



## The Frequency and Distribution of ABO Blood Groups in Patients with Haematological Cancers in Uyo, Nigeria: A Hospital Based Retrospective Study

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### Authors' contributions

*This work was carried out in collaboration between all authors. Author MBIE contributed substantially to study design, acquisition of data, drafting of the article, revising it critically for important intellectual content, final approval of the version to be published. Author TAE contributed substantially to the conception and design, acquisition of data, analysis and interpretation of data, drafting the article, revising it critically for important intellectual content, final approval of the version to be published. Author AME analysis and interpretation of data, drafting the article, revising it critically for important intellectual content, final approval of the version to be published.*

### Article Information

DOI: 10.9734/IBRR/2018/42665

#### Editor(s):

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Complete Peer review History: <http://www.sciedomain.org/review-history/25770>

Original Research Article

Received 22<sup>nd</sup> May 2018  
Accepted 27<sup>th</sup> July 2018  
Published 3<sup>rd</sup> August 2018

### ABSTRACT

**Background:** The pattern and distribution of haematological malignancies vary depending on age, sex and geographical location. Studies on the association between haematological cancers and ABO blood types have been largely conflicting.

**Aim:** To determine the frequency and distribution of ABO blood groups among a cohort of patients with haematological cancers.

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**Methods:** This was a retrospective descriptive cross-sectional study involving the review of records of patients with various haematological cancers, their demographic characteristics and ABO blood group distribution over a 5 year period.

**Results:** The record of 132 patients with haematological malignancies over a 5 year period were reviewed. The mean age of the patients was  $47.93 \pm 17.9$  years. The peak age incidence for the various haematological cancer was the fourth and fifth decades of life. The male to female sex ratio was 2:1. NHL was the commonest haematological cancer among the patients. Majority of the patients were of the O-blood type, the different blood group distribution among the patients was statistically not different from that of the general population. Also, there was no significant association between haematological cancers and ABO blood type of the patients.

**Conclusion:** The distribution, age and sex ratio of haematological malignancies in our study was comparable to those reported by other authors with NHL being the most common haematological cancer in our environment. Majority of the patients were of the O-blood type, comparable to the general population. There was no significant association between haematological cancers and ABO blood type of the patients.

*Keywords: Haematological malignancies; cancers; blood group; ABO; Rh.*

## 1. INTRODUCTION

Haematological malignancies are a group of cancers that affect the blood, bone marrow and lymph nodes. These cancers include but not limited to; leukaemias which are sub-classified into acute leukaemia (acute lymphoblastic leukaemia [ALL] and acute myeloid leukaemia [AML]) and Chronic Leukaemia (Chronic lymphocytic leukaemia [CLL] and Chronic myeloid leukaemia [CML]), Myeloma and lymphomas (Non Hodgkin lymphoma [NHL] and Hodgkin lymphoma [HL]) [1].

The aetiology of haematological cancers is largely unknown. However, for a few of these haematological cancers, risk factors associated with their occurrence have been identified [2,3]. Globally, haematological cancers account for 7.5% and 6.4% respectively of male and female cancers diagnosed worldwide [4]. In the United States, its account for about 6-8% of all diagnosed cancers in both sexes [5]. The prevalence is much less in Asian countries. In Korea for instance, it accounts for about 4.5% of all cancers [4]. In Africa, a study from Eastern Morocco reported a prevalence of 10.9% while the prevalence of 18.05 % was reported in Ilorin North-Central region of Nigeria [7,8] when compared to other cancers.

The ABO blood group is by far the most important and most antigenic of the blood group system [9]. The antigens of this blood group system are defined by carbohydrate moieties expressed on the surface of the erythrocyte membrane [10]. However, in addition to the erythrocyte membrane, these antigens are also

expressed on the surfaces of a large number of normal human cells and tissues including body fluids as well as some tumours [11,12]. Based on the carbohydrate moieties (antigens) on the erythrocytes membrane, the following blood groups including A, B, AB and O are derived from the ABO system [11]. The ABO blood group system can also be classified as the O and the non-O blood types, the later comprising persons with blood group A, B, and AB. Furthermore, the subtype of A-antigen has been identified. Hence, the A and AB blood groups have been further sub-classified. About 20% of persons with A-antigen in their blood belongs to A2 thus forming either A2 or A2B subgroup while the remaining 80% belong to A1, thus forming either A1 or A1B [13]

Right from the first study in 1953 that demonstrated an association between stomach cancer and blood group-A [14], there have been several other studies on the plausible association or relationship of blood types to some disease conditions [15,16]. For instance, kaffenberger et.al [17], in their study found that ABO blood group was independently associated with the overall survival of patients undergoing surgery for renal cell carcinoma. The non-O blood type was identified as an independent predictor of mortality [17]. Similar findings though with subtle differences have been reported among other solid tumours [18,19,20].

