

Original Research Article

To find any association of maternal blood group as a risk factor for preeclampsia

Premlata Mital*, Divya Gupta, Devendra Kumar Benwal, Himanshi Gangwal, Nupur Hooja, Suchita Agarwal, Richa Ainani

Department of Obstetrics & Gynecology, S. M. S. Medical College, Jaipur 302004, Rajasthan, India

Received: 04 October 2016

Accepted: 04 November 2016

*Correspondence:

Dr. Premlata Mital,

E-mail: drpremlatamital@rediffmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Preeclampsia, a multisystem disorder, one of the three leading causes of maternal morbidity and mortality worldwide. Various risk factors have been identified for its development. Recently ABO blood group has been related to risk of preeclampsia. Aims and Objective: to investigate any possible relationship between the ABO/Rh blood group system and preeclampsia.

Methods: 250 pregnant women with Rh positive blood group, who were fulfilling the criteria for preeclampsia were selected as cases and 250 women with normal pregnancy without any complications, with Rh positive blood group, were selected as controls. Odd ratio was calculated to find the correlation of the patients with preeclampsia and control group from the point of ABO blood groups.

Results: Blood group AB has the highest, and O has lowest risk for preeclampsia among the ABO blood groups. Out of 41 women with severe pre-eclampsia, most of them (39.0) had blood group AB and there was a significant difference between the patients with severe preeclampsia, mild preeclampsia and control group in terms of distribution of ABO blood groups.

Conclusions: It was observed that women with AB blood group are at higher risk. So to prevent the PIH and improve the prognosis ABO blood groups of each pregnant women should be done in first trimester and special attention should be given to women with AB blood group.

Keywords: ABO Rh blood group, Preeclampsia, Pregnancy risk factors

INTRODUCTION

Preeclampsia (PE) and related hypertensive disorders of pregnancy impact 5-8% of all births in the United States.^{1,2} In developing countries, a woman is seven times as likely to develop preeclampsia than a woman in a developed country and severe forms of preeclampsia and eclampsia are more common, ranging from a low of 4% of all deliveries to as high as 18% in parts of Africa.^{1,3} Preeclampsia/eclampsia is one of the 3 leading causes of maternal morbidity and mortality worldwide. During the past 50 years, there has been a significant reduction in the rates of eclampsia, maternal mortality,

and maternal morbidity in the developed countries. In contrast, the rates of eclampsia, maternal complications, and maternal mortality remain high in the developing countries.⁴

Preeclampsia is a multisystem disorder of unknown etiology characterised by development of hypertension to the extent of 140/90 mm Hg or more with proteinuria after the 20th week in previously normotensive and non-proteinuric patients.⁵ Risk factors with PIH development include previous history of PIH, preexisting diabetes, multiple pregnancy, nulliparity, previous raised blood pressure and raised body mass index before pregnancy.⁶

Karl Landsteiner in 1900 first discovered the ABO blood group system. The blood group of a person depends upon the presence or absence of two genes, A and B. The gene that determines human ABO blood type is located on chromosome 9 and is called ABO glycosyltransferase.⁷ ABO blood-group antigens are oligosaccharides attached to cell-surface glycoconjugates expressed by epithelia, endothelia and erythrocytes (RBCs) in primates.^{8,9} There are six major genotypes and four phenotypes in the ABO blood group with differing frequencies among various populations, which might have been evolutionarily advantageous in conferring resistance against pathogens.¹⁰ ABO antigens may alter the presentation of cell-surface glycans and modulate their interactions with pathogens or may provide receptors for pathogen attachment.^{10,11} For example, gastric cancer is more common in group A, whereas gastric and duodenal ulcers occur more commonly among blood group O individuals.

ABO blood-group antigens are linked to the protein backbone of coagulation factor VIII and von Willebrand factor and critically affect coagulation.^{12,13} Patients with blood-group O are prone to excess bleeding because of the approximately 25% lower plasma concentrations of these coagulation factors, which is the consequence of the increased clearance of these glycoproteins, a phenomenon that is related to the H antigen linked to their backbone.¹³ Conversely, the elevated plasma concentrations of coagulation factor VIII and von Willebrand factor in non-O blood-group individuals has been implicated in the increased risk for thromboembolic disease and ischemic heart disease.¹³⁻¹⁷ It was recently suggested that blood group differences in glycosylation of these glycoproteins may alter their interaction with galectins and siglecs, and influence systemic immune functions.¹⁸

Earlier It was suggested that risk of preeclampsia in a women is due to inherited thrombophilia.^{19,20} And increased plasma concentrations of coagulation factors in blood-group AB individuals may have a prothrombotic effect¹⁹, triggering or exacerbating the pathophysiologic events or exaggerated maternal systemic immune response component leading to preeclampsia.¹⁹⁻²² Blood-group antigens influence the bioavailability of E-selectin, TNF-alpha and ICAM1, factors implicated in the pathogenesis of preeclampsia.^{23,24}

The relationship between ABO/Rh blood groups and patients with PE has been observed in many studies for years, which resulted in conflicting findings. In this study, we aimed to investigate any possible relationship between the ABO/Rh blood group system and PE.

