

Erişkin Kalp Cerrahisinde, ABO ve Rh Kan Gruplarının İnotropik Ajan Kullanımı Üzerine Etkileri

Effects of ABO and Rh Blood Groups on Inotropic Agent Use in Adult Cardiac Surgery

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Amaç: Bu çalışmanın amacı, erişkin kalp cerrahisinde farklı kan gruplarında inotropik ajanların intraoperatif ve postoperatif kullanımının araştırılmasıdır.

Gereç ve Yöntemler: 15 Haziran 2017 ve 15 Kasım 2019 tarihleri arasında kardiyopulmoner bypass (CPB) uygulanan hastaların hastane bilgi yönetim sistemi kayıtlarını ve dosyalarını retrospektif olarak inceledik. Hastaların yaşı, cinsiyeti, kan grubu, tanısı, induksiyonda fentanil ve demizolam kullanımı, CPB zamanı, kros klemp zamanı, ameliyat süresi, intraoperatif ve postoperatif inotropik ajan kullanımı, postoperatif entübasyon süresi ve yoğun bakım yatış gün süresini araştırdık.

Bulgular: ABO ve RH kan grupları arasında induksiyonda fentanil ve demizolam kullanımı, CPB zamanı, kros klemp zamanı, postoperatif entübasyon zamanı, yoğun bakım hastanede yatış günü ve ameliyat süresi açısından fark yoktu. Postoperatif dopamin kullanımı kan grubu A, B ve O'da intraoperatif kullanıma göre daha yüksekti ($p=0.001$, $p=0.014$, $p=0.001$). Postoperatif norepinefrin kullanımı A, B ve O kan grupları arasında intraoperatif kullanıma göre daha yüksekti ($p=0.001$, $p=0.025$, $p=0.002$). Postoperatif nitrogliserin kullanımı kan grubu O'da intraoperatif kullanıma göre daha yüksekti ($p=0.034$). Postoperatif dopamin, norepinefrin ve nitrogliserin kullanımı Rh (+) grubunda intraoperatif kullanıma göre daha yüksekti ($p=0.001$, $p=0.001$, $p=0.011$). Rh (-) grubunda, postoperatif norepinefrin kullanımı intraoperatif kullanıma göre daha yüksekti ($p=0.004$). Rh (+) grubunda intraoperatif nitrogliserin kullanımı Rh (-) grubuna göre daha yüksekti ($p=0.042$).

Sonuç: Çalışmamızda ABO ve Rh kan gruplarında inotropik ajan kullanımı farklılık gösterdi.

Anahtar Kelimeler: ABO, Rh, İnotropik ajan, Erişkin kalp cerrahisi

Abstract

Objective: The objective of this study was to investigate the intraoperative and postoperative use of inotropic agents in different blood groups in adult cardiac surgery.

Material and Methods: We retrospectively analyzed the hospital information management system records and files of patients who underwent cardiopulmonary bypass (CPB) between June 15, 2017 and November 15, 2019. We evaluated the patients' age, sex, blood group, diagnosis, use of fentanyl and demazolam in induction, CPB time, cross-clamp time, operation time, use of intraoperative and postoperative inotropic agents, postoperative intubation period, and day of intensive care hospitalization.

Results: There was no difference between the ABO and Rh blood groups in terms of use of fentanyl and demazolam in induction, CPB time, cross-clamp time, postoperative intubation time, day of intensive care hospitalization and duration of surgery. Postoperative dopamine use was higher in blood groups A, B, and O than its intraoperative use ($p=0.001$, $p=0.014$, $p=0.001$). Postoperative norepinephrine use was higher among A, B, and O blood groups than its intraoperative use ($p=0.001$, $p=0.025$, $p=0.002$). Postoperative nitroglycerin use was higher in blood group O than its intraoperative use ($p=0.034$). The use of postoperative dopamine, norepinephrine, and nitroglycerin was higher in the Rh (+) group as compared to intraoperative use ($p=0.001$, $p=0.001$, $p=0.011$). Postoperative norepinephrine use was higher in the Rh (-) group than in its intraoperative use ($p=0.004$). The use of intraoperative nitroglycerin in the Rh (+) group was higher as compared to the Rh (-) group ($p=0.042$).

Conclusion: Our study found that the use of inotropic agents was different in ABO and Rh blood groups.

Key words: ABO, Rh, inotropic agents, adult cardiac surgery

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INTRODUCTION

There may be differences in ABO and Rh blood groups in people because of their ethnicity and geography (1). According to the presence of antigens on the surface of erythrocytes, blood groups are divided into different groups (2). The ABO system is characterized by complex carbohydrate molecules with A, B, and H antigens, whereas the O allele does not encode a transferase enzyme (3). The antigens belonging to the ABO blood groups are found on the surface of erythrocytes and platelets; vascular epithelium cells; intestinal, cervical, and mammary gland; epithelium cells; plasma; saliva; urine; milk; and feces. The presence of Rh D antigen on erythrocytes causes individuals to be classified 'Rh positive', whereas its absence causes the individuals to be classified as Rh negative (4). The prevalence of ABO alleles varies among different populations. Researchers have observed a relationship between some diseases and different genotypes of ABO blood groups (5). In addition, research works have most frequently reported cardiovascular diseases, gastro-duodenal diseases, tumors, and infections in different genotypes of ABO blood groups (6-8).

The first hours of patient care in the intensive care unit after cardiac surgery is a very crucial period because different hemodynamic changes may occur in this time. Therefore, hemodynamic monitoring, administration of inotropic drugs and vasopressors are critical check points during the assessment of perioperative cardiovascular function. Inotropes and vasopressors are the cornerstones of hemodynamic therapy. Inotropic agents are used in 30–50% of patients to improve their heart performance after open heart surgery and cardiopulmonary bypass (9-11).

The purpose of this study was to investigate the intraoperative and postoperative use of inotropic agents in different blood groups in adult cardiac surgery.

MATERIAL and METHODS

The study was planned according to the principles of the Helsinki Declaration. The Ethics Committee granted their approval for this study protocol on March 18, 2020 (2020/06-01). We performed our study on 192 patients who were extubated within 24 hours of cardiopulmonary bypass (CPB) surgery between June 15, 2017–November 15, 2019 in Department of Anesthesiology, Faculty of Medicine, Kahramanmaraş Sutcu Imam University. Further, we retrospectively analyzed the hospital information management system records and files of these patients who underwent CPB. We evaluated the patients' age, sex, body mass index (BMI), blood group, diagnosis, use of fentanyl and demizolam in induction, CPB time, cross-clamp time, operation time, use of intraoperative and postoperative inotropic agents, postoperative intubation period, and day of intensive care hospitalization.

We aimed to investigate the effects of ABO and Rh blood groups on inotropic agent use in adult cardiac surgery.

Statistical Analysis

We employed the Shapiro–Wilk test to examine the suitability of the data for normal distribution. Further, we used the Kruskal–Wallis H test for analyzing the comparisons among the four blood groups in the non-normally distributed variables. We used Mann–Whitney *U* test for the comparison of two groups, and performed Wilcoxon test to compare the parameters before and after the surgery. $P < 0.05$ was considered statistically significant for this study. We used IBM SPSS version 22 program to evaluate the data of this study.

Table 1. Demographic structures of the patients and surgery

Age		Median (Q1–Q3)	62 (50–69)
BMI		Median (Q1–Q3)	26 (24.0–29.3)
Sex	Female	n (%)	79 (41.10)
	Male	n (%)	113 (58.9)
Surgery	Aortic aneurysm	n (%)	9 (4.7)
	Aortic stenosis	n (%)	1 (0.5)
	ASD	n (%)	15 (7.8)
	Atrial myxoma	n (%)	1 (0.5)
	AVR	n (%)	15 (7.8)
	AVR+MVR	n (%)	11 (5.8)
	AVR+TVR	n (%)	1 (0.5)
	CABG	n (%)	103 (53.6)
	CABG+AVR	n (%)	3 (2.0)
	CABG+MVR	n (%)	6 (3.1)
	CABG+TVR	n (%)	1 (0.5)
	MVR	n (%)	16 (8.3)
	MVR+TVR	n (%)	5 (2.6)
	TVR	n (%)	3 (1.6)
VSD	n (%)	2 (1.0)	

ASD, atrial septal defect; AVR, aortic valve replacement; MVR, mitral valve replacement; CABG, coroner artery bypass graft; TVR, tricuspid valve replacement; VSD, ventricular septal defect

RESULTS

The mean age of the patients was 62 years, and the mean BMI was 26. Our study had 79 (41.10%) female and 113 (58.90 %) male patients (**Table 1**).

Most of the patients had blood group A (84, 43.8 %). There were higher number of patients with RH (+) (174,

90.6 %) than RH (-) (**Table 2**). We found that there was no difference among the ABO blood groups in terms of use of fentanyl and demizolam, CPB duration, cross-clamp time, postoperative intubation time, intensive care hospitalization time, and operation time (**Table 3**).

Table 2. Distribution of blood groups

		N	%
Blood groups	A	84	43.8
	B	32	16.7
	AB	11	5.7
	O	65	33.9
RH	RH (+)	174	90.6
	RH (-)	18	9.4

Table 3. Clinical parameters according to ABO blood groups

	Blood groups												P
	A (n=84)			B (n=32)			AB (n=11)			O (n=65)			
	Median	Q1	Q3	Median	Q1	Q3	Median	Q1	Q3	Median	Q1	Q3	
Fentanyl induction (mcg)	250	200	350	250	200	350	250	200	300	300	250	362.5	0.48
Demizolam induction (mg)	4	3	5	4	3	5	4	3	5	400	3	4	0.64
CPB time (min)	104	82	138	109	84	150	93	66	148	99	83.5	130	0.59
CCT time (min)	65.5	43	104	60	44	95	50	32	73	60	44	83.5	0.44
ET (min)	390	300	600	360	300	600	360	285	720	390	300	480	0.91
ICDT	3	3	4.5	4	3	5	3	3	4	4	3	5	0.55
OT (min)	255	220	290	230	210	240	220	192	285	240	210	300	0.12

Kruskal-Wallis H test; a:0,05; CPB, cardio pulmonary bypass; CCT, cross-clamp time; ET, extubation time; ICDT, intensive care day time; OT, operation time.

Postoperative dopamine use was higher in blood groups A, B, and O than its intraoperative use ($p = 0.001$, $p = 0.014$, and $p = 0.001$, respectively). Postoperative norepinephrine use was higher in blood groups A, B, and O than its intraope-

rative use ($p = 0.001$, $p = 0.025$, and $p = 0.002$, respectively). Postoperative nitroglycerin use was higher in blood group O as compared to its intraoperative use ($p = 0.034$) (**Table 4**).

Table 4. Intraoperative and postoperative comparisons of inotropic agents (mg) used according to blood groups

	Blood groups												P
	A (n=84)			B (n=32)			AB (n=11)			O (n=65)			
	Median	Q1	Q3	Median	Q1	Q3	Median	Q1	Q3	Median	Q1	Q3	
Intraoperative dopamine	28.00	12.00	44.00	29.04	12.00	41.30	11.80	6.00	24.00	24.00	16.00	40.00	0.287 ^a
Postoperative dopamine	61.15	14.400	144.000	39.550	18.600	90.450	23.200	.00	111.000	42.150	20.900	92.250	0.273 ^a
p^b	0.001^{b*}			0.014^{b*}			0.327 ^b			0.001^{b*}			
Intraoperative norepinephrine	.300	.060	.720	.190	.054	.500	.225	.120	.480	.280	.080	.678	0.919 ^a
Postoperative norepinephrine	3.150	.000	24.000	.306	.000	12.700	1.560	.000	13.500	.240	.000	14.800	0.324 ^a
p	0.001^{b*}			0.025^{b*}			0,051 ^b			0.002^{b*}			
Intraoperative dobutamine	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	0.646 ^a
Postoperative dobutamine	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	0.097 ^a
p	0.181 ^b			0.500 ^b			0.317 ^b			0.484 ^b			
Intraoperative epinephrine	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	0.698 ^a
Postoperative epinephrine	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	0.270 ^a
p	1.00 ^b			1.00 ^b			0.317 ^b			0.715 ^b			
Intraoperative nitroglycerin	3.00	1.50	5.50	2.50	1.25	4.35	2.50	1.00	4.00	3.80	2.20	6.60	0.184 ^a
Postoperative nitroglycerin	1.00	.00	15.80	.00	.00	17.60	1.50	.00	7.80	4.55	.00	16.25	0.530 ^a
p	0.315 ^b			0.107 ^b			0.407 ^b			0.034^{b*}			

^aKruskal–Wallis H test; ^bWilcoxon test; a:0,05; * Statistically significant difference.

There was no difference among RH blood groups in terms of use of fentanyl and demizolam, CPB time, cross-clamp time, postoperative intubation time, intensive care hospitalization time, and operation time (**Table 5**).

The use of postoperative dopamine, norepinephrine, and nitroglycerin was higher in the Rh(+) group than their intraoperative use ($p = 0.001$, $p = 0.001$, and $p = 0.011$, respectively). Postoperative norepinephrine use was higher in the Rh (-) group than in its intraoperative use (0.004). The use of intraoperative nitroglycerin in the Rh (+) group was higher than in the Rh (-) group ($p = 0.042$) (**Table 6**).

DISCUSSION

Our study demonstrated that postoperative use of dopamine and norepinephrine was higher in blood groups A, B, and O than its intraoperative use. Postoperative use of nitroglycerin was higher in blood group O than its intraoperative use. Postoperative uses of dopamine, norepinephrine, and nitroglycerin was higher in the Rh (+) blood group than in intraoperative use. Postoperative norepinephrine use was higher in the Rh (-) blood group than in its intraoperative use.

Intraoperative nitroglycerin use was more in Rh (+) blood group than in Rh (-) blood group.

Although different studies have been conducted about the blood group, as far as we know, our study is the first one in the literature to demonstrate the use of intraoperative and postoperative inotropic agents of different blood groups in adult cardiac surgery. A study that was conducted to determine the anesthetic effects of propofol among blood groups demonstrated that the measured values of mean arterial pressure and heart rate were higher in the patients with blood group B. Moreover, the bispectral index values were higher in patients with blood group A (12). Another study showed that after the placement of left ventricular assist device, there was no significant difference in blood transfusions between blood group O and non-O blood group in the intraoperative and postoperative periods between 7 and 90 days. In addition, there was no significant difference in the hematocrit values during the implantation of chest tube in the first 24 hours or within the first 48 hours after surgery (3). A Nordic cohort study that was conducted on patients with acute type A aortic dissection demonstrated there was no association

Table 5. Clinical parameters according to Rh groups

	Rh						
	Rh (+) (n=174)			Rh (-) (n=18)			p
	Median	Q1	Q3	Median	Q1	Q3	
Fentanyl induction (mcg)	250.00	200.00	350.00	275.00	200.00	425.00	0.773
Demizolam induction (mg)	4.00	3.00	5.00	4.00	3.00	4.00	0.721
CPB time (min)	101.00	82.00	133.00	127.50	88.00	181.00	0.080
CCT (min)	60.00	43.00	90.00	74.00	49.00	147.00	0.095
ET (min)	390.00	300.00	540.00	360.00	300.00	420.00	0.399
ICDT	3.50	3.00	5.00	3.00	3.00	4.00	0.365
OT (min)	240	210	285	284	210	330	0,113

Mann–Whitney U test; CPB, cardio pulmonary bypass; CCT, cross-clamp time; ET, extubation time; ICDT, intensive care day time; OT, operation time

Table 6. Intraoperative and postoperative comparison of inotropic agents used according to Rh blood groups

	Rh						
	Rh (+) (n=174)			Rh (-) (n=18)			P
	Median	Q1	Q3	Median	Q1	Q3	
Intraoperative dopamine	24.00	12.00	40.00	34.00	21.00	43.50	0.215 ^a
Postoperative dopamine (mg)	43.400	14.400	126.000	48.150	21.900	140.000	0.750 ^a
p	0.001^{b*}			0.148 ^b			
Intraoperative norepinephrine (mg)	.280	.080	.645	.290	.090	.745	0.720 ^a
Postoperative norepinephrine (mg)	.800	.000	16.900	2.400	.360	13.500	0.334 ^a
p	0.001^{b*}			0.004^{b*}			
Intraoperative dobutamine	.00	.00	.00	.00	.00	.00	0.277 ^a
Postoperative dobutamine (mg)	.00	.00	.00	.00	.00	.00	0.904 ^a
p	0.249 ^b			0.180 ^b			
Intraoperative epinephrine	.00	.00	.00	.00	.00	.00	0.411 ^a
Postoperative epinephrine(mg)	.00	.00	.00	.00	.00	.00	0.263 ^a
p	0.735 ^b			0.317 ^b			
Intraoperative nitroglycerin (mg)	3.16	1.61	5.55	2.00	.00	3.39	0.042^{a*}
Postoperative nitroglycerin (mg)	2.15	.00	16.40	1.00	.00	9.00	0.558 ^a
p	0.011^{b*}			0.363 ^b			

^aMann–Whitney U test; ^bWilcoxon test; a:0,05;* Statistically significant difference.

among surgical incidence, postoperative complications, and survival among the ABO blood groups (13). Komatsu et al, showed that there was no increase in postoperative blood loss in blood group O, and less erythrocytes (RBC) transfusions were required intraoperatively in blood group O than the non-O blood group (14). Contrary to this study, Mazzeffi et al, showed that in 111 patients who underwent extracorporo-

real membrane oxygenation, erythrocytes (RBC) transfusion in individuals with blood group O needed a higher rate of transfusion than non-O blood group individuals (15). Patients with blood group O were more likely to develop bleeding complications (16).

It is known that dopaminergic and noradrenergic systems play vital roles in addiction, drug abuse, impulsivity,

and socially unacceptable behavior (17-18). Some studies have showed that subjects with blood group O have produced more norepinephrine than subjects with other ABO blood groups (17). A study that investigated the correlation between blood groups and opioid addiction revealed that there was a relationship between D2 receptors and psychoactive substance dependence. Moreover, this study showed that the frequency of the A1A1 genotype was significantly higher among people with opium addiction (19). Another study that investigated the relationship between psychiatric disorders and ABO blood groups showed an patients belonging the blood group AB have an increased tendency to develop psychiatric disorders (5). Rinieris et al, pointed out that there is a negative relationship between blood group A and bipolar affective disorder (20). Another study found a relationship between blood group A and unipolar depression (21). A different study found difference in the incidence of cancer in different blood groups (22). A group of researchers found reduction in the risk of esophageal carcinoma (EC) in individuals with blood group O (23). Patients with blood group B had a higher risk of developing EC. However, there was no significant relationship between individuals with blood groups A and AB (24). Another study reported a positive relationship between blood group A and the risk of pancreatic cancer (25).

In December 2019, there was an outbreak of an unknown pneumonia epidemic in Wuhan, Hubei Province, China. Chinese scientists have confirmed that this outbreak was caused by a new virus. The World Health Organization named this disease as coronavirus disease 2019 (2019-nCoV or SARS-CoV-2 or COVID-19) (26). In this new COVID 19, blood group A was associated with an increased risk for infection, whereas blood group O was associated with a reduced risk (27).

Limitations of our study: The different number of cases in the blood groups and the retrospective nature of this study constitute the two major limitations of our study.

As a conclusion, It has been observed in studies that some diseases occur more frequently in different blood groups. The uses of blood transfusion and inotropic agents are very common in CPB surgeries. In our study, we observed a difference in the use of inotropic agents in ABO and Rh blood groups.

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The authors declare that, they have contributed equally to the manuscript.

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