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ORIGINAL ARTICLE

SCREENING FOR B-THALASSEMIA CARRIERS AMONG STUDENTS IN SECONDARY SCHOOL FAQUOS, SHARKIA.

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ABSTRACT

***Background*:** Beta-thalassemia represents a major public health problem in Egypt. The carrier rate varies between 5.5% to ≥ 9%.Unfortunately, most patients suffer from complications of blood transfusions, mainly transfusion transmitted viral infections and iron overload. Prevention by carrier detection and prenatal diagnosis is needed in populations with high incidence of the disease, such as Egypt. This study aimed at identifying thalassemia carriers among secondary school children in Faquos city, EL-Sharkia Governorate to be taken in consideration of prevention program of β-thalassemia and to update carrier rate data in EL-Sharkia Governorate.

Methods: This was a prospective cross-sectional study conducted on 350 se condary school students in Faquos, Sharkia Governorate. All subjects were subjected to the following: Complete blood count, Serum ferritin level, Serum iron level, total iron binding capacity(TIBC). Subjects with microcytic anemia were subjected to specific laboratory tests: High Performance Liquid Chromatography(HPLC) which include hemoglobin A2(HbA2).

Results: Headache and pallor were the most common findings in all studied subjects.Investigations of all studied subjects (350) revealed that 200 (57.14%) subjects were non anemic , 150 (42.86 %) subjects were anemic. Among anemic group , 45 (12.85%) subjects had normocytic anemia and 105 (30%) subjects had microcytic anemia. Beta-thalassemia carrier rate was 10% among all the studied group. Beta-thalassemia carrier rate was 33.3% among microcytic anemia group.There was significant decrease in the mean value of red blood cells count, hemoglobin, hematocrite, mean corpuscular volume and mean cell hemoglobin in B-thalassaemia carriers compared to non-carriers among microcytic anemia group.There was a significant increase in hemoglobin A_2 level in β-thalassemia carrier group compared to non-carrier group among microcytic anemia group.

Conclusion: Carrier rate among secondary school students in Faquos ,Sharkia Governorate was 10%.Hemoglobin A2 is the gold standard for B-thalassemia carrier screening.

Key words: Beta-thalassemia; Microcytic hypochromic anemia; Screening; B-Thalassemia Carrier

INTRODUCTION

Beta thalassemia is an autosomal recessive blood disorder caused by reducing or absent synthesis of the beta chains of hemoglobin that result in variable outcomes ranging from severe anemia to clinically asymptomatic individuals [1] .

Beta-thalassemia is caused by any of more than 200 mutations that affect different levels of the beta-globin gene expression by a variety of mechanisms [2].

Beta thalassemia trait (carrier) may has mild anemia that must be differentiated from iron

deficiency anemia to avoid unnecessary iron therapy and for the prevention of thalassemia major by genetic counseling **[3].**

"Screening" is distinct from "definitive" diagnosis in that the purpose of screening is to test for a defined set of conditions using simple biochemical tests. Screening programmers are designed using a protocol of first and second line methods in order to obtain a reliable diagnosis, which is essentially a presumptive diagnosis. If an unequivocal, definitive diagnosis is required, characterization methods based on either protein or DNA analysis must be utilized [4].

Many successful premarital and antenatal screening programmes of beta thalassemia carriers were achieved in many countries all over the world. In Montreal, Canada, no one screened has given birth to an affected child, that has caused a 95% decrease in the incidence of β-thalassaemia in that region [5] . A mandatory screening programme started in Cyprus in the early 1980s, lead to no affected births between 2002 and 2007 **[6].**

The aim of this work is to identify thalassemia carriers among secondary school children in Faquos city, EL-Sharkia Governorate to be taken in consideration of prevention program of β-thalassemia and to update carrier rate data in EL-Sharkia Governorate.

Methods

This cross sectional study which carried on 350 secondary school students from Faquos city , Al Sharkia governorate , (155 female&195 male) aged from 15-18 years during the period from September 2016 to September 2017.

Inclusion criteria: Students were randomly selected from secondary school students in Faquos city , Al Sharkia Governorate, both sex are included, aged from 15 to 18 years and the participants had no previous history suggesting hematological diseases.

Exclusion criteria: Students with history of chronic renal disease and chronic liver disease, students who are known to have hemoglobinopathies, students with other hemolytic diseases and students who refuse to participate in the study.

Methods: All cases were studied by careful history taking regarding: personal history, history of present illness, past history of diseases, operations & medications, personal and family history.

Clinical examination were done including general examination as heart rate, blood pressure, respiratory rate or pallor.

Laboratory Tests:

Complete Blood Count: The key components of the complete blood count include: hemoglobin, red blood cells count, mean corpuscular volume (MCV) and red cell distribution width (RDW). The thalassemia is generally classified as hypochromic microcytic anemia; hence the mean corpuscular volume is a key diagnostic indicator. In most population screening programs such as hemoglobin of less than 11(according to the age of secondary school children) , mean corpuscular volume of less than 80 femtoliter and or mean cell hemoglobin of less than 27 picogram are generally used as cut off points for further screening .