METHODS

This cross sectional study was conducted in the Department of Obstetrics and Gynaecology at S.M.S.

medical college, Jaipur. An informed written consent was taken from every patient after full explanation about the study procedure. The subjects for the study were selected from the out-patient and in -patient department of obstetrics and gynaecology and also from the labour room. 250 pregnant women who were fulfilling the criteria for preeclampsia were considered as cases and 250 women with normal pregnancy without any complications were selected as controls. Only Rh positive cases were included in the study. Subjects having any other medical and surgical complication and women having history of any drug use, multi-fetal pregnancy, history of smoking, erythroblastosis fetalis, were excluded from the study.

Statistical analysis

Data were entered in Microsoft excel sheet and analysed statistically. Continuous variables were given as mean $\pm$ standard deviation; categorical variables were defined as percentages. Qualitative variables are given as percent. Odd ratio was calculated to find the correlation of the patients with PE and control group from the point of ABO blood groups. A P-value 0.05 was considered significant.

RESULTS

Mean age of the women in control group was 24.66 ± 3.95 and in prelamptic group was 24.76 ± 3.83 .

Of the women who had PE, 26.8% had type O blood, 17.6% had type A blood, 27.6% had type B blood, and 28% had type AB blood, whereas those of control group (healthy pregnant women) had O group in 35.2%, A in 17.2%, B in 35.6%, and AB in 12%. There was a significant difference between the patients with PE and control group in terms of distribution of ABO blood groups and the percentage of group AB was found to be significantly higher in patients with PE compared to the control group ($P=0.00008$) (Table 1).

Using blood group O as the reference group, the association between blood group and preeclampsia was estimated using odds ratios and 95% confidence intervals from logistic regression models. The results as shown in table- 2 indicated that AB has the highest, and O has lowest risk for preeclampsia among the ABO blood groups (Table 2).

Table 3 compares association between blood group and severity of preeclampsia. Out of 41 women with severe pre-eclampsia, most of them (39.0) had blood group AB and there was a significant difference between the patients with severe PE, mild PE and control group in terms of distribution of ABO blood groups (p value 0.0001).

Table 1: Distribution of women according to maternal blood group.

Category	Blood group								Total
	A No.	%	B No.	%	AB No.	%	O No.	%	
Cases	44	17.6	69	27.6	70	28.0	67	26.8	250
Controls	43	17.2	89	35.6	30	12.0	88	35.2	250
Total	87	17.4	158	31.6	100	20.0	155	31.0	500

$\chi^2 = 21.3883$, p value – 0.00008, significant at $p < .05$.

Table 2: Association between ABO Rh blood group and preeclampsia.

Blood groups	Odds ratio	95% Confidence interval		Significance (p – value)	
		Lower bound	Upper bound		
A	1.344	0.7935	2.2763	0.2715	NS
B	1.0183	0.6512	1.5922	0.93	NS
AB	3.0647	1.7988	5.2215	0.0001	Sig

Table 3: Association of ABO Rh blood group with severity of preeclampsia.

Blood groups	Categories of pre-eclampsia					
	Controls		Mild pre-eclampsia		Severe pre-eclampsia	
	No	%	No	%	No	%
A	43	17.2	34	16.3	10	24.4
B	87	34.8	67	32.1	4	9.8
AB	32	12.8	52	24.9	16	39.0
O	88	35.2	56	26.7	11	26.8
Total	250		209		41	

$\chi^2 = 27.5597$; p value-0.0001 significant.

DISCUSSION

Preeclampsia is a relatively common multifactorial pregnancy disorder which is a leading cause of maternal and perinatal mortality and morbidity. Recently it is stated that ABO acts as a locus for venous thromboembolism (VTE), myocardial infarction (MI), and multiple cardio-vascular biomarkers. According to some studies there is an association between the ABO blood group and DBP. This study was done to find any relation of blood group with preeclampsia.

