

Research Article

# Distribution of Blood Groups in Patients with Angiographically Defined Coronary Artery Disease in Iranian Community

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## Abstract

**Background:** In the past, the relationship between coronary artery disease (CAD) and blood group type has been studied extensively. The ABO blood group has a significant effect on homeostasis and is therefore associated with adverse cardiovascular events. This study aimed to determine the distribution of ABO blood group and rhesus (Rh) status (ABO/Rh) in patients with different severity of CAD in Iranian community.

**Material and Methods:** A total of 1,236 CAD patients undergoing angiography were evaluated and their ABO/Rh blood type was determined in a study center between February 2005 and December 2010. Of the 1,236 records, only 1,046 medical documents recorded the number of involved vessels. The patients were classified according to the number of significantly affected stenotic vessels into single vessel (1VD), two vessels (2VD), and three vessels (3VD) disease subgroups.

**Results:** A substantially different ABO/Rh blood groups distribution was seen in the examined samples (O: 29.7%, A: 39.7%, B: 22.2%, AB: 8.3%, Rh positivity: 89.2%). The ABO/Rh blood group phenotype distribution in CAD patients with 1VD, 2VD, and 3VD was as follows: 37.5%, 41.3%, and 41.5%, respectively, for group A; 24.1%, 20.5%, and 20.6%, respectively, for group B; 31.2%, 26.8%, and 30.2%, respectively, for group O; 7.1%, 11.4% and 7.7%, respectively, for group AB ( $p = 0.26$ ), and 88.7%, 90.5%, and 87.6%, respectively, for Rh positivity, ( $p = 0.47$ ).

**Conclusions:** No significant correlation was not found among the ABO/Rh blood group distribution and the number of vessels involved, however, according to the different distribution of ABO/Rh blood group in CAD patients and healthy population, ABO/Rh might have an unknown role in CAD patients.

**Keywords:** Coronary artery disease, Blood group, Stenosis, Vessel, Rhesus.

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## 1. Introduction

The ABO blood group system was first described by Karl Landsteiner in 1901 [1]. It consists of three alleles: A and B (co-dominant) and O (recessive) [2, 3]. Each A and B allele encodes glycosyltransferases that add the N-acetylgalactosamine and D-galactose to precursor H antigen and convert it to A and B antigen. While O does not encode any transferase enzyme, the H antigen is expressed unchanged in this group [4]. The ABO antigens [3] are not only present at the surface of red blood cells (RBCs) but are also widely expressed in a number of human tissues and cells, including sensory neurons, the epithelium, the vascular endothelium and platelets [3]. A number of experimental and clinical studies have evaluated whether the ABO blood group could affect the traditional risk factors of arterial or venous thrombotic events [5]. Several reports have indicated a specified relationship among non-O blood groups, and the risk of progressing severe manifestations of atherosclerosis [6–8]. Atherosclerosis is one of the major causes of adults' death in numerous countries. Atherosclerotic developmental risk factors provide useful ways to prevent coronary artery disease (CAD) [9]. Gender, obesity, smoking, age, hypertension, diabetes mellitus, and family history are considered as main cardiovascular risk factors [10]. One of the recently published cohort articles of *BMC Medicine* evaluated over 50,000 subjects and demonstrated that almost 6% of total death and 9% of cardiovascular death have non-O blood groups [11]. In addition, some studies have suggested that in A blood group subjects, the incidence of ischemic heart disease may be higher than other blood groups [7, 12]. On the other hand, Amirzadegan *et al.* reported that there is not association between different ABO blood types and the development of CAD in Iranian population [13]. So, the present study aimed to determine the distribution of ABO blood group and rhesus (Rh) status (ABO/Rh) in patients with different severity of CAD in Iranian community.

