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Spectrum of Haemoglobinopathies in a Suburb of Indore (India): A Two Year Study

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Abstract

Hemoglobinopathiesare monogenic disorders of erythrocyte production. We present an observational study of 200 anaemic patients at a tertiary health care center presented over two years (January 2015 to December 2016). Sickle-thalassemia was the most common form of haemoglobinopathy (56.4%), followed by β-thalassemia carrier (16.6%), Sickle cell trait (15.3%) β-thalassemia (10.2%), & Sickle cell disease (1.28%), respectively. Almost equal incidence in male and female were found. The maximum number of cases came to attention in the age group of 6-15 years followed by those in the age group of 16-30 years.

Keywords: Haemoglobinopathy; Sickle Thalassemia; β-Thalassemia; β-Thalassemia Carrier.

Introduction

The term haemoglobinopathy encompasses a large number of genetic disorders which are mostly of interest to the academicians rather than the clinicians since they do little but add to the already available plethora of scientific jargon. The thalassemias comprise a diverse group of disorders and are broadly classified into α, β, δ-β and γ-δ-β thalassemias, depending on the globin chain(s), which are insufficiently synthesized [1]. Humans have 4α-globin genes on chromosome 16 and 2β-globin genes on chromosome 11, symptomatic α-thalassemia is rarer than β-thalassemia. In addition to the transfusion-dependent form of β-thalassemia, β-thalassemia major, there are milder conditions that may escape detection until adulthood. Because of their high frequency and severity, the β-thalassemias pose the most important public health problem.

These inherited disorders of haemoglobin synthesis are, therefore, an important cause of morbidity and mortality worldwide. They place a large burden on the patients, their families, and even their communities. They are generally not curable but can be prevented by population screening, genetic counseling, and prenatal diagnosis [2]. The present study was undertaken to evaluate the spectrum and pattern of haemoglobinopathies in a selected population of Indore-India.

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Material and Methods

A total of 200 individuals were recruited in this study. The samples were collected from Outdoor and Indoor patients of Index medical college- a tertiary care center from January 2015 to December 2016. They were clinically suffering from anemia and were referred to this hospital from the nearby surrounding regions.

The samples were analyzed in the Department of Pathology, Index Medical college, Hospital, and Research center Indore (MP).

Sample

About 2-3 ml intravenous blood samples were collected from each individual free of blood transfusions in EDTA (Ethylene Diamine Tetra Acetic Acid) vacutainers using disposable syringes and needles.

Haematological Analysis

The Sysmex XE-2100 system Haematology analyzer (Sysmex Corporation, Kobe, Japan) was used to determine peripheral cell count and red blood cell indices (RBC, Hb%, HCT, MCV, MCH, and MCHC) using standard procedure [3] that employed RF/DC detection method, hydrodynamic focusing, flow cytometry method and SLS-haemoglobin method.

Haemoglobin Electrophoresis

Haemoglobin Electrophoresis was carried out on fully automated GENIOS Elecctrophoresis machine-INTERLAB (Lilac) based on the process of migration of charged molecules through solutions in applied electric field wherein a charged particle moves towards the region of an opposite charge.When the particle has unequal charge distribution in the chemical bonds, it aligns on the electric potential.

Results

Out of 200 cases, 122 (61%) cases were found normal and 78 (39%) had one or the other form of haemoglobinopathies. Out of 78 abnormal cases, 37 (48.2%) were males and 41 (52.8%) were females, which amounts to the almost equal incidence in male and female.

Table 1 represents the spectrum of haemoglobinopathies encountered during this period and Figure 1depicts the electropherograms of different types of haemoglobinopathies.

It is important to note here that Sickle-thalassemia was the most common form of haemoglobinopathy (56.4%), followed by β-thalassemia carrier (16.6%), Sickle cell trait (15.3%) β-thalassemia (10.2%), & Sickle cell disease (1.28%), respectively.

Table 1:

Total No of Abnormal Hbpathies	Sickle-thalassemia	β-thalassemia carrier	Sickle cell trait	β-thalassemia	Sickle cell disease
N=78 (100%)	44 (56.4%)	13(16.6%)	12(15.3%)	08(10.2%)	01(1.28%)

