



PREVALENCE OF A2 BLOOD GROUP IN THE POPULATION OF VISAKHAPATNAM

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ABSTRACT

The **ABO System** is the only System of Blood Groups where the reciprocal antibodies are known to be consistently and predictably present in the sera of people who have had no previous exposure to human red cells. **Genes at three separate loci** control the occurrence and location of **ABO, Rh and H antigens**. **A and B genes code for enzymes** that add an immunodominant sugar to the H antigen-Immunodominant Sugars are present at the terminal ends of Chains and confer the ABO antigen Specificity. The cells of approximately 80% of all group A (or Group AB) individuals are A1 (or Group A1B) and the remaining 20% are A2 (or Group A2B) or weaker sub group. An attempt is made to find the prevalence of A2 subgroup (among A and AB) blood group population in this part of Visakhapatnam, in this study.

KEYWORDS :

INTRODUCTION :

Clinically **ABO and Rh System** of Blood Groups are the most important ones. The **ABO System** is the only System of Blood Groups where the reciprocal antibodies are consistently and predictably present in the sera of people who have had no exposure to human red cells.

A or B antigen expression fully developed at 2 -4 years of age and remain constant throughout life.

Genes at three separate loci control the occurrence and location of **ABO, Rh and H antigens**. **Presence or absence of the ABH antigen on the red cell membrane** is controlled by the **H gene**. The **H gene codes for an enzyme (fucosyl transferase)** that adds the sugar **fucose** to the terminal sugar of a Precursor Substance. The Precursor Substance (Proteins and Lipids) is formed on an Oligosaccharide chain (the basic structure). The **H antigen** is the foundation upon which **A and B antigens** are built. **A and B genes code for enzymes** that add an immunodominant sugar to the H antigen-Immunodominant Sugars are present at the terminal ends of Chains and confer the ABO antigen Specificity. The **A gene codes for an enzyme (transferase)** that adds N-acetylgalactosamine to the terminal Sugar of the H antigen N-acetylgalactosaminyl Transferase. The **B gene codes for an enzyme** that adds D galactose to the terminal Sugar of the H antigen - D galactosyl transferase. Genotype refers to the genes present. Chromosomes carrying A B genes is Chromosome 9. Chromosomes carrying Rh.gene is Chromosome 1.

Phenotype is the Red Cell antigen on the cell surface.

Landsteiner (1901) and later workers Jansky (1907) and Moss(1907) showed that the RBC of all individuals can be grouped according to the presence of two blood group antigens called 'A' and 'B' into 4 main blood groups i.e. 'A', 'B', 'AB' and 'O'. Group A is further subdivided into A1 and A2. Anti A serum contains two antibodies anti A and anti A1;

It is believed that A1 has two antigens, 'A' and 'A1' while A2 has only A antigen. A2 cells react weakly with anti A1 Serum; hence a high titre serum is necessary while grouping A2 Cells; A2B cells react even less readily with anti A serum.(1)

In 1911 Von Dungern described two different A antigens based on reactions between Group A RBC, s and anti A and anti A1

sera. Group A RBC, s that react with both anti A and anti A1 sera are classified as A1, whereas those that react with anti A and not anti A1 sera are classified as A2.

The cells of approximately 80% of all group A (or Group AB) individuals are A1 (or Group A1B) and the remaining 20% are A2 (or Group A2B) or weaker sub group.

MATERIALS AND METHODS :

The present study is conducted on 877 'A' and 'AB' blood groups out of a total of 3000 blood groups tested in the Blood Bank of Anil Neerukonda Hospital.

The Study is spread over a period of 3 years between 2018 2020 after permission from the Institutional Ethics Committee The grouping is done in the Blood Bank of our Hospital attached to our NRI Institute of Medical and Health Sciences, Sanghivalasa, Visakhapatnam. The blood is collected in EDTA bottles and the sample is a fresh one.

It also consists of a Study of 4202 Nos. of A and AB Blood Groups out of a total of 16266 blood groups collected from Red Cross Society Of India, Visakhapatnam Branch between January 2018 to March 2021.

The technique followed in Subtyping of A blood Groups is **Moist Chamber Slide Method**.

