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Study of blood groups and Rhesus factor in beta thalassemia patients undergoing blood transfusions

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Abstract

Beta thalassemia is the most common genetic blood disease, affecting millions of people in both developing and developed countries including Iraq. Patients with thalassemia require frequent blood transfusions, which can cause a variety of complications. Several researches have looked into the link between ABO blood groups and diseases. The associations of ABO blood group with thalassemia have not been extensively studied. In order to know the prevalence of thalassemia according to age, gender and blood group frequency, a study was conducted on 200 individuals, 100 of them were a control sample, which was considered a standard sample, while the rest 100 individuals were infected with beta thalassemia. The study aims to find out any relationship between the frequency of blood group phenotypes and susceptibility to thalassemia compared to the control sample. Our findings indicate that the prevalence of thalassemia was higher in female patients than in male patients. Found in the lowest age group 15-19 years. There was a significant difference (P 0.05) in the frequency of ABO blood groups that was O > B > A > AB. A significant difference of Rh factor (P<0.01) was found in the patients compared with the control group. The current study indicated the importance of the studied blood groups, as they are sources for detecting the risks of inheriting beta thalassemia or the variability in the likelihood of its appearance, and they can be used with other laboratory tests in genetic counseling.

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Introduction

Advances in medical science have not yet been able to replace the unique role of blood transfusion in controlling complications and saving the lives of thalassemia patients and other blood transfusion-dependent hemoglobinpathies. As an adjuvant treatment strategy, blood transfusions can still save the lives of many patients (Chou, 2013 and Hood, 2019).

Thalassemia (Greek: Thalassa-meaning sea) is a set of a single inherited autosomal recessive gene Hematological disorders triggered by defective hemoglobin Synthesis of one or more hemoglobin chains Hemolytic anemia caused (Rai and Bisu, 2017; Mohssin *et al.,* 2015). Due to the reduction or lack of synthesis of alpha and beta globulin chains respectively. The imbalance of the globin chain can cause hemolysis and erythropoiesis disorders. There are three forms of phenotypic beta-thalassemia. Thalassemia Minor is heterozygous about 50% reduced beta-globin synthesis Protein, resulting in mild to moderate small cell anemia. Pretentious people are normally asymptomatic. Thalassemia Intermediate media show mild, severe anemia (Mohssin, *et al.,* 2015).

In 60 countries, βThalassemia is common, but highly prevalent in South Asia, Sardinia, Sardinia (Galanello and Origa, 2010) including India (Purohit, 2014) and Pakistan (Ahmed, 2016) it is estimated that 60,000 people suffer from thalassemia every year, the vast majority in the developing world. Annually, all over the Worldwide (Galanello and Origa, 2010).

Blood group A, B, O is the most powerful descent system in Europe. It was discovered by Landsteiner in 1900 and was later accompanied by the discovery of the rhesus monkey system: the second most powerful blood group system. The determination of blood type depends on the antigenic material inherited on the surface of red blood cells (Kondam and Chandrasekhar, 2012). In this regard, these blood types are divided into four types A, B, AB and O in the A, B, O groups and Rh positive (Nishi *et al.,* 2012). A large number of studies have been conducted to assess the prevalence of ABO and Rh phenotypes in various populations. Although the A, B, O/Rh blood type is determined at conception and remains the same throughout life, the phenotype is different (Pramanik and Pramanik, 2000; Abdollah *et al.,* 2009).

A, B, O and Rh blood group systems are critical for the safe use of blood transfusion and organ transplantation. In addition, these two mechanisms are well known in population genetic research, population migration trends, and decision-making forensics and contested paternity issues (Pennap *et al.,* 2011 and Mondal *et al.,* 2012)In addition, studies have identified correlations between some diseases and the A, B, O and Rh blood group systems (Wu *et al.,* 2008 and Anstee,2010).

The relationship between blood type and certain human diseases has been well established, which may not have very important genetic significance. Previous studies have shown that the association and severity of chronicity with group B are associated with a greater risk of developing more severe forms of periodontitis (Watkins, 2001). Such research found that blood type o susceptible to thalassemia patients (Marbut *et al.,* 2018 and Laghari *et al.,* 2018). The purpose of this study was to see if there were any genetic differences in the distribution of blood groups between the thalassemia patient sample and the control sample by statistically comparing the phenotypic frequency of blood groups in the two samples.