Similarly, several studies have demonstrated an association between haematological cancers and blood type though these studies have been largely inconsistent [21,22,23]. A study that examines genetic predisposition of individuals to

lymphoma and leukaemia with respect to their ABO blood types, found that among patients with leukaemia, those with CLL had an increased frequency of the A2 blood phenotype while the blood group phenotype of those with lymphoma was similar to those of the controls [22]. Also, in a study to assess the distribution of ABO blood groups and the difference in the distribution from the source population in patients with acute leukaemias and lymphomas, the authors found that there were more patients with blood group-B who had HL [45.6% (95% CI 6.8-84.5)] and also more patients with blood group O with ALL [14.3% (95% CI 3.2-25.3)] when compared to other blood groups [23].

To the best of our knowledge, very few studies have evaluated the frequency and distribution of ABO blood groups among patients with haematological malignancies as well as the association between these cancers and ABO blood groups in our environment. Furthermore, if the risk of different diseases and/or cancers are known for different ABO blood types, it could serve as a potential epidemiological marker to identify at risk persons in the population. Therefore, the objectives of this study were to determine the frequency and distribution of the ABO blood groups of patients suffering from different haematological malignancies and to determine if any, the association between the haematological malignancies and ABO blood groups as seen in our centre.

## 2. MATERIALS AND METHODS

### 2.1 Study Location

The study was conducted in the Department of Haematology, University of Uyo Teaching Hospital; a tertiary referral health facility in the South-South region of Nigeria that provides specialized healthcare services to residents of Uyo and its environs. The Department of haematology attends to adult patients with various haematological disorders including haematological cancers.

### 2.2 Study Population

This consist of male and female adult patients diagnosed with haematological malignancies in the last five years from January 2012 to December 2017 in Haematology Department. A total of 132 adult patients with various haematological malignancies were reviewed during the study period.

### 2.3 Study Design

The study design was a retrospective descriptive cross-sectional study set out to achieve the above objectives. Data of all haematological malignancies seen in the department over a five year period (Jan.2012-Dec. 2017) were reviewed. Information on the type of haematologic cancers, the age and sex of the subjects, possible risk factors for cancer and their ABO blood types were extracted from patient's case files and recorded in a proforma designed for the study.

### 2.4 Inclusion and Exclusion Criteria

The case-files of patients who had confirmed diagnosis of any of the haematological malignancies and with complete clinical and laboratory records were used in the study. Case-files of patients with a presumptive diagnosis of haematological cancers and incomplete records were excluded from the study. Also, records from paediatric patients were excluded from the study.

### 2.5 Ethical Consideration

Ethical approval was obtained from The Institutional Health Research Ethical Committee of the Hospital before the commencement of the study.

### 2.6 Data Analysis

Data obtained was analysed using STATA software for windows version 10.0. Results were presented in simple tables. Descriptive statistics, **frequency, analysis of variance (ANOVA)** were used as appropriate and statistically significant levels were set at  $p < 0.05$

## 3. RESULTS

A total of 132 adult patients with haematological malignancies were reviewed during the study period. The mean age of the subjects was  $47.93 \pm 17.9$  years with a range of 17- 81 years. More than half of the subjects were males (54.6%) Table 1.

NHL was the most common (31.1%) haematologic malignancy, while CML was the most frequent leukaemia seen (25.8%). Table 2.

