Is There Association between ABO Blood Group and Congenital Heart Diseases in Neonates Born to Diabetic Mothers?

Mohammed Abbas1,5 | Eltayeb Tayrab2,6 | Dhafer Alqahtani3 | Abedelmonium M. Elmaksi4 | Jowayria E. Tayrab3

1Department of pediatrics, college of Medicine, University of Bisha, KSA.
2Department of chemical pathology, Faculty of Medical Laboratory Sciences, National Ribat University, Sudan.
3Department of pediatrics, King Abdullah Hospital, Bisha, KSA.
4Department of medical laboratory sciences, Faculty of Applied Medical Science, University of Bisha, KSA.
5Department of pediatrics, College of Medicine, Kassala University, Sudan
6Department of basic medical science, Faculty of Applied Medical Science, University of Bisha

Corresponding Author:
Eltayeb Tayrab,
Associate professor of chemical pathology, current address: Department of basic medical science, Faculty of Applied Medical Science, University of Bisha, KSA

Phone: 00966509950231,
Emails: eltayebtayrab@gmail.com

ABSTRACT

Background: ABO blood group; besides its fundamental role in transfusion medicine, it has a causal role in predisposing to several human diseases. This study aimed to determine the ABO blood groups of neonates born to diabetic mothers in relation to congenital heart diseases (CHDs) in King Abdullah Hospital, Bisha, Saudi Arabia.

Materials and methods: The study included 151 full-term neonates, aged from 0 to 28 days, admitted in the neonatal intensive care unit. The study covered the period from July 2011 to August 2015. The cases were received either from King Abdullah Hospital or referred from nearby primary hospitals. Mothers were grouped as pregestational and gestational diabetics. ABO blood grouping and echocardiogram were done to all neonates included in the study.

Results: Twenty (13.25%) of neonates with congenital heart disease possessed blood group (O+ve), 10(6.62%) possessed (A+ve), 5(3.31%) possessed (B+ve), while only 1(0.66%) possessed (O-ve), no others blood groups with congenital heart diseases found in the study. The congenital heart diseases in (O+ve) blood group were; atrial septal defect (ASD) (10/20), patent foramen ovale (PFO) (5/20), patent ductus arteriosus (PDA) (4/20) & hypertrophic obstructive cardiomyopathy (HOCM) (1/20). CHDs in (A+ve) group was PDA (4/10), ASD (3/10) & PFO (3/10). CHDs in (B+ve) group; were HOCM (2/5), PDA (2/5) & ASD (1/5). CHD among (O-ve) was only one with PDA.

Conclusion: In neonates with congenital heart diseases born to diabetic mothers in Bisha; blood group O is more common, followed by blood group A, and blood group AB is not common. No significant correlation is observed in this study.

Key Words: ABO blood groups, neonates, diabetic mothers, Echocardiography, congenital heart disease
INTRODUCTION

The antigens of the ABO blood group system (A, B and H determinants) are complex carbohydrate molecules.[1] ABO blood group consists of four types: A, B, AB, and O, characterized by three alleles at ABO genetic locus.[2] Four hundred blood group antigens have been reported.[3] Human ABO blood groups are expressed on the surface of red blood cells and a variety of cells and tissues.[4,1] ABO and Rh have been known as the major clinically significant blood group antigens.[3] Many studies showed that the ABO blood group; beside its fundamental role in transfusion medicine, it has a causal role in predisposing to several human diseases including cardiovascular diseases.[4,1] Some diseases like cancers vary in people with different ABO blood types.[5] ABO hemolytic disease of the neonates occurs exclusively in infants of blood group A and B who are born to group O mothers.[6] Blood group O patients had more pathological complications in comparison to patients with blood group non-O.[7] The cause may be the anti-A, anti-B, and anti-A,B antibodies formed in group O individuals, which are able to cross the placenta.[8,6] It has been suggested that patients with non-O blood had increased rate of cardiovascular mortality.[9] Some clinical studies concluded that; individuals of the A phenotype blood group are more susceptible to cardiovascular diseases.[3] In British, Hungarian and Pakistani the incidence of (CHDs) are higher in patients with blood group A.[3,10,11] Fetal development influences by different genetic factors leading to defective embryogenesis and abnormalities in the newborn.[12] Congenital heart diseases are known to be one of the important causes of neonatal morbidity and mortality.[13,14] The prevalence of congenital heart defects is around 1% of live births.[13] In United States of America; CHDs is the most common birth defect.[15] Although several researchers tried to find the potential association between ABO blood group and a variety of diseases over the last six decades, the results were still controversial and unclear.[1,3].

