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RESEARCH ARTICLE

A COMPARISON OF PREVALENCE OF ABO AND RHESUS BLOOD GROUPS IN MOTHERS AND THEIR NEONATES BORN IN A TERTIARY CARE HOSPITAL

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ABSTRACT

In this study, the aim was to compare the prevalence of ABO and Rhesus blood groups in mothers and their neonates born in a tertiary care hospital in North India. In this cross-sectional study, the results showed that the B gene was most common, followed by O gene and further followed by A gene in both mothers and their neonates. The blood group A was 3rd most common blood group and the blood group AB and Rh negatives were infrequent in both mothers and their neonates. In this cross-sectional study, the results also showed that most often about 42.63% mothers had same blood group as that of neonates, about 27.13% mothers and neonates had ABO incompatibility, about 23.26% mothers and neonates had other compatible blood groups, about 6.01% mothers and neonates had Rh incompatibility and least often, about 0.97% mothers and neonates had both ABO and Rh incompatibility.

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INTRODUCTION

Karl Landsteiner has been credited for the discovery of ABO blood group system in 1900. 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 (Landsteiner, 1900). Landsteiner discovered that human blood contain iso-agglutinins capable of agglutinating other human red blood cells (Landsteiner, 1900). He was awarded the Nobel Prize for medicine in 1930 (Owen, 2000). It was not until 1940 when Landsteiner and Weiner discovered the Rh factor that transfusion medicine involved less risk. Immunogenicity of the Rh factor along with A, B antigens made it mandatory for pre-transfusion testing (Lefrère, 2010; Gundrajukuppam *et al.*, 2016). Currently there are more than 50 antigens in the Rh blood group system but the principal Rh antigens of medical interest are D, C, E, c and e (Gundrajukuppam *et al.*, 2016). A person with Rhesus antigen is referred to as Rhesus positive while individuals lacking the antigen are Rhesus negative. About 85% of all white people are Rh positive and 15% are Rh negative (Vaz Mario *et al.*, 2013).

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In American blacks, the percentage of Rh positives is about 95%, whereas in African blacks, it is virtually 100% (Vaz Mario *et al.*, 2013). The ABO incompatibility in newborns occurs when the mother is type O and the baby is B, A or AB; the mother is type A and the baby is B or AB; or the mother is type B and the baby is A or AB. The Rh incompatibility in newborns occurs when the mother has Rh negative blood and the baby has Rh positive blood (Kliegman *et al.*, 2020).

AIMS AND OBJECTIVES

To compare the prevalence of ABO and Rhesus blood groups in mothers and their neonates born in a tertiary care hospital in North India.

MATERIALS AND METHODS

Study Setting and Period of Study: The study was conducted at Department of Pathology, Rockland Hospital in Delhi in North India during the period from 01 January 2012 to 07 August 2014.

Study Design: The study was a Cross-sectional Study, conducted at Department of Pathology, Rockland Hospital in Delhi in North India.

Sample Size: For the present cross-sectional study, blood groups of a total of 516 neonates (500 singleton neonates and 16 twin neonates) and their 508 mothers were recorded and studied at Rockland Hospital in Delhi, North India, during the period from 01 January 2012 to 07 August 2014.

Sampling Design: The study was done as Random Sampling of the neonates that were born in the Department of Paediatrics, Rockland Hospital. The venous blood samples were collected for blood groups of about 516 neonates as well as blood groups of their mothers were also done.

Study Variables: ABO and Rhesus Blood Groups of neonates and their mothers

Inclusion Criteria/ Selection Criteria: Participants in the study eligible for inclusion were neonates of either gender, born alive in Rockland Hospital during the period 01.01.2012 till 07.08.2014. The mothers of these neonates were also included as participants after obtaining written consent from them. Neonates were included after obtaining proper informed written consent from their parent/guardian.

Intrauterine deaths were excluded from the study.

There were about 145 neonates whose blood groups were not done, so these 145 neonates and their mothers were excluded from this study.

Study Characteristics: In this study, the blood groups of 516 neonates and their 508 mothers were evaluated. The demographic information, history, physical examination, and type of blood group in the subject's questionnaire were recorded. In this study, blood groups were recorded after collecting venous blood samples from the neonates and their mothers, under all aseptic procedures. Subjects that satisfied the inclusion criteria were selected and the subjects who did not meet the inclusion criteria were excluded.

