

Frequency and Distribution of ABO and Rh Blood Groups Among the in-Patients at a Tertiary Hospital in Northern Telangana

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Abstract

Background: International Society of Blood Transfusion has recently recognized 33 blood group system however the ABO system and rhesus (Rh) blood group remain clinically most important. After ABO blood group and Rh blood grouping discovered by Landsteiner and Weiner in 1901 and 1941 respectively, these two systems have proved to be the most important systems. Based on presence of the antigens and agglutinins human blood is divided into four major blood groups A, B, AB and O, based on which transfusions are made. The present study aims to investigate the ABO and rhesus (Rh) blood group frequency in the in-patients of Government general hospital, Nizamabad, Telangana state, over a period of 3 years from 2019 January to 2021 December.

Method: The retrospective study was conducted on more than thirty thousand in-patients including both male and female patients admitted to the government general Hospital, Nizamabad. Blood samples were taken from each subject and subsequently ABO and Rh blood groups were evaluated separately by using commercially available standard poly clonal antisera applying on the slide by using Tile Agglutination techniques. And all relevant data of patients were collected from blood bank department of the hospital.

Results: Out of 45352 individuals, 29932 (66%) were males and 15420(34%) were female individuals. The most common blood group found was O positive (33%) and least common being AB negative (1%). The prevalence of Rhesus positive and negative distribution in the present studied population was found as 93.9% and 6.1%, respectively.

Conclusion: The present study is useful in providing information on the status of ABO and Rh-D blood group distribution in the district of the Nizamabad and knowledge of it will help in effective management of regional blood transfusion services of the area.

Keywords: ABO and Rh blood group, frequency and distribution of blood groups.

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Background

Karl Landsteiner discovered ABO and Rh blood grouping systems in homosapiens and suggested the letters O, A, B and AB to express blood groups which were universally followed by the early 1950s[1,2] In 1907, Reuben Ottenberg started the first practical use of blood typing and it applied on a large scale during the First World War (1914–1915) [3]. Multiple alleles of ABO blood groups are located on a single locus of long arm of ninth chromosome (9q34) that exhibit Mendelian inheritance pattern [4]

ABO gene has mainly three types of alleles: i expresses no antigen hence type O, I A expresses type A antigen, and I B expresses type B antigen where I is a designation for iso-agglutinogen[5] Both I A and I B are dominant over i, and only ii people have type O blood group. I AI B individual has both phenotypes due to co dominance and is typed as AB blood group. Rh is the second major blood group system which comprises of more than 50 blood group antigens. Out of them, RHD and RHCE are the most clinically important Rh antigens. RHD and RHCE are closely linked genes on chromosome 1 that controls expression of Rh proteins [6]

Blood group distribution of any region can be influenced by race, ethnicity, geographical conditions, genetic drift and migration frequency of population. Environment factors and natural selection for survival of population in that region also affect the blood group distribution. The study of distribution of blood groups is of great importance for inventory management, safe blood transfusion, disease association with blood group in specific area and preparation of donor data for organ transplantation [7,8]

Methods

The present study is a retrospective observational study conducted at Government general hospital, Nizamabad over a period of 3 years from January 2019

to December 2021. We analysed the data of the in patients admitted in Government general hospital, Nizamabad. A total of 45352 in-patients were admitted during this period. The patient records were retrieved from the medical records department and were analysed, the records of all individuals between the age groups of 10 years to 70 years were included. Data of patients were collected like personal details, demographic details, occupational and medical history. The blood grouping of these patients was done by using the commercially available standard poly clonal antisera (arkray) applying on the tile by using slide agglutination techniques. In this method tile is divided into three parts as for each part, a drop of patient blood is mixed with anti A, anti B, anti D separately. The agglutination or blood clumping pattern can be visually observed from which the ABO and rhesus D (Rh D) type of blood can be determined. Although many other methods like test tube method, microplate method, column agglutination technique are available, we use the classical tile method and when in doubt the test tube method is employed. The patient data is analysed using the MS- excel sheet and appropriate statistical analysis was done. The incidence of various blood groups was analysed. The most common blood and least common among the different genders and age groups was studied.

