

Current Demographic Trends in Acute Leukemia: A Cross-sectional Survey of Adult Acute Leukemia Cases Presenting at Medical Oncology Department at Jinnah Postgraduate Medical Center, Karachi

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ABSTRACT

This study was conducted to determine demographic distribution of Acute Leukemia (AL) among the adult patients in Pakistan. This was a cross-sectional survey conducted between September 2023 and February 2024 from the Department of Oncology at Jinnah Post-graduate Medical Center, Karachi Pakistan. This department receives cancer patients from all over the province of Sindh as well as from other provinces. A total of 130 adult patients with diagnosis of acute leukemia were included in this study. Participants were selected using convenient sampling technique. The median age of male AL patients was significantly higher as compared to females i.e. 30 years ;IQR=18 versus 24 years; IQR=21.25 years (p value= <0.05). There was statistically significant difference in the age distribution among AL patients between males and females. This study found male: female ratio of 1.8:1 among AL patients. No statistically significant difference was observed in the socio-demographic and disease-related characteristics among male and female. The current study concludes that acute leukemia demonstrates male predominance. The average age of presentation was comparatively lower among females as compared to males. However, sociodemographic and disease characteristics does not appear to be influenced by gender. Large scale studies are required to evaluate its influence on clinical outcome.

Key words: Acute Leukemia, Epidemiology, Oncology

INTRODUCTION

Globally, epidemiology of various cancers shows obvious dipartites in the incidence, disease prognosis and mortality on the basis of gender (1). According to cancer statistics of 2020 the overall combined incidence of all cancers can be 19% more among men as compared to women. However, the estimates may vary in some populations depending on regional variations (2). The role of gender can be explained by various differences in the normal human physiology under the influence of sex hormones, chromosomal differences or genetics as well as difference in environmental exposures (3-7). Hence, the gender has been reported that gender not only influences susceptibility for a particular type of cancer but also impacts its overall prognosis including treatment outcomes and mortality (2,3).

Leukemias have been identified globally as one of the commonest type of cancers. According to global cancer statistics collected from 186 countries. Leukemia is the 11th major contributor to global cancer related mortality (6). The global age standardized incidence of leukemia in the developing world is 3.8 cases /100,000 for males while 2.9 cases/100,000 for females. However, it is important to explore the possible regional differences for understanding the diseases epidemiology and risk stratification for implementation of better evidence based prevention strategies (1). The burden of Leukemia is on rise particularly in the developing countries located in South Asian region. Among all the South Asian countries the highest incidence of leukemia is reported from India, followed by Pakistan, Bangladesh and Sri Lanka. However, the gender-based burden of leukemia is unevenly differentiated in most of the populations (7).

Pakistan is a country where cancer burden is on rise while health care system is struggling with many other chronic as well as communicable diseases. In Pakistan women found to have a higher incidence of Leukemia than men. Moreover, leukemias are more common in younger age groups (7), further making the situation alarming. A retrospective study conducted in 2016 at Institute of Radiotherapy and Nuclear Medicine (IRNUM) Peshawar found that in Khyber-Pakhtun-Khwa Acute leukemia was more prevalent in adult males as compared to females. However, there is dearth of regional information regarding gender distribution of Acute Leukemia cases among adult population from other provinces. This warrants for targeted research to establish the basic epidemiology of Acute Leukemia in different regions of Pakistan. Hence, this study aims to determine the gender distribution and other demographic characteristics of Acute Leukemia among the adult patients presenting at Medical Oncology department at Jinnah Postgraduate Medical Center (JPMC), Karachi, Pakistan.