Materials and methods

Data collected

Data were collected from hospital al-Karma –Iraq/ Baghdad. The research was performed in 200 enrolled 100 patients with beta- thalassemia and 100 as control in 2021. The patients attended repeated blood transfusions in the Thalassemia Care Center. Of 100 patients, 54 were women and 46 were men. Data have been collected through standardized questionnaires and records from the thalassemia care center. All ethical considerations were taken into considerations.

Statistical analysis

Statistical analysis of the information obtained was performed by the chi-square method regarding the types of A,B,O. Blood groups and rhesus factor were conducted at the $P < 0.01$ and $P < 0.05$ significance

level, Degrees of freedom = 3 and 1 according to the following equation.

$$X^2 = \sum \frac{(O - E)^2}{E}$$

O=Observed number

E=Expected number

∑= Summation,

X^2 =chi-square

Degrees of freedom = the number of samples – 1

RESULT

The data of total 100 beta-thalassemia patients was enrolled in the study. The age of patients ranged from 1 ≤ year to 45 years old. Depending to (Table 1), number of male patients was lower than female patients. Out of total 100, 46% (n=46) male patients and 54% (n=54) were female patients. This study showed that the age group 15-19 years, which included 100 thalassemia patients 30% (n=30), was the largest group. The older age groups, included less number of patients than younger age groups, 3% (n=3),patients were in age group of 1 ≤ years, 5% (n=5), patients were in age group of 1-4 years,9% (n=9), patients were in age group of 5-9 years, 18% (n=18), patients were in age group of 10-14 years,21% (n=21), patients were in age group of 20-44 years, 11% (n=11).

Table 2 shows that of ABO blood groups in thalassemia patients compared with control the presence of significant differences in the ABO blood groups between the two samples at a probability value less than 0.05 if the calculated chi-square value is 9.01 and it is higher than the tabular chi-square value (7.815) Degrees of freedom (3).

Table 1. Distribution of thalassemia patients, depending to gender, age.

Variables	No=100			%
Gender				
Females	54			54
Male	46			46
Age (year)				
	Female	Male	Total	
1 ≤	3	2	5	5
1-4	6	3	9	9
5-9	8	10	18	18
10-14	12	9	21	21
15-19	18	12	30	30
20-44	6	5	11	11
45≥	1	2	3	3
Total	54	46	100	

The results showed a significant increase of blood type a- in thalassemia patients 32% compared to the control sample 17%. The recurrence rate of blood type B was 29% in thalassemia patients compared to control sample 25%, and blood type B was 13% in the sample of patients compared to 11% in the control sample, and the O blood type was 45% in the sample of patients compared to 28% in the control sample. Fig. 1.

The results shown in the table 3 when comparing the frequency of the Rhesus blood group in the sample of thalassemia patients compared with the control sample, there was a significant difference between the two mentioned samples and at the value of P < 0.01 if the calculated chi-square value 7.303 compared with Calculated chi-square value 6.635 at the degree of freedom of 1.

Table 2. blood group distribution of thalassemia patients and control sample.

Total	A		B		AB		O		Blood Groups	Sample
	expected	observed	expected	observed	expected	observed	expected	observed		
100	24.5	32	27	29	12	13	36.5	45		Patients No =100
100	24.5	17	27	25	12	11	36.5	28		Control No=100
200	49		54		24		73			Total

$\sum X^2 = 9.01$

Calculated chi-square value =7.815

Degrees of freedom = 3

Significance level = (P < 0.05)

Table 3. Rhesus factor distribution of thalassemia patients and control sample.