Fig. 1: Electropherograms Showing Different Types of Haemoglobinopathies

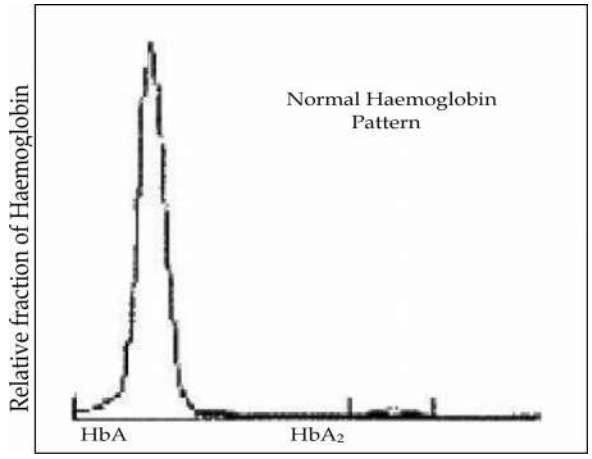

Fig. 1A: Figure showing normal haemoglobin pattern

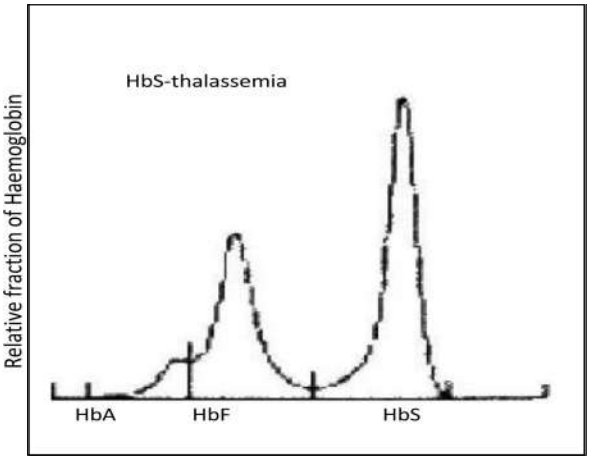

Fig. 1B: Showing increased HbS, increased HbF and decreased HbA

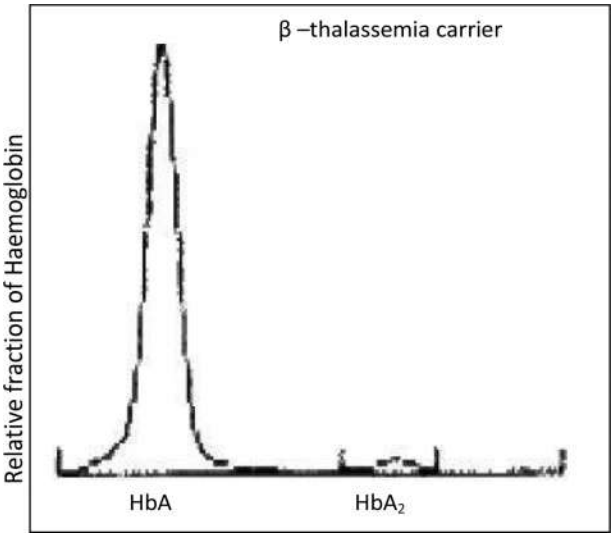

Fig. 1C: Showing increased HbA_2

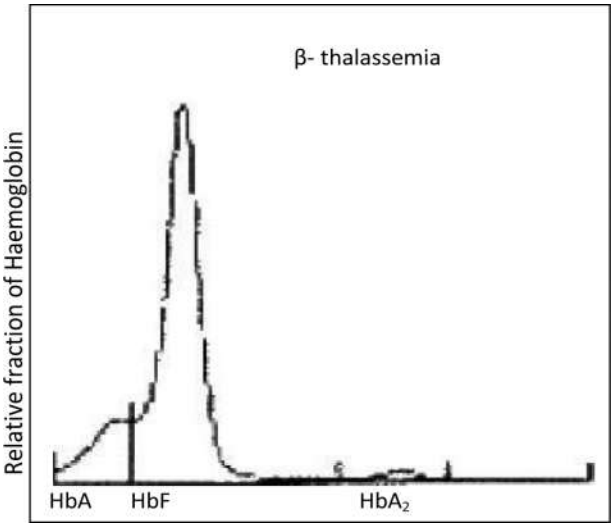

Fig. 1E: Showing decreased HbA, increased HbF and increased HbA_2

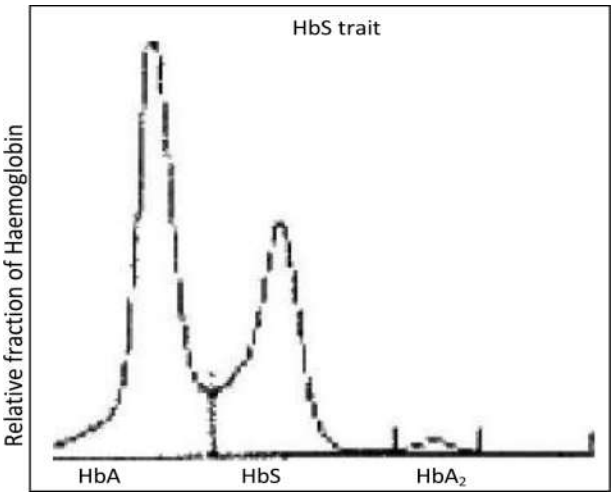

Fig. 1D: Showing increasedHbS, increased HbA_2

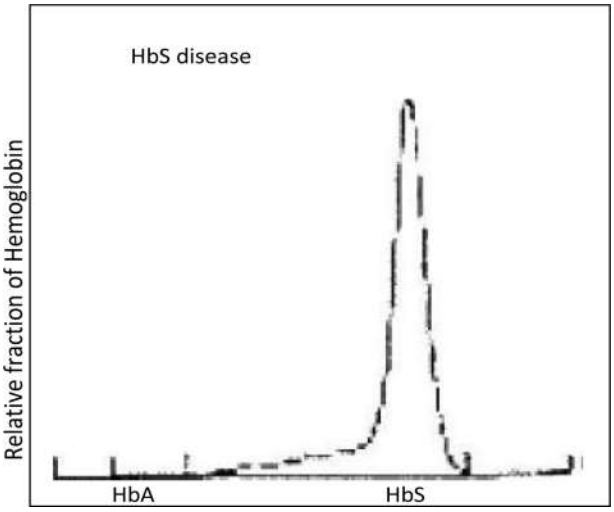

Fig. 1F: Showing increased HbS and absent HbA

Table 2: Showing the distribution of various haemoglobinopathies according to age

S. No	Age Groups	Sickle-Thal (N=44)	Thalassemia carrier(N=13)	Sickle Trait (N=12)	Beta Thalassemia (N=08)	Sickle disease (N=01)
1	Upto 5 years	11	02	03	01	Nil
2.	6-15 years	17	02	04	06	01
3.	16-30 years	13	05	03	01	Nil
4	>30 years	03	04	02	Nil	Nil

As shown in Table 2 Maximum number of cases came to attention in the age group of 6-15 years (N=30) followed by those in the age group of 16-30 years (N=22).

Table 3: Showing severity of anaemia in various haemoglobinopathies

S. No	Severity of Anaemia	Hemoglobinopathy
1.	Severe	β- thalassemia
2.	Severe	Sickle cell disease
3.	Moderate	Sickle-thalassemia
4.	Mild	Sickle cell trait
5.	Mild	β- thalassemia carrier

Discussion

The term haemoglobinopathy encompass a large number of genetic disorders which has worldwide prevalence extending from the Indian subcontinent, Mediterranean zone, Middle east and part of southeast Asia [4]. In India, most of the states are showing epidemic outbreaks. It is more common in the tribal population of India. For the prevention of disease, the detection of carrier and awareness among the people are very necessary. The treatment part is blood transfusion and iron chelating agents.

Our study was conducted on 200 individuals referred to Index Medical College a tertiary care centerbetween January 2015 to December 2016. Among the 200 cases, 61% were found to be normal and 39% had one or other form of haemoglobinopathies. Out of 78 abnormal cases, almost equal incidence in males 48.2% and females 51.8% was observed. Most common haemoglobinopathies observed were sickle thalassemia (56.4%) followed by β thalassemia carrier (16.6 %), sickle cell trait (15.3%), β thalassemia (10.2 %), sickle cell disease (1.28%) (Table 1). Several other studies also have documented such type of frequency of haemoglobinopathy [5-8].

