Original Article

Distribution of ABO and Rh Blood Group in Myeloproliferative Diseases

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Abstract

Background: The aim of this study was to investigate the distribution of ABO and Rh blood group in myeloproliferative disease and if association, if any exists can be used as a preclinical marker for cancer development and risk; hence, we can modify other modifiable risks for myeloproliferative diseases (MPDs). **Materials and Methods:** This was a cross-sectional study which included 252 cases who were diagnosed as a patient with lymphoid malignancies of any age group of both gender, 350 controls were taken as healthy people who have donated blood. Cases and controls were collected between January 1, 2016 and May 30, 2017. Blood group sampling of all cases and controls was performed. The obtained information regarding the presence or absence of myeloproliferative disorder, blood group type, age group, and type of myeloproliferative disorder analyzed, the statistical analysis was performed using SPSS for windows version 16.0 software. The findings were present in number and percentage analyzed using frequency, percentage, and Chi-squared test. **Results:** Of 266 cases of MPDs, majority of cases were of blood Group B (35.34%), followed by O (27.81%), A (26.69%), and AB (10.16%). Majority of cases were Rh positive (85.33%). Of 266 cases of MPDs, the most common was chronic myeloid leukemia (CML) (53.38%), polycythemia vera (16.55%), essential thrombocytosis (15.78%), primary myelofibrosis (11.28%), mastocytosis (1.5%), chronic neutrophil leukemia (1.13%), and the least common chronic eosinophilia leukemia (0.38%). In CML, primary myelofibrosis, mastocytosis, chronic neutrophilic leukemia, and chronic eosinophilic leukemia blood Group B was the most common, while blood Group O was more common in polycythemia vera and essential thrombocytosis. In control group, the most common blood group was O (36%), followed by B (32.67%), A (21.33%), and AB (10%), respectively. Majority of control groups (94.33%) were Rh positive and (5.67%) were Rh negative. **Conclusions:** The present study revealed that there are significant associations between ABO blood group and patients with MPDs. Male gender and blood group B and Rh factor positive are more prone for the development of myeloproliferative disorder. These findings also raise the possibility of using blood groups as an epidemiological marker for identifying population subgroups who are at high risk of these MPDs.

Keywords: ABO, blood, male, myeloproliferative, Rh

Introduction

ABO antigens are regarded as red blood cells antigens but they are also expressed on a variety of human tissue and are present on most of endothelial and epithelial cells. Other blood cells such as T-cells and platelets have ABO blood group antigens that have been adsorbed from plasma. Individuals known as secretors, a soluble form of ABO blood group antigens is found in saliva and in all body fluids except cerebrospinal fluid.[1]

A number of illnesses may alter a person's ABO phenotype, for example, patient can acquire the B antigen during a necrotizing infection. ABO blood groups can be altered in hematological malignancies that modifies sugar chains which bears the ABO group antigens, leading to use of the A and B antigens as tumor markers for leukemia, myeloproliferative disorders, and myelodysplasia.[2]

Different blood groups have been shown to be associated with different disease as well. Knowing the causes of cancer provides a basis of understanding the potential for preventing cancers. In India and western countries, research has been carried out to find relation between ABO blood group and various systemic diseases which shows diseases such as peptic ulcer, dental caries, salivary gland tumors, chicken pox,

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malaria, oral cancer, hematological malignancies, ischemic heart diseases, and had significant association.[3]

High incidence of blood Group A consisted with gastric cancer, neurological tumors, salivary gland, colon, ovary, kidney, and cervix. O blood group consisted with skin malignancy and melanoma. The relationship between the epidemiological determinants such as gender, race, geographical location, and various hematological malignancies are well known.[4] However, association between blood groups and these malignancies are not well established. If the risks of these malignancies are known, for the different ABO blood groups, then it could be used as an epidemiological marker to identify high-risk population. The present study is an attempt to correlate ABO blood group frequency with preponderance of various myeloproliferative diseases (MPDs) to assess the utility of ABO blood group as a preclinical marker.