Sub grouping of A and AB Groups :

Lectins prepared from all seeds of Dolichos biflorens (horse gram) will agglutinate red cells containing A1 antigen but not A2 antigen.

Anti A1 Lectin, a cold agglutinin which destroys A1 cells is clinically significant when they react at 37° C causing transfusion reactions.

A1 and A2 are distinguished by the reactivity of lectin i.e. anti A1 which occurs as a cold agglutinin and exclusively agglutinates A1 cells.

AIMS AND OBJECTIVES :

Mutation in A gene leads to A2 formation. In A2 there is weakened enzymatic activity and consequently weakened antigen expression.

A2 antigen being a weak antigen may be missed by Anti A

Serum and the group may be labelled incorrectly as O group.

In such a situation if group A2 red cells are given to a group O person, anti A of O recipient will destroy the Donor A2 red cells resulting in hemolysis and consequent complications.

By proper assessment of these subtypes and incorporating them in ABO typing rare but dangerous blood transfusion reactions can be avoided.

Subtyping of 'A' group blood into 'A1' and 'A2' groups will prevent such hazardous transfusions.

DISCUSSION :

Anti A1 Lectin, a cold agglutinin which destroys A1 cells is clinically significant when they react at 37° C causing transfusion reactions .(2)

A1 and A2 are distinguished by the reactivity of lectin i.e. anti A1 which occurs as a cold agglutinin and exclusively agglutinates A1 cells.

About .4% of A₂ and 25% of A₂B sub groups possess anti A1 antibodies. These antibodies become clinically significant if they react at 37° C destroying A1 cells . (3)

Out of a total of 19266 Blood Groups in our Study A Group prevalence is 20.3% and while that of AB Groups is 6% .

In a study from USA ,prevalence of A and AB was found to be 37.1% and 4.1% while in England it was found to be 41.8% and 3% (4)

Our prevalence of 20.3% A Group correlated with that of a Study from Orissa where the A group was 22.3% (5)

A1 and A2 are the major Sub Groups of Blood Group A .These are differentiated by the reaction of anti A1 Lectin with A1 Cells . A2 and A2B are rare Sub groups . Individuals having these sub groups do not recognize A1 antigen as their own and hence make up specific anti A1 antibody against A1 cells. About .4 % of A2 and 25% of A2B have anti A1 antibodies.(6)

Variation in A1 expression was recognized early in the 20th. Century(7) and the A Blood Group was divided into A1 and A2 which are the two principal A sub groups. (8) .

The frequency of the common A sub groups varies greatly among different populations. Approximately 80% of blood type A or AB are classified as A1 or A1B and the remaining are either A2 or A2B.(9).

In a study from India , the frequency of A1 and A2 sub groups among A group was respectively 98.4% and 1.07% ; In our Study the Prevalence of 97.9% of A1 and 2.1% of A2 matched with the above study closely.

In the same Study amongst AB group the frequency of A1B was 89.28% and A2B was 8.99% .

This report described the proportion of A2B among AB Samples as significantly higher than that of A2 in Group A Samples.(10) and approximately the same distribution was obtained by Bangera.(11)

In our Study A1B is 94.5% and A2B is 5.5%. Our Study also correlated with the above Studies with respect to A2B significantly higher value of 5.5% compared to 2.1% of A2 Group.

In a study conducted in North Karnataka Region by Sujatha .S Giriyan, Akanksha, Agarwal et.al on 20864 donors over a period of 2 years between 2014 -15 'A' group was prevalent in 26.2 % and 'AB' in 8.2%.The study showed that A1 was more common in A group and A1B was more common in AB which was in agreement with study done in Sudan and Parts of South India. In their study the prevalence of A1 was 25.9% and A1B was 7.34% and A2 was .3% and A2B was .8% respectively. (12)

In a study done on the Muslim population of UP by Hussain R et.al the prevalence of A1 and A1B was 26.52% and 19.34% and A2 and A2B was 2.9% and 1.24% respectively.(13).Their study was similar to a study done on Muslim Population by Ara.G et. al in which prevalence of A1, A1B, A2, and A2B was 24.64%,20.21% , 3.97% and 1.6% respectively.(14)

A study from South India showed prevalence of A2 and A2B as 3.01 % and 1.43% respectively (Das PK).

