

## DISTRIBUTION OF ABO AND RH-D BLOOD GROUPS IN THE CACHAR DISTRICT OF BARAK VALLEY OF ASSAM: IMPLICATION FOR REGIONAL BLOOD TRANSFUSION SERVICE

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### ABSTRACT

#### BACKGROUND

ABO and Rhesus (Rh)-D blood group antigens are integrated parts of the red blood cell membranes. They are hereditary characters and are useful in population genetic studies, in resolving medico-legal issues and more importantly in compatibility test in blood transfusion and organ transplant practices. They show a wide geographical and racial variation. The knowledge of the distribution of ABO and Rh-D blood groups among different population is essential in health care and transfusion practices.

#### AIMS AND OBJECTIVES

To study the distribution of ABO and Rh-D blood groups amongst the population of Cachar district of Barak valley of Assam.

#### MATERIALS AND METHODS

We did a retrospective analysis of records of 1,60,500 blood samples grouped for ABO and Rh-D typing at Silchar Medical College and Hospital Blood Bank, Silchar, over a period of 10 years from 1<sup>st</sup> January 1999 to 31<sup>st</sup> December 2008.

#### RESULTS AND OBSERVATIONS

Out of total 1,60,500 blood samples grouped for ABO and Rh-D typing during the period in the centre, the distribution of phenotype A, B, AB and O were 24.80% (39,804), 32.00% (51,360), 5.60% (8,986) and 37.60% (60,350) respectively. The Rh-D positive phenotype was 95.40% (1,53,117) and remaining 4.60% (7,383) was Rh-D negative. The frequency of Rh-D phenotypes in the various ABO blood groups was as - A Positive 23.70% (38,039), A Negative 1.10% (1,765), B Positive 30.80% (49,433), B Negative 1.20% (1,927), AB Positive 5.40% (8,665), AB Negative 0.20% (321), O Positive 35.50% (56,980) and O Negative 2.10% (3,370) respectively.

#### DISCUSSION

Silchar Medical College and Hospital Blood Bank receives blood samples for grouping of almost all population of Cachar district. Hence, the data revealed in the present study fairly reflects the prevalence of ABO and Rh-D groups distribution in the Cachar district in Barak valley of Assam.

#### CONCLUSION

The present study provide information on the status of ABO and Rh-D blood groups distribution of the region and the knowledge of it will help in effective management of regional blood transfusion service of the area.

#### KEYWORDS

Blood Group, ABO and Rhesus-D, Hereditary, Phenotype, Blood Transfusion, Health Care.

**HOW TO CITE THIS ARTICLE:** Kumbhakar D. Distribution of ABO and Rh-D blood groups in the Cachar district of Barak Valley of Assam: Implication for regional blood transfusion service. *J. Evolution Med. Dent. Sci.* 2016;5(58):4017-4021, DOI: 10.14260/jemds/2016/919

#### INTRODUCTION

Blood group antigens are integrated parts of the red blood cell membranes.<sup>[1,2]</sup> Despite the long list of several other blood groups discovered so far, the ABO and Rh-D blood groups hold a respectable position in view of safety of blood/blood products transfusion, more importantly in compatibility test in blood transfusion and organ transplant to date.<sup>[3,4]</sup> The knowledge of the distribution of ABO and Rh-D blood groups is essential for effective management of blood bank inventory, being it a smaller local transfusion service or a regional or national transfusion service.

ABO and Rh-D blood group antigens are genetically determined.<sup>[5,6]</sup> They are the most frequently studied genetic markers in a large group of population.<sup>[7]</sup> ABO and Rh gene and phenotypes vary widely across geographical boundaries despite the fact that the antigens involved are stable throughout the life.<sup>[8]</sup> A racial difference in the distribution of these blood groups has been noted by some researchers. Apart from their importance in blood transfusion practice, the ABO and Rh-D blood group antigens are useful in population genetic studies, researching population migration patterns, evaluating the probability of haemolytic disease in the new born as well as resolving certain medico-legal issues, particularly disputes in paternity/maternity and for forensic purposes.<sup>[9]</sup> It is, therefore, imperative to have information on the distribution of these blood groups in any population.<sup>[10]</sup>

No study has been done investigating the ABO blood group and Rh-D typing frequency in any population in and around Cachar district of Barak valley of Assam till date. Hence, data on frequency of ABO and Rh-D phenotypes in the population of this area are not available.

