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Association of β-Thalassemia and its Types with ABO and Rh Blood Groups in Lahore, Pakistan

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ABSTRACT

The current study aims to determine the relationship of ß-thalassemia and its types (major, minor, intermedia) with ABO and Rh blood groups in Lahore, Pakistan. It is an observational study in which ABO and Rh blood grouping of 711 β-thalassemia patients was performed (with their consent). Blood grouping was performed through forward and reverse grouping using tube method. The observed ABO blood group pattern in both genders was O>B>A>AB. It was found that the overall frequency of O and A blood groups was higher in female patients, while the frequency of B and AB blood groups was higher in male patients, although the difference was non-significant. However, a significant difference was observed in the relationship between gender and Rh factor. Most patients of β-thalassemia suffered from the type β-thalassemia major (48%), followed by patients suffering from β-thalassemia minor (44%) and β-thalassemia intermedia (8%). Overall, patients with AB blood group mostly suffered from β-thalassemia major, while patients with β-thalassemia minor and β-thalassemia intermedia had the highest frequency of blood group B. It was concluded that ß-thalassemia patients have a higher frequency of O+ blood group and the lowest frequency of AB- blood group. Moreover, a significant difference was seen between male and female patients with respect to Rh blood group. However, no significant difference ($p > 0.05$) was found in the distribution of ABO and Rh blood groups corresponding to β-thalassemia types.

Keywords: blood groups, β-thalassemia, hemoglobin, iron overload

1. INTRODUCTION

Thalassemia is a hereditary disorder characterized by the lack or reduction in the amount of one or more globin chains of hemoglobin [1]. People can inherit the thalassemia trait or disease from their parents through the genes. There are two main types of thalassemia known as α-thalassemia and β-thalassemia. Individuals with α-thalassemia cannot create sufficient alpha globin chains that causes an increase in beta globin chains, while individuals with β-thalassemia cannot make enough beta globin chains, causing an excess number of alpha chains [2, 3]. β-thalassemia can be further divided into further types namely β-thalassemia minor, β-thalassemia intermedia, and β-thalassemia major [4].

Thalassemia is a serious disease causing severe anemia and ineffective production of RBCs. Moreover, hematopoiesis occurs outside the bone marrow because of the regular transfusion of blood, while increased iron absorption causes iron overload in the patients [5]. The patients of β-thalassemia major experience serious anemia and severe problems including liver damage, heart disease, and endocrine dysfunction.

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These patients need to treated with iron chelation therapy and regular transfusions or hematopoietic stem cell transplantation, otherwise they cannot survive more than the age of 5 years [6]. Recently, the survival rate of such patients and their age expectation have increased because of iron-chelating therapies and routinely implemented blood transfusion therapy [7].

Thalassemia has no known treatment. Prevention is the only way to reduce the disease burden. It is a more cost-effective approach as compared to the provision of optimum treatment to the victims. Thus, spreading awareness regarding the disease is critical for its prevention [8].

The current research attempts to investigate the connection between ß-thalassemia and blood group antigens in order to sort the population suffering or resistant to ß-thalassemia. It is also essential to explore this connection in order to understand the region-wise demand of rare blood groups for the patients [9].

2. MATERIALS AND METHODS

This descriptive study was performed in the department of University Institute of Medical Lab Technology, University of Lahore, in collaboration with Punjab Thalassemia Centre, Sir Ganga Ram Hospital, Lahore, Pakistan. This study was conducted from July 2020 to December 2020 and included a total of 711 patients of ß-thalassemia (293 males and 418 females). The study was conducted after approval from the institutional ethical committee of Punjab Thalassemia Centre, Sir Ganga Ram Hospital, Lahore, Pakistan and with the informed consent of the patients. Data was collected through a questionnaire based on recorded history. Blood groups were determined using tube method in the University Institute of Medical Lab Technology, University of Lahore, Pakistan. The data was analyzed using SPSS (version 25). The relationship of blood group with gender and thalassemia types was determined using the Chi square test.

