

Susceptibility to Pulmonary Tuberculosis as a Function of ABO-Rh Blood Group Antigens

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Abstract

Background: Earlier studies have proved a strong correlation between ABO blood groups and specific diseases, but for pulmonary tuberculosis (PTB) no consensus has been reached as the study results have been variable.

Aims: This study was done to establish any possible correlation between ABO blood groups/Rh D status and sputum acid-fast bacillus positive PTB and also to find out the frequency distribution of ABO blood groups in a population of Odisha, an eastern state of India.

Materials and Methods: Blood grouping was done for 122 smear positive PTB cases (study group) during the study period of September 2010 - August 2012. During the same period, blood group data of 2842 healthy blood donors (control group) were collected. This data were analyzed using Chi-square test to establish any possible correlation.

Results: Blood Groups "A" and "B" have a significant association with sputum smear positive PTB ($P = 0.005$ and 0.0002 , respectively). Rh D status has no correlation with sputum positive PTB ($P = 0.073$). Most common blood groups among residents of the coastal belt of Odisha are blood Group "O" (36.6%) and "B" (33.3%).

Conclusions: Individuals having blood Group "A" or "B" are more likely to suffer from tuberculosis compared to blood Group "O" and "AB" in Eastern India. The reason for this vulnerability is not known.

Key words: ABO blood group, Acid-fast bacillus, Pulmonary tuberculosis, Rh D status, Sputum

INTRODUCTION

More than 130 years have passed since Sir Robert Koch first discovered the causative agent of tuberculosis (TB), i.e., *Mycobacterium tuberculosis*¹ but it still remains a major health problem globally. According to the World Health Organization Global TB Report 2015, 9.6 million people fell ill, and 1.2 million people died of TB in the year 2014.² TB is an infectious disease transmitted most commonly through droplet nuclei released into the atmosphere by people suffering from pulmonary TB (PTB) through

coughing, sneezing, and speaking. Identified risk factors for TB are overcrowding, poor ventilation, young age, low socioeconomic status, addictions such as alcohol and smoking, occupational risk such as health care workers, human immunodeficiency virus infection (HIV), diabetes, and malnutrition.³ Apart from these well-established factors other markers or individual trait increasing the incidence and prevalence of TB has been debated in view of geographical and ethnic. One of such debated factor is relation blood group and TB.

Landsteiner, in the year 1901, discovered ABO blood group system and marked the era of safe blood transfusion.⁴ It also provided a strong factor contributing to identity and individuality of people. Since then, the association of ABO blood groups with various diseases has intrigued many researchers. Susceptibility to TB as a function of blood group has been studied previously, and the results were variable. We conducted this study to look for association

Access this article online



www.ijss-sn.com

Month of Submission : 02-2016

Month of Peer Review : 03-2016

Month of Acceptance : 03-2016

Month of Publishing : 04-2016

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of ABO and Rh typing with sputum positive PTB and also to find out frequency distribution of blood groups in healthy adults in Odisha, India.

MATERIALS AND METHODS

The study was conducted from September 2010 to August 2012 in the Sriram Chandra Bhanja Medical College and Hospital, a Tertiary Care Hospital catering to the coastal area of Odisha and parts of West Bengal from September 2010 to August 2012.

In patients (TB ward) of the Department of Pulmonary Medicine who were sputum smear positive for acid-fast bacillus (AFB) in microscopy were recruited into the study and formed the "Study group." The sputum AFB microscopy was done according to the standard Revised National TB Control Program protocol in the designated microscopy center of the hospital. During the same period, blood group data of healthy subjects coming to the blood bank as donors were collected and they formed the "control group." Study subjects in both the groups were explained about the nature and objective of the study in their own language and consent was taken. Those who agreed to participate in the study were subjected to blood grouping test by standard tube agglutination reaction in the blood bank in the Department of Transfusion Medicine. The Institutional Ethical Committee clearance was taken beforehand, and data were kept confidential.

Data were entered and analyzed in Epi-info Version 2007. Categorical variables were expressed regarding numbers and proportions. Chi-square test was used for showing an association. $P < 0.05$ was considered significant.

RESULTS

A total number of study participants in the study group were 122 and in the control group were 2842. Frequency distribution of ABO blood groups among cases and controls is summarized in Table 1. A total number of subjects having blood Group A were 624 (21.95%) and 40 (32.8%) in control and study group, respectively, which showed a statistically significant difference ($P = 0.005$).

The proportion of subjects with blood Group B in the study group was (18%) and was less as compared to control group (34.06%). This difference was statistically significant ($P < 0.001$). Although percentages of study subjects having blood Groups "O" and "AB" were more in the study group compared to the control group, it did not show any statistical significance. Analysis of Rh D typing as a separate predictor for TB did not show any statistical significance ($P = 0.073$) (Table 2). Rh D status within individual blood groups also did not show any significant associations with sputum positive PTB patients as shown in Table 3. Most common blood group among the healthy control group was "O Rh+" (36.6%) closely followed by B Rh+ (33.3%). In the study group of AFB positive PTB cases, blood Group "O Rh+" was most common (39.3%) followed by "A Rh+" (32.8%).