Total	Rh $^{-}$		Rh $^{+}$		Rh Group
	expected	observed	expected	observed	Sample
100	11	7	89	93	Patients No =100
100	8.40	15	15	85	Control No =100
200	22		178		Total

$\sum x^2 = 7.303$

Calculated chi-square value = 6.635

Degrees of freedom = 1

Significance level = ($P < 0.01$)

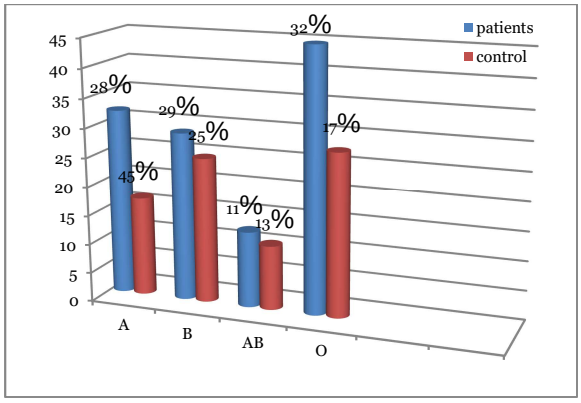

Fig. 1. The percentage of blood group distribution in thalassemia patients compare with control sample.

It was observed that there was a significant decrease in the Rh- in the sample of patients with thalassemia 7% compared to the rate of recurrence of the same phenotype in the control sample 15%while Rh+ in the sample of patients with thalassemia 93% compared to the rate of recurrence of the same phenotype in the control sample 85% Fig.2.

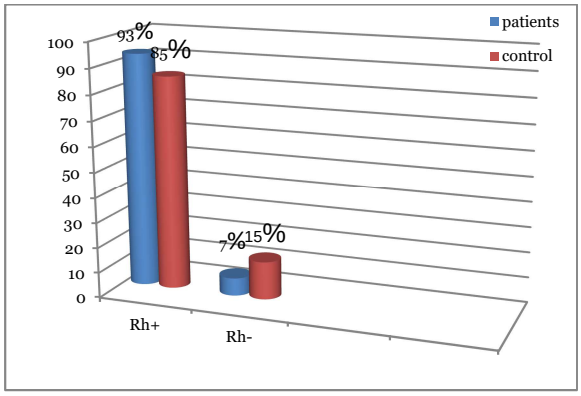

Fig. 2. The percentages of the presence of Rhesus factor in Thalassemia patients and their control sample.

Discussion

Beta- thalassemia is a genetically inherited illness that is a major public health concern in Iraq. Consanguineous mating is widespread in Iraq, which contributes to the high prevalence of thalassemia in Iraq. Patients with thalassemia have periodic blood transfusions to avoid anemia; nonetheless, the recurring problems may develop difficulties. As a result of these complications, there is a substantial mortality rate.

In our study, thalassemia patients were showed age group 15-19 years 30%, which included 100 thalassemia patients, was the largest group. This is consistent with already published data found in study Ahmed (2016) that younger children up to 12 year old were higher 60.3% than older 39 years old 39.7%. be due to decreased The possible interpretation of higher percentage of lower age group patients might be due to the fact that complications arise at the older age due to repeated transfusions**.**

Results are in agreement with the study Laghari *et al.* (2018) has in indicated that blood type O is the most common among thalassemia patients compared to the control sample in the central region of Saudi Arabia. Also Marbut *et al.* (2018]) has indicated that blood type O is the most common among thalassemia patients compared to the control sample in study Sinha, *et al. (2017*) but AL-Assadi (2007) no significant differences were found for the blood group ABO when compared with the standard sample Canatan *et al.* (2003).

The reason for the significant difference is attributed to the decrease in the Rh- phenotype in patients by 7% compared to 15% in the control sample, which indicates that the above phenotype is resistant to thalassemia.

The above result is consistent with the study Laghari *et al. (*2018) and Sinha *et al. (*2017).while he did not reach Canatan *et al. (*2003) there are significant differences in the Rh blood group between thalassemia patients and the control sample, and this difference differs with our results.

Conclusion

The present study indicates that a higher prevalence of female patients than male patients. Significant difference was found in the distribution of ABO blood groups thalassemia patients. Thalassemia patients have a significantly higher frequency of Rh positive, especially O. Our study was generally and apparently consistent with studies in other regions it showed statistically significant correlation with other studies. This study will aid in the development of public health policy.

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