Materials and Methods

The present study entitled as "distribution of ABO and Rh blood group in MPDs" was carried out in Department of Medicine, Division of Hematology in association with Blood Bank, Sir Sunderlal Hospital, Banaras Hindu University between January1, 2016 and May 30, 2017.

Details of procedure and methods used

This was a cross-sectional study having clinical and hypothesis testing with research design included the patients attending to hematology outpatient department (OPD)/Medicine OPD with MPDs total of 266 in number (CML, chronic neutrophilic leukemia, chronic eosinophilic leukemia, polycythemia vera, primary myelofibrosis, essential thrombocytosis, mastocytosis, and myeloproliferative neoplasm unclassified) of any age group of both gender. A total of 300 gender-matched healthy controls who were voluntary blood donors comprised the study. Patients with dual MPD, myelodysplastic syndrome, and not giving consent for the study were excluded from the study.

Source of data

Blood bank, hematology ward/OPD, general medicine ward/OPD in Sir Sunderlal Hospital, Banaras Hindu University, and Varanasi, Uttar Pradesh, India.

Methods of data collection

Blood groups of those specific patients have been obtained (who requires blood transfusions) from blood bank, Sir Sunderlal Hospital. Patients were followed up to final confirmation of diagnosis. All relevant patient data were recorded. Patients having confirmed diagnosis MPD elsewhere attending to hematology/medicine outpatient between January 1, 2016 and May 30, 2017 were also included in the study and sample for blood grouping was done in our blood bank. A well-informed written consent was obtained from all participants in language understood by patients.

Sample collection

Under aseptic condition with a disposable syringe blood sample was collected from accessible peripheral vein in ethylenediaminetetraacetic acid and plain vial (1.5 ml in each vial). Sample vial will be labeled with sample number and name of the patient sample details including age, gender, residential address, contact number of donors, clinical details, and diagnosis of patient was noted on performa. ABO blood grouping was done using slide agglutination method and gel card technology.

Statistical analysis

The statistical analysis was performed using SPSS for windows version 16.0 software (Mac, and Linux). The findings were present in number and percentage analyzed by frequency, percent, and Chi-squared test. Chi-squared test was used to find the association among variables. The critical value of *P* indicating the probability of significant difference was taken as <0.05 for comparison.

Observations and Results

In this study, patient's age ranged from 4 to 77 years. The most common age group of patients with MPD was between 31 and 40 years. In controls, the most common age group was between 21 and 30 years. The study was statistically significant in respect to age distribution between cases and controls [Table 1].

There was statistically significant difference between cases and controls in respect to gender [Table 2].

Blood Group B (35.34%) was common in patients, followed by blood Group O (27.81%), A (26.69%), and AB (10.16%), respectively. In controls, the most common blood group was O (36%), followed by B (32.67%), A (21.33%), and AB (10%), respectively [Table 3].

Of 266 cases of MPDs, majority were Rh positive (85.33%), followed by Rh negative (14.67%) as compared to control group (94.33%) were Rh positive and (5.67%) were Rh negative. There was statistically significant association found between cases and controls [Table 4].

Of 266 cases of MPDs, the most common were CML (53.38%), then polycythemia vera (16.55%), followed by essential thrombocytosis (15.78%), primary myelofibrosis (11.28%). mastocytosis (1.5%), chronic neutrophilic leukemia (1.13%), and chronic eosinophilic leukemia (0.38%) was least common [Table 5].