*Financial or Other, Competing Interest: None.*

*Submission 13-06-2016, Peer Review 07-07-2016,*

*Acceptance 13-07-2016, Published 20-07-2016.*

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*DOI: 10.14260/jemds/2016/919*

The population structure of Cachar district with over 10 lacks people, mainly comprises of Bengali, Assamese, Manipuri and Bodos. The Silchar Medical College and Hospital Blood Bank, Silchar, occupies an important place in the health sector of Cachar district of Barak valley of Assam. This blood bank receives blood samples for grouping from almost all population of Cachar district being blood donors, blood recipients, patients admitted and attended for treatment, routine antenatal care as well as for routine medical examinations of Silchar Medical College Hospital and other government and private health establishments. Thus the Silchar Medical College and Hospital Blood Bank does and keeps records of blood groups of these all. Hence, we did a retrospective analysis of records of ABO grouping and Rh-D typing of the blood donors, transfusion recipients and patients attending antenatal care or some other medical interventions at Silchar Medical College and Hospital Blood Bank, Silchar, over a period of 10 years from 1<sup>st</sup> January 1999 to 31<sup>st</sup> December 2008. This study seeks to provide data on ABO and Rh-D groups distribution in the Cachar district in Barak valley of Assam. The collation of immuno-haematology data would therefore enhance sustainable regional blood bank services in the region of Cachar district.

**MATERIALS AND METHODS**

Records of ABO and Rh-D blood groupings of blood donors, transfusion recipients and patients attending routine antenatal care as well as individuals who presented for

routine medical examination at Silchar Medical College and Hospital Blood Bank, Silchar between 1<sup>st</sup> January 1999 and 31<sup>st</sup> December 2008 (10 years) were examined and a care was exercised to eliminate any repeated entry. All entries were double checked by the author.

ABO and Rh-D blood groupings were carried out in our blood bank between 1<sup>st</sup> January 1999 and 30<sup>th</sup> June 2003 by standard tiles technique with appropriate positive and negative controls using one drop of whole blood mixed with one drop of appropriate anti-sera and rocked gently and read for agglutination under microscope after 30 minutes. In case of doubt, the results were confirmed by reverse grouping using known Group A and B red blood cells.<sup>[2,11]</sup>

From 1<sup>st</sup> July 2003 to 31<sup>st</sup> December 2008, ABO and Rh-D blood groupings were carried out in our blood bank by tube sedimentation method. Both cell and serum grouping were carried out for the entire samples with appropriate positive and negative controls. For cell grouping (Table 1), one drop of 5% three times washed cell suspension was mixed with one drop of appropriate anti-sera, mixed well and read for agglutination after 30 minutes keeping the tubes at 37 degrees centigrade in incubator.<sup>[2,11]</sup> In case of doubt, the test was examined under microscope. Results were confirmed by reverse (Serum) grouping (Table 2) using known Group A and B red blood cells.<sup>[2,11]</sup> Data on the frequency of ABO and Rh-D blood groups were reported in simple numbers and percentage.

Anti-A	Anti-B	Anti-AB	Saline	ABO Group	Anti-D	Rh-D Group
Agglutination	No Agglutination	Agglutination	No Agglutination	A	Agglutination	Rh-D Positive
No Agglutination	Agglutination	Agglutination	No Agglutination	B	No Agglutination	Rh-D Negative
Agglutination	Agglutination	Agglutination	No Agglutination	AB		
No Agglutination	No Agglutination	No Agglutination	No Agglutination	O		

**Table 1: Interpretation of Results of ABO and Rh-D Blood Grouping by Cell Grouping Method**

A Pooled Cell	B Pooled Cell	O Pooled Cell	ABO Group
No Agglutination	Agglutination/Haemolysis	No Agglutination	A
Agglutination/Haemolysis	No Agglutination	No Agglutination	B
No Agglutination	No Agglutination	No Agglutination	AB
Agglutination/Haemolysis	Agglutination/Haemolysis	No Agglutination	O

