteristic of demographic data according the six.

The median age of the male patients was 35.0(21.0-52.0) of the 163 patients studied, and 40.0(26.3-55.0) for female patients. For male and female age groups were 32.5 %, 16.7 of the patients were found in the age group < 24 years, 22.1 %, 30.3% of the patients between 25-37, 26.4%, 31.8% of the patients were found in age groups 38-55, and 19.0%, 21.2% years of the patients were found in the age group > 55 years respectively. 28.2 %, 27.3% of the male and female patients have acute myeloid leukemia, 12.9% , 11.4% of the male and female patients have chronic lymphocytic leukemia, 30.7%, 40.2% of the male and female patients have chronic myeloid leukemia, and 28.2%, 21.2 of the male and female patients have acute lymphoblastic leukemia.

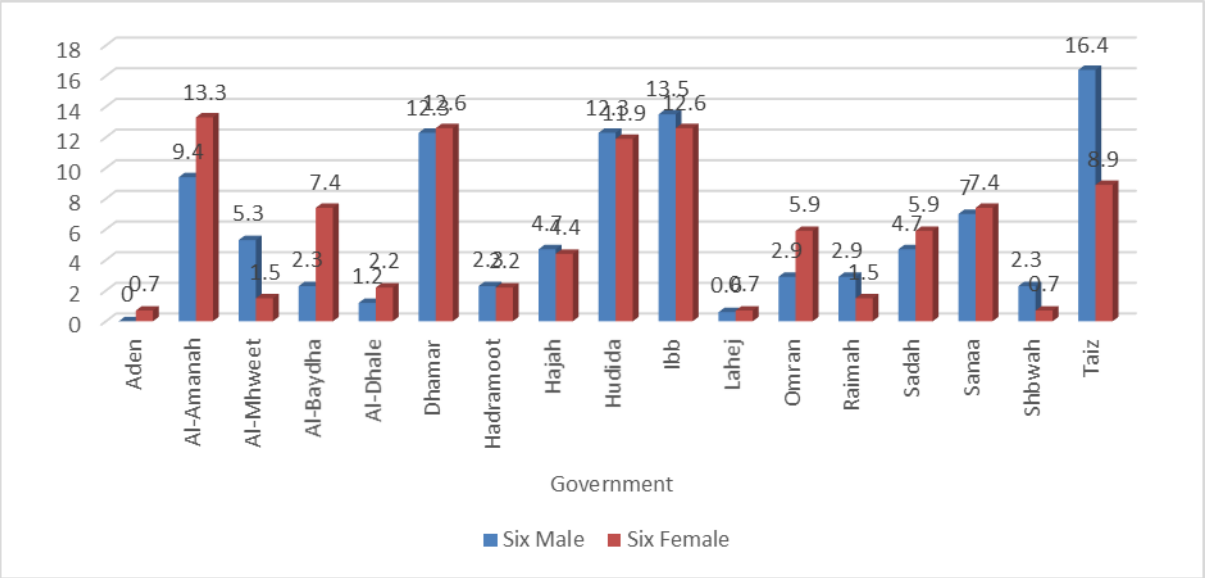

Figure 3.2. Distribution of Leukaemia in the government according six

This figure explained that, the highest percentage in male 16.4% in Taiz city, while the lowest percentage 0% in Aden city. And the highest percentage in female 13.3% in Al Amanah city, while the lowest percentage 0.7% in Aden, Lahej, and Shbwah cities.