It was observed that in women with preeclampsia 28% had AB blood group while in control group only 12% had AB blood group. Our results were consistent with the result of Manjunatha S et al and Vinod et al.^{25,26} Further it was observed in our study that women with blood group AB have the highest risk for preeclampsia compared to other blood group. They also have an increased risk of severe preeclampsia. The result of our study are consistent with findings of Manjunatha S et al²⁵, Lee BK et al, Bharali et al, Spinillo et al and Phaloprakram C et al.^{25,27-30} The results of a meta-analysis demonstrated an association between maternal AB blood group and increased risk for developing PE.³¹ Our observation was

different from the study done by Mostafa ARA et al who observed that pregnant women with blood group B have the highest risk for PIH compared to other blood group.³² Similarly Reshmarani et al 2014 and Mishra and Pradhan found in their study that A blood group type is significantly associated with hypertensive disorders of pregnancy.^{4,33}

It is believed that ABO antigens play a role in the immune- and coagulation systems by influencing gene-environment interactions therefore differences in ABO blood groups may put a patient at a specific risk according to her inherited antigens. Women with blood group AB have increased plasma concentrations of coagulation factors (factor VIII and von Willebrand factor) which may have a prothrombotic effect, triggering or exacerbating the pathophysiologic events leading to preeclampsia.

Another proposed view for the pathogenesis of preeclampsia is through the maternal immune response. Placental protein (PP13) is considered to be an early marker for preeclampsia. It is a galectin (galectin-13) that binds beta-galactosides, such as N-acetyl-galactosamine, galactose, fucose, located at terminal positions on ABO blood-group antigens. PP13 is primarily produced by the

placenta and is predominantly localized to the syncytiotrophoblast apical membrane, from where it can be secreted and/or shed into the maternal circulation. , PP13-binding to RBCs inversely mirrored serum PP13 concentrations according to ABO blood groups. PP13 values were almost identical in blood-group O and A women throughout pregnancy as was PP13-binding to blood-group O and A RBCs. Blood-group B women had the highest serum PP13 values throughout pregnancy, and PP13-binding was the weakest to blood-group B RBCs. The lowest first trimester PP13 values were found in blood-group AB women in parallel with the strongest PP13-binding to blood-group AB RBCs. the reduced first trimester placental expression of PP13, a galectin that may have important immunobiological functions at the maternal-fetal interface, may contribute to the early events in the placental pathogenesis of preeclampsia in these patients.

CONCLUSION

As a preliminary study we found a potential association between maternal ABO blood groups and risk of preeclampsia which needs to be further investigated along with the paternal blood group and the pathogenesis mechanisms that lead to development of Hypertensive disorders of pregnancy. It was observed that women with AB blood group are at higher risk. So to prevent the PIH and improve the prognosis ABO blood groups of each pregnant women should be done in first trimester and special attention should be given to women with AB blood group.

ACKNOWLEDGEMENTS

Authors would like to thank Dean, Smt. Kashibai Navale Medical College and General Hospital, Narhe, Pune.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

- Villar J, Say L, Gulmezoglu AM, Meraldi M, Lindheimer MD, Betran AP, Piaggio G. Eclampsia and pre-eclampsia: a health problem for 2000 years. In Pre-eclampsia, Critchley H, MacLean A, Poston L, Walker J, eds. London, RCOG Press. 2003: 189-207.
- Ronsmans C, Graham WJ. On behalf of the Lancet Maternal Survival Series steering group, "Maternal mortality; who, when, where and why." The Lancet, Maternal Survival, September 2006.
- Maternal mortality in 2005: estimates developed by WHO, UNICEF, UNFPA and the World Bank, Geneva, World Health Organization, 2007.
- Ghulmiyyah L, Sibai B. Maternal mortality from preeclampsia/eclampsia. Semin Perinatol. 2012;36(1):56-9.
- Manjunatha S, Anita K. The relationship between maternal blood group and preeclampsia. Int J Reprod Contracept Obstet Gynecol. 2015;4(6):1749-52
- Reshmarani, Veena HC, Bennal A. Association between ABO Blood Group and Pregnancy Induced Hypertension. Sch J App Med Sci. 2014;2(6C):3054-6.
- Farhud DD, Yeganeh MZ. A brief history of human blood groups. Iran J Public Health. 2013;42(1):1-6.
- Varki A, Cummings R, Esko JD, Freeze H, Stanley P, et al. (2008) Essentials in Glycobiology. New York: Cold Spring Harbor Laboratory Press. 2008: 784.
- Watkins WM. The ABO blood group system: historical background. Transfus Med. 2001;11: 243-65.
- Marionneau S, Cailleau-Thomas A, Rocher J, Le Moullac-Vaidye B, Ruvoen N, et al. ABH and Lewis histo-blood group antigens, a model for the meaning of oligosaccharide diversity in the face of a changing world. Biochimie. 2001;83:565-73.
- Cohen M, Hurtado-Ziola N, Varki A. ABO blood group glycans modulate sialic acid recognition on erythrocytes. Blood. 2009;114: 3668-76.
- Gill JC, Endres-Brooks J, Bauer PJ, Marks WJ Jr, Montgomery RR. The effect of ABO blood group on the diagnosis of von Willebrand disease. Blood.1987;69:1691-5.
- O'Donnell J, Laffan MA. (2001) The relationship between ABO histo-blood group, factor VIII and von Willebrand factor. Transfus Med. 2001;11: 343-51.
- Medalie JH, Levene C, Papier C, Goldbourt U, Dreyfuss F, et al. Blood groups, myocardial infarction and angina pectoris among 10,000 adult males. N Engl J Med. 1971;285:1348-53.
- Meade TW, Cooper JA, Stirling Y, Howarth DJ, Ruddock V, et al. Factor VIII, ABO blood group and the incidence of ischaemic heart disease. Br J Haematol. 1994;88:601-7.
- Koster T, Blann AD, Briet E, Vandenbroucke JP, Rosendaal FR. Role of clotting factor VIII in effect of von Willebrand factor on occurrence of deep-vein thrombosis. Lancet. 1995;345:152-5.
- Larsen TB, Johnsen SP, Gislum M, Moller CA, Larsen H, et al. ABO blood groups and risk of venous thromboembolism during pregnancy and the puerperium. A population-based, nested case-control study. J Thromb Haemost. 2005;3: 300-4.
- Lenting PJ, Pegon JN, Christophe OD, Denis CV. Factor VIII and von Willebrand factor—too sweet for their own good. Haemophilia. 2010;16(5):194-9.
- Hiltunen LM, Laivuori H, Rautanen A, Kaaja R, Kere J, et al. Blood group AB and factor V Leiden as risk factors for pre-eclampsia: a population-based