The peak age incidence of the various haematological malignancies occur majorly within the fourth to the fifth decades of life. HL was found predominantly among young adults. However, unusual occurrence was the finding of

**Table 1. Age and sex zdistribution of subjects**

Characteristics	Frequency	Percentage (%)
<b>Sex</b>		
Males	72	54.6
Females	60	45.4
Age in years (Mean $\pm$ SD)	47.93 $\pm$ 17.9	
<b>Total</b>	132	100

**Table 2. Types and Proportion of haematologic malignancies**

Types	Frequency	Percent
CML	34	25.8
CLL	27	20.5
Non Hodgkin Lymphoma	41	31.1
Hodgkin Lymphomas	8	6.1
Multiple Myeloma	22	16.7

**Table 3. Age distribution of the various haematological malignancies**

Age Group	CML	CLL	NHL	HL	MM	Total
<b>17-26</b>	7 (20.6)	0 (0.00)	4 (9.8)	3 (37.5)	1 (4.6)	15 (11.4)
<b>27-36</b>	2 (5.9)	1 (3.7)	7 (17.1)	1 (12.5)	0 (0.00)	11 (8.3)
<b>37-46</b>	12 (35.3)	5 (18.5)	10 (24.4)	1 (12.5)	5 (22.7)	33 (25.0)
<b>47-56</b>	6 (17.7)	9 (33.3)	9 (21.9)	1 (12.5)	8 (36.4)	33 (25.0)
<b>57-66</b>	1 (2.9)	6 (22.2)	5 (12.5)	1 (12.5)	3 (13.6)	16 (12.1)
<b>67-76</b>	5 (14.7)	5 (18.5)	5 (12.5)	0 (0.00)	5 (22.7)	20 (15.2)
<b>77-86</b>	1 (2.9)	1 (3.7)	1 (2.4)	1 (12.5)	0 (0.0)	4 (3.0)
<b>Total</b>	34 (100)	27 (100)	41 (100)	8 (100)	22 (100)	132 (100)

\*CML=Chronic Myeloid Leukaemia CLL= Chronic lymphocytic Leukaemia, NHL=Non Hodgkin lymphoma, HL=Hodgkin Lymphoma, MM=Multiple Myeloma

MM myeloma in a patient between the age brackets of 17-26 Table 3.

The majority (58.3%) of the subjects were of the Rh O positive blood type while Rh B positive blood type was the least common (10.6%) among the subjects. Collectively, subjects with the O blood type were more than the non-O blood type Table 4.

**Table 4. The different blood groups of subjects**

Characteristics	Frequency	Percent
<b>Blood groups</b>		
O Rh Positive	77	58.3
A Rh Positive	41	31.1
B Rh Positive	14	10.6
<b>O and non O blood groups</b>		
O group	77	58.3
Non O group	55	41.7

CML (55.9% vs 44.1%), NHL (68.3% vs 31.7%), HL (87.5% vs12.5%) were commoner among

subjects with O blood type than the non-O while CLL (55.6% vs 44.4%) was commoner among non O blood type than the O blood type. However, this difference was not statistically significant ( $p=0.125$ ). Both blood types (O and the non-O) was equally distributed among subjects with multiple myeloma. Also, except for CLL, the other haematologic malignancies were more common in male subjects than females. Table 5

#### 4. DISCUSSION

Several studies have described a link between ABO blood type and cancer risk. A number of the plausible mechanisms have been proposed for this link, however, results from studies evaluating the prognostic relevance of ABO antigens in various haematologic cancers have been largely inconsistent. [21,22,23].

Non Hodgkin lymphoma was the most common haematological malignancy in this study. The high prevalence of NHL (31.1%) observed in this study was comparable to that observed in

**Table 5. Association between selected characteristics and types of hematologic malignancies**

Factors	Types of haematologic malignancies					Total n (%)	Statistical tests and values
	CML n(%)	CLL n(%)	NHL n(%)	HL n(%)	MM n(%)		
<b>Blood Grp</b>							
O Rh +	19 (55.9)	12 (44.4)	28 (68.3)	7 (87.5)	11 (50.0)	77 (58.3)	$X^2=7.328$
Non O Rh+	15 (44.1)	15 (55.6)	13 (31.7)	1 (12.5)	11 (50.0)	55 (41.7)	P=0.125
<b>Sex</b>							
Male	18 (52.9)	13 (48.2)	26 (63.4)	5 (62.5)	12 (54.5)	72 (54.5)	$X^2=2.7193$
Female	16 (47.1)	14 (51.8)	15 (36.6)	3 (37.5)	10 (45.5)	60 (45.5)	P=0.605

\*CML=Chronic myeloid leukaemia; CLL= Chronic lymphocytic Leukaemia; NHL=Non Hodgkin lymphomas; HL=Hodgkin lymphoma; MM=Multiple myeloma

Eastern Morocco (29.1%), but less than that obtained in Ilorin, (42%), North Central Nigeria respectively [7,8,24]. Studies from the equatorial belt of Africa have reported similar findings with NHL being among the top ten haematologic malignancies [25].