Table 3.3. The association type of Leukaemia with Six

Type of leukemia	Six				Total n=295		*χ^2	*p*
	Male		Female					
	No.	%	No.	%	No.	%		
Acute myeloid leukemia	46	28.2	36	27.3	82	27.8	**3.5**	**0.3**

Chronic lymphocytic leukemia	21	12.9	15	11.4	36	12.2		
Chronic myeloid leukemia	50	30.7	53	40.2	103	34.9		
Acute lymphoblastic leukemia	46	28.2	28	21.2	74	25.1		
Total	163	55.2	132	44.8	295	100.0		

In this table: the male and female in acute myeloid leukemia were 28.2 %, 27.3% respectively. the male and female in Chronic lymphocytic leukemia were 12.9 %, 11.4% respectively. the male and female in chronic myeloid leukemia were 30.7 %, 40.2% respectively, the male and female in Acute lymphoblastic leukemia were 28.2 %, 21.2% respectively. There was no statistical significant between sex and type of leukemia, where ***p***= 0.3.

Table 3.4. The association type of Leukaemia with Age groups

Type of leukemia	Age								**Total**		*χ^2	***p***
	< 24		**25-37**		**38-55**		**> 55**					
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**		
Acute myeloid leukemia	٢٥	33.3	28	36.8	15	17.6	14	23.7	82	27.8	**75.8**	**0.001**
Chronic lymphocytic leukemia	0	00	0	00	16	18.8	20	33.9	36	12.2		

Chronic myeloid leukemia	16	21.3	32	42.1	37	43.5	18	30.5	103	34.9		
Acute lymphoblastic leukemia	34	45.3	16	21.1	17	20.0	07	11.9	74	25.1		
Total	**75**	**25.4**	**76**	**25.7**	**85**	**28.8**	**59**	**20.1**	**295**	**100.0**		

In this tab 5-37, while the lo ronic lymphocytic n age group o 38-55yea acute lympl 9% in age g emia, where

Chapter 4:

Discussion

Discussion

Leukemia is a malignant neoplasm of hematopoietic origin, characterized by diffuse replacement of bone marrow and peripheral blood with neoplastic cells [1]. Although, many subtypes of leukemia were known, four main subtypes were frequently seen in diagnosis such as: Acute Myeloid Leukemia (AML), Chronic Myeloid Leukemia (CML), Acute Lymphoblastic Leukemia (ALL) and Chronic Lymphocytic Leukemia (CLL). Globally, between 1990 to 2018, the number of leukemia cases markedly increased from 297,000 to 437, 033 [2]. Cancer is a major public health problem worldwide, and a systematic analysis for the Global Burden of Disease Study (GBD) reported that in 2015 there were 17.5 million cancer cases worldwide and 8.7 million deaths. Moreover, there was an increase by 33% in the number of cases between 2005 and 2015 [29] . Cancer is a preventable and manageable disease. It is important to study the level of knowledge among the population to provide valuable proofs and perspectives towards formulating relevant cancer epidemic prevention plans and strategies. So, a thoughtful, comprehensive, and integrated

approach is required at the country level, led by the government officials, and with the effective participation of various relevant categories of the community Because data about the level of knowledge in the population are very important for the build and evaluation of cancer epidemic awareness and prevention programs, [30].

