Distribution of ABO Blood Groups among Patients with Congenital Heart Defects

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ABSTRACT

BACKGROUND: Although an association between congenital heart disease (CHD) and ABO blood group types have been proposed, this relationship has not been well-established. The purpose of this study was to determine the distribution of different ABO blood groups according to CHD sub-types in a large population of patients undergoing surgical repair for CHD.

METHODS: In a retrospective review of hospital data registry, medical profiles of 34,239 admitted patients between January 2003 and December 2012 were reviewed to identify cases with CHD who had undergone surgical repair. CHD types, ABO blood groups and clinical and final outcomes were recorded.

RESULTS: Data from 1,155 patients were analyzed. We did not find an association of a blood group type and a particular CHD type. Similarly, we did not find an association between blood group types and outcomes.

CONCLUSION: We did not find an association between blood group type and type of CHD or outcomes after CHD correction.

Keywords: Congenital Heart Defects; ABO Blood Groups; Outcomes

INTRODUCTION

With major advances in medical care during the past decades, the number of patients with congenital heart disease (CHD) who survive into adulthood is increasing [1, 2]. Moreover, CHD patients suffer from cardiovascular complications due to structural defects as they live longer than ever before [3, 4]. As a mainstay of treatment, most patients with CHD undergo surgical correction by their early adulthood [1]. Identifying predictors of more desirable outcomes and stratifying risk factors for poorer prognosis would help in better management of treatment options [5].

Several factors have contributed to the clinical progress and outcomes of patients with CHD [1, 3, 4]. ABO blood groups have recently been reported to play a role in some cardiovascular diseases [6-9]. Several studies have investigated the relationship between CHD and blood types, but the results are yet inconclusive [10-12].

Our study, therefore, aimed to examine the distribution of ABO blood groups among patients with CHD who were admitted for surgical repair and to investigate ABO blood group association with patients' in-hospital outcomes such as renal failure, cerebrovascular accidents (CVA), myocardial infarction and mortality.

METHODS

This study was approved by the ethics committee of our hospital and conducted in accordance with the tenets of the Declaration of Helsinki. In a retrospective study of data registry of our hospital, medical profiles of 34,239 admitted patients between January 2003 and December 2012 were reviewed to identify cases with CHD that had undergone surgical repair. Medical history, laboratory test results including ABO blood groups, and early in-hospital outcomes such as renal failure, cerebrovascular accidents (CVA), myocardial infarction and mortality were collected for each patient. Distribution of ABO blood groups was determined according to the CHD types and then clinical and laboratory variables were compared between different ABO blood groups.

Data were analyzed using Statistical Package for

Social Sciences (SPSS, version 16, Chicago, Inc, US). One-way analysis of variance (ANOVA) was used for comparison of continuous variables between ABO blood groups and chi square or Fisher's exact test for cross-tabulation of categorical variables. Data was presented as mean ± SD and number (%) where appropriate and values were considered statistically significant at $p < 0.05$.

RESULTS

During the study period, 1,155 patients, 554 males (48%), mean ± SD age was 42.2 ± 19.9 years, underwent surgical repair for CHD. The study population consisted of 379 patients with blood group A (32.8%), 269 patients with blood group B (23.3%), 79 with blood group AB (6.8%), and 428 blood group O (37.1%). Moreover, 1019 patients (88.2%) were Rh^+ and 136 patients (11.8%) Rh^-. There was no significant difference between 4 blood ABO and 2 RH blood groups for primary characteristics (Table 1; $p>0.05$).

Isolated atrial septal defect (ASD) constituted the most frequent type of CHD with 699 cases (60.5%), followed by isolated patent foramen ovale (PFO) (N= 154; 13.3%), isolated ventricular septal defect (VSD) (N=109; 9.4%), 34 (3.9%) isolated patent ductus arteriosus (PDA), 18 (1.6%) isolated tetralogy of Fallot (TOF), 17 (1.5%) isolated Coarctation of aorta, and 6 (0.5%) isolated transposition of great arteries (TGA), etc. However, the different distribution pattern of ABO and RH blood groups among CHD types did not reveal a statistically significant difference ($p=0.25$ and $p=0.54$, respectively).

There was no statistical significant difference in terms of major clinical incidents or final outcomes in favor of any blood subgroup after adjusting for multiple comparisons. Ten patients (0.9%) in blood group A, 7 patients (0.6%) in blood group B, 2 patients (0.17%) in blood group AB, and 9 patients (0.8%) in blood group O died in hospital (Table 1).

