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Hemoglobinopathy in pediatric population: A cross sectional study at tertiary care center in Assam

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ABSTRACT

Objectives: The objectives of the study were to find out the prevalence, epidemiology, and clinicohematological profile of hemoglobinopathies.

Material and Methods: During the period of September 2010–August 2011, an observational study was done in the Department of Pediatrics, Assam Medical College and Hospital, Dibrugarh. Children (<12 years) suffering from chronic anemia were the study population.

Results: Hemoglobinopathies were noted in 72 (35.0%) out of 206 chronic anemia cases, of which sickle cell disease (SCD) was found in 23 cases (11.2%), beta-thalassemia major (BTM) in 21 cases (10.2%), hemoglobin E (HbE)-β thalassemia in 12 cases (5.8%), HbE disease was seen in 10 cases (4.8%), and HbE trait and sickle cell trait (SCT) in 3 cases each. Overall hemoglobinopathy was most commonly seen among teagarden community in Assam. Clinical presentation ranged from completely asymptomatic to congestive heart failure. In majority cases, decreased mean Hb (%) and mean corpuscular volume were found. Anisopoikilocytosis, reticulocytosis, and target cells were frequently noted in peripheral blood smear.

Conclusion: Chronic anemia cases should be screened for hemoglobinopathies as these genetic disorders are commonly seen in Assam. SCD and BTM are the major types of hemoglobinopathies. Heterozygous hemoglobinopathies (HbE trait and SCT) had lesser clinical manifestations. As the definitive treatment of hemoglobinopathies is still difficult to avail in this region, genetic counseling should be considered for hemoglobinopathy patients and their families as well, to prevent new cases.

Keywords: Hemoglobinopathies, Hemoglobin E-β thalassemia, Hemoglobin, Pediatric, Sickle cell disease

INTRODUCTION

Anemia is a major health problem in pediatric populations of India. In a study from South India, the prevalence of anemia in school-going children (6–12 years) was found to be 53.6%.[1] The prevalence of anemia among 6–59-month-old children in India is 58.6% whereas it is 35.7% in Assam as per NFHS-4 data. Many factors are responsible for childhood anemia, for example, undernutrition, iron and vitamin deficiency, tuberculosis, HIV, chronic infections, malaria, etc. With the advancement in diagnosis and public health management through different ongoing national health programs, congenital hemolytic anemia has come to the forefront as predominant cause of anemia in children.

Inherited disorders of hemoglobin (Hb) are the most common genetic disorders with 7% of the world population being carriers but their frequency and distribution varies among different racial and ethnic groups.[2]

MATERIAL AND METHODS

This study was carried out in the Pediatric Department of Assam Medical College Hospital, Dibrugarh. Children aged up to 12 years were recruited during the period of September 2010–August 2011.

Inclusion criteria

Both inpatient and outpatient children with chronic anemia were included in the study.

Exclusion criteria

Children who had received blood transfusion within the past 4 months of recruitment were excluded from the study.

A pro forma was prepared for recording patient's identification, particulars, presenting complains, general and systemic examination, anthropometric measurements, and relevant laboratory investigations.

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Blood was collected for the following tests:

1. Complete hemogram
2. Sickling test
3. Reticulocyte count
4. High-performance liquid chromatography (HPLC) for Hb fractions.

RESULTS

In our study, 206 children suffering from chronic anemia formed the study population. Of which, 72 cases (35.0 %) were found to have hemoglobinopathies by HPLC.

The prevalence of individual hemoglobinopathies was as follows, sickle cell anemia disease (SCD) was found in 23 cases (11.2%), beta-thalassemia major (BTM) in 21 cases (10.2%), HbE-β thalassemia 12 cases (5.8%), HbE disease in 10 cases (4.8%), and HbE trait and sickle cell trait (SCT) in 3 cases each (1.5% each).

We found a male preponderance in general, female preponderance among HbE trait and no sex difference was found in cases of HbE disease.

Age distribution showed that the youngest case was a 7-month-old boy suffering from BTM and the oldest was an 11-year-old girl with HbE trait. Mean age was 6.76 years.

Overall incidence of hemoglobinopathies was highest in teagarden community 40 (55.6%), followed by Ahom 14 (19.44%). Among different hemoglobinopathies, HbE was mostly found in Ahom community and Hb S in tea garden community [Table 1].