Table 1: Age distribution between patients with myeloproliferative disease and controls

Age	Patient with MPD, *n* (%)	Controls, *n* (%)
0-10	1 (0.38)	0
11-20	5 (1.87)	22 (7.33)
21-30	31 (11.65)	148 (49.34)
31-40	63 (23.68)	96 (32.00)
41-50	57 (21.43)	24 (8.00)
51-60	50 (18.80)	10 (3.33)
61-70	36 (13.54)	0
>70	23 (8.65)	0
Total	266 (100)	300 (100)

P<0.001. MPD: Myeloproliferative disease

Table 2: Gender distribution between patients with myeloproliferative disease and controls

Gender	Patient with MPD, *n* (%)	Controls, *n* (%)
Male	154 (57.89)	266 (88.67)
Female	112 (42.11)	34 (11.33)
Total	266 (100)	300 (100)

$P<0.001$. MPD: Myeloproliferative disease

Table 3: Distribution of ABO blood group between patient with myeloproliferative disease and controls

Blood group	Patient with MPD, *n* (%)	Controls, *n* (%)
A	71 (26.69)	64 (21.33)
B	94 (35.34)	98 (32.67)
AB	27 (10.16)	30 (10)
O	74 (27.81)	108 (36)
Total	266 (100)	300 (100)

$\chi^2=4.93$; $P=0.176$. MPD: Myeloproliferative disease

Table 4: Distribution of Rh factor between patient with myeloproliferative disease and controls

Rh	Patient with MPD, *n* (%)	Control, *n* (%)
Positive	227 (85.33)	283 (94.33)
Negative	39 (14.67)	17 (5.67)
Total	266 (100)	300 (100)

$\chi^2=12.79$; $P=0.0003$. MPD: Myeloproliferative disease

Table 5: Distribution of myeloproliferative diseases

Diagnosis	Frequency (%)
CML	142 (53.38)
PCV	44 (16.55)
PMF	30 (11.28)
ET	42 (15.78)
Mastocytosis	4 (1.50)
CNL	3 (1.13)
CEL	1 (0.38)
Total	266 (100)

CML: Chronic myeloid leukemia, PCV: Polycythemia vera, PMF: Primary myelofibrosis, ET: Essential thrombocytosis, CNL: Chronic neutrophilic leukemia, CEL: Chronic eosinophilic leukemia

Of 142 cases of CML, majority of cases were in age group ranging from 31 to 40 years (35.21%). Of 44 cases of polycythemia vera, majority were in age group 61–70 years (31.82%) Of 30 cases of primary myelofibrosis majority were in age group 51–60 years (33.33%). Of 42 cases of essential thrombocytosis majority were in age group 51–60 years (33.33%). Mastocytosis, chronic neutrophilic leukemia, and chronic eosinophilic leukemia being very rare disease [Table 6].

Of 142 cases of CML, majority of cases were males (66.90%) while (33.10%) were female. Among polycythemia vera, majority were male (68.18%) while females were (31.82%). Of 30 cases of primary myelofibrosis majority were male (73.33%). Among patient with essential thrombocytosis majority were males (61.90%) [Table 7].

Of 142 cases of CML, majority of cases were in B blood group (40.14%), followed by A blood group (29.57%), followed by O blood group (16.91%), and AB blood group was least common with 13.38%. Of 44 cases of polycythemia vera, majority were in blood Group O (40.92%), followed by A blood group (27.27%), B blood group (25%), least common was AB blood group (6.81%). Of 30 cases of primary myelofibrosis majority were in blood Group B (46.67%), followed by O blood group (30%), A blood group (16.67%), and least common was AB blood group (6.66%). Of 42 cases of essential thrombocytosis majority were in blood Group O (50%), followed by blood Group A (28.57%), B blood group was (16.67%) while least common was blood Group AB (4.76%) [Table 8].

Of 142 cases of CML, majority of cases were Rh positive (83.10%). Of 44 cases of polycythemia vera, majority were Rh positive (84.10%) while Rh negative were (15.90%). Of 30 cases of primary myelofibrosis, majority was Rh positive (90%) while (10%) were Rh negative. Of 42 cases of essential thrombocytosis majority were Rh positive (88.10%) while (11.90%) were Rh negative.

