



Frequency of Different Types of Leukemia in Bone Marrow- Study at a Tertiary Care Center, Lucknow

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Authors' contributions

This work was carried out in collaboration between all authors. Author SA designed the study and helped in data collection while author Neema Tiwari helped in writing the paper, data collection and analysis with the help of author ZHZ who was the statistician in the study, authors Nishi Tandon, SRM and NZ helped in designing and writing of the paper.

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ABSTRACT

Leukemia is one of the most common types of cancers worldwide. It was first recognized in the year 1845. Leukemia is a heterogeneous group of malignancies, broadly divided into acute and chronic leukemia with further sub-classification into lymphoid and myeloid varieties. In 2000, nearly 2,056,000 children and adults around the world were found suffering from leukemia, and 2,009,000 died from it. World Health Organization (WHO) has classified leukemia and lymphomas into various entities on the basis of their clinic-morphological features, immunophenotyping, cytogenetic and molecular biology. Many factors related to the development of leukemia's are prior chemotherapy, hereditary syndromes, ionizing radiation, viruses, and smoking. People with leukemia's are treated with a combination of therapy including chemotherapy (main treatment), antibiotic, blood transfusion, radiation therapy, and bone marrow transplantation. These treatment

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modalities have prolonged the survival rate of patients with leukemia.

Materials and Methods: We carried out a study to see the frequencies of ALL, AML, CLL and CML, diagnosed in our hospital. Study also aimed at calculating frequencies as per World Health Organization (WHO) classified leukemia on the bone marrow studies. We assessed the retrospective data of patients diagnosed as leukemia in the Department of Pathology Era's Lucknow Medical College & Hospital, Lucknow, Uttar Pradesh.

Results: An upward trend in incidence of leukemia with age was seen, although the acute leukemia's were more common in patients below 20 years of age. The total number of males who participated in this study were 116[40.6%] while females were 170[59.4%]. Maximum patients were in the age group 21-30 years. The prevalence percentage of leukemia seen in our study was more in the age group of 51-60 and 71-80 years. Males were seen to be afflicted more than females in all age groups. No correlation between the gender of the patients and type of leukemia was seen on applying Fischer Exact test. Acute leukemia show a greater prevalence in second decade.

Conclusion: The present study revealed that acute leukemia was more prevalent than chronic leukemia in second decade. The most common type of leukemia was CML followed by AML, ALL and CLL. No overall correlation of type of leukemia with gender was seen although more males were afflicted with leukemia's than females.

Keywords: Leukemia; bone marrow; lymphoid; myeloid; incidence; prevalence.

1. INTRODUCTION

Leukemia was a rare disease few years back. However it is increasing in incidence and prevalence slowly and steadily. It is defined as a widespread, rapid and disorderly proliferation of leukocytes and their precursor and the presence of immature leukocytes in blood often in very large numbers. Leukemia's are to a great extent associated with epidemiological features like age and sex but due to the changing classification of leukemia and upcoming trends of juvenile chronic leukemia's occurring in younger adults and acute leukemia's occurring in older individuals an epidemiological survey is the need of the hour [1].

Acute leukemia's are hematological malignancies, where there is an increase in numbers of myeloid or lymphoid blasts. "Acute," refers to a rapid onset and fatal outcome of disease, indicating the relatively undifferentiated nature of the leukemic cells [2]. The overall annual incidence of these disorders in the general population is about 4 per 100,000, with approximately 70% of them being acute myeloid leukemia (AML). AML accounts for about 15% of childhood leukemia's and for approximately 80% to 90% of acute leukemia's in adults, with the median age at diagnosis being about 70 years. Acute lymphoblastic leukemia (ALL) is primarily a childhood disease, with the peak incidence between the ages of 2 to 3 years. It diminishes in frequency from about the ages of 25 to 50, after which it increases to achieve a second, but minor, peak at ages older than 8 [2].

Another important subgroup of leukemia's is the chronic myeloproliferative disorder (CMPD). The most common CMPD, chronic myelogenous leukemia (CML), accounts for about 20% to 35% of all adult leukemia's. It typically occurs at ages 40 to 60, with about 20% to 40% of patients asymptomatic. Clinically patient presents with hepatosplenomegaly accompanied with leukocytosis, anemia, or thrombocytosis[3].