The onset of disease was most prominent in (6-15) years of age, followed by (16-30) years than (0–5)years and more than 30 years of age (Table 2). All haemoglobinopathies on peripheral smear exhibited microcytic hypochromic anemia.

Sickle thalassemia was detected in 56.4% of the total cases. Patient's belonging to this group were moderately anemic. On electrophoresis they showed the increased HBS, increasedHbF and decreased HbA (Figure 1).

β thalassemia carrier was detected in 16.6% of the total cases. Patients had mild anemia with decreased total Hb and HbA compared to the normal person. On Electrophoresis showing a slight increase in HbA2 (Figure 1). Since the patients inherit one gene of β thalassemia they are either asymptomatic or developed mild anemia.

Sickle cell trait was detected 15.3% of total cases. It is a heterozygotic condition where either one HbD or S chain is combined with one normal β chain. Both D and S are variants of beta chain, in which a single amino acid is replaced. In HbS the beta subunit has the amino acid valine at position 6 instead of glutamic acid, whereas in HbD glutamine replaces glutamic acid at 121 positions on beta chain. Patients belonging to this group were mild anemic. Electrophoresis revealed increased HbS, increased HbA (Figure 1). The carrier frequency of the sickle gene is cited as 1 in 10 in the USA and may be higher in Canada where the black population is composed largely of individuals of the Caribbean and African origin [9].

β thalassemia was detected in 10.2% of the overall study group. Patient's belonging to this group were severely anemic. Electrophoresis revealed decreasedHbA and increase HbFand increased HbA2 (Figure 1). This finding is similar to another study by Pootrakui et al [10].

Sickle cell disease was detected 1.28% of the total cases. Patients belonging to this group were severely anemic.Electrophoresis revealed increased HbSand HbA absent (Figure 1). Sickle cell disease is most common in people of African ancestry and tribal people of India. HbS, on the other hand, occurs mainly in Northeast India, Pakistan and Iran [11].

Conclusion

It is our conclusion that Sickle- thalassemia combination hemoglobinopathy isthe most commonly encountered type in our area.High index of suspicion in anaemic subjects especially between 6-15 years of age is the most important factor for curbingthis condition by early detection followed by genetic counselling and prenatal diagnosis in subsequent pregnancies.Larger studies spread over a wide geographical area should also be undertaken.

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