- nested case-control study. *Thromb Res*. 2009;124:167-73.
20. Sibai B, Dekker G, Kupferminc M. Pre-eclampsia. *Lancet*. 2005;365:785-99.
21. Roberts JM, Hubel CA. (2009) The two stage model of preeclampsia: variations on the theme. *Placenta*. 2009;30:AS32-7.
22. Burton GJ, Yung HW, Cindrova-Davies T, Charnock-Jones DS. (2009) Placental endoplasmic reticulum stress and oxidative stress in the pathophysiology of unexplained intrauterine growth restriction and early onset preeclampsia. *Placenta*. 2009;30:AS43-8.
23. Paterson AD, Lopes-Virella MF, Waggott D, Boright AP, Hosseini SM, et al. (2009) Genome-wide association identifies the ABO blood group as a major locus associated with serum levels of soluble E-selectin. *Arterioscler Thromb Vasc Biol*. 2009;29:1958-67.
24. Johnson MR, Anim-Nyame N, Johnson P, Sooranna SR, Steer PJ (2002) Does endothelial cell activation occur with intrauterine growth restriction? *BJOG*. 2002;109:836-9.
25. Manjunatha S, Anita K. The relationship between maternal blood group and preeclampsia. *Int J Reprod Contracept Obstet Gynecol*. 2015;4(6):1749-52.
26. Vinod, Tayade MC, Latti RG. Association between maternal ABO blood group and risk of Pregnancy Induced Hypertension (PIH). *International J. of Healthcare and Biomedical Research*. 2015;3(4):122-5.
27. Lee BK, Zhang Z, Wikman A, Lindqvist, Reilly M. ABO and RhD blood groups and gestational hypertensive disorders: a population-based cohort study. *BJOG*. 2012;119(10):1232-7.
28. Bharali R. ABO blood group - a risk factor for pregnancy induced hypertension. *Int J Biol Med*. 2014;5(1):3797-801.
29. Spinillo A, capuzzo E, Baltaro F, Piazzzi G, Iasci A. Case-control study of maternal blood group. *J Hum Hypertens*. 1995;9(8):623-5.
30. Phaloprakarn C, Tangjitgamol S. Maternal ABO blood group and adverse pregnancy outcomes *Journal of Perinatology*. 2013;33:107-11.
31. Alpoim PN, de Barros Pinheiro M, Junqueira DR, Freitas LG, das Graças Carvalho M, et al. Preeclampsia and ABO blood groups: a systematic review and meta-analysis. *Mol Biol Rep*. 2013;40(3):2253-61.
32. Mostafa ARA, Emam EAR, Eldeeb AME. Relationship between types of ABO blood groups and Rh group with Hypertensive disorder among pregnant women in Bani Suef, Egypt. *IJSR*. 2016;5(3):538-41.
33. Mishra S, Pradhan P. Association of Maternal ABO Blood Group And Hypertensive Disorders Of Pregnancy. *IJIRTS*. 2013;3(2):12-6.

Cite this article as: Mital P, Gupta D, Benwal DK, Gangwal H, Hooja N, Agarwal S, Ainani R. To find any association of maternal blood group as a risk factor for preeclampsia. *Int J Community Med Public Health* 2016;3:3445-9.