Due to the lack of any nationwide leukemia screening program, the majority of the population of India is still unaware of this blood disorder. Lack of awareness also plays a role in underlying late presentation and noncompliance with screening guidelines [1]. Hence it is important for the physicians and pathologists to determine the current burden of leukemia's in India as well as to understand how the occurrence and outcome of the disease differs across the whole country. In this context, this study aims to describe the frequency and prevalence of Leukemia in the north-western population of Lucknow, Uttar Pradesh, India.

2. MATERIALS AND METHODS

The study was performed for 3 consecutive years i.e.; from 2013 to 2015 on patients diagnosed to have immature cells on peripheral blood smear study. Further typing and evaluation was done by bone marrow study. The medical records are collected from Hematology section, Department of Pathology, Era's Lucknow Medical College, Lucknow, Uttar Pradesh. Care was taken to see that records of patients were not repeated in

follow up cases. The data was collected in relation to types of leukemia, patient's age, and gender of the patients. In laboratory, patient's bone marrow sample was received and peripheral blood/ bone marrow smears made from it and the smear stained with Leishman's stain and examined under microscope for the detection of leukemic cells and their relative percentages. According to the percentage of blast cells and premature cells in smear, leukemia was diagnosed either as acute or chronic form and their variants. Special stains were done in order to determine the myeloid or lymphoid series. Special stains included MPO (Myeloperoxidase stain), PAS (Periodic Acid Schiff stain), NSE (Non-specific esterase) and Sudan Black.

3. RESULTS

An upward trend in incidence of leukemia with age was seen, although the acute leukemia's were more common in patients below 20 years of age. The total number of males who participated in this study were 116[40.6%] while females were 170[59.4% Table 1] Maximum patients were in the age group 21-30 years [Fig. 1], however the prevalence percentage of leukemia seen in our study was more in the age group of 51-60 and 71-80 years [Tables 2, 3]. Males were seen to be afflicted more than females in all age groups. No correlation between the gender of the patients and type of leukemia was seen on applying Fischer Exact test [Table 4], acute leukemia show a greater prevalence in second decade [Table 5, Fig. 6].

It is evident from the table that acute leukemia's like AML & ALL are more commonly seen below 20 years of age and chronic leukemias like CML & CLL are more common in older age groups.

4. DISCUSSION

The largest contributors to childhood mortality in Britain are CNS tumors, reflecting its poor survival followed by leukemia and neuroblastomas. In India, leukemia continues to be the largest contributor to cancer-related mortality in children [3]. This pattern is a result of the lower survival of all cancers, including Leukemia in India [4,5]. Multiple factors are responsible for the poorer outlook of blood cancer in India. Expensive treatment, treatment related death, treatment refusal or abandonment by patients, relapse of diseases are frequent unwanted outcomes [6,7,8]. Many studies have

been conducted on various aspects of individual hematological malignancies. Some researchers have reported that in India all hematological malignancies are commonest in Delhi followed by Mumbai. Urban population shows a higher incidence of leukemia's as compared to rural areas. This difference in urban and rural set up could be due to socioeconomic status of people. The urban class has access to more damaging dietary habits and lifestyle. In rural areas, on the other hand, people stick to traditional eating habits and lifestyle. These factors may be responsible for the relative differences in the incidence of hematological malignancies in urban versus rural population [5,6]. In a study conducted on the population of Haryana, it was seen that all leukemia's occur two decade earlier in that region.

Table 1. Number of males and females in the cases studied

Sex distribution		
Sex	Number of patients	Percentage
Male	116	40.6
Female	170	59.4
Chi sq=10.20, p=0.006		

Table 2. Age demography

Age years	Prevalence of leukemia (%)	95% CI for prevalence	
		Lower	Upper
0-10	7.41	0.00	17.29
11-20	7.58	1.19	13.96
21-30	8.57	2.01	15.13
31-40	17.78	6.61	28.95
41-50	6.25	0.00	14.64
51-60	21.43	6.23	36.63
61-70	14.29	0.00	32.62
71-80	33.33	0.00	86.68

More prevalence of leukemia in 50-80 age group

Table 3. Prevalence of leukemia in different age groups

Age years	Prevalence of Leukemia (%)	
	Male	Female
0-10	10.0	5.9
11-20	10.0	5.6
21-30	13.3	5.0
31-40	25.0	12.0
41-50	8.3	5.0
51-60	16.7	30.0
61-70	16.7	12.5
71-80	100.0	0.0
Total	15.0	8.2