DISCUSSION

Although a relationship between blood group type and CHD has been proposed, we did not find such a relationship in a large dataset from our hospital. The possible role of blood groups in congenital heart diseases was first proposed by Lev et al. in 1967 [11]. They studied 130 African children free of CHD and 68 patients with CHD and compared them with normal population from the standpoint of ABO, RH, and MN system. They proposed that the incidence of type B of ABO blood group and CC Dee subtype of Rh^+ blood group may be higher in patients with CHD. Moreover, the authors excluded any relationship between maternal-fetal blood group incompatibility and CHD. In contrast, we determined the distribution of blood groups among different CHD types and investigated patients clinical and final outcomes across these blood groups. In regard to our findings, blood group O had a higher prevalence among patients with ASD, VSD and PFO.

According to our country blood transfusion organization report, blood group O predominates in the general population of the country with a prevalence of 37.6%, followed by blood group A (30.2%), blood group B (24.4%), and blood group AB (7.8%) [6]. A similar distribution pattern was also seen in our study population with blood group O as the most predominant one (37.1%), followed by blood group A (32.8%), group B (23.3%), and group AB (6.8%). This suggests that there is likely no relationship between blood groups and CHD incidence. However, a definite conclusion can be made only when the prevalence of ABO blood groups types is compared with a sample of normal population.

Although the retrospective design is a limitation of the current study, its large sample size is strength.

CONCLUSION

In conclusion, our study did not reveal any significant association between ABO and Rh blood groups and different types of congenital heart diseases and patients' outcome.

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Table 1: Demographics, primary characteristics, distribution of congenital heart defects types and patients' outcome according to the blood groups

Features	A	B	AB	O	P value	RH^+	RH^-	P value
Number (%)	379 (32.8)	269 (23.3)	79 (6.8)	428 (37.1)	0.247	1019 (88.2)	136 (11.8)	0.543
Age (year)	42.5±19	42.4±20.7	44.1±22.5	41.4±19.8	0.685	41.9±20.1	44.0±19.2	0.243
Female	196	141	41	223	0.998	534	67	0.374
Cigarette smoking	24	20	4	24	0.405	65	7	0.379
Opiate use	16	6	3	20	0.371	42	3	0.207
Family History of CAD	93	60	23	99	0.697	250	25	0.074
ASD	234	158	41	266	0.589	616	83	0.219
PFO	43	42	15	54	0.310	136	18	0.553
VSD	35	28	3	43	0.410	95	14	0.429
PDA	19	4	1	10	0.038*	30	4	0.629
TOF	8	2	3	5	0.189*	15	3	0.361
CA	5	4	3	5	0.365	15	2	0.677*
TGA	4	1	1	0	0.154*	5	1	0.530*
ASD+VSD	20	14	8	22	0.389	59	5	0.229
ASD+PFO	1	2	1	4	0.626*	6	2	0.235*
VSD+TGA	0	1	0	2	0.568*	2	1	0.308*
PDA+TGA	0	0	0	1	0.638*	1	0	0.885*
TGA+TOF	0	1	0	0	0.351*	1	0	0.885*
CA+PDA	1	2	1	1	0.475*	4	1	0.458*
CA+ASD	1	0	0	0	0.563*	0	1	0.116*
ASD+VSD+PDA	0	2	0	1	0.308*	3	0	0.694*
ASD+VSD+TOF	1	1	0	1	0.952*	2	1	0.308*
Diabetes	53	43	9	50	0.389	139	16	0.255
Dyslipidemia	100	79	20	105	0.565	273	31	0.153
Hypertension	86	70	24	95	0.339	246	29	0.288
Renal failure	3	0	0	2	0.448*	5	0	0.537*
Cerebrovascular accident	24	15	1	17	0.068*	52	5	0.326
Carotid artery stenosis > 75%	0	0	1	0	0.003*	1	0	0.883*
Peripheral vascular diseases	5	1	0	3	0.447*	8	1	0.716*
Valvular surgery	9	5	0	8	0.575*	21	1	0.251*
Myocardial infarction	41	38	8	55	0.558	120	22	0.094
Mortality	10	7	2	9	0.849	24	4	0.445*
Place of death								
Operating room	0	1	0	1	0.642*	2	0	0.730*
Hospital ward	10	6	2	8		22	4	
Cause of death								
Cardiac	7	5	1	5		15	3	
Infection	1	2	0	1		4	0	
Neurologic	1	0	0	0	0.373*	1	0	
Renal	1	0	0	0		1	0	0.607*
Vascular	0	0	1	1		2	0	
Valvular	0	0	0	2		1	1	

* Fisher's exact test, ASD: atrial septal defect; PFO: patent foramen ovale; VSD: ventricular septal defect; TOF: tetralogy of fallot; PDA: patent ductus arteriosus; TGA: transposition of great arteries; CA: coarctation of aorta.

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