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Research Article

Role of ABO Blood Group as Risk Factor for Ischemic Heart Disease

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ABSTRACT

Background: Around the world, CAD is the leading cause of mortality. The Kazakhstan population has one of the most remarkable risks of IHD in the world. Observational studies on the association between ABO blood types and coronary artery disease risk must be examined.

Aim: The aim of the research is to find whether there is a link between the ABO blood group and IHD.

Materials and methods: This is a descriptive, cross-sectional study carried out in" JSC hospital" during 2020. The research included patients who were hospitalized with an IHD diagnosis. Data were recorded and analyzed using SPSS 22. Association between blood group and IHD was analyzed using chi-square test and independent T-test for comparison of patients' age in both genders.

Results: During the one-year study, a total of 649 patients were enrolled. The patients' average age was 64.2 ± 9.238 and the frequency of participants was 232 (35.74%) females and 417 (64.25%) males. The distribution of blood group was as follows: Blood group O was 32.2%, A-31.43%, B-27.73%, AB-8.62%. Among these blood groups, blood group O was the common type of blood group (not significant), and AB was the least common. In the study population, there was no considerable variation in the prevalence of blood groups with IHD (p=0.108).

Conclusion: In this single hospital-based study, there was no significant connection between ABO blood types and ischemic heart disease (p= 0.77).

Keywords: ABO blood group; Ischemic heart disease; Rh factor

INTRODUCTION

Ischemic heart disease, stroke, hypertension, peripheral artery disease, rheumatic coronary disease, congenital coronary disease, and heart failure are all examples of cardiovascular disease caused by heart and blood vessel disarrays [1]. IHD affects approximately 12 million people, angina pectoris affects over 6 million, and a persistent MI affects over 7 million.

Ischemic Heart Disease (IHD) is a significant health problem that can lead mortality [2]. It is a major source of mortality and morbidity in developing and undeveloped countries, more over half of all deaths in affluent countries are due to this state. IHD is almost always caused by atherosclerosis [2]. A variety of conditions have been linked to the development of IHD, since the Framingham Heart Study began in 1948. As modern science evolved, specific characteristics became identified risk factors for IHD [3]. Age, sex, family history of IHD, and height are all risk factors that cannot be changed [3]. Major modifiable risk factors include cigarette smoking, arterial hypertension, diabetes mellitus, obesity, and hyperlipidemia [2]. According to a study, CVD-related premature mortality was placed second among all Commonwealth of Independent States countries, and was 3-4 times higher in Kazakhstan than in Western European countries. In Europe and Kazakhstan [4], especially among middle-aged men, CVD, particularly IHD, remains a prominent cause of death. More than a third of Kazakhs who died of CVD in 2005 had age of 20 and 65, with approximately 70% of them being men. In actuality, the principal causes of Cardiovascular

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Disease (CVD) are well-known, and avoiding these Risk Factors (RFs) will prevent at least 80% of all CVDs [5]. The ABO blood group model, which was the first human blood group system, was established and developed by Landsteiner in 1901. Blood type was later studied and identified as a RF for a number of disorders, including peptic ulcer disease, stomach cancer, periodontal disease, and diabetes mellitus [6]. Gertler and White introduced the role of blood type as a non-modifiable risk factor for IHD in 1945 [7].

The A and B alleles of the ABO locus code for A and B glycosyltransferase activities, respectively, which convert precursor H antigen into A or B determinants, with the A and B antigens bearing an extra saccharide unit to the O unit (N-acetylgalactosamine and galactose, respectively). Individuals in group O lack particular transferase enzymes but have unmodified essential H antigen [8]. ABO antigens may be found on the surface of various human cells and organs, including epithelia, platelets, vascular endothelia, and neurons, in addition to red blood cells [9]. Many recent studies have looked into whether blood group phenotypic is linked to an increased risk of IHD.