Data Collection Methods and Tools: Subject's history information was collected in questionnaires and blood groups data was collected and reported, and then statistical analysis of data was performed using SPSS software. Calculations of P values were done using Quick Calcs-Graphpad Software.

Statistical Methods and Statistical Interpretation: The Chi-square test was used to calculate the Two-tailed P values in our study. When presenting P values, it was helpful to use the asterisk rating system as well as quoting the P value:
$P < 0.05$* , it is statistically significant,
$P < 0.01$** , it is very statistically significant,
$P < 0.001$***, it is extremely statistically significant.

RESULTS AND OBSERVATIONS

For the present cross-sectional study, blood groups of a total of 516 neonates (500 singleton neonates and 16 twin neonates) and their 508 mothers were recorded and studied at Rockland Hospital in Delhi, North India, during the period from 01 January 2012 to 07 August 2014. The prevalence of various blood groups in 516 neonates was as follows: A 23.64% (122) (116+6), B 35.66% (184) (174+10), AB 9.88% (51) (44+7) and O 30.82% (159) (146+13). The prevalence of various blood groups in 508 mothers was as follows: A 22.64% (115) (109+7-1), B 33.47% (170) (153+18-1), AB 12.20% (62) (51+11) and O 31.69% (161) (155+12-6). In our study, approximately 93.02% of neonates expressed RhD antigen (Rh positive), and 90.75% of mothers were Rh-positive. In the table 1, the blood groups of 8 mothers of twins were counted twice (A+ 1, B+ 1, O+ 5 and (O-) 1), so the corresponding correction was done in the results.

Overall, the prevalence of various blood groups in 1024 subjects (both 508 mothers and 516 neonates) was as follows: A 23.14% (237) (122+115), B 34.57% (354) (184+170), AB 11.04% (113) (51+62) and O 31.25% (320) (159+161). The prevalence of Rh negatives in 516 neonates was about 6.98% (36) (6+10+7+13). The prevalence of Rh negatives in 508 mothers was about 9.25% (47) (48-1) (7+18+11+12-1). Overall, the prevalence of Rh negatives in both 508 mothers and 516 neonates was about 8.11% (83) (47+36), in our study.

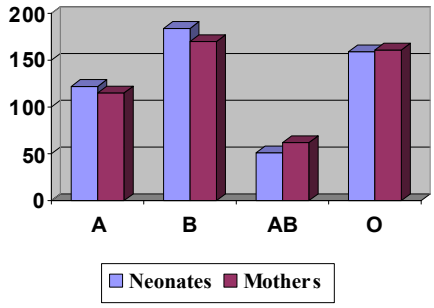

Figure 1: Bar diagram showing a comparison of prevalence of blood groups in a group of 516 neonates born to 508 mothers in Rockland Hospital, Delhi.

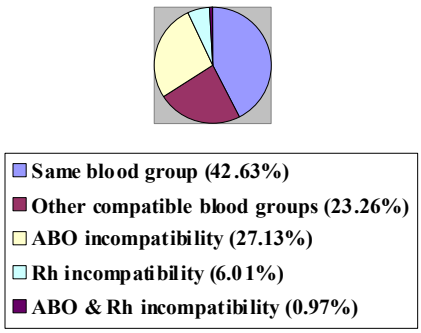

Figure 2: Pie diagram showing prevalence of same blood group, other compatible blood groups, ABO and Rh incompatibility in a group of 516 neonates born to 508 mothers in Rockland Hospital, Delhi.

The prevalence of same blood group in mother and baby was about 42.63% (220) and prevalence of other compatible blood groups was about 23.26% (120). Besides, the prevalence of ABO and Rh incompatibility was about 34.11%, in our study.

Approximately 28.10% (140+5) of live births were at theoretical risk for immune mediated hemolysis based on ABO mismatch; most often (46.7%) (78/161X100) the mother being group O (161) (167-6) and the infant was group B (48), A (29) or AB (1). Less often (27.83%), the mother was group A (115) (116-1) and the infant was group AB (17) or B (15) and least often (20.59%), the mother was group B (170) (171-1) and the infant was group AB (20) or A (15), in our study.