## 2. Methods

### 2.1. Study design and population

In this retrospective study, medical documents of 1,236 CAD patients (with documents that showed cardiac disease or suspected for poss it) hospitalized at the Department of Cardiology, Urmia University of Medical Sciences (UMSU), Urmia, Iran between February 2005 and December 2010 were reviewed. Coronary angiography and determination of ABO/Rh blood group were performed for all patients. Subjects were classified into four groups according to the different blood types and two groups according to the Rh

types, respectively: AB-type group, A-type group, B-type group, and O-type blood group and Rh-positive and Rh-negative groups. Further analysis was performed between O type and non-O type. All clinical and demographic data were prepared in the dedicated cardiovascular database. Smoking habits, hypertension, diabetes mellitus, hypercholesterolemia, and renal disorders were recorded. However, of the 1,236 CAD records, only 1,046 medical documents recorded severity of stenosis. Next, according to the results of the angiography, the subjects with stenosis in at least one major coronary artery were classified into three subgroups depending on the number of diseased vessels: patients with single-vessel (1VD), two-vessels (2VD), and three-vessels (3VD) disease subgroups. This research agrees with current ethical considerations and was approved by the Medical Ethics Committee of UMSU.

## 2.2. Statistical analysis

Data were analyzed using the SPSS version 18. Fisher's exact test, Chi-square test, and one way-ANOVA were used to analyze the data from different disease groups. *P*-value < 0.05 was considered to be statistically significant.

## 3. Results

A total of 1,236 medical documents of CAD patients were reviewed. Table 1 presents the gender, smoking habit, history of diabetes mellitus, hypertension, hyperlipidemia,

TABLE 1: The relation of ABO/Rh blood group distribution with demographics and characteristics of coronary artery disease patients.

	Blood Groups						Rh Status			
	A	B	AB	O	Non-O blood	P <sup>‡</sup>	P <sup>¶</sup>	Rh+	Rh-	P-value
Female/male*	187/304	106/169	42/61	139/228	335/534	0.95	0.43	416/686	57/76	0.09
Age (Mean ± SD)	58.6 ± 11.2	57.7 ± 10.7	58.2 ± 11.5	59.4 ± 11.1	58.3 ± 11.1	0.28	0.28	59.4 ± 11.2	58.7 ± 10.3	0.58
Smoking (+/-)*	161/266	99/140	37/58	104/224	298/463	0.09	0.11	359/610	42/77	0.39
Diabetes (+/-)*	85/345	41/191	16/76	73/236 (30.9%)	142/612 (23.2%)	0.30	0.04	195/757	19/91	0.25
Hypertension (+/-)*	183/248	106/133	36/51	139/161	325/432	0.72	0.17	416/534	48/59	0.49
Hyperlipidemia (+/-)*	41/109	23/60	7/19	32/72	71/188	0.93	0.30	89/230	14/30	0.31
Renal disorders (+/-)*	13/450	8/255	0/96	11/334	21/802	0.38	0.33	29/1009	3/125	0.52

\*Different number between groups in Table 1 is related to impaired medical documents records.

P<sup>‡</sup>: between different blood groups; P<sup>¶</sup>: between O and non-O blood groups

and renal disorders based on the blood group distribution of these persons ( $p > 0.05$ ). Patients included 474 women (38.3%) and 762 (61.7%) men, with a mean age of  $58.5 \pm 11.4$  years, of which 61.9% (401/648) were smokers. The mean age of all types of ABO blood group in patients is demonstrated in Table 1. The age distribution among different blood groups were alike in patient subgroups ( $p = 0.28$ ). Only the prevalence of diabetes was significantly different in 23.2% (142/612) patients with non-O blood group versus 30.9% (73/236) of patients with group O; Table 1 ( $p = 0.04$ ).

As mentioned earlier, of the 1,236 CAD patient records, only in 1,046 medical documents had records of number of vessels involved with stenosis. Further, of the 1,046 CAD patients, 365 (34.9%) patients had 1VD, 317 (30.3%) had 2VD, and 364 (34.8%) had stenosis in 3VD. Table 2 shows the ABO and Rh blood group distribution in 1VD, 2VD, and 3VD patients ( $p = 0.26$  and  $p = 0.47$ , respectively). Of note, no significant difference was observed in the distribution of 1VD, 2VD, and 3VD stenosis when the patients were divided according to the presence of O and non-O blood groups; Table 2 ( $p = 0.42$ ).

TABLE 2: Distribution of ABO/Rh blood group in the number of vessels involved in coronary artery disease patients.