METHODS

This was a prospective cross-sectional study conducted in the Out-Patient-Department (OPD) of Oncology Department of Jinnah Postgraduate Medical Center (JPMC), Karachi between September 2023 and February 2024. The JPMC Oncology department is offering oncology services for all kind of cancers including acute leukemia. The department receives cancer patients from all over the province of Sindh as well as other provinces. The adult patients presenting at Oncology OPD with the diagnosis of acute leukemia were approached and invited to participate in this study using non-probability convenient sampling technique. Hence, male and female patients of age 18 years or above presenting with histopathology confirmed diagnosis of acute leukemia were included in this study. However, any patient presenting in a severely debilitating condition or any patient who was mentally unstable to provide written informed consent was excluded from the study despite meeting study inclusion criteria. The study was completed within 6 months after obtaining approval from Institutional Review Board of JPMC, Karachi, Pakistan. The sample size for this study was calculated using WHO Sample Calculator. At 95% level of confidence, 80% power and an anticipated proportion of leukemia cases 59% among males and 41% among females the obtained sample size was 118. After adjusting for 10 % non-response rate the obtained final sample size was 130 (2,8).

Data was collected by the trained data collectors with a medical background including the Principal Investigator. The patients presenting at Oncology OPD at JPMC and eligible to participate in this study were directly approached by the designated data collectors. The data was collected using a structured questionnaire translated into local language i.e. Urdu. The face validity of the questionnaire was assessed by a senior experienced in oncology research. However, the cognitive validity as well as lingual validity of the questionnaire was tested before the start of data collection by running a pilot survey in any other OPD at JPMC. The information was collected regarding the socio-demographic characteristics such as age, gender, education, marital status, ethnicity, occupation, health related characteristics including type and stage of acute leukemia and family history of acute leukemia. The information regarding disease diagnosis, including histopathology findings, type, stage and origin of cancer were collected from the medical records available with the patient. The patients whose cancer staging or diagnosis was incomplete were followed-up on phone or during next follow-up visits to collect the required clinical information.

Statistical Methods

Data was analyzed using SPSS version 21.0. Descriptive statistics were calculated for the socio-demographic and health related characteristics. Chi-square test of significance was applied to assess the possible differences in the presentation of disease and socio-demographic characteristics.

RESULTS

A total of 130 adult patients presented with AL during the study period, were included in the study. The median age of patients was 28 years with Interquartile Range (IQR) of 20 years. The highest proportion of patients i.e. 51.5% (n=67) were of age between 18-28 years followed by the second highest proportion of AL patients from the age category of 29-38 years i.e. 27.7% (n=36). 64.4% (n=84) of all the AL patients were males while 35.4% (n=46) were females. Majority of the AL patients included in the study were married with a proportion of 52.3% (68). 53.1%

(n=69) of all the patients were literate and had some level of formal education while 46.9% (n=61) of the study participants were illiterate with no education at all. Most of the patients belonged to Pashto ethnicity i.e.33.8% (n=44) followed by Sindhi and Urdu ethnicities with the proportion of 23.8%(n=31) and 20.8%(n=27) respectively (Table 1). When compared for age and socio-demographic characteristics the study found significantly higher median age among leukemia patients who were male as compared to females i.e. 30 years (IQR=18 years) versus 24 years (IQR=21.25 years)(p-value= <0.05). Similarly statistically significant differences were observed in the distribution of AL patients in various age categories on the basis of Gender. Statistically significant differences were also observed in the occupation among male and female patients; however, no significant differences in the marital status, educational status, ethnicity and socio-economic status was found (Table 2). Male and female AL patients were also compared for disease-related characteristics including type of AL, biopsy finding, risk category, reported symptoms and organs involved. No statistically significant differences were observed (Table 3).

Table: 1 Socio-demographic characteristics of the adult patients presenting with Acute Leukemia in Oncology Department at JPMC, Karachi (n=130)

Variable	Frequency (n)	Percentage (%)
Mean Age: 28 years (IQR; 20 years)		
Age (in completed years)		
18- 28years	67	51.5
29-38years	13	10.0
39-48years	36	27.7
49-59 years	08	6.2
60 years and above	06	4.6
Marital status		
Unmarried	62	47.7
Married	68	52.3
Education		
Literate	69	53.1
Illiterate	61	46.9
Ethnicity		
Urdu	27	20.8
Sindhi	31	23.8
Pashto	44	33.8
Punjabi	12	9.2
Balochi	13	10.0
Saraiki	01	0.8
Hindko	02	1.5
Occupation		
Businessman/ woman	16	12.3
Farmer	14	10.8
Home maker	28	21.5
Student	46	35.4
Laborer/Manual worker	15	11.5
Technician	07	5.4
Office job	04	3.1