**Table 2: Interpretation of Results of ABO and Rh-D Blood Grouping by Serum Grouping Method**

**RESULTS AND OBSERVATIONS**

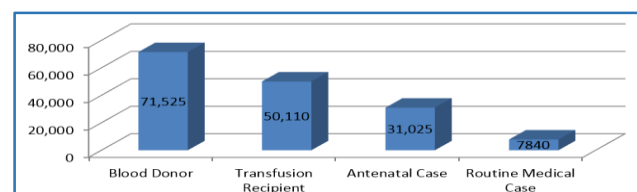
During the period of 10 years between 1<sup>st</sup> January 1999 and 31<sup>st</sup> January 2008, a total of 1,60,500 blood samples were collected in Silchar Medical College and Hospital Blood Bank for ABO and Rh-D grouping.

antenatal cases and 7,840 (4.89%) were from routine medical samplings. Figure 1 shows the numbers and Figure 2 shows the percentage of different sources of samples for ABO and Rh-D grouping.

Sources of Blood Samples	Numbers	Percentage
Blood Donor	71,525	44.56%
Transfusion Recipient	50,110	31.22%
Antenatal case	31,025	19.33%
Routine Medical case	7,840	4.89%
<b>Total</b>	<b>1,60,500</b>	<b>100.00%</b>

**Table 3: Different Sources of Samples for ABO and Rh-D Grouping**

Table 3 shows that out of total 1,60,500 samples 71,525 (44.56%) were from blood donors; 50,110 (31.22%) were from transfusion recipients; 31,025 (19.33%) were from



**Fig. 1: Diagram showing Different Sources of Samples for ABO and Rh-D Grouping (Numbers)**

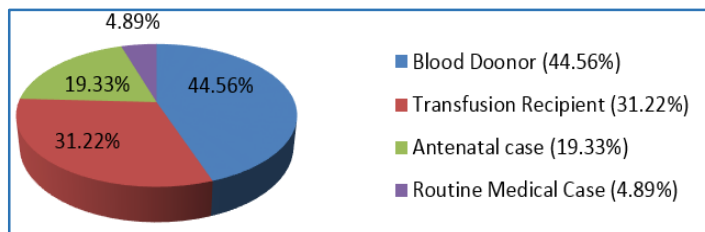


Fig. 2: Diagram showing Different Sources of Samples for ABO and Rh-D Grouping (Percentage)

Blood Samples	ABO Blood Group Phenotypes				Rh-D Phenotype	
	Group-A	Group-B	Group-AB	Group-O	Rh-D Positive	Rh-D Negative
Number	39,804	51,360	8,986	60,350	1,53,117	7383
Percentage	24.80%	32.00%	5.60%	37.60%	95.40%	4.60%

Table 4: The Frequency of Blood Groups ABO and Rh-D Phenotypes in the Population Sample Studied

Table 4 shows the distribution of various ABO and Rh-D phenotypes among the sample studied. The frequency of Group O phenotype was the most prevalent at 37.60% (60,350) followed by B at 32.00% (51,360), A at 24.80% (39,804) and AB at 5.60% (8,986). Rh-D antigen was detected in 1,53,117 (95.40%) samples, while Rh-D negative phenotype was found in 7,383 (4.60%) samples in the total sample size of 1,60,500. Figure 3 shows the numbers of different ABO and Rh-D phenotypes among the sample studied. Figure 4 shows the percentage of different ABO Group and Figure 5 shows percentage of Rh-D phenotypes in the study sample.

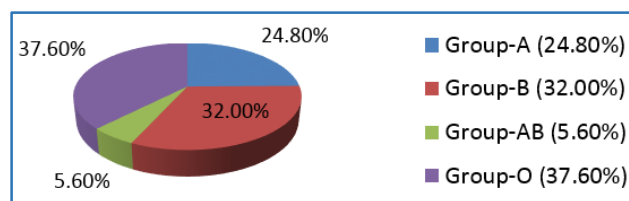


Fig. 4: Diagram showing Percentage of Different ABO Blood Group in the Study Group