Chronic leukaemia (CML & CLL) were the only form of leukaemia reported in this study. None of the subjects had ALL or AML. This is because our study population were mainly adults with few adolescents. These type of leukaemias are commoner among individuals in this age bracket [26]. Multiple myeloma constitutes about 16% of haematological malignancies in this study. This value is relatively higher than 8.3% reported by some other authors in Nigeria. [24], however this figure closely approximate with prevalence in Morocco and the general global prevalence [7,27]. Worthy of note is a case of multiple myeloma in a patient within the age bracket of 17-26 years. This is quite a rare occurrence. In most reported case series, less than 0.3% of patients affected are younger than 30 years [28]. The disease entity is found majorly in adults in the 6-7 decades of life with a few occurring earlier in the 4th decade [28]. While environmental factors have been identified as the main determinants in the subtle variation in the incidence rate of most haematological and non-haematological cancers, certain pathogens especially those of viral origin have been equally implicated [29,30].

Gender wise, there were slightly more affected male patients than females, with a male to female ratio of 2:1. These findings are consistent with findings from other studies including studies from France and United Kingdom where the male and female ratio was 1.2 and 1.3 respectively [31,32]. However, a higher male to the female sex ratio of 2.2 and 1.6 have equally been reported. [33,34]. Also, it is important to note that

the sex ratio also varies within age group despite the slight male predominance [34].

Furthermore, the majority of haematological malignancies were observed among patients in the fourth and fifth decades of life except for HL which was more prevalent in patients in late adolescent and early adulthood. These findings are similar to the study by Omoti et al. [35] who reported a peak age incidence of between 46-59 years for a patient with lymphoid malignancies. It is also in agreement with the study by Babatunde et.al [8], who reported the mean age incidences of patients with haematological malignancies to be largely in the fourth and fifth decades of life. However, in Western countries, the disease affects older people usually in the seventh decade of life [28,36]. The differences observed in the age incidences in our clime and the developed countries could be attributed largely to our relatively younger population, shorter life expectancy among the populace due to poor socio-economic status and environmental factors.

In this study, the majority of the patients were of the O-blood type while the non-O blood type was less than 50%. However, of the non-O blood type, none had AB blood group. The observed pattern follows the ABO blood group distribution in the general population in our clime in whom over 50% are of the O-blood type while the AB blood group is the least common [37]. A similar finding was reported by Janardhana et.al, [38]. CML and the lymphomas were commoners among patients with O-blood type while CLL was commoner among patients with non-O blood type, however this difference was not statistically significant ( $p=0.125$ ). Our finding is consistent with the study by Steinberg et al. [39] who observed that the blood group distribution in a cohort of 450 acute leukaemia patients was statistically not different from that of the general

population. However, our findings contrast with a much earlier study by Shirley et al, [40] who reported a correlation between the incidence of blood group A and leukaemia. It also contrasts study by Tavasolian et al. [41] who equally demonstrated that AB blood group was associated with a higher risk of ALL. The inconsistencies in the various studies including ours could largely be attributed to environmental and ethnic differences in the study populations. Studies involving ABO blood types in different populations have shown considerable variation in different geographic locations thus, reflecting both the underlying genetic and ethnic diversity of human populations [42].

## 5. CONCLUSION

The distribution, age and sex ratio of haematological malignancies in our study is comparable to those reported by other authors with NHL being the most common haematological cancer in our environment. Majority of the cancer patients were of the O-blood type and the blood group distribution among the patients was statistically not different from that of the general population. Also, there was no association between haematological cancers and ABO blood types of the patients.

## CONSENT

As per international standard or university standard written participant consent has been collected and preserved by the authors.

## ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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