DISCUSSION

This study is one of the few studies exploring the epidemiology of Acute Leukemia (AL) among adults presenting in oncology department of Pakistan. This study reported that average age of adults presenting with AL was 28 years (IQR=20 years) with a male to female ratio of 1.8:1; hence reporting approximately 2 cases of AL among male

Table: 2 Differences in socio-demographic characteristics of the adult male and female patients presenting with Acute Leukemia in Oncology Department at JPMC, Karachi (n=130)

Variable	Male (n=84)	Female (n=46)	p-value **
Frequency (%)			
Median Age (IQR)	30.0(18) years	24(21.25) years	0.04
Age (in completed years)			
18- 28years	37(44.0)	30(65.2)	
29-38years	13(15.5)	0	0.009
39-48years	26(31.0)	10(21.7)	
49-59 years	04(4.8)	04(8.7)	
60 years and above	04(4.8)	02(4.3)	
Marital status			
Unmarried	39 (46.4)	23(50.0)	0.69
Married	45 (53.6)	23(50.0)	
Education			
Literate	46 (54.8)	23(50.0)	0.60
Illiterate	38(45.2)	23(50.0)	
Ethnicity			
Urdu	17(20.2)	10(21.7)	
Sindhi	19(22.6)	12(26.1)	
Pashto	09(10.7)	03(6.5)	
Punjabi	29(34.5)	15(32.6)	0.90
Balochi	07(8.3)	06(13.0)	
Sariki	01	0	
Hindko	02	0	
Occupation			
Businessman/ woman	16 (19.0)	0	<0.001
Farmer	14(16.7)	0	
Home maker	0	28(60.9)	
Student	29(34.5)	17(37.0)	
Laborer/Manual worker	15(17.9)	0	
Technician	07(8.3)	0	
Office job	03(3.6)	01(2.1)	
**Chi-square test was applied to compare disease characteristics among male and female sex. P-value of 0.05 or less was considered statistically significant.			

population for each case of AL in female population. This finding is consistent with the results of the recent study conducted in KPK which found same ratio of leukemia among male and female patients (1.8:1). However, when compared to regional evidence the male: female ratio of AL in our study was comparable to the evidence from Southern China but was relatively higher when compared to evidence from Iran (9,10).

Table: 3 Comparison of disease related characteristics among adult male and female patients presenting with Acute Leukemia in Oncology Department at JPMC, Karachi (n=130)

Variable	Total Sample N=130	Male N=84	Female N=46	P-value**
	Frequency (%)			
Type of AL				
B-Cell ALL	75 (57.7)	47(56.0)	28 (60.9)	
T-Cell ALL	06(4.6)	05(6.0)	01(2.2)	0.66
AML	47(36.2)	30(35.7)	17(37.0)	
APML	02 (1.5)	02(2.4)	0	
Biopsy finding				
>30% blasts cells	01 (0.8)	01(1.2)	0	
>50% blasts cells	03(2.3)	0	03(6.5)	0.16
>60% blast cells	37(28.4)	21(25.0)	16(34.8)	
>70% blast cells	24(18.5)	17(20.2)	07(15.2)	
>80% blast cells	25(19.2)	18(21.4)	07(15.2)	
>90% blast cells	40(30.7)	27(32.1)	13(28.3)	
Risk Category				
Poor Risk	41 (31.5)	29(34.5)	12(26.1)	
Standard Risk	20(15.4)	09(10.7)	11(23.9)	0.14
Good Risk	69 (53.1)	46(54.8)	23(50.0)	
Main Symptoms*				
Fever	119(91.5)	77(91.7) _i	42(91.3)	1.00
Bleeding	108(83.0)	67(79.8)	41(89.1)	1.73
Gum swelling	30(23.0)	24(28.9)	06(13)	0.041
Weakness	56(43.0)	37(44.6)	19(41.3)	0.81
Fatigue	67(51.5)	44(53.0)	23(50.0)	0.74
Shortness of breath	74(56.9)	49(58.3)	25(54.3)	0.66
Body ache	98(75.3)	61(73.5)	37(80.4)	0.37
Organs involved				
Liver and Lymph node	07(5.4)	07(8.3)	0	
Liver, Spleen and lymph node	02(1.5)	01(1.2)	01(2.2)	
Liver and Lung	01(0.8)	01(1.2)	0	0.29
Liver only	20(15.4)	12(14.3)	08(17.4)	
Lymph node only	04(3.1)	02(2.4)	02(4.3)	
None	96(73.8)	61(72.6)	35(46.1)	
*Multiple Responses Possible. **Chi-square test was applied to compare disease characteristics among male and female sex. P-value of 0.05 or less was considered statistically significant. _i Chi-square test was applied using 2x2 table.				