Another study by Chaitanya Kumar IS et.al concluded that prevalence of A2 and A2B is .85% and 1.21% respectively(15). In a study done by Sharma DC et.al in which A2 and A2B were found to be 8% and 8.6% respectively. In their Study (North Karnataka) the prevalence of A1 and A2 blood groups was 89.7% and 10.3% respectively. These results were similar to the study done by Bangera IS et.al in which prevalence of A2 and A2B in group A and AB respectively was 1.3% and 12.7% (Bangera IS)

In a study of Blood Groups of 720 Donors in Blood Bank of Indira Gandhi Mahila Evam Balya Chikitsalaya, Bhopal , India, A group were 166 Donors .Out of these 151 were (91%)belonged to A1 subtype and only 15(9.0%)belonged to A2. Of 64 Donors with group AB, 54 (84.37%) belonged to A1B subtype and only 10 (15.63%) belonged to A2B.

It was noted that A2 in AB Blood Group was more frequent in occurrence than presence of A2 as in an A Blood Group.

In our Study of 3000 Nos. Blood group cases at the Blood Bank of Anil

Out of a total of 19266 Blood Groups in our Study A group prevalence is 20.3% and while that of AB Groups is 6% .

Table Showing the Frequency of 'A' Blood Groups from Various Studies.

	Incidence of A & AB Blood Groups		Frequency of A1 & A2 Subtypes in A Blood Group		Frequency of A1 B & A2 B subtypes in AB Blood Groups	
	A	AB	A1	A2	A1 B	A2 B
USA	37.10%	4.10%				
England	41.80%	3%				
Orissa	22.30%	Not recorded				
India (Shamee Sastry)	98.40%	1.07%			89.28%	8.99%
North karnataka (Sujatha .S)	26.20%	8.20%	More Common		More Common	
Muslim Population Of UP in India (Hussain R et al)			26.52%	2.90%	19.34%	1.24%
Muslim Population of North India (Ara, G et al)			24.64%	3.97%	20.21%	1.60%

South India			3.01%		1.43%
Rayelaseema Region,AP (Chaitanya kumar et.al)			0.85%		1.21%
North karnataka (Sharma DC et. Al)			8%		8.60%
Bhopal			91%	9%	84.37% 15.63%

Statistics of A and AB Subtypes in the Study of 3000 Blood Samples in ANH Blood Bank

	Total	%		Total	%
A1 + ve	591	19.70%	A1 B +ve	245	8.20%
A2+ve	2	0.66%	A2B +ve	1	0.30%
A1-ve	30	1%	A1B-ve	6	2%
A2-ve	2	0.66%	A2B-ve	0	0

Statistics of A and AB Subtypes in the Study of 16,266 Cases of Blood Groups of Red Cross Society of India ,Visakhapatnam

Total Blood Groups Done	Total	%
A1 Positives	3072	18.9%
A2 Positives	69	.4 %
A1 Negatives	148	.9%
A2 Negatives	8	.049%
A1B Postitives	810	4.97%
A2BPostitives	59	.36%
A1B +Ve	33	.2%
A2B -ve	3	.01%

Statistics of A and AB Subtypes in Our Study of 17143 Blood Groups in Visakhapatnam between January 1st 2018 to March 31st 2021

Total Blood Groups Done	Total	%
A1 +ve	3663	21.3%
A2+ve	71	.4%
A1-ve	178	1.03%
A2-ve	10	.058%
A1B +ve	1055	6.15%
A2B +ve	60	.35%
A1B-ve	39	.2%
A2B-ve	3	.017%

CONCLUSION:

By proper assessment of the sub types of 'A' Blood Group and incorporating them in ABO typing rare but dangerous blood transfusion reactions can be avoided.

In conditions of Emergency Situations where Laboratory facilities are not available it is not mandatory that Sub typing of A blood Group for A2 Sub type be done .

This is because the Statistics of A2 Blood type is very insignificant as per our Studies.

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