Zahedan J Res Med Sci. 2016 September; 18(9):e3500. doi: 10.17795/zjrms-3500.

Published online 2016 August 10. **Research Article**

Determination of Relative Frequency of ABO/Rh Blood Groups in Patients with Bacteremia in Shahid Sadoughi Hospital, Yazd, Iran

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Received 2015 July 11; **Revised** 2015 August 29; **Accepted** 2016 August 07.

Abstract

Background: As regards the role of genetics in susceptibility to various diseases and similarity of microorganisms' superficial monosaccharide to blood group antigens, blood group antigens may be considered as a risk factor for bacteremia. The present study aimed to determine the association between ABO blood groups/Rh and bacteremia risk in our center.

Methods: This study is a cross-sectional research consisting of 100 patients with symptoms of bacteremia from March to December 2014. Blood group was determined through tubular method, Cell Type and Back Type. After getting the results, the statistical significance of differences between groups was estimated by Chi-Square Test and Z-test. Statistical analyses were performed using SPSS 22.

Results: Among 100 patients with bacteremia, 48 and 52 were male and female, respectively. The patients' mean age was 44.34 ± 31.91 years. Enterobacteriaceae (58%) and Staphylococcus aureus (27%) were the most common causes of bacteremia among these patients. In this study, Blood group A was found in 31% of patients, B in 33%, AB in 12% and O in 24%. 91% of patients were Rh positive and 9% were negative. We compared the relative frequency of blood group O with A, B and AB groups (in comparison with normal population in Yazd) and the difference was significant (P value = 0.036).

Conclusions: Our results show that there is an association between blood group antigens and chance of developing bacteremia. Conducting other studies with greater sample size is essential.

Keywords: Bacteremia; ABO Blood Group System; Rh Factor

1. Background

Bacteremia is a condition in which bacteria enter blood stream. It may occur transiently (after dental surgery affairs), intermittently (due to not drained abscesses) or continuously (intravascular infections) [1]. Predisposing conditions are different such as asymptomatic gallstones, narrowing of the bile ducts, hepatic or renal abscess, Empyema, or intracranial sinus infections which can create persistent bacteremia [1]. On the other hand bacteremia can produce metastatic infections without any predisposing factors. Bacteremia symptoms include tachypnea, fever, tachycardia, hypoxemia, and sweating [2]. Blood culture is the gold standard of microbiological investigations made by adding individuals' blood suspected to bacteremia and sepsis to vials of diphasic medium (Castaneda) [3, 4]. Once the pathogens overcome the immune system defense, the systemic effects of infection progress causing sepsis symptoms [1].

Genetic marker is one of the indicators considered as a risk factor of many diseases. One of the genetic markers is ABO blood group system in which the type of blood group depends on the presence or absence of the two genes A and B [5, 6]. Over the past eight decades, many studies conducted on the possibility of relation between illness and blood group. Over different studies, focused on distribution of blood groups in terms of geography and race, it seems that sensitivity of some groups to diseases as plague, cholera, smallpox, malaria and other diseases can be associated with specific blood groups [7]. Springer et al. (1961) examined 282 patients infected with gram-negative bacteria regarding to blood group type. The results suggested that surface monosaccharides of these microorganisms are similar to blood group antigens (serological similarity) [8]. In 1962, White et al. reported an analysis of nasal carriage and wound sepsis due to Staph. aureus in

male hospital in-patients in relation to their ABO and rhesus groups. Their study showed that the distribution of blood groups for the patients with sepsis does not differ significantly from that of any of the groups of carriers or non-carriers [9]. Similarity of surface monosaccharides microorganisms to blood group antigens ABO is another factor that can suggest blood group as a risk factor of causing bacteremia [8].

2. Objectives

Thus, the aim of the present study is to evaluate the association between ABO blood groups and bacteremia risk in patients who referred to Shahid Sadoughi Hospital, Yazd in 2014.

3. Methods

This study was approved by the ethics committee of Shahid Sadoughi University of Medical Sciences. The current research is a descriptive cross-sectional study. The target populations were the whole patients, suspected to bacteremia, who referred to laboratory of Shahid Sadoughi Hospital, Yazd, Iran, from the beginning of March to December 2014. Inclusion criterion of the study was positive blood culture test. Exclusion criterion was positive culture of Staphylococcus epidermidis.