Results

Blood groups of 45352 patients were analysed. The test was done by using of tile agglutination method. The patient load over a period of 3 years from 2019 January to 2021 December was included in the study. From our study, it is observed that majority of the patients belonged to blood group O positive 14931(33%) least common being AB negative 429 (1%). And other groups include A positive belongs to 12273 (27%) and this is the second most common group, followed by

B positive 12073 (26.6%), AB positive 3356 (7.3%), A negative 745 (1.6%), B negative (1.7%), O negative (1.8%)

Out of 45352 individuals, 29932 (66%) were males and 15420 (34%) were female

individuals. The prevalence of Rhesus positive and negative distribution in the present studied population was found as 93.9% and 6.1%, respectively.

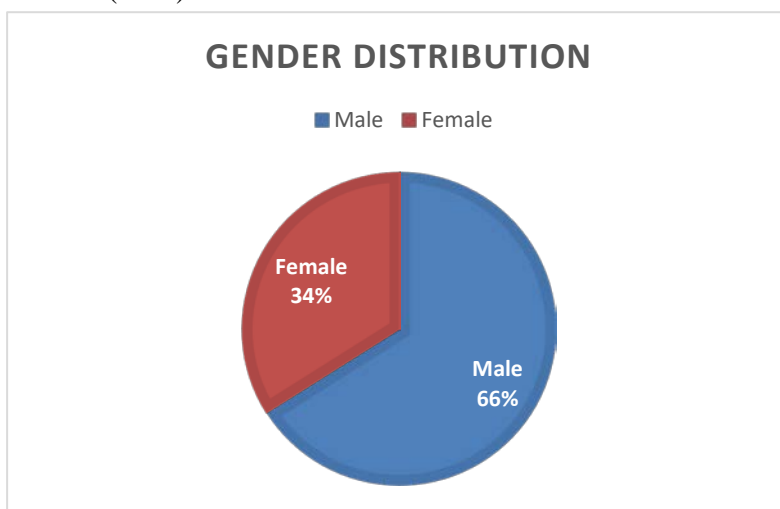


Figure 1: Gender Distribution

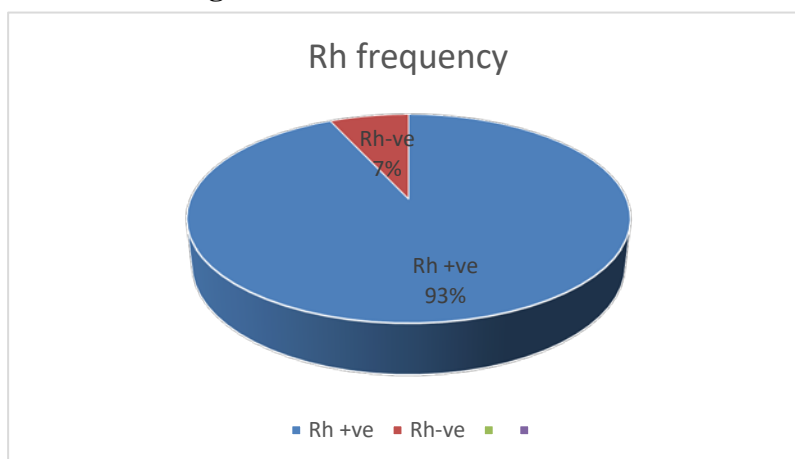


Figure 2: Rh frequency

Table 1: Frequency distribution of blood groups in 2019,2020,2022

Blood groups	2019	2020	2021	Total
A+ve	4120(25%)	3503 (26%)	4650(29.2%)	12273(27%)
B+ ve	4719(30%)	3811(29%)	3548(22.5%)	12073(26.6%)
AB+ve	1243(7.7%)	847(6%)	1266(8%)	3356(7.3%)
O+ve	5006(31.5%)	4430(33% %)	5489(34.5%)	14931(33%)
A-ve	266(1.6%)	233(1.7%)	246(1.5%)	745(1.6%)
B-ve	255(1.5%)	225(1.6%)	278(1.6%)	758(1.7%)
AB-ve	157(1%)	129(1%)	143(1%)	429(1%)
O-ve	271(1.7%)	231(1.7%)	286(1.7%)	788(1.8%)
Total	16037	13409	15906	45352