Blood Group B was most common in MPDs. Blood Group B patients were 94 in number. 78 were Rh positive and 16 were Rh negative. Fifty-seven patients were in CML, of which 50 were Rh positive and 7 Rh negative. 11 patients in polycythemia vera, of which eight were Rh positive, three Rh negative, 14 patients in primary myelofibrosis, of which 12 were Rh positive and two Rh negative, seven patients in essential thrombocytosis of which five Rh positive and two Rh negative, two patients of mastocytosis both Rh positive, CNL has two patients both Rh positive, CEL has one patient and was Rh positive [Table 9].

Discussion

It was reported that blood Group O was found to be more common in India although studies have reported that group B was more common in Northern India while Group O was more common in Southern India. The relationship between ABO blood group and susceptibility of various diseases has been studied for at least the past 60 years.[4]

In a study among voluntary blood donors conducted by Chandra and Gupta[5] at King George's Medical University, Lucknow, UP, India, found that the blood Group B (34.84%) was the most common group prevalent in donors, followed by Group O (29.75%), A (21.50%), and AB (13.91%). Same as a study conducted by K Akhtar *et al*. at Jawaharlal Nehru Medical College Aligarh, UP, India.[6]

Hirszfeld and Hirszfeld[7] showed the frequencies of blood Groups A and B differ between populations which may be due to the random genetic drift and founder effects or the result of natural selection. Tavasolian *et al*.[8] conducted a similar study

Table 6: Distribution of age according to myeloproliferative diseases

Age	CML, *n* (%)	PCV, *n* (%)	PMF, *n* (%)	ET, *n* (%)	Mastocytosis, *n* (%)	CNL, *n* (%)	CEL, *n* (%)
0-10	0	0	0	0	1 (25)	0	0
11-20	4 (2.81)	0	0	0	1 (25)	0	0
21-30	26 (18.31)	0	3 (10)	0	2 (50)	0	0
31-40	50 (35.21)	3 (6.81)	5 (16.67)	4 (9.52)	0	0	1 (100)
41-50	34 (23.94)	8 (18.18)	8 (26.67)	7 (16.67)	0	0	0
51-60	14 (9.87)	12 (27.27)	10 (33.33)	14 (33.33)	0	0	0
61-70	10 (7.04)	14 (31.82)	2 (6.67)	8 (19.05)	0	2 (66.67)	0
>70	4 (2.82)	7 (15.92)	2 (6.66)	9 (21.43)	0	1 (33.33)	0
Total	142 (100)	44 (100)	30 (100)	42 (100)	4 (100)	3 (100)	1 (100)

P=0.763. CML: Chronic myeloid leukemia, PCV: Polycythemia vera, PMF: Primary myelofibrosis, ET: Essential thrombocytosis, CNL: Chronic neutrophilic leukemia, CEL: Chronic eosinophilic leukemia

Table 7: Distribution of gender according to myeloproliferative diseases

Gender	CML, *n* (%)	PCV, *n* (%)	PMF, *n* (%)	ET, *n* (%)	Mastocytosis, *n* (%)	CNL, *n* (%)	CEL, *n* (%)
Male	95 (66.90)	30 (68.18)	22 (73.33)	26 (61.90)	3 (75)	2 (66.67)	1 (100)
Female	47 (33.10)	14 (31.82)	8 (26.67)	16 (38.10)	1 (25)	1 (33.33)	0
Total	142 (100)	44 (100)	30 (100)	42 (100)	4 (100)	3 (100)	1 (100)

P=0.881. CML: Chronic myeloid leukemia, PCV: Polycythemia vera, PMF: Primary myelofibrosis, ET: Essential thrombocytosis, CNL: Chronic neutrophilic leukemia, CEL: Chronic eosinophilic leukemia

Table 8: Distribution of ABO blood group according to myeloproliferative diseases