Variables recorded were age, gender, the type of bacteria causing bacteremia, blood group and Rh. Blood group type in the form of cell type and back type was done using tubular method. Besides, to compare the results of this study with blood group in general population, blood donors' results in Yazd Blood Transfusion Center, in 2013, were used.After getting the results, the statistical significance of differences between groups was estimated by Chi-Square Test and Z-test. Statistical analyses were performed using SPSS.22. The data was also performed in Excel software to create charts and tables. A P value < 0.05 was considered statistically significant.

4. Results

In this research, 1800 patients who were suspected to bacteremia were studied. Among these patients 100 cases had positive blood culture. 48% of the patients were male and 52% were female. The mean age of patients was 44.34 $\pm$ 31.91 and the range of 0-93 years. As it is shown in Table 1, we divided the patients into 3 age groups (0-29, 30-69, 70-94 years). 42 of patients were infected with *Escherichia Coli*, 27 patients with *Staphylococcus aureus*, 13 individuals with *Klebsiella*, 6 with *Pseudomonas aeruginosa*, 6 infected with the species *Acinetobacter*, 3 cases were infected by *Streptococcus*, 2 individuals by *Proteus* and 1 case was infected with *Salmonella typhi* bacteremia (Table 1). In this study, Blood group A was found in 31% of patients, B in 33%, AB in 12% and O in 24%. In terms of factor Rh, 91% were positive and 9% negative (Table 2). Distribution of ABO blood group in patients with bacteremia with the distribution of ABO blood group in Yazd was examined by chi-square test. Comparing O blood group with other blood groups (A, B, and AB) in patients with bacteremia relative to normal condition (using Z-test) showed significant difference (P value = 0.036). Rh distribution in bacteremia patients was tested with Rh distribution in Yazd through Z-test. the distribution of Rh in patients under study is identical with Rh distribution in Yazd (P value > 0.05).

Table 1. Demographic Characteristics and Type of Bacteria Causing Bacteremia in Patients

Factor	Frequency
Age at entry	
0 - 29	34 (34%)
30 - 69	36 (36%)
70 - 94	30 (30%)
Gender	
Male	48 (48%)
Female	52 (52%)
Bacteria Type	
Escherichia Coli	42 (42%)
Staphylococcus aureus	27 (27%)
Klebsiella	13 (13%)
Pseudomonas aeruginosa	6 (6%)
Acinetobacter	6 (6%)
Streptococcus	3 (3%)
Proteus	2 (2%)
Salmonella typhi	1 (1%)

5. Discussion

The present study aimed to determine the association between ABO blood groups/Rh and bacteremia risk. Zukerman et al. investigated the distribution of the ABO blood groups and rhesus factor in 2226 cases. 133 cases were infected with nose *staphylococcal* infection, among whom Blood A was frequently observed. However, it was not statistically significant. This research states that there is no relationship between Blood group antigens and susceptibility to *staphylococcal* infection or carrier state [10].

Table 2. ABO System Blood Group Frequency Distribution on the Basis of Rhesus System Among Patients and Blood Donors

ABO	RH	Frequency Distribution of Patients (n = 100)	Total, No. %	Frequency Distribution of Blood Donor (n = 38818)	Total, No. %
A	+	29	31, (31%)	8292	9733, (25.1%)
	-	2		1441	
B	+	29	33, (33%)	10575	12231, (31.5%)
	-	4		1656	
AB	+	10	12, (12%)	3106	3658, (9.4%)
	-	2		552	
O	+	23	24, (24%)	11225	13196, (34%)
	-	1		1971	
Total		100	100%	38818	100%

Regan et al. examined 1062 pregnant women for group *B streptococcus* infection and its relationship with ABO blood group. Blood Group B was more common in mothers with Group *B streptococcus* infection ($P < 0.005$). This reflects the fact that lack of antibody againts B antigen increases the chances of Group *B Streptococcus* infection [11]. Pasnick et al. studied 1213 women with a history of prematue labor, in 1980. It found out that 10.2% had a history of *B-hemolytic streptococcus* infection, which was not associated with ABO blood group; however, was significantly seen in mothers with Rh negative ($P < 0.001$) [12]. Pinaroc et al. investigated the relationship between bacteremia and different ABO blood group types. The results suggested that in patients with *Staphylococcus aureus* bacteremia, the relative frequency of blood group A is more than other groups; however, not significant [13]. Wittels et al. tested the hypothesis that the presence of naturally occurring anti-B isoagglutinins afford protection against the development of *E. coli* septicemia. The blood groups found in 115 patients with *E. coli* septicemia were compared with those found in three "control" populations: 138 patients with septicemia due to other organisms, 23135 hospitalized patients, and 40038 normal blood donors. The relative incidence of B and AB blood groups (not containing anti-B antibodies) was significantly higher than A and O blood groups (containing anti-B antibodies) in the group with *E. coli* septicemia [14].