Epidemiological data on the ABO blood group and the risk of CAD has been contradictory [10]. A study at the Armed Forces Institute of Cardiology in Rawalpindi discovered a strong link between blood group A and ischemic heart disease [6]. The other study which was conducted at Mayo Hospital in Lahore, Pakistan discovered no link between ABO blood types and ischemic coronary disease [11]. In Pakistan, the Type A phenotype is relatively frequent, with a prevalence of 24 percent [12]. IHD is the most frequent non-communicable disease in Pakistan, making study into potential risk factors an important public health priority [6]. In Almaty, we decided to investigate the association between the ABO blood group and IHD in a single hospital-based study.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted on patients admitted at JSC hospital in Almaty, Kazakhstan, from 1 January 2020 to 30 December 2020 on 649 patients. The study received approval from the Institute of Medicine's Institutional Review Committee.

All patients above the age of 18 years with the diagnosis of IHD (chronic stable angina, variant angina, unstable angina, STEMI, NSTEMI) were included in the study. Diagnosis of IHD was based on clinical history, examination, serial electrocardiography, angiography, and measurement of cardiac enzymes and was confirmed by a specialist physician.

The primary goal of this study is to investigate the link between ABO blood types and IHD in Almaty's JSC hospital, with some objectives such as; assessment of ABO blood group according to gender in IHD patients, ABO blood group in IHD patients in comparison with Rh factor, and the relation of ABO blood group with lipid profile fluctuation in IHD patients.

ABO blood groups with Rh factor, sex, and a family history of CAD. Aside from that, we had some co-morbidity such as CKD, pancreatitis, cholecystitis, COPD, thyroid gland dysfunction, and fluctuation of left ventricular ejection fraction in addition to previous history of IHD, Alcohol consumption, and occupation subgroup.

Lipid profile was defined as the presence of any levels of the following [13]:

Total cholesterol: Optimal- <5.2 mmol/L, Intermediate- 5.3-6.2 mmol/L, High- >6.2 mmol/L

LDL cholesterol: Optimal- <3.36 mmol/L, Intermediate- 3.36 mmol/L-4.11 mmol/L, High- >4.11 mml/L

HDL cholesterol: Optimal- >1.55 mmol/L, Intermediate- 1.03 mmol/L, Low- < 1.03 mmol/L

Triglycerides: Optimal- <1.69 mmol/L, Intermediate- 1.69 mmol/L-2.25mmol/L, High- >2.25 mmol/L

According to the European cardiology society blood pressure categorized into [14]:

Normal BP: SBP less than 120 mmHg and DBP less than 80 mmHg.

Elevated BP: SBP between 120-129 mmHg and DBP less than 80 mmHg.

Hypertension stage-1: SBP 130-139 mmHg or DBP 80-89 mmHg.

Hypertension stage-2: SBP ≥ 140 mmHg or DBP ≥ 90 mmHg.

Hypertensive crisis: SBP >180 mmHg and/or DBP >120 mmHg.

Obesity and overweight as risk factors was referenced as; Underweight <18.5 kg/m^2, Normal weight 18.5-24.9 kg/m^2, Overweight 25.0-29.9 kg/m^2, Class I obesity 30.0-34.9 kg/m^2, Class II (severe) obesity 35.0-39.9 kg/m^2, Class III (morbid, extreme) obesity 40.0 kg/m^2, Class IV (super) obesity 50.0 kg/m^2[15].

Positive family history was considered if first-degree relatives had CAD before the age of 55 years in men and 65 years in women [16].

The quantitative variables' mean and standard deviation were provided, whereas the categorical variables' findings were expressed in percentages. For categorical data, a Chi-square test was performed. We selected that likely the most important of the ABO blood group and gathered data from several researches for debate. The chi-square test was performed to determine the frequency of IHD in relation to various ABO blood groups and the Rh factor. SPSS software version 22 was used to conduct all statistical analyses.

RESULTS

A total of 649 patients were enrolled during a study period of one year. The average age of the patients was 64.2 ± 9.238 years, among them 232 (35.74%) were female and 417 (64.25%) were male (Table 1).

Gender	Female	Male
Number (%)	232 (35.74)	417 (64.25)
Mean of Age	66.09 ± 8.96	63.15 ± 9.43

Table 1: Mean of age in male and female (n=649).

There were significant differences between the mean of age in both genders (p=0.000),(Table 2).