	Blood Groups							N (%)	Rh Status		
	A	B	AB	O	Non-O blood type	P <sup>‡</sup>	P <sup>¶</sup>		Rh+	Rh-	P-value
1VD	137	88	26	114	251			365 (34.9%)	324	41	
2VD	131	65	36	85	232	0.26	0.42	317 (30.3%)	287	30	0.47
3VD	151	75	28	110	253			364 (34.8%)	318	45	

1VD = single vessel disease; 2VD = 2 vessels disease; 3VD = 3 vessels disease

P<sup>‡</sup>: between different blood groups; P<sup>¶</sup>: between O and non-O blood groups

## 4. Discussion

ABO blood groups are the most studied antigenic system of red blood cells and their phenotypes are easily identified; they have been used as genetic markers in researches of relationship with different diseases [14]. Unsurprisingly, the clinical significance of the ABO blood group now develops beyond the traditional boundaries of immunohematology and blood transfusion medicine, in which the antigen system appears to play a role in the pathophysiology of most human diseases including cardiovascular disorders [15, 16].

However, the association among ABO blood group and CAD in clinical practice is unclear. Biancari *et al.* reported that ABO blood groups had a very similar distribution between patients undergoing coronary artery bypass graft compared to the general

population. The study also found that blood type B was associated with higher angiographic scores, but postoperative complications did not differ between groups (17).

Moreover, the data from the official report of the local Blood Transfusion Center showed the distribution of ABO/Rh groups in the Iranian people as follows: O: 34.7%, A: 33.7%, B: 20.7%, AB: 8.4%. Also, positive Rh was seen in 89.6% of the healthy population [18]. The result of this study showed a diverse distribution in our evaluated population (O: 29.7%, A: 39.7%, B: 22.2%, AB: 8.3%, and Rh<sup>+</sup>: 89.2%), which may be related to the lower susceptibility of O blood group to CAD as presented in Table 3.

TABLE 3: Comparison of the ABO/Rh groups distribution between Iranian healthy population and CAD patients

	A	B	AB	O	Rh <sup>+</sup>
<b>Iranian healthy population</b>	33.7%	20.7%	8.4%	34.7%	89.6%
<b>CAD patients</b>	39.7%	22.2%	8.3%	29.7%	89.2%

Stakisaitis *et al.* found a relation between B blood group and coronary atherosclerosis in Lithuanian women [19], which is not compliant with our study. Chen *et al.* [20] reported that non-O group is associated with the presence of significant CAD indicated by > 50% stenosis in  $\geq 1$  coronary artery in angiography, however, we did not observe any significant association between the O and non-O groups with CAD. Perhaps, this contradiction is because the study type of these two investigations was different. Also, they reported that there was no association between the ABO group and the number (1 or 2 or 3) of coronary arteries with > 50% stenosis.

Omidi *et al.* [21] in Iran investigated the relationship between O and non-O groups with severity of CAD and found that there is severe involvement among them.

A database of 1,236 patients undergoing coronary angiography were evaluated to better understand the relation among CAD severity and ABO blood type. The authors of this study analyzed the possible relationship between CAD severity and ABO blood type, as well as its association with traditional atherosclerosis risk factors. Our data do not support the major contribution of ABO blood system in severe CAD stenosis, and no clinical outcome can be deduced from this data. For many years, the ABO blood group has been related with a tendency to venous and arterial disorders including peripheral vascular disease, CAD, and venous thromboembolism [7, 12, 22]. Non-O individuals have a higher susceptibility to these conditions, which can be due to high levels of plasma VIII factors and von-Willebrand factor [23]. In the majority of previous studies, patients under study were known case of CAD, and this study could not find enough information about ABO blood groups and severity of CAD. Therefore, this study's investigators designed a study on the ABO/Rh blood groups distribution in a series of patients who

were diagnosed angiographically as CAD in order to evaluate whether ABO/Rh blood groups are associated with the number of vessels involved as a risk of CAD severity.

According to the best of author's knowledge, there is no other research in Iranian society about the evaluation of ABO blood type and CAD severity.

## 5. Conclusion

In this study, no association was observed between the type of ABO blood groups and the rate of coronary artery atherosclerotic lesions in Iranian patients with chronic CAD. Also, no significant relationship between O-type blood and the number of vessels involved as a risk of CAD severity was observed.

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