Table 1: Table showing prevalence of ABO and Rhesus Blood Groups in a group of 508 mothers and their 516 neonates, born in Rockland Hospital, Delhi.

BBG	A+	A-	B+	B-	AB+	AB-	O+	O-	Same BG	OCBG	ABO Inc	Rh Inc and ABO Inc	Rh Inc and Same ABO BG	Rh Inc and OC ABO BG	Total MBG	P value
MBG A+	50	2	14	1	15	0	26	1	50	29	30	0	0	0	109	<0.0001
MBG A-	03	0	00	0	01	1	02	0	00	00	01	1	3	2	007	<0.0001
MBG B+	12	2	82	2	16	2	35	2	82	39	32	0	0	0	153	<0.0001
MBG B-	01	0	08	3	02	0	01	3	03	03	00	3	8	1	018	<0.0001
MBG AB+	18	1	22	1	07	2	00	0	07	44	00	0	0	0	051	<0.0001
MBG AB-	04	0	03	0	02	2	00	0	02	00	00	0	2	7	011	<0.0001
MBG O+	27	1	45	2	01	0	74	5	74	05	76	0	0	0	155	<0.0001
MBG O-	01	0	00	1	00	0	08	2	02	00	01	1	8	0	012	<0.0001
Total BBG	116	6	174	10	44	7	146	13	220	120	140	5	21	10	516	<0.0001

Key words for table: (MBG)-Mother Blood Group, (BBG)-Baby Blood Group, (BG) - Blood Group, (Inc)-Incompatibility, OCBG=other compatible BG

Approximately 6.98% (31+5) of live births were at theoretical risk for immune mediated hemolysis based on Rh mismatch, most often 4.07% (21) mothers had same ABO blood group as that of neonates, less often, about 1.94% (10) mothers and neonates had other ABO compatible blood groups and least often, about 0.97% (5) mothers and neonates also had ABO incompatibility. The two-tailed P value was less than 0.0001***, in the Chi-square test. By conventional criteria, this difference was considered to be extremely statistically significant.

DISCUSSION

In this study, the results showed that the prevalence of different blood groups among one group of 516 neonates evaluated at Rockland Hospital, Delhi in North India was approximately: B 35.66%, O 30.82%, A 23.64% and AB 9.88%. The results also showed that the prevalence of different blood groups among their 508 mothers was approximately: B 33.47%, O 31.69%, A 22.64% and AB 12.20%. About 6.98% of neonates were Rh negative and about 9.25% of mothers were Rh negative, in our study. Thus, it is concluded that in the present study in North India, B gene was most common, followed by O gene and further followed by A gene in both mothers and their neonates.

The blood group A was 3rd most common blood group and the blood group AB and Rh negatives were infrequent in both mothers and their neonates. In this cross-sectional study, the results also showed that most often about 42.63% mothers had same blood group as that of neonates, about 27.13% mothers and neonates had ABO incompatibility, about 23.26% mothers and neonates had other compatible blood groups, about 6.01% mothers and neonates had Rh incompatibility and least often, about 0.97% mothers and neonates had both ABO and Rh incompatibility. Approximately 28.10% mothers and neonates had ABO incompatibility; most often the mother being group O and the infant was group B, A or AB. Less often, the mother was group A and the infant was group AB or B and least often, the mother was group B and the infant was group AB or A, in our study.

Approximately 6.98% of live births were at theoretical risk for immune mediated hemolysis based on Rh mismatch, most often about 4.07% mothers had same ABO blood group as that of neonates, less often, about 1.94% mothers and neonates had other ABO compatible blood groups and least often, about 0.97% mothers and neonates also had ABO incompatibility, in our study. The two-tailed P value was less than 0.0001***, in the Chi-square test. By conventional criteria, this difference was considered to be extremely statistically significant.

Following studies support our observations

- The commonest ABO blood group was group B in Northern India with Rh negativity at only 4.29%. The frequency of various blood groups in North India was as follows: group B (34.84%) followed by group O (29.75%), group A (21.50%) and group AB (13.91%) (Chandra, 2012).
- In our study, the results showed that the prevalence of different blood groups among one group of 2140 patients in North India was approximately: B 35%, O 32%, A 23% and AB 10%. The Rh negatives were about 07% in North India. Thus in our study, the commonest ABO blood group was group B in North India with Rh negativity at only 07% (Chaudhary Veena, May 2020).
- In American blacks, the percentage of Rh positives is about 95% (Vaz Mario *et al*., 2013).