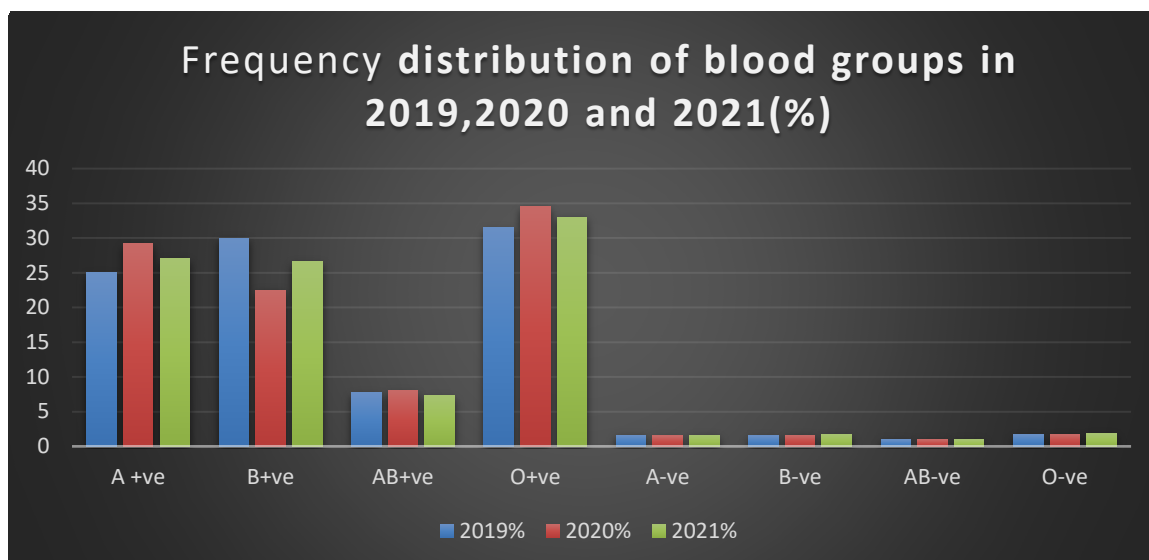


Figure 3: Frequency distribution of blood groups in 2019,2020 & 2021

Table 2: Gender wise frequency distribution of blood groups in 2019,2020,2022(%)

	2019		2020		2021		Total
	Male	Female	Male	Female	Male	Female	
A+ve	2472 (25%)	1648 (26%)	2137 (26%)	1366 (26%)	2790 (28%)	1860 (30%)	12273
B+ve	2925 (29%)	1794 (18%)	2286 (28%)	1525 (29%)	2199 (22%)	1349 (22%)	12073
AB+ve	758 (7.7%)	485 (7.8%)	508 (6.2%)	339 (6.4%)	772 (7.8%)	494 (8.1%)	3356
O+ve	3103 (31%)	1903 (30%)	2746 (33%)	1684 (32%)	3514 (35%)	1997 (32%)	14931
A-ve	159(1.6%)	107(1.7%)	138(1.6%)	93(1.%)	147(1.4%)	99(1.6%)	745
B-ve	153(1.5%)	102(1.6%)	130(1.5%)	95(1.8%)	172(1.7%)	106(1.7%)	758
AB-ve	91(0.9%)	66(1.0%)	77(0.9%)	52(0.9%)	84(0.8%)	59(0.9%)	429
O-ve	163(1.6%)	108(1.7%)	140(1.7%)	91(1.7%)	185(1.8%)	101(1.6%)	788
Total	9824	6213	8162	5225	9863	6065	45352

Discussion

The term “blood group” refers to the entire blood group system comprising red blood cell (RBC) antigens whose specificity is controlled by a series of genes which can be allelic or linked very closely on the same chromosome. “Blood type” refers to a specific pattern of reaction to testing antisera within a given system. Over a period of time, our understanding on blood groups has evolved to encompass not only transfusion-related problems but also specific disease association with RBC surface antigens. Karl Landsteiner has been credited for the discovery of ABO

blood group system in 19009. His extensive research on serology based on simple but strong scientific reasoning led to identification of major blood groups such as O, A, and B types, compatibility testing, and subsequent transfusion practices. He was awarded Noble Prize in 1930 for this discovery. His obituary lists an immense contribution of more than 346 publications. Later, Jan Jansky described classification of human blood groups of four types. Among the 33 systems, ABO remains the most important in transfusion and transplantation since any person above

the age of 6 months possess clinically significant anti-A and/or anti-B antibodies in their serum. Blood group A contains antibody against blood group B in serum

and vice-versa, while blood group O contains no A/B antigen but both their antibodies in serum [10].

