

ORIGINAL RESEARCH

A Study of Haemoglobin Types in Adolescents

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ABSTRACT

Introduction: Although haemoglobinopathies are recognized all over the world, their frequency and distribution among different racial and ethnic groups show some peculiar endemicity. For example, sickle cell haemoglobin is mostly confined to the people of tropical Africa, thalassaemia in Mediterranean region and haemoglobin E is frequently seen among people of South-East Asia. Aim of the study was to study the different haemoglobin types in adolescents and the relation, if any, between the different types of haemoglobin and haemoglobin level in blood.

Materials and Methods: 118 patients were studied in the study period. Co-relation between clinical findings, investigations and haemoglobin types were studied. It was a study of 118 patients, referred from various departments, presenting with different haemoglobin types between the study period of six months (March 2000 – Feb 2001) in the, Department of Physiology, Assam Medical College, Dibrugarh, Assam, India.

Results: The study showed that the abnormal variants of haemoglobin are common amongst the Hindus.

Conclusion: Abnormal haemoglobin types are fairly common genetic disorder among the different population groups of Assam, especially in Upper Assam.

Keywords: Haemoglobin, Blood, Disorder

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INTRODUCTION

Ever since the Dutch microscopist, Antony Von Leeuwenhock accurately described erythrocytes in 1674, the study of blood has been one of the most fascinating and fast advancing branch of Medicine.¹ The functional significance of red blood corpuscles was appreciated a bit later when Hoppe-Seyler demonstrated that haemoglobin has the property of readily taking up and discharging oxygen and more intensive research was focussed on haemoglobin.² Towards the later part of the 19th century E.Korber discovered a different type of haemoglobin from the umbilical cord of new born babies and thereby HbF came into focus. Search for other haemoglobin types continued and subsequently different disorders of haemoglobin synthesis were discovered. These disorders of haemoglobin otherwise known as haemoglobinopathies, constitute the commonest of genetic disorders and dates back to 1910 when Herrick first described “peculiar elongated and sickle shaped red corpuscles” in a case of severe anaemia. The identification of abnormal haemoglobin variants started in 1949 when Pauling et al showed the abnormality of haemoglobin structure in electrophoretic study. After several years, the use of filter paper electrophoresis by Spact in 1953, make it possible for the easy demonstration of abnormal haemoglobin in most of the haematological laboratories. Hb S is found to be more prevalent among some ethnic group of south, central and eastern India and among tea garden labourers of Assam.³ Sporadic cases of HbJ, HbK, HbL have also been reported from various parts of India. Hb D is found to be more frequent in Punjabis and Gujaratis. Hb E is more prevalent among some Assamese population of Mongoloid and Tibeto-Burman origin.⁴ Among Kacharis of Assam the gene frequency of Hb E has been found to be as high as 0.549 and is comparable to that found in some parts of South East India.⁵ About 439 such abnormal haemoglobins (Wintrobe, 1993) most being delta beta chain variants have been detected so far. According to the review World Health Organisation of working group (1982-83) about 240 million of heterozygotes and at least 0.2 million of homozygotes of haemoglobinopathies are born every year. The study has been undertaken with the following aim :- 1. To study the different haemoglobin types in adolescents. 2. To study the relation, if any between the different types of haemoglobin and the haemoglobin level in blood.

MATERIALS AND METHODS

Study population had a size of 118 patients, referred from various departments like surgery and ENT with age group between 9 – 19 years and the place of study was department of physiology, Assam Medical College, Dibrugarh, Assam, India. The time period was between march, 2000 to february, 2001.

Exclusion Criteria: There was no specific criteria for selection of subjects and blood was collected from subjects randomly.

RESULTS

In the present study, all total 118 cases were studied and it has been observed that of these cases, 81 cases had shown haemoglobin A/A i.e. the percentage of haemoglobin A/A was 68.64%. Haemoglobin A/E was found in 24 cases i.e. in 20.33% cases, haemoglobin E/E was found in 8 cases i.e. in 6.78% and both haemoglobin A/S and haemoglobin S/S were found in 2 cases i.e. 1.69% each, Haemoglobin E/F (E Thalassaemia) was found in only one case (.85%). These findings are shown in Table-1.

In the present study out of the total 118 cases, 65 cases were males and 53 cases were females. Of the 65 males, 49 cases (75.38%) were found to have haemoglobin A/A or the normal adult haemoglobin followed by 11 cases (16.92%) with haemoglobin A/E and 3 cases (4.62%) with haemoglobin E/E. Haemoglobin A/S and S/S were found in 1 case (1.54%) each. Findings are shown in Table-2.

In the present study, there were 109 Hindus and only 9 Muslims. It has been observed that the abnormal variants of haemoglobin are common amongst the Hindus. Out of the 109 Hindus, 73 cases had shown haemoglobin A/A, 23 cases had shown haemoglobin A/E, 8 cases had shown haemoglobin E/E, 2 cases each had shown haemoglobin A/S and S/S and 1 case had shown haemoglobin E/F (E thalassaemia). No comment can be given regarding Muslims as the number of cases were very few. Of the 9 Muslims, only 1 case had shown a haemoglobin E trait (Hb A/E) as shown in Table 3.

In the present study, majority of the cases belonged to Ahom Community. There were 31 Ahoms and of them 17 cases (54.84%) had shown haemoglobin A/A, 9 cases (29.03%) had shown haemoglobin A/E; 4 cases (12.90%) had shown haemoglobin E/E; and 1 case (3.23%) had shown