DISCUSSION

The antigens of the ABO blood group system (A, B, and H determinants, respectively) are complex carbohydrate molecules expressed on the surface of RBC membranes.⁵ They are also present on the surface of a variety of human cells and tissues, including the epithelium, sensory neurons, platelets, and the vascular endothelium,⁶ due to their extensive distribution in human body association of these blood group antigens with various cardiological, oncological, and other diseases were suspected, studied, and proved.^{7,8} Individuals with blood Group O are more prone to develop peptic ulcer disease and those with blood Group A are more prone to have gastric carcinoma. Carcinoma cervix and pernicious anemia are found more often in persons with blood Group A.⁹ Blood Group O individuals are less susceptible to rheumatic heart disease,¹⁰ and there is some association between blood Group O and HIV infection.¹¹

Many studies with similar intent were conducted earlier. Viskum,¹² suggested blood Groups O and AB individuals are more susceptible to TB. However, a study by Rao *et al.*, concluded that blood Groups O and A were the most common blood groups associated with PTB.¹³ A study in Gujarat, a significant association was discovered between blood Group AB and pulmonary TB.¹⁴ Similarly, Jain¹⁵ had

Table 1: Distribution of ABO blood groups in sputum positive PTB cases (study group) and healthy adults (control group)

Blood group	Study group n (%)	Control group n (%)	Total n (%)	OR	95% CI	P-value
A	40 (32.8)	624 (21.95)	664 (22.4)	1.73	1.17-2.55	0.005
B	22 (18)	968 (34.06)	990 (33.4)	0.42	0.27-0.68	0.0002
AB	12 (9.8)	183 (6.43)	195 (6.58)	1.58	0.86-2.93	0.138
O	48 (39.3)	1067 (37.54)	1115 (37.62)	1.08	0.74-1.56	0.688
Total	122	2842	2964			

OR: Odds ratio, CI: Confidence interval, $P < 0.05$ considered significant, PTB: Pulmonary tuberculosis

Table 2: Distribution of Rh D antigen type in sputum positive PTB (cases) and healthy adults (controls)

Rh type	Study group	Control group	P-value
Positive	122	2767	0.073
Negative	0	75	

P<0.05 considered significant. PTB: Pulmonary tuberculosis

Table 3: Association of Rh D status within individual blood group with sputum positive PTB

Blood group	Study group n (%)	Control group n (%)	P-value
A Rh D+	40 (32.8)	602 (21.18)	0.636
Rh D-	0	22 (0.78)	
B Rh D+	22 (18)	946 (33.29)	1.0
Rh D-	0	22 (0.77)	
AB Rh D+	12 (9.8)	179 (6.29)	1.0
Rh D-	0	4 (0.14)	
O Rh D+	48 (39.3)	1040 (36.59)	0.625
Rh D-	0	27 (0.95)	

P<0.05 considered significant. PTB: Pulmonary tuberculosis

similar observations for AB blood group and pulmonary TB. People with blood Group O showed protection from TB in a Chinese population.¹⁶

Some of the studies also reported no association between TB and ABO blood groups. Buchannan and Hingley¹⁷ in their study with 2,446 subjects concluded that there was no relation between blood groups and any disease. Shenoy and Daftary¹⁸ too ruled out any such correlation between TB and blood groups. Reddy and Reddy¹⁹ Reddy and Usha²⁰ and co-workers conducted two different studies in Chittoor district of Andhra Pradesh and Warangal district of Telangana region found no association between ABO-Rh and PTB.

Some studies found Rh D positivity increases risk of TB,¹³ some studies observed Rh D negativity renders individuals more susceptible.²¹ However, there are studies which find no such associations.^{22,18} The present study did not show any correlation between Rh D status and TB.

Most common blood group among Punjabis²³ and Bengalis²⁴ was blood Group "B." Blood Group "O" was commonly observed in people of Kashmir and South Rajasthan¹⁵ and North Rajasthan.²⁵ According to previously published data,²⁶ most common blood group in Odisha is blood Group "O" followed by blood Group "B." The present study is in agreement with this data, blood Group O and "B" being the two most common blood groups.

Limitations

The limitations of study are:

1. Small number of subjects in study group
2. It was not a multicenter study.

CONCLUSION

In the present study, it was found that individuals are having blood Groups "A" and "B" are more likely to suffer from TB compared to those with blood Group "O" and "AB." The reason for this vulnerability is not known. Rh D status has no effect on susceptibility to TB. To confirm or negate the findings of this study large multicenter randomized controlled trial should be done.

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How to cite this article: Pradhan G, Sahu A, Giri PK, Sahoo J. Susceptibility to Pulmonary Tuberculosis as a Function of ABO-Rh Blood Group Antigens. *Int J Sci Stud* 2016;4(1):146-149.

Source of Support: Nil, **Conflict of Interest:** None declared.