Table 3: Distribution of blood groups in India

Population	A	B	AB	O	Rh positive	Rh negative
Northern India						
1. Lucknow [11]	21.73	39.84	9.33	29.10	95.71	4.29
2. Punjab [12]	21.91	37.56	9.3	31.21	97.3	2.7
3. Jodhpur [13]	22.2	36.4	9.4	31.7	91.75	8.25
Western India						
4. Western Ahmedabad [14]	21.94	34.90	7.86	30.79	95.0	4.95
5. Eastern Ahmedabad [15]	23.30	35.50	8.80	32.50	94.20	5.80
6. Surat [16]	24.10	34.89	8.69	32.32	94.18	5.82
7. Maharashtra [17]	23.38	31.89	8.72	30.99	95.36	4.64
Eastern India						
8. Durgapur [18]	23.90	33.60	7.70	34.80	94.70	5.30
Southern India						
9. Bangalore [19]	23.85	29.95	6.37	39.82	94.2	5.8
10. Vellore [20]	21.86	32.69	6.70	38.75	94.5	5.5
11. Devangere [21]	26.15	29.85	7.24	31.76	94.8	5.2
12. Shimoga- Malnad [22]	24.27	29.43	7.13	39.17	94.93	5.07
Present study	27	26.6	7.3	33	93.1	6.9

We compared our results with other studies carried out in different regions of India and worldwide. Our study O positive is more common followed by A group, B group, AB group, followed by O negative, B negative, A negative and AB negative. The study done in Eastern India by Durgapur *et al* [18], in Southern India by Bangalore *et al*, vellore *et al*, Devenagere *et al*, shimoga malnad *et al* showed blood group O [19-22] was the commonest and

these results are correlated with our study.

The study done in Northern India by Chandra *et al* Lucknow, Sindhu *et al* Punjab and Behra *et al* Jodhpur showed blood group B was the commonest, followed by O, A and AB. Our study does not correlate with these studies [11-13].

In above all study groups and present study group Rh positive group was most common that is accounts for all most 96%.

Table 4: Frequency of blood groups in different countries

Britain [22]	42.0	8.0	3.0	47.0	83	17
USA [23]	41.0	9.0	4.0	46.0	85	15
Nigeria [24]	21.60	21.40	2.80	54.20	95.20	4.80
N. Guinea [25]	22.50	23.70	4.70	48.90	95.90	4.10
Saudi Arabia [26]	24.0	17.0	4.0	52.0	93.0	7.0
Pakistan [27]	22.40	32.40	8.40	30.50	93.0	7.0
Nepal [28]	34.0	29.0	4.0	32.50	96.70	3.30

Outside India, studies were carried out in different countries of the world like Britain, USA, Nigeria, New Guinea, Saudi Arabia, Pakistan and Nepal. All countries,

except Pakistan and Nepal22-28, showed O blood group to be most common in their respective studies, which is similar from our observations, as O blood group was

commonest in our study followed by A, B, AB groups.

Conclusion

From our study, we established that among the various ABO and Rh-D blood groups, group O (33%) is the commonest, followed next in frequency by blood group A (27%) and then blood group B (26.6%).

The present study is therefore useful in providing information on the status of ABO and Rh-D blood group distribution in Government General Hospital, Nizamabad and knowledge of it will help us in effective management of regional blood transfusion services of the area. The study helps to prepare a database for the hospital and blood banks and creates awareness as to which blood groups should be stored and given importance. So, it is advisable to do blood grouping studies in each region for drafting proper national transfusion policies and for supplying blood to the needy patients during emergency

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