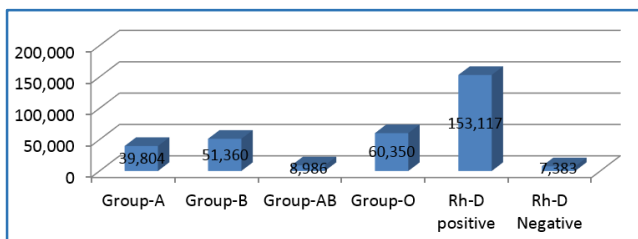


Fig. 3: Diagram showing Numbers of Different ABO Blood Group and in Rh-D Phenotypes the Study Group

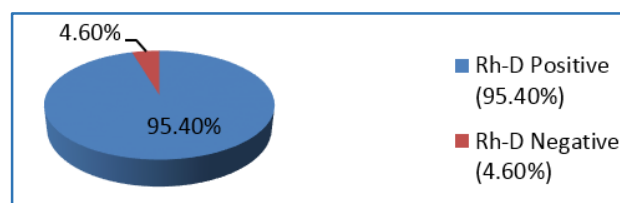


Fig. 5: Diagram showing Percentage of Different Rh-D Grouping

Blood Samples	A Pos.	A Neg.	B Pos.	B Neg.	AB Pos.	AB Neg.	O Pos.	O Neg.	Total
Numbers	38,039	1,765	49,433	1,927	8,665	321	56,980	3,370	1,60,500
Percentage	23.70%	1.10%	30.80%	1.20%	5.40%	0.20%	35.50%	2.10%	100%

Table 5: The Frequency of Rh-D Phenotypes in the Various ABO Blood Groups of the Different Population Sample

Table 5 shows the frequency of Rh-D Phenotypes among the samples studied with respect to ABO blood groups. Rh-D positivity to blood Group O, A, B, AB were found in the study as 56,980 (35.50%), 38,039 (23.70%), 49,433 (30.80%) and 8,665 (5.40%) respectively. Rh-D negativity to blood Group O, A, B, AB were found in the study as 3,370 (2.10%), 1,765 (1.10%), 1,927 (1.20%) and 321 (0.20%) respectively. Figure 6 shows the numbers and Figure 7 shows the percentage of samples showing Rh-D typing amongst different ABO groups.

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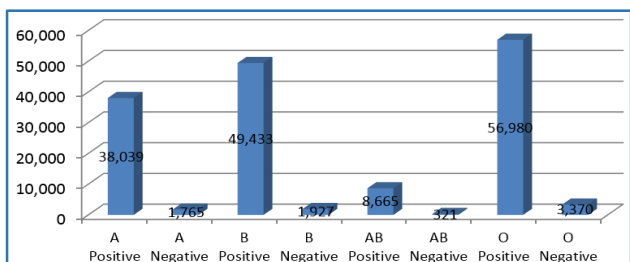


Fig. 6: Diagram showing Numbers of Samples showing Rh-D Typing amongst Different ABO Groups

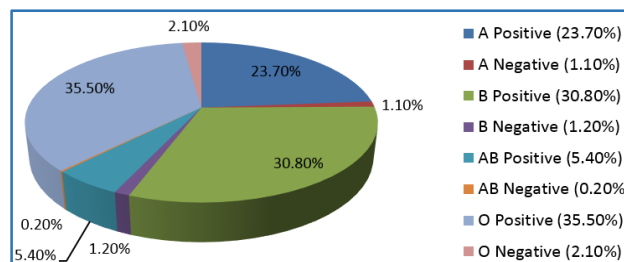


Fig. 7: Diagram showing Percentage of Samples showing Rh-D Typing amongst Different ABO Groups

Blood Samples	A Pos.	A Neg.	A Total	B Pos.	B Neg.	B Total	AB Pos.	AB Neg.	AB Total	O Pos.	O Neg.	O Total
Numbers	38,039	1,765	39,804	49,433	1,927	51,360	8,665	321	8,986	56,980	3,370	60,350
Percentage	95.57%	4.43%	100%	96.25%	3.75%	100%	96.43%	3.57%	100%	94.42%	5.58%	100%

**Table 6: The Frequency of Rh-D amongst A, B, AB and O Groups**

Table 6 shows the frequency of Rh-D phenotypes among the samples studied with respect to individual blood groups. The Rh-D positivity and negativity to total 60,350 (100%) Group O samples showed 56,980 (94.42%) and 3,370 (5.58%), whereas total 8,986 (100%) AB Group was 8,665 (96.43%) and 321 (3.57%); total 39,804 (100%) A Group was 38,039 (95.57%) and 1,765 (4.43%); total 51,360 (100%) B Group was 49,433 (96.25%) and 1,927 (3.75%).