3. RESULTS

The data was collected from 711 β-thalassemia patients including 418 (59%) female patients and 293 (41%) male patients. According to Table 1, most of the patients of β-thalassemia had blood group O (34.6%, *n*=246), followed by B (29%, n=206), A (25%, *n*=178), and AB (11.4%, *n*=81) blood groups, respectively. The prevalence of Rh+ factor was 94.2% (*n*=670) and Rh- factor was 5.8% (*n*=41). According to results, the observed pattern of ABO blood group amongst β-thalassemia patients was O>B>A>AB.

Table 1. Distribution of β-thalassemia Patients According to Gender and Blood Group

Variables	No. of patients (n)	Percentage (%)
Gender		
Male	293	41
Female	418	59
ABO blood group		
A	178	25
B	206	29
AB	81	11.4

Variables	No. of patients (n)	Percentage (%)
O	246	34.6
Rh blood group		
Rh +	670	94.2
Rh -	41	5.8

The observed ABO blood group pattern in both genders was the same, that is, O>B>A>AB. The overall frequency of O and A blood groups was higher in female patients as compared to male patients. The frequency of blood group O in female patients was 35.6%, while in male patients it was 33.3%. The frequency of blood group A in female patients was 25.4% and in male patients it was 24.6%. The overall frequency of B and AB blood groups was higher in male patients. The frequency of blood group B in male patients was 30.1%, while in female patients it was 28.2%. The frequency of AB blood group in male patients was 12.2% and in female patients it was 10.8%. Rh factor distribution showed that Rh+ blood group was more prevalent in female patients (95.6%) than male patients (91.9%). While, Rh- blood group was more prevalent in male patients (8.1%) than female patients (4.4%). Table 2 shows no significant difference ($p > 0.05$) in the gender-wise distribution of ABO blood group. However, it shows a significant difference ($p < 0.05$) in Rh factor distribution between male and female patients.

Table 2. Gender-wise Distribution of ABO and Rh Blood Groups in β-thalassemia Patients

Blood group	Male						Female					
	Rh+		Rh-		Overall		Rh+		Rh-		Overall	
A	67	22.8%	5	1.8%	72	24.6%	104	24.9%	2	0.5%	106	25.4%
AB	33	11.2%	3	1.0%	36	12.2%	45	10.8%	0	0.0%	45	10.8%
B	83	28.3%	5	1.8%	88	30.1%	111	26.5%	7	1.7%	118	28.2%
O	87	29.8%	10	3.5%	97	33.3%	140	33.4%	9	2.2%	149	35.6%
711	270	91.9%	23	8.1%	293	100%	400	95.6%	18	4.4%	418	100%

According to Table 3, most of the patients of β-thalassemia suffered from the type β-thalassemia major (48%, *n*=341), followed by the patients of the type β-thalassemia minor (44%, *n*=313) and β-thalassemia intermedia (8%, *n*=57), respectively. ABO and Rh blood group distribution were observed in all three types of β-thalassemia (major, minor, and intermedia). The distribution of ABO blood group revealed that the majority of β-thalassemia patients with A, AB, and O blood groups suffered from β-thalassemia major, with the frequency of patients with blood group A (48.3%, *n*=86), blood group AB (53%, *n*=43), and blood group O (49.6%, *n*=122). Overall, the patients of AB blood group mostly suffered from β-thalassemia major. According to Table 4, most of the patients of β-thalassemia minor had blood group B (47.6%, *n*=98), while the patients of β-thalassemia intermedia also had the highest frequency of blood group B (8.7%, *n*=18). Table 5 shows the Rh factor distribution. It shows that Rh+ blood group was the most prevalent in patients with β-thalassemia major (47.9%, n=321) than patients with β-thalassemia

minor (43.9%, *n*=294) and β-thalassemia intermedia (8.2%, *n*=55), respectively. The same pattern was observed with the distribution of Rh- blood group. It had the highest frequency among patients with β-thalassemia major (48.8%, *n*=20) and the lowest frequency among patients with β-thalassemia intermedia (4.9%, *n*=2). No significant difference ($p > 0.05$) was found in the distribution of ABO and Rh blood groups corresponding to the types of β-thalassemia.