Hemoglobin A2 Estimation: Raised hemoglobin A2 level is the gold standard for diagnosis of thalassemia trait. Subjects were found to be positive to preliminary screening tests by red cell indices were confirmed for carrier state by HbA2 measurement using the haemglobin analyzer ARKRAY ADAMS A1C HA-8180T (Japan) device.

Serum iron level by automated analyzer; normal range 70-200µg/dl.

Total iron binding capacity (TIBC) by automated analyzer; normal range 250-435µg/dl.

Serum ferritin: using Tosoh AIA1800ST (Japan) immunoassay analyzer. Ferritin in circulation, as measured in serum levels is satisfactory index of body iron storage.

All tests were performed in pediatrics and clinical pathology departments, Zagazig University. Written informed consent was obtained from all participants. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Ethical considerations:

The study was done after approval from the ethical committee of research center in Zagazig University and an informed written parental consent obtained from every subject who participated in this research. The study was also approved from the ministry of Education in Al-Sharkia Governorate.

Statistical analysis: Once the data was collected, a code sheet was developed. Organization, tabulation, presentation and analysis of data were performed using SPSS V21 (Statistical Package for Social Studies version 21). Qualitative data was described using number and percent. Quantitative data was presented as mean, range and standard deviation (SD). Parametric tests were applied for normally distributed data. Correlations were done by using Pearson's correlation coefficient for normally distributed variables value. Comparison between groups was done using Chi-square test for qualitative variable.

RESULTS

The age of the studied group ranged from 16 to 18 years with mean 17.06 years. Regarding sex 55.7% of them were male and 44.3% were females as shown in table (1). Headache was the most common symptom and pallor also was the most common sign in all studied subjects as shown in table (2). The results of complete blood count testing of all studied subjects revealed that 200 (57.14%) subjects were non anemic , 150 (42.85 **%)** subjects were anemic, 45 (12.85%) subjects of them had normocytic anemia and 105 (30%) subjects had microcytic anemia. Among microcytic anemia group, B-thalassemia carrier group (with HbA2>3.5) were 35 subjects (10%) and non thalassemia carrier group (with HbA2<3.5) were 70 subjects (20%) as shown in table (3). There was 10% of the studied group were thalassemia carriers and 90% were not carriers as shown in table (4).There was 33.3% of the microcytic anemia group were thalassemia carriers and 66.7% were non-carriers as shown in table (5). There was statistical significance differences between thalassemia carrier and non carrier in age and regarding sex there was statistical significance increase in frequency of male among thalassemia carriers. Family history was positive among 60% of thalassemia carriers as shown in table (6).There was statistical significance differences between thalassemia carrier and non carrier in regarding sex and there was statistical significance increase in frequency of male among thalassemia carriers. Family history was positive among 60% of thalassemia carriers as shown in table (7)**.**

***Table 1: Demographic data of the studied* subjects.**

Variable	(*n*=350)	
Age : (year) *Mean ± SD* *Range*	17.06± .677 16 – 18	
Variable	**No**	**%**
Sex: *Female* *Male*	 155 195	 44.3 55.7

Sd: Stander deviation

Table 2: Clinical data of all studied subjects

Symptoms		N	%
Palpitation	**Yes**	49	14.0
	No	301	86.0
Headache	**Yes**	84	24.0
	No	266	76.0
Easy fatigability	**Yes**	63	18.0
	No	287	82.0
Signs		**N**	**%**
Pallor	**Yes**	35	10.0
	No	315	90.0
Tachycardia	**Yes**	28	8.0
	No	322	92.0

Table 3: Classification of all the studied subjects according to Hemoglobin level and Mean Corpuscular Volume and HbA_2..

Total (n=350)			
Non anemic (n=200)	**Anemic (n=150) 42.85 %**		
200 (57.14%)	**Normocytic anemia MCV >80fl n=45 (12.85%)**	**Microcytic anemia MCV <80 fl n=105 (30%)**	
		Carrier HBA2 >3.5%	**Non Carrier** HBA2<3.5%
		n=35(10%)	n=70(20%)

Table 4: Prevalence of B-Thalassemia carrier among all the studied subjects

Variable	(*n*=350)	
	No	%
Diagnosis:		
Non Thalassemia carrier	315	90
Thalassemia Carrier (HbA2 >3.5)	35	10

Table 5: Prevalence of thalassemia carrier among microcytic anemic subjects

Variable	(*n*=105)	
	No	%
Non-carrier *(HbA2<3.5)*	70	66.7
Carrier *(HbA2 >3.5)*	35	33.3
Total	105	100.0

Table 6: Difference between thalassemia carrier and non-carrier among all the studied group according to Demographic data:

Variable	Non carrier (*n*=315)		Carrier (n=35)		t	P
Age : (year)						
Mean ± SD	17.09± .695		16.80± .406		**2.41**	**.016**
Range	16 - 18		16 – 17			
Variable	**No**	**%**	**No**	**%**	χ^2	**P**
Sex:					3.89	.049
Male	181	57.5	14	40		
Female	134	42.5	21	60		
family history:					142.87	.000
yes	7	2.2	21	60		
no	308	97.8	14	40		

Sd: Stander deviation t: Independent t test χ^2: Chi square test
NS: Non significant (P>0.05) **: Highly significant (P<0.01)

Table 7: Difference between thalassemia carrier and non-carrier among all the studied group according to Demographic data:

Variable	Non carrier (*n*=315)		Carrier (n=35)		T	P
Age : (year)						
Mean ± SD	17.09± .695		16.80± .406		**2.41**	**.016**
Range	16 - 18		16 – 17			
Variable	**No**	**%**	**No**	**%**	χ^2	**P**
Sex:					3.89	.049
Male	181	57.5	14	40		
Female	134	42.5	21	60		
family history:					142.87	.000
yes	7	2.2	21	60		
no	308	97.8	14	40		

Sd: Stander deviation t: Independent t test χ^2: Chi square test
NS: Non significant (P>0.05) **: Highly significant (P<0.01)

DISCUSSION

Thalassemia was recognized as the most prevalent hereditary disorder all over the world with a significant negative impact on public health and the society especially endemic areas [7].

Community screening was an important component of identifying carriers in the country. Whether carrier screening should be done at school or college level, before or after marriage or during pregnancy is debatable [8].

This study aimed to identify Thalassemia carriers among secondary school children in Faquos, EL-Sharkia Governorate to be taken in consideration of prevention program of β-thalassemia and to update carrier rate data in EL-Sharkia Governorate.
The results of complete blood count testing of all studied subjects revealed that 200 (57.14%) subjects were non anemic , 150 (42.86 %) subjects were anemic. Among anemic group , 45 (12.85%) subjects had normocytic anemia and 105 (30%) subjects had microcytic anemia.
Also these results were in agreement with **Tayel and Ezzat [9]** who reported that anemia was prevalent among young adolescents in Alexandria, Egypt. The findings showed that 27.4% of the studied adolescents were anemic and incidence of anemia was higher (38.1%) among students from governmental schools.
This study showed that 10% of the studied group were thalassemia carriers.This was considered a higher percent in comparison to other studies.
In a screening done in UAE in 2013 they reported that the frequency of β-thalassemia carrier was 4.56% (n = 293) among the 6,420 UAE nationals screened through Premarital Screening Program **[10]**.
This agreed with **Jameela et al. [3] and Khatak et al.** [11] who found that prevalence of thalassemia carrier among the screened microcytic anemia group was 25% and 26.5 % respectively .
Also, these results in accordance with **Sharma et al.[12]** who found that prevalence of thalassemia carrier among the screened microcytic anemia group was 25% and 27 %.
The carrier rate of this disease varies between 5.3% and ≥9%. It was estimated that 1,000/1.5 million per year live birth born with thalassemia disease [13].
Prevention by carrier detection and prenatal diagnosis was needed in populations with high incidence of the disease. Several prevention programs have been applied in at risk populations in the Mediterranean areas**[14].**
A major outcome of thalassaemia carrier screening was a reduction in the incidence of thalassaemia. The other factors that can lead to a reduction in disease incidence were the prenatal diagnosis and use of reproductive technologies to prevent the births of affected children, as well as a decrease in marriages between carriers [15].
In Egypt, Beta-thalassemia created a social and financial burden for the patients' family and the Egyptian government. The high frequency of β-thalassemia carriers with increasing rate of newly born cases was a pressing reason for the importance to develop prevention program for β-thalassemia in Egypt [14].
In Pakistan carrier rate varies from 1 to 7 per cent [16].
Another study in Iran in (2008), was done to determine the frequency of beta-thalassemia trait among Moslem and Jewish population. Among Moslem subjects, 7.0% were diagnosed as carriers of beta-thalassemia minor, whereas no carriers were detected among Jewish subjects [17].
This study showed that there were no statistical significance differences between carrier and non carrier in age but there was statistical significance increase in frequency of male among carriers.

Limitations of the study

This study have significant limitations including the small sample size and that we were not able to cover more areas in Faquos city , Al Sharkia Governorate. Also we were not able to study different age goup due to limited age group of this study.

CONCLUSION

Carrier rate among 350 secondary school students in Faquos ,Sharkia Governorate was 10%.Hemoglobin A2 is the gold standard for B-Thalassemia carrier screening.

RECOMMENDATIONS

A universal approach of screening for -thalassemia trait should be included as a part of standard blood testing among secondary, college students, premarital and of the extended family of thalassemics **.**
Establishment of public health
awareness program for general population to educate them about importance of carrier screening as prevention is much better than treatment.

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