This research was done to assess the role of ABO group in relation to CHDs in Saudi neonates born to mothers with pre-gestational and gestational diabetes in Bisha.

MATERIAL AND METHOD:

Ethical consideration: The informed written consents were taken from the fathers or the mothers of the neonates after they agreed to participate in this study.

Study location and design: This cross-sectional, hospital based study; was carried out at King Abdullah Hospital Bisha; which is a secondary care referral district general hospital with 400 beds, and serving 500000 populations in Southern Saudi Arabia. The study covered the period from July 2011 to January 2013 then from August 2014 to August 2015.
Study population: The study was done on 151 neonates born to pre-gestational and gestational diabetic mothers, irrespective of gravida and birth weight. Neonates born after less than 37 weeks of gestation were excluded. The cases were received either from the department of obstetrics in King Abdullah Hospital, Bisha, Saudi Arabia, or referred from the 78 primary health care centers and 5 primary hospitals. All the pregnant women included in the study were identified and recorded from the onset of the each pregnancy. The gestational diabetes was diagnosed as per diagnostic criteria of American Diabetic Association Guideline.

Data collection: For ABO blood typing; blood samples collected in EDTA had been used. ABO blood groups were determined by the Department of Laboratories and Blood Bank in King Abdullah Hospital, Bisha, by commercially available hemagglutination techniques recommended in Saudi Arabia. All neonates enrolled were screened for (CHDs) by clinical assessment and echocardiography (ECHO). The screening was done by the same expert pediatric cardiologist within 28 days of delivery. The echocardiography examination was conducted using M-mode, colored 2-dimensional, pulse, and continuous wave Doppler echocardiogram. Two-dimensional echocardiographic pictures were recorded in the standard para sternal long-axis, short-axis, apical 4 chamber, subcostal and suprasternal views.

Data analysis: Statistical analyses were performed using SPSS (version 20). Then Fisher’s exact test and chi-square analysis were performed. The level P<0.05 was considered significance.

RESULT

The study revealed that; on echocardiography 115 (76.15%) of neonates were normal while; CHDs were found in 36(23.84%) neonates of diabetic mothers. Twenty (13.25%) of neonates with congenital heart disease possessed blood group (O+ve), 10(6.62%) possessed (A+ve), 5(3.31%) possessed (B+ve), while only 1(0.66%) possessed (O-ve), no others blood groups with congenital heart diseases found in the study Table (1). The congenital heart diseases in (O+ve) blood group were; atrial septal defect (ASD) (10/20), patent foramen ovale (PFO) (5/20), patent ductus arteriosus (PDA) (4/20) & hypertrophic obstructive cardiomyopathy (HOCM) (1/20). CHD in (A+ve) group were PDA (4/10), ASD (3/10) & PFO (3/10). CHDs in (B+ve) group were HOCM (2/5), PDA (2/5) & ASD (1/5). CHD among (O-ve) was only one with PDA Table (2).

Among the screened neonates 94 (62.25%) were males and 57(37.74%) were females. Regarding gender influence ratio in neonates with CHDs was as follow; 23/94 (24.5%), were males; while 13/57 (22.8%) were females. Maternal history showed that 68 (45.03%) mothers got diabetes during the pregnancy and 83 (54.97%) were having pre-gestational diabetes. The mean gestational age of
the neonates was (38.95±1.05 weeks). The mean age of the mothers was (33.48± 5.98 years). Blood group (O+ve) was the most common phenotype (13.25%) associated with CHD, followed by blood groups (A+ve) (6.62%), (B+ve) (3.31%), and (O-ve) (0.66%). ABO group of babies were significantly highly correlated with their mothers ABO group P value (0.000), while echocardiological findings were not significantly correlated to either blood groups of the neonates nor to blood groups of their mothers P value (0.417 & 0.664).