**DISCUSSION**

ABO and Rh gene phenotypes vary widely across races and geographical boundaries despite the facts that the antigens involved are stable throughout the life.<sup>[12]</sup> The resultant polymorphism remains important in population genetic studies, estimating the availability of compatible blood, evaluating the probability of haemolytic disease of newborn, resolving disputes in paternity/maternity and forensic purposes. A racial difference in the distribution of blood groups has been noted by some researchers.<sup>[7,8]</sup> Few studies on the prevalence of ABO and Rh blood groups have been carried out in the Indian population, and majority of these studies are limited to individual communities or to a

particular region of the country.<sup>[13]</sup> No such study has yet been reported from Cachar district of Barak valley of Assam.

The present study revealed that blood Group O was the most prevalent at 37.60% followed by B at 32.0%, A at 24.80% and AB at 5.60%. This observation is in accordance with previous studies from other parts of India. The findings of studies conducted in the National Institute of Mental Health and Neuroscience, Bengaluru and on the population of some parts of Andhra Pradesh reveal similar trends. Amongst Indians, Group O is highest.<sup>[14]</sup> However, the study in the North Indian population by Nanu A Thapliyal, Chandra and Gupta and Agarwal et al reported blood Group B to be the most prevalent.<sup>[13]</sup> Similar results with predominance of blood Group B have also been noted in a study conducted in Gujarat. Some other studies from different parts of Europe, America and South-East Asia have reported blood Group O to be the commonest blood group (Table 7). Group O has been found to be more amongst Indian tribes of America, a section of Australian and Africa, North-Eastern Europeans, etc. White people of America, West Europeans and West Asians have a higher frequency of Group A; whereas Group B is more common in Central and South-East Asians.

ABO Phenotype	Population						
	Caucasoid	Whites	Blacks	Mexicans	Asians	British	Indians
Group-O	47%	45%	49%	56%	43%	46.7%	37.5%
Group-A	41%	41%	28%	28%	27%	41.7%	24.7%
Group-B	09%	10%	19%	13%	25%	8.6%	32.5%
Group-AB	03%	04%	04%	03%	05%	3.0%	5.3%

**Table 7: ABO Phenotypes Frequencies amongst Different World Population**

The Rh-D blood group is the most polymorphic and its clinical significance in transfusion medicine is only next to the ABO blood group system.<sup>[5]</sup> The present study showed that the prevalence of Rhesus ‘D’ antigen is 95.40%. So Rh-D negative phenotype is 4.60%. This finding is in agreement with the results of other studies in India. Rh-D negative phenotype is 5.0% in India, whereas it is 15% in Europe. There was no association between Rh-D status.

Mordant et al<sup>[6]</sup> have earlier shown that the frequency of ABO/Rh-D blood groups is valid only for the specific region or the specific population group from where the data were derived. The Silchar Medical College and Hospital Blood Bank receives blood samples for grouping of almost all population of Cachar district. Hence, the data revealed in the present study fairly reflects the prevalence of ABO and Rh-D groups distribution in the Cachar district in Barak valley of Assam. The present study is therefore useful in providing information on the status of ABO and Rh-D blood groups distribution in the region and the knowledge of it will help in effective management of regional blood transfusion service of the area.

**CONCLUSION**

With a large sample, we established that among the various ABO and Rh-D blood groups in the Cachar districts in Barak

valley of Assam, Group O is the commonest with Rh-D antigen, the occurrence of blood Group A and B with Rh-D antigen is nearly equal and frequency of AB is least. The frequency of Rh-D negative is, although, slightly lower in present series than the data of the country. The present study is therefore useful in providing information on the status of ABO and Rh-D blood groups distribution of the region and the knowledge of it will help in effective management of regional blood transfusion service of the area. However, studies of other minor blood group antigens are also needed in order to effective management for repeated transfusion dependant transfusions.

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