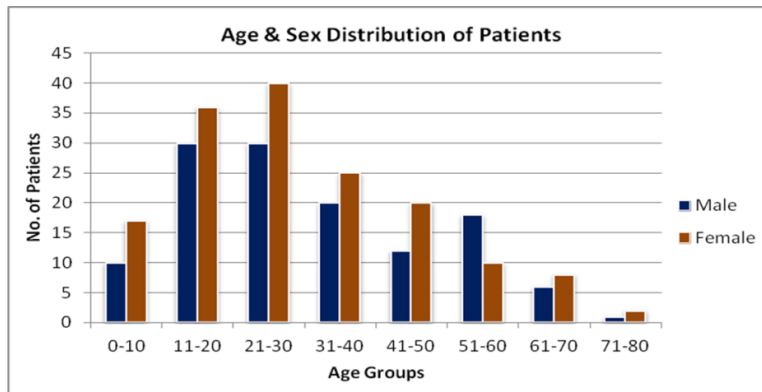


Fig. 1. Age and sex distribution of patients

Table 4. Association between gender and leukemia type

Types of leukemia	Male	Female	Total
	N (%)	N (%)	
AML	7 (38.9)	6 (42.9)	13 (40.6)
ALL	1 (5.6)	1 (7.1)	2 (6.3)
CML	8 (44.4)	6 (42.9)	14 (43.8)
CLL	2 (11.1)	1 (7.1)	3 (9.4)
Total	18 (56.3)	14 (43.7)	32

$P = 1.000$ using Fisher's Exact test. [Performed to find out the significance of association]
No association was seen between gender & types of leukemia ($p = 1.000$).

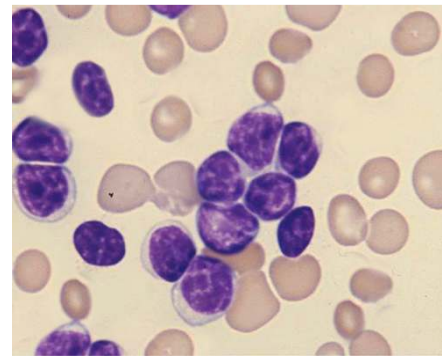


Fig. 3. Lymphoblasts in ALL

Table 5. Association between age group and leukemia type

Age group	Leukemia type			
	AML	ALL	CML	CLL
0-10	1	1		
11-20	4	1		
21-30	4		2	
31-40	3		5	
41-50	1		1	
51-60			6	
61-70				2
71-80				1

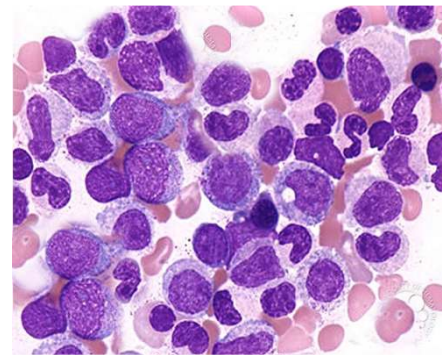


Fig. 4. Immature cells of myeloid series comprising of myelocytes, metamyelocytes, few band forms with precursor erythroid series cells in CML

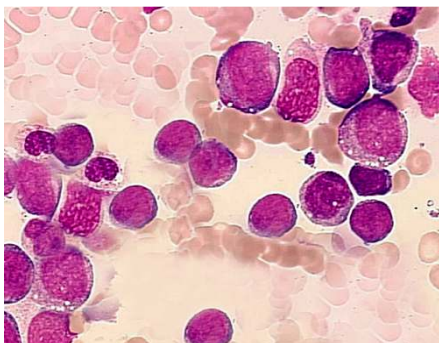


Fig. 2. Myeloblasts in AML

Acute leukemia (51%) has a higher prevalence than the chronic type (49%) as seen in some other studies [7]. Some studies have also reported more cases of chronic leukemia in their study (60%) as compared to acute leukemia [8,9]. In one study, the commonest type of leukemia was CML followed by AML, ALL and CLL. Many studies have reported more cases of

myeloid leukemia than lymphoid, as seen in our study [7,9,10]. These studies have reported more cases of CML than AML with a higher incidence of CML has especially in Indian population. [5,11]. This difference could be attributed to geographical variation in the studies conducted.