Blood group	CML, *n* (%)	PCV, *n* (%)	PMF, *n* (%)	ET, *n* (%)	Mastocytosis, *n* (%)	CNL, *n* (%)	CEL, *n* (%)
A	42 (29.57)	12 (27.27)	5 (16.67)	12 (28.57)	0	0	0
B	57 (40.14)	11 (25)	14 (46.67)	7 (16.67)	2 (50)	2 (66.67)	1 (100)
AB	19 (13.38)	3 (6.81)	2 (6.66)	2 (4.76)	1 (25)	0	0
O	24 (16.91)	18 (40.92)	9 (30)	21 (50)	1 (25)	1 (33.33)	0
Total	142 (100)	44 (100)	30 (100)	42 (100)	4 (100)	3 (100)	1 (100)

P<0.001. CML: Chronic myeloid leukemia, PCV: Polycythemia vera, PMF: Primary myelofibrosis, ET: Essential thrombocytosis, CNL: Chronic neutrophilic leukemia, CEL: Chronic eosinophilic leukemia

Table 9: Distribution of B blood group with Rh factor according to myeloproliferative diseases

Rh factor in B blood group	CML, *n* (%)	PCV, *n* (%)	PMF, *n* (%)	ET, *n* (%)	Mastocytosis, *n* (%)	CNL, *n* (%)	CEL, *n* (%)
Positive	50 (87.7)	8 (72.7)	12 (85.7)	5 (71.4)	2 (100)	2 (100)	1 (100)
Negative	7 (12.3)	3 (27.3)	2 (14.3)	2 (28.6)	0	0	0
Total	57 (100)	11 (100)	14 (100)	7 (100)	2 (100)	2 (100)	1 (100)

CML: Chronic myeloid leukemia, PCV: Polycythemia vera, PMF: Primary myelofibrosis, ET: Essential thrombocytosis, CNL: Chronic neutrophilic leukemia, CEL: Chronic eosinophilic leukemia

to find an association between ABO blood group in 293 patients with acute lymphoblastic leukemia (ALL) and compared to 300 patients in control group; the ABO blood group distribution was, 82 were blood Group A, 59 blood Group B, 24 blood Group AB, and 128 blood Group O. Blood group in controls were (63) 25% A, (69) 25.6% B, (18) 6.8% AB, and (101) 42.6% O blood group. The ABO blood group distribution showed that there are significant differences between ABO blood group and patients with ALL comparable with another study by.[9]

In this study, among patient with MPD, majority had blood Group-B (35.34%), followed by blood Group-O (27.81%), blood Group-A (26.69%), and blood Group-AB (10.16%). Majority of cases were Rh positive (85.33%). Among controls, the most common blood group was O (36%), followed by B (32.67%), A (21.33%), AB (10%), and (94.33%) were Rh positive. There was statistically significant association found between the patient with (MPD) and controls in regards to occurrence of blood group.

A hospital-based retrospective study was conducted to study the distribution of ABO blood groups in lymphoma, acute myeloid leukemia, and ALL, the results of the study showed that in Hodgkin's lymphoma and ALL there is an increased proportion of B blood group and O blood group, respectively.[10] Similar to above irrespective type of MPD, in this study, there is an increased proportion of blood Group-B followed by blood Group-O.

A study was conducted in Northeast Malaysia to find relation between leukemia with gender and blood group of population. It was concluded that acute leukemia was more common among males with O blood group and females with B blood group.[11] In this study, male preponderance was observed in MPD.

Several authors have investigated the relation between various hematological malignancies with blood groups to find an association/susceptibility to the disease with a given phenotype. Data have been reviewed by Shirley and Desai[12] concluded that blood group-A patients may be more susceptible. In another study carried out by Ayres *et al.*, found that there was no increased incidence of malignancy in blood Group A.[13]

In this study, MPDs proportion of males was more than females. These findings also raise the possibility of using blood groups as an epidemiological marker for identifying population subgroups who are at high risk of these myeloproliferative diseases.

Conclusion

MPDs proportion of males was more than females. These findings also raise the possibility of using blood groups as an epidemiological marker for identifying population subgroups who are at high risk of these myeloproliferative diseases.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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