Table 3. Frequency of Thalassemia Types in β-Thalassemia Patients

Blood group	No. of patients	Percentage
β –thalassemia major	341	48%
β –thalassemia minor	313	44%
β –thalassemia intermedia	57	8%
Total	711	100%

Table 4. Frequency of ABO Blood Group in Thalassemia Types

Blood Group	Beta Thalassemia Types			Total	p-value
	Intermedia	Major	Minor		
A	12(6.7%)	86(48.3%)	80(45%)	178	0.778
AB	6(7.4%)	43(53%)	32(39.6%)	81	
B	18(8.7%)	90(43.7%)	98(47.6%)	206	
O	21(8.5%)	122(49.6%)	103(41.9%)	246	
Total	57	341	313	711	
Percentage	8%	48%	44%	100%	

Table 5. Frequency of Rh Blood Group in Thalassemia Types

Beta Thalassemia Types	Rh –	Rh +	Total	Percentage	p-value
Intermedia	2(4. 9%)	55(8.2%)	57	8.0 %	0.743
Major	20(48.8%)	321(47.9%)	341	48.0 %	
Minor	19(46.3%)	294(43.9%)	313	44.0 %	
Total	41	670	711	100 %	

4. DISCUSSION

Thalassemia is a frequent blood disorder and an important public health problem [10]. Pakistan is among those countries which have the highest thalassemia burden in the world. The commonly quoted figure for the country is 100,000 transfusion-dependent thalassemia patients [11]. These patients need repeated blood transfusions to avoid anemia, to maintain growth and development, and to sustain the quality of life; however, these repeated transfusions also cause complications which might reduce the average age of thalassemia patients [12].

Out of the selected 711 β-thalassemia patients in this study, 418(59%) were female patients and 293 (41%) were male patients, which is in accordance with a previous study having the same gender frequency (males 41.6% and females 58.4%) [13]. According to Table 1, the most common blood group present in β-thalassemia patients was O (34.6%), followed by B (29%), and A (25%), while the least common blood group was AB (11.4%). The ABO blood group pattern observed in the current study was O>B>A>AB, which is similar to the past studies [14–17]. It was found that Rh factor was present in most of the β-thalassemia patients (94.2%) and absent only in a few (5.8%) patients. These results are similar to the studies conducted earlier by Pranoti [9] (Rh+ 93%, Rh- 7%), Sarah [18] (Rh+ 95%, Rh- 5%), and Yasir [19] (Rh+ 92.65%, Rh- 7.35%).

The observed ABO blood group pattern in both genders was the same, that is, O>B>A>AB. The overall frequency of O and A blood groups was higher in female patients. On the contrary, the prevalence of AB and B blood groups was higher in male patients. These results are consistent with another study which showed a high prevalence of blood group O in female patients and AB in male patients (Zulfiqar, 2018). The data also suggests that Rh positive prevalence was significantly higher ($p < 0.05$) in female as compared to male patients, which is in concordance with the results of a previous study (female patients 50.53% and male patients 43.01%) [20].

The overall frequency of the different types of β-thalassemia in patients (n=711) is shown in Table 4. The most prevalent type of thalassemia was β–thalassemia major (48%). These results are consistent with the results of Mohssin [21], which found that the highest prevalence was of β–thalassemia major at 51%. This aspect needs to be investigated further.

4.1. Conclusion

The current study showed that females are more affected with the ß-thalassemia disease than males. It also suggests that overall the affected patients with ß-thalassemia have a higher frequency of O+ blood group and the lowest frequency of AB- blood group. The study found a non-significant difference in ABO blood group frequency between male and female patients. While, a significant difference was seen in Rh blood group between the two genders. There is no significant difference ($p > 0.05$) in the distribution of ABO and Rh blood groups according to the type of β-thalassemia. This study would be useful in making health policies by determining the association of various blood groups with different types of β-thalassemia.

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