**Table (1). Descriptive study of the ABO blood groups in the neonates and their diabetic mothers included in the study (N= 151)**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Neonates N (%)</th>
<th>Diabetic mothers N (%)</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood group O+</td>
<td>77(50.99%)</td>
<td>76(50.33%)</td>
<td>50.66%</td>
</tr>
<tr>
<td>Blood group A+</td>
<td>42(27.82%)</td>
<td>44(29.14)</td>
<td>28.48%</td>
</tr>
<tr>
<td>Blood group B+</td>
<td>26(17.22%)</td>
<td>25(16.56%)</td>
<td>16.89%</td>
</tr>
<tr>
<td>Blood group O-</td>
<td>4(2.65%)</td>
<td>4(2.65%)</td>
<td>2.65%</td>
</tr>
<tr>
<td>Blood group AB+</td>
<td>2(1.32%)</td>
<td>2(1.32%)</td>
<td>1.32%</td>
</tr>
<tr>
<td>Others</td>
<td>zero</td>
<td>Zero</td>
<td>Zero</td>
</tr>
<tr>
<td>Total</td>
<td>151(100%)</td>
<td>151(100%)</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Table (2). Descriptive study of the ABO group and echocardiography findings in neonates of diabetic mothers (N =151)**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Echocardiograph finding</th>
<th>Number (N)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABO group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Atrial septal defect (ASD)</td>
<td>10</td>
<td>13.25</td>
</tr>
<tr>
<td></td>
<td>Patent ductus arteriosus (PDA)</td>
<td>4</td>
<td>6.62</td>
</tr>
<tr>
<td></td>
<td>Patent foramen ovale (PFO)</td>
<td>3</td>
<td>4.63</td>
</tr>
<tr>
<td></td>
<td>Hypertrophic cardiomyopathy (HOCM)</td>
<td>1</td>
<td>1.36</td>
</tr>
<tr>
<td></td>
<td>Bicuspid valve (BAV)</td>
<td>1</td>
<td>0.66</td>
</tr>
</tbody>
</table>

**DISCUSSION:**

ABO blood group involvements in human diseases are controversial; its participation in the pathogenesis of CHD is still unclear, except in transfusion medicine. The data concerning the relationship between the CHD in neonates born to diabetic mothers is controversial.

Eltayeb Tayrab. "Is There Association between ABO Blood Group and Congenital Heart Diseases in Neonates Born to Diabetic Mothers?" *Journal of Medical Biomedical and Applied Sciences* Online, 30.10 (2017)
diabetic mothers are scary. Although in this study, some ABO phenotypes are more presents than the others. In Saudi neonates included in the study; blood group O is more common, followed by blood group A and the blood group B; while blood group AB is not common. Similar results were reported by Santanu et al, (2013) 3, in other words; the presence of AB blood phenotype decreases the risk of cardiovascular diseases. Other investigators confirmed that; blood group A is associated with a substantially increased risk for CHD as reported by Hafeezullah et al, (2005)11, Svetlana et al, (2013)16 & Zhuo el al, (2016)17, but in this research we also suggest the involvement of blood O group in CHDs in the neonates of diabetic mothers in south west Saudi Arabia, followed by the blood group A; the late finding is also reported in British, Hungarian and Pakistani population, as stated by10,3,11. Some researchers noted that blood group A is associated with low HDL cholesterol or the good cholesterol, that increases the risk of cardiovascular diseases; as written by Svjetlana et al, (2013)16. On the other hand, no significant difference found in ABO group distribution between the group of coronary artery disease patients and healthy blood donors as stated by Svjetlana et al, (2013)16. According to this research finding, approximately 80% of Bisha neonates possess either blood group O or blood group A; these two ABO phenotypes are suggested to be as higher risk factors of CHDs. In this study similar blood group between the neonates (Table 1); reduces the effect of other confound factors; such as antibodies that may cause hemolytic disease of the newborn. Nowadays ABO group is used potentially in transfusion medicine, as a valuable prediction (Vasan et al, 2016)18; but its clinical utility requires further studies in big samples to explain its value and association within other risk factors especially in CHDs.

CONCLUSION: in neonates with congenital heart diseases born to diabetic mothers in Bisha, KSA; blood group O is more common, followed by blood group A, and blood group AB is not common. No significant correlation is observed in this study.

ACKNOWLEDGMENTS: The authors would like to thank all the staff of King Abdullah Hospital
Bisha, especially Um Abdelrahman for their great support and help.

FINANCIAL SUPPORT AND SPONSORSHIP:
no financial was received from any agent or company.

CONFLICT OF INTERESTS:
there are no conflicts of interest.

REFERENCE
11. Hafeezullah W, Rao AA, Joachim WH. Association of blood group A with increased...