Following studies partly support our observations:

- The prevalence of different blood groups among one group of persons studied was approximately: O 47%, A 41%, B 9 % and AB 3 %. It is obvious from these percentages that the O and A genes occur frequently, whereas the B gene is infrequent (Vaz Mario *et al*., 2013).
- About 85% of all white people are Rh positive and 15% are Rh negative. In American blacks, the percentage of Rh positives is about 95%, whereas in African blacks, it is virtually 100% (Vaz Mario *et al*., 2013).
- Approximately 85% of Caucasians express RhD antigen (Rh positive), whereas 99% of persons from Africa or Asia are Rh positive (Kliegman *et al*., 2020).
- In our study, the Rh negatives were about 08.11% in North India, which is intermediate between the percentage of Rh negatives of about 05% in American blacks and 15% in white people.

SUMMARY

In this study, the aim was to compare the prevalence of ABO and Rhesus blood groups in mothers and their neonates born in a tertiary care hospital in North India. The study was done as random sampling of the neonates that were born in the

Department of Paediatrics, Rockland Hospital. For the present cross-sectional study, blood groups of a total of 516 neonates (500 singleton neonates and 16 twin neonates) and their 508 mothers were recorded and studied at Rockland Hospital in Delhi, North India, during the period from 01 January 2012 to 07 August 2014. Participants that satisfied the inclusion criteria were selected and the participants who did not meet the inclusion criteria were excluded. Subject's history information was collected in questionnaires and blood groups data was collected and reported, and then statistical analysis of data was performed using SPSS software. Calculations of P values were done using QuickCalcs-Graphpad Software. The Chi- square test was used to calculate the Two-tailed P values in our study.

In this study, the results showed that the prevalence of different blood groups among one group of 516 neonates evaluated at Rockland Hospital, Delhi in North India was approximately: B 35.66%, O 30.82%, A 23.64% and AB 9.88%. The results also showed that the prevalence of different blood groups among their 508 mothers was approximately: B 33.47%, O 31.69%, A 22.64% and AB 12.20%. About 6.98% of neonates were Rh negative and about 9.25% of mothers were Rh negative, in our study. Thus, it is concluded that in the present study in North India, B gene was most common, followed by O gene and further followed by A gene in both mothers and their neonates. The blood group A was 3rd most common blood group and the blood group AB and Rh negatives were infrequent in both mothers and their neonates. In this cross-sectional study, the results also showed that most often about 42.63% mothers had same blood group as that of neonates, about 27.13% mothers and neonates had ABO incompatibility, about 23.26% mothers and neonates had other compatible blood groups, about 6.01% mothers and neonates had Rh incompatibility and least often, about 0.97% mothers and neonates had both ABO and Rh incompatibility. Approximately 28.10% mothers and neonates had ABO incompatibility; most often the mother being group O and the infant was group B, A or AB. Less often, the mother was group A and the infant was group AB or B and least often, the mother was group B and the infant was group AB or A, in our study. Approximately 6.98% of live births were at theoretical risk for immune mediated hemolysis based on Rh mismatch, most often about 4.07% mothers had same ABO blood group as that of neonates, less often, about 1.94% mothers and neonates had other ABO compatible blood groups and least often, about 0.97% mothers and neonates also had ABO incompatibility, in our study. The two-tailed P value was less than 0.0001***, in the Chi-square test. By conventional criteria, this difference was considered to be extremely statistically significant.

CONCLUSION

It is concluded that in the present cross-sectional study in North India, B gene was most common, followed by O gene and further followed by A gene in both mothers and their neonates. The blood group A was 3rd most common blood group and the blood group AB and Rh negatives were infrequent in both mothers and their neonates. In this cross-sectional study, the results also showed that most often about 42.63% mothers had same blood group as that of neonates, about 27.13% mothers and neonates had ABO incompatibility, about 23.26% mothers and neonates had other compatible blood groups, about 6.01% mothers and neonates had Rh incompatibility and least often, about 0.97% mothers and neonates had both ABO and Rh incompatibility. By conventional criteria, this difference was considered to be extremely statistically significant.

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