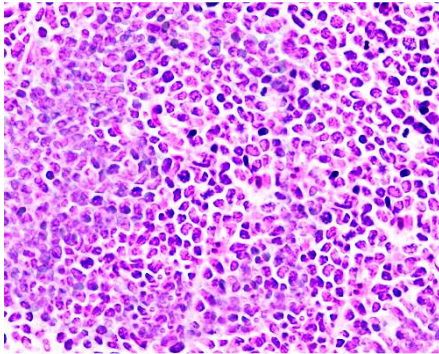


Fig. 5. Mature small lymphocytes with irregular borders due to fragile cytoplasm in CLL

ALL has been seen to occur more commonly than CLL [9,10,11,12,13,14,15] while a markedly high incidence of CLL has been reported by some studies [8,16,17]. In studies conducted in Denmark, Poland and Scandinavia they have reported CLL as being more common than CML in countries like. ALL has been seen to be of intermediate frequency in the West and is most frequent in the South [10,18,19]. The incidence of ALL is lesser in East India as well as Northern areas a fact endorsed by some authors [20]. The incidence of ALL is intermediate in the East, Centre and West and in one series from South [21,20].

Increased incidence of all leukemia in males could be due to the fact that comparatively more

exposed to occupational and environmental carcinogens, a finding seen in our study too [1,4,22]. It has been seen that low grade fever, progressive pallor, generalized weakness and body aches were the most frequent symptoms found in AML and ALL, while splenomegaly was noted most frequently in CML. Bone tenderness is the most common symptom in ALL and AML. Lymphadenopathy has been seen in 78% and 74% of CLL, and ALL patients respectively [1] while retinal hemorrhages have been seen in 15% cases of AML. Bleeding is another symptom that has also been seen in acute leukemia [23,24,25].

In the present study acute leukemia was more prevalent than chronic leukemia in the younger age group while overall leukemia were seen to occur more in the older age. Also males were seen to be affected more as compared to females however no association of type of leukemia was seen with the sex of the patients. Among all subtypes of leukemia myeloid series leukemia are much more common than lymphoid series a finding similar to some other studies [3].

In one study it has been seen that the incidence of leukemia varies with the age and gender which according to the author could be due to the life style and habits like tobacco smoking other than genetic factors [3].

It has been seen that the spectrum of cancer epidemiology seen in India is different than that seen in any developed country. It should be stressed that there are not many cancer registry data's in India despite a large population, so better development of regional and national registries is the need of the hour.

A study conducted by Modak et al. [25] showed a male to female ratio 1.8:1, which is similar our

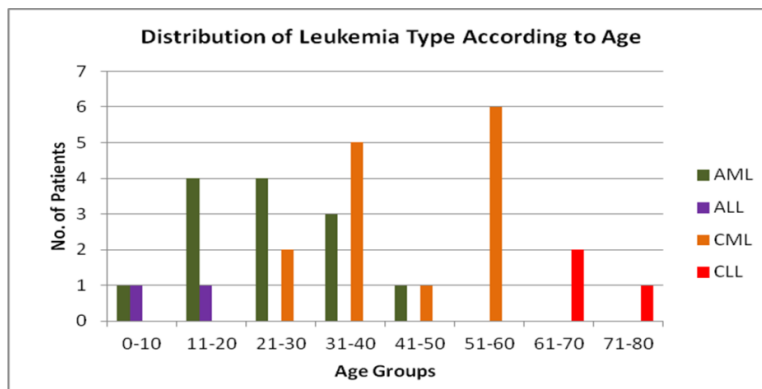


Fig. 6. Distribution of leukemia type as per age

finding and to another similar study [1,3]. They found that myeloid leukemia's were common as compared to lymphoid, a finding similar to our study. Another study, shows high male prevalence of leukemia's which is the case in our study [1].

5. CONCLUSION

The present study revealed that acute leukemia was more prevalent than chronic leukemia in second decade. The most common type of leukemia was CML followed by AML, ALL and CLL. Chronic myeloid leukemia which came out to be more common in our study, is mainly a leukemia of adults affecting the myeloid series while AML occurring in younger age group is characterized by presence of >20% blasts in marrow, as per the WHO criteria. CLL which mainly shows mature small lymphocytes and smudge cells, was not as common as CML. ALL showing immature blasts in marrow and PBS was again more common in younger individuals. To identify different types of blasts special staining with MPO and PAS should have to be done, where confusion arises in typifying. No overall correlation of type of leukemia with gender was seen although more males were afflicted with leukemia than females.

CONSENT

All authors declare that written informed consent was obtained from the patients for publication of the work.

ETHICAL APPROVAL

No humans were specially recruited for the study. The study was carried out using the hospital data for the patients diagnosed as leukemia who had consented to undergo a bone marrow examination. The study was approved by the institutional ethical committee.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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