In addition to anemia, splenomegaly (i.e., >4 cm) was a predominant clinical features of BTM, SCD, and cases of HbE-beta-thalassemia [Table 2].

Laboratory investigations revealed mean Hb of 5.74 g/dl for all hemoglobinopathies. Lowest Hb was 1.3 g/dl in case of BTM. Mean corpuscular volume (MCV) was 71.7fl, mean corpuscular hemoglobin (MCH) was 23.2 pg, and red cell diameter width (RDW) was 23.8 [Table 3].

HPLC showed that mean level of Hb A was 8.7%, Hb A2 was 20.65%, and Hb F was 40.3%.

Few patients had clinical presentations other than anemia (febrile convulsion, pneumonia, etc.) where laboratory features indicated hemolysis. The diagnosis was confirmed by HPLC.

DISCUSSION

Assam has a mixed population with an ethnic link of Southeast Asia, Aryans, immigrant Oryahs comprising the tea garden laborers, migrating population from other states, Bengalis.[3]

In our study, the prevalence of hemoglobinopathies was almost 35.0% while the study by Warghade *et al*. for abnormal Hb had shown a rate of 18.44% and Sanghavi *et al*. as 27%.[4,5] In the study by Warghade *et al*., a large population (n = 65779) from all over India of all age groups was screened to identify Hb fractions prevalent in India whereas our study incorporated a small number (n = 206) of sick children, specifically suffering from chronic anemia and resident of a state which is a known reservoir for hemoglobinopathies. The prevalence of abnormal Hb variants was 59.11%, as seen by Baruah *et al*. in his laboratory-based study involving all age groups from Assam.[6] In another study by Kalita *et al*. involving 100 individuals of all age groups, prevalence was 55%.[7] Borah *et al*. from Gauhati Medical College showed prevalence of hemoglobinopathies as 67.46% in a hospital-based study.[8]

A male preponderance was noted in our study as well as by Sanghavi *et al*. – 61% and 59.2%, respectively.[5]

In the all India study by Warghade *et al*., most prevalent hemoglobinopathy was found to be beta-thalassemia trait(11.2%).[4] Various researchers from Assam have reported HbE trait as most prevalent (varying from 20% to 55%) hemoglobinopathy followed by HbE disease.[6,7,9] Different states of the Northeastern region show a variable incidence of HbE varying from 16.2% to 47.3%.[9-12] At the same time, huge migrant tea garden population shows a high incidence of HbS in this part of India.[13,14] In our study, sickle cell anemia was the most prevalent hemoglobinopathy (11.2%) whereas HbE disease had a prevalence of 4.8%. In the study by Sanghavi *et al*., most prevalent hemoglobinopathy was sickle cell anemia.[5]

Kalita *et al*. have reported Ahom community as most commonly affected whereas in our study, hemoglobinopathies were mostly noted among tea garden workers.[7]

This variation of the prevalence of hemoglobinopathies (total and individual) in different studies actually reflects the fact that hemoglobinopathy is a genetic disorder which is clustered among few particular communities and also the Indian practice of marriages into same community. In our study, tea garden community was predominant, as our hospital was the main referral center for tea garden hospitals. Tea garden community consists of tribal population, originally from Orissa, Chotanagpur, Andhra Pradesh, and Jharkhand where HbS gene is more common than others.[3,15]

In the hematological parameters, we found that mean Hb for BTM and SCD was 5.3 ± 0.7 g/dl and 6.0 ± 0.0 g/dl, respectively. Sanghavi et al. reported quite similar values for mean Hb of 6.28 ± 1.75 g/dl and 6.5 ± 1.7 g/dl, respectively, for BTM and SCD. Our values of MCV and MCH regarding BTM tally with those of Sanghavi *et al*. but these RBC

Table 1: Distribution of cases by caste and community.

Hemoglobinopathies	Communities							
	Ahom (%)	Chutia (%)	Bengali Hindu (%)	Teagarden (%)	Muslim (%)	Kayastha (%)	Nepali (%)	Sonowal-Kachari (%)
Total=72	14 (19.6)	2 (2.8)	3 (4.1)	40 (55.6)	3 (4.1)	4 (5.6)	3 (4.1)	3 (4.1)
HbE disease	4 (5.6)	1 (1.4)	0	2 (2.8)	1 (1.4)	0	0	2 (2.8)
HbE trait	2 (2.8)	1 (1.4)	0	0	0	0	0	0
HbE-β-thalassemia	4 (5.6)	0	0	3 (4.2)	2 (2.8)	1 (1.4)	1 (1.4)	1 (1.4)
β-thalassemia major	4 (5.6)	0	2 (2.8)	11 (15.2)	0	2 (2.8)	2 (2.8)	0
Sickle cell disease	0	0	1 (1.4)	21 (29.2)	0	1 (1.4)	0	0
Sickle cell trait	0	0	0	3 (4.2)	0	0	0	0

HbE: Hemoglobin E

Table 2: Clinical signs and symptoms in different hemoglobinopathies.