Savalonis et al. began to investigate the relationship between blood-group antigens and bacterial constituents. Only *Escherichia coli* 0125:B15, subtype 12808, had specific K1-like activity. Thus the finding of such activity in at least one *E. coli* subtype confirms the idea that bacterial components may play a role in the production of naturally occurring antibodies directed against non-ABO red cell antigens [15]. Stowell et al. demonstrated that two innate immune lectins, galectin-4 (Gal-4) and Gal-8, which are expressed in the intestinal tract, recognize and kill human blood group antigen-expressing *Escherichia coli* while failing to alter the viability of other *E. coli* strains or other Gram-negative or Gram-positive organisms. These results demonstrate that innate defense lectins can provide immunity against pathogens that express blood group-like antigens on their surface [16]. Che Kou et al. studied 23 infants and children with *Pseudomonas aeruginosa* sepsis in term of blood group type. In this study, blood group B showed the highest frequency, and finally blood group B introduced as a risk factor in *Pseudomonas aeruginosa* infections [17]. Miura et al. demonstrated that the blood antigens as receptor or co-receptor in the intestinal cells are for the entrance of Human Noroviruses. In a study, authors isolated an enteric bacterium strain (SENG-6), closely related to *Enterobacter cloacae*, bearing HBGA-like substances from a fecal sample of a healthy individual by using a biopanning technique with anti-HBGA antibodies. These results indicate that A-like substances in the some bacteria play a key role in their binding [18]. Reilly et al. investigated the effect of ABO blood group on the development of ARDS in patients with severe trauma and severe sepsis. 976 patients with severe trauma or severe sepsis were selected. In the group with severe trauma, 197 of 732 patients (27%) were diagnosed with ARDS where the blood group A in white patients of this group was more common. In severe sepsis group, 222 out of 976 patients (23%) diagnosed with ARDS and blood group A was also common in white patients of this group. The results of this study reveal that Blood Group A is a risk factor for ARDS development in white patients with severe trauma of severe sepsis [19]. In the present study 42 of patients were infected with *Escherichia Coli*, *Staphylococcus aureus*, *Klebsiella, Pseudomonas aeruginosa*, *Acinetobacter*, *Streptococcus*, *Proteus* and *Salmonella ty-*

phi. In this study, blood group A was found in 31% of patients, B in 33%, AB in 12% and O in 24%. 91% were Rh positive and 9% negative. In order to compare the results of this study with blood group in general population, blood donors' results in Yazd blood transfusion center, in 2013, were used. Comparing O blood group with other blood groups (A, B, and AB) in patients with bacteremia relative to normal condition (using Z-test) showed significant difference (P value = 0.036).

According to the past studies and the finding of this study, it seems that there is an association between ABO/Rh blood groups and bacteremia. In our study the possibility of bacteremia in blood type A, B and AB was more than O. Anyway, conducting other studies with greater statistical sample size is essential.

Acknowledgments

The authors thank to infectious diseases research center and the hematology, oncology and genetics research center of Yazd University of Medical Sciences, blood transfusion service of Yazd and especially Hosein Neamatzadeh and Pouran Jahan Mehr for their sincere assistance. The research was also a research project (3221) dated as January 2014.

Footnotes

Authors' Contribution: This work was carried out in collaboration between all authors; Author Aref Atefi designed the study, wrote the protocol and wrote the first draft of the manuscript; Author Fariba Binesh managed the literature searches and revised the manuscript; Authors Jamshid Ayatollahi, Atefeh Atefi and Fatemeh Dehghan Mongabadi managed analysis of the data; All authors read and approved the final manuscript.

Conflict of Interest: The authors declare no conflict of interest.

Funding/Support: The funding related to this study was performed by Shahid Sadoughi University of Medical Sciences.

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