In Yemen the prevalence of Leukemia is documented, however this study determine the pattern of Leukemia among adult Patients in Oncology center at AlJumhori Hospital, Sana'a city in period (2021) because the important of this problems. In this retrospectively analyzed a hospital - based medical records study , we enrolled a number of 295 Leukemia patients who fulfilled the inclusion criteria. The baseline demographics and clinical characteristics of the 295 leukemia patients enrolled are summarized in Table 3.1. and figure 3.1. The study explained that, the frequency and type of leukemia among the patients who attended to the Oncology Center at AlJumhori Hospital were four type leukemia, the AML was 27.8 %, CML was 34.9 %, ALL was 25.1% and CLL was 12.2%. This result nearly with a study reported by Radfan et al., (2017), where the percentage of AML was 26.5 %, CML was 23.5 %, ALL was 33.6% and CLL was 16.4%.. A similar result was reported by Gamal., (2012) who explained that where the percentage of AML was 15.6 %, CML was 9.3 %, ALL was 7.7% and CLL was 4.6% This study showed that there was a statistical significance difference between Age and type of leukemia, where p= 0.001. This result nearly with a study reported by Amen et al., (2019), where p < 0.001. This result nearly with a study reported by Radfan et al., (2017), where the percentage of groups <30 for AML was 59.6, groups 31-45 was 24.6 %,and group > 45 was 15.8%. the percentage of groups <30 for CML was 18.4, groups 31-45 was 28.5 %,and group > 45 was 53.1%. the percentage of groups <30 for ALL was 93.7, groups 31-45 was 2.9 %,and group > 45 was 3.3%. the percentage of groups <30 for CLL was 00, groups 31-45 was 10.4 %,and group > 45 was 89.6%. This result nearly with a study reported by Gamal et al., (2012), where the percentage of groups <30 for AML was 29.8, groups 31-45 was 40.4 %,and group > 45 was 29.8%. the percentage of groups <30 for CML was 25.0, groups 31-45 was 46.4 %,and group > 45 was 28.6%. the percentage of groups <30 for ALL was 73.9, groups 31-45 was 13.1 %,and group > 45 was 13.3%. the percentage of groups <30 for CLL was 00, groups 31-45 was 14.3 %,and group > 45 was 85.7%.While in this study, the percentage of groups < 24 for AML was 33.3, groups 25-37 was 36.8 %, group 38-55 was 17.6% and group > 55 was 23.7%. the percentage of groups < 24 for CML was 21.3%, groups 25-37 was 42.1 %, group 38-55 was 43.5% and group > 55 was 30.5%. the percentage of groups < 24 for ALL was 45.3%, groups 25-37 was 21.1 % group 38-55 was 20.0% ,and group > 55 was 11.9%. the percentage of groups < 24 for CLL was 0%, groups 25-37 was 0 %, group 38-55 was 18.8% and group > 55 was 33.9%. This study explained that there was no statistical significance difference between Sex and type of leukemia,

where p= 0.3. This result disagree with a study reported by Amen et al., (2019), where p < 0.001. This result disagree with a study reported by Radfan et al., (2017), where the percentage of male for AML was 54.3 %, CML was 46.45 %, ALL was 63.6% and CLL was 55.2%. This result disagree with a study reported by Gamal et al., (2012), where the percentage of male for AML was 53.1 %, CML was 50.0 %, ALL was 60.9% and CLL was 57.1%. while this study the percentage of male for AML was 28.2 %, CML was 30.7 %, ALL was 28.2% and CLL was 12.9%. this difference may due to the difference in time and geographical location and community customs.

Conclusions

- The prevalence of acute myeloid leukemia was 27.8 with CI 95%(23.1-32.9).
- The prevalence of chronic lymphocytic leukemia was 12.2 with CI 95%(8.8-15.6).
- The prevalence of chronic myeloid leukemia was 34.9 with CI 95%(28.8-40.5).
- The prevalence of acute lymphoblastic leukemia was 25.1 with CI 95%(20.1-30.0).
- The highest percentage 13.2% in Ibb city, while the lowest percentage 0.3 in Aden city.
- The highest percentage in male 16.4% in Taiz city And the highest percentage in female 13.3% in Al Amanah city.
- There was no statistical significant between sex and type of leukemia, where $p = 0.3$.
- There was a statistical significant between age groups and type of leukemia, where $p = 0.001$.

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Amen Bawazir1,5 , Nouf Al-Zamel2, Abeer Amen3, Maaged A. Akiel4,5, Naif M. Alhawiti4,5 and Ali Alshehri1* ***The burden of leukemia in the Kingdom of Saudi Arabia: 15 years period (1999–2013), 2019*** *decompensated cirrhosis (CTP class C).*

Appendix : Questionnaire

The Pattern of leukemia among adult Patients in Oncology center at Aljumhori

Hospital, Sana'a city .

Personal history :

Name ( )

Age ( )

Gender Male ( )

Female ( )

region ( )

Diagnosed as :

AML ( )

CML ( )

ALL ( )

CLL ( )