Signs-symptoms anthropometry	Sickle cell disease		Sickle cell trait		HbE disease		HbE trait		HbE-beta-thalassemia		Beta-thalassemia major	
	Total cases=23		Total cases=3		Total cases=10		Total cases=3		Total cases=12		Total cases=21	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Pallor	18	78.3	2	66.7	9	90	3	100	12	100	21	100
Generalized weakness	23	100	2	66.7	7	70	0	0	11	91.6	21	100
Hemolytic facies	7	30.4	0	0	3	30	0	0	9	75	16	76.2
Jaundice	15	65.2	1	33.3	5	50	0	0	3	25	11	52.4
Joint pain	7	30.4	2	66.7	0	0	0	0	0	0	0	0
Pedal edema	1	4.34	0	0	1	10	0	0	1	8.3	2	9.52
Hepatomegaly	23	100	2	66.7	3	30	0	0	10	83.3	19	90.4
Congestive heart failure	1	4.34	0	0	0	0	0	0	1	8.3	1	4.75
Splenomegaly	23	100	0	0	7	70	0	0	11	91.6	21	100
Stunted	7	30.4	0	0	0	0	0	0	7	58.3	17	80.9
Wasted	14	60.8	3	100	5	50	0	0	11	91.6	19	90.4

HbE: Hemoglobin E

Table 3: Hb fractions and RBC indices in various hemoglobinopathies.

HPLC diagnosis	No.	Hb (g/dl)	RBC ($/10^{12}$/L)	MCV (fl)	MCH (pg)	MCHC (g/dl)	RDW	HbA%	HbA2/E%	HbF%	HbS%
		±SD	±SD	±SD	±SD	±SD	±SD	±SD	±SD	±SD	±SD
HbE disease	10	6.4±3.2	3.9±0.5	60.1±2.1	22.5±1.7	31.1±2.3	18.0±1.1	4.5±0.0	71.6±1.0	4.8±0.9	0±0
HbE trait	3	5.36±4.6	3.8±1.3	78.6±0.7	24.5±0.8	31.6±0.9	15.7±0.4	54.6±0.1	26.0±1.6	8.1±0.3	0±0
HbE-beta-thalassemia	12	5.8±1.1	3.7±0.7	67.1±4.2	20.8±2.7	29.6±3.4	26.3±1.4	3.8±0.2	38.2±1.0	50.5±6.3	0±0
Beta-thalassemia major	21	5.3±0.7	3.8±1.2	64.7±9.2	21.7±3.2	34.7±3.2	27.3±1.5	7.5±1.97	6.2±2.1	82.9±6.2	0±0
Sickle cell disease	23	6.0±0.0	4.2±0.0	81.3±8.5	25.1±3.2	29.1±1.5	22.9±2.0	2.5±1.3	3.4±0.5	20.4±0.1	70.9±1.6
Sickle cell trait	3	5.1±0.0	4.0±0.0	98.7±15.6	31.9±8.9	31.4±4.3	24.3±5.1	51.6±9.6	5.1±0.6	5.8±3.0	29.3±7.4

Hb: Hemoglobin, HbE: Hemoglobin E, RBC: Red blood cell, MCV: Mean corpuscular volume, MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration; RDW: Red cell diameter width, HbA: Hemoglobin A, HbA2: Hemoglobin A2, HbF: Hemoglobin F, HbS: Hemoglobin S, HPLC: High-performance liquid chromatography

parameters differ in case of SCD. HPLC findings in both BTM and SCD in our and as well as in the study by Sanghavi *et al*. are comparable.[5]

CONCLUSION

We could conclude that SCD is commonly found among migrant tea garden workers whereas HbE among native

population. Thalassemias, both homo and heterozygous were more severe than other varieties.

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Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Conflicts of interest

There are no conflicts of interest.

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