This finding is also supported by the previous evidence from various populations including South American, Caribbean, Asian, and African populations which revealed higher burden acute leukemia among male sex as compared to females (10-13). However the average age of male patients presenting with AL was higher as compared to female patients with AL and this finding was statistically significant. Similarly, statistically significant differences in the age distribution of male and female patients were observed. 65% of all female patients presented

between the ages of (18-28) years as compared to male patients with only 44% of patients presented between the ages of (18-28) years. Similar differences were observed for other age group categories among male and female patients. This can be supported by the possible role of genetic predisposition as supported by a recent study conducted among adult patients with Acute Lymphoblastic Leukemia (ALL). The study investigated the gene expressions and concluded that genetic susceptibility can be a major determinant for the age at diagnosis of ALL among adult patients in China and Singapore (14-16). However, further research is required to determine the role of genetic expressions in the development of acute leukemias on the basis of difference in sex (6). Furthermore, the age at the diagnosis and patient's sex are widely recognized as an important predictor of prognosis among patients with acute leukemia. Therefore, the age and sex of the leukemia patient need to be considered while assessing the prognosis and survival to decide the overall treatment plan.

This study found no statistically significant differences in the characteristics of AL among male and female patients such as the frequency distribution for the type of AL, biopsy findings, risk category as well as symptoms except gum swelling and organ involved. This finding can be explained by the limited sample size of this study and need further exploration with a larger representative sample to reach a definite conclusions. However, this finding is similar to the previous studies conducted in Asia including Iran and China reporting no significant differences in the AL morphology among male and female patients on the basis of difference in sex (9,17).

This study had a few limitations. First of all, this study was not a population-based study, but it represented the general population from one of the largest public sector hospital in Karachi, receiving patients from Karachi as well as other areas of the region. Hence, this limits generalizability of the study findings at large. This study did not collect any information regarding family history of leukemias; hence, we could not compare the male and female genders for genetic susceptibility, as well as any possible differences in the age at presentation among those with a family history of leukemias as compared to those with no such family history. Moreover, this study did not collect detailed information about the education level such as qualification or level of education achieved as well as socio-economic status of participants. This did limit the assessment of differences among study participants, specifically male and female patients, on the basis of differences in socio-demographic characteristics.

Nevertheless, this study provides valuable insights into the local evidence regarding AL epidemiology. In a country with no established effective surveillance of cancers, even small-scale studies are of crucial importance to gain insight into the local situation. Findings from this study are found consistent with previous studies from other populations. This study also highlights a dire need to explore further possible differences in the epidemiology of AL among male and female patients. Large-scale multi-center or population-based studies need to be conducted to explore the unknown as well as emerging facts about AL prevention, diagnosis, and management.

CONCLUSION

The current study concludes that acute leukemias in Pakistani population demonstrates male predominance. The average age of presentation was comparatively lower among females than among males. The study did not find any statistically significant differences in the socio-demographic and disease-related characteristics among male and female patients with AL.

Conflict of interest:

The authors declare no conflict of interest

Ethical consideration:

Ethical approval for this study was obtained from Institutional Review Board of JPMC, Karachi. Written informed consent was obtained from each study participant at the time of data collection once they were fully explained about the possible risks and benefits for participating in this study.

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