The distribution of blood groups was as follows: Blood group O was 32.2%, A-31.43%, B-27.73%, AB-8.62%. Among these blood groups, blood group O was the common type of blood group (not significant), and AB was the least common. Prevalence of blood group showed no significant difference between each other in the study population (p=0.108), (Table 3).

The complied data of prevalence of different blood groups from different studies availed mean distribution of ABO blood group was as; O-31%, A-28%, B-27% and AB- 8% [17-20]. Frequency of

Levene's test		Test of differences for mean comparison							95% CI	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Age	Equal variances assumed	0.624	0.43	-3.94	647	0	-2.949	0.748	-4.418	-1.479
	Equal variances not assumed			-3.883	457.16	0	-2.949	0.759	-4.441	-1.456

Table 2: Significance of mean of age differences in both gender (n=649).

It was observed that hypertension was the most common risk factor. In our study,average prevalence of high blood pressure was 86.21% (SBP; 76.27%, DBP; 96.15%) ,previous history of IHD 42.84% , obesity and overweight(33.74% ,43.61%) respectively, dyslipidemia 53.69%,DM 28.04% , smoking 14.79% and family history 11.71%. In this study maximum and peak of blood pressure during whole life included.

ABO in both gender were; group O 32.45% (female, 33.2%; male 31.7%), group A 30.9%(female 28.9%; male;32.9%),group B 28% (female, 28.9%; male 27.1%) ,finally AB blood group was 8.75%(9.1% in female and 8.4% in male),there was no significant change in frequency of ABO blood group in female and male (Table 4).

ABO Group		Rh Factor			Test of Difference
		Negative	Positive	Total (%)	p-value
O	N (%)	21(10)	188 (90)	209 (100)	0.108
A	N (%)	11 (5.4)	193 (94.6)	204 (100)	
B	N (%)	9 (5)	171 (95)	180 (100)	
AB	N (%)	2 (3.6)	54 (96.4)	56 (100)	
Total (%)	N (%)	43 (6.6)	606 (93.4)	649 (100)	

Table 3: ABO blood group with Rh factor (n=649).

ABO Group	Gender				Test of Differences	
	Female		Male			
	N	%	N	%	Chi-square	p-value
O	77	33.20%	132	31.70%	1.104	0.776
A	67	28.90%	137	32.90%		

B	67	28.90%	113	27.10%
AB	21	9.10%	35	8.40%

Table 4: Frequency of ABO blood group based on gender (n=649).

In our study, we did not find any significant changes in the lipid profile of IHD patients in different ABO blood groups (Table 5).

In this study we could not find any signification relationship between ABO blood group and blood pressure in ischemic heart diseases patients (Table 6).

Categories	ABO Blood Group									
	O		A		B		AB		Test of Differences	
	N	%	N	%	N	%	N	%	Chi-square	p-value
Total cholesterol										
Optimal	156	7460.00%	143	7010.00%	130	72.2	38	67.9	1.568	0.667
Intermediate	53	2540.00%	61	2990.00%	50	27.8	18	32.1		
High	0	0.00%	0	0.00%	0	0	0	0		
HDL cholesterol										
Optimal	18	8.6	20	9.8	9	5	8	14.3	7.571	0.271
Intermediate	85	40.7	89	43.6	88	48.9	24	42.9		
Low	106	50.7	95	46.6	83	46.1	24	42.9		
LDL cholesterol										
Optimal	137	65.6	133	65.2	119	66.1	36	64.3	2.656	0.851
Intermediate	47	22.5	37	18.1	36	20	12	21.4		
High	25	12	34	16.7	25	13.9	8	14.3		
Triglycerides										
Optimal	82	39.2	90	44.1	61	33.9	24	42.9	6.762	0.343
Intermediate	41	19.6	32	15.7	36	20	6	10.7		
High	86	41.1	82	40.2	83	46.1	26	46.4		

Table 5: The relation of ABO blood group with lipid profile fluctuation in IHD patients (n=649).

ABO blood group		O		A		B		AB		Chi square	p-value
SBP	Normal	6	2.90%	9	4.40%	5	2.80%	3	5.40%	7.297	0.837
	Elevated BP	13	6.20%	8	3.90%	9	5.00%	1	1.80%		
	Stage-1	4	1.90%	3	1.50%	6	3.30%	1	1.80%		
	Stage-2	59	28.20%	58	28.40%	47	26.10%	20	35.70%		
	H-Crisis	127	60.80%	126	61.80%	113	62.80%	31	55.40%		

DBP	Normal	0	0.00%	2	1.00%	1	0.60%	2	3.60%	10.585	0.565
	Elevated BP	8	3.80%	6	2.90%	5	2.80%	1	1.80%		
	Stage-1	27	12.90%	26	12.70%	26	14.40%	6	10.70%		
	Stage-2	169	80.90%	166	81.40%	141	78.30%	46	82.10%		
	H-Crisis	5	2.40%	4	2.00%	7	3.90%	1	1.80%		

Table 6: Relation of ABO blood group with blood pressure (n=649).

DISCUSSION

Since CAD is the leading cause of death globally, it is important to assess all factors that may predispose to the disease's development. The current study's findings appear to support the idea that blood group phenotype is not a significant risk factor for CAD in this single hospital-based study in Almaty, Kazakhstan. The prevalence of IHD in blood group O is somewhat greater than in the other ABO blood classes, although not considerably, according to the findings of this study. There were no significant variations in the frequency of ABO blood group in patients with CAD in an Iranian community in the research of Amirzadegan A, et al. which was comparable to our findings [21].

A comparison of various studies in Nepalese revealed that group O is the more common in ACS patients [20,22,23]. Mayan SA, et al. discovered that the prevalence of coronary artery disease is much greater in blood group O than in other blood groups [24]. In other studies, blood type A was linked to an earlier development of coronary artery disease [25]. In a prospective assessment of 7665 males in 24 British towns, windup reported a greater frequency of IHD in places with a high prevalence of blood type O [26].

In a research published in 2017, Omidi N, et al. discovered that the risk of severe IHD was higher in the O blood type than in non-O blood groups [27]. In 2020, a study found that diabetic individuals with the A blood group had the highest risk of IHD compared to diabetic individuals with the O blood group [28].

Patients with blood group A (or non-O blood group) had a little greater but significant risk of IHD than those with blood group O [7]. Patients with blood categories A and B have a greater risk of IHD than those with blood group O, according to Bronte-Stewart B, et al. [29]. He, et al. in 2012 showed that the O blood group had a less significant role in IHD than the non-O blood group [10]. In another study by Lutfullah, et al. in 2011 showed that group B was more common in IHD patients [11]. Furthermore, Sharif, et al. reported in 2014 that individuals with blood group A had a greater frequency of IHD than those with blood group O [3]. The Northwick Park Heart Study, conducted by TW Mead, et al. in 1994, discovered a greater prevalence of IHD in the AB blood population [30].

CONCLUSION

Our results suggest that there is no association between the ABO blood group and coronary artery disease, other risk factors especially lipid profile fluctuation and blood pressure. In both genders there was no any significant difference in frequency of ABO blood group, just a little bit frequency of group O was more than others, to accept as risk factor needs more investigations and studies to confirm this point.

In this study distribution of ABO group in female and male had no any significant differences.

Prevalence of O blood group in female and male were (33.2% and 31.7%) respectively, while prevalence of A-blood group in female was 28.9% and in male was 32.9%. Prevalence of B blood group in female was similar with A-blood group but in male was 27.1% and there was not any significant difference in prevalence of AB blood group in female and male (9.1% and 8.4%) respectively.

According to Rh factor, 90% of O blood group, 94% percent of A-blood group, 95% of B blood group and 96.4% of AB blood group had positive Rh factor.

Prevalence of patients who had intermediate elevation and high level of total cholesterol in O blood group was 28.7% ,group A 26 %, group B 26.7%, and in group AB was 35.7%. Intermediate and severe decline in the level of HDL in group O, A, B, AB were (91.4%, 90.2%, 95%, 85.8%) respectively. Intermediate and high increase of LDL in ABO blood group were(O-34.5% ; A-34.8% ; B-% ; AB-35.7%).And finally 60.7% of O blood group, 55.9% of A blood group, 66.1% B blood group and 57.1% AB blood group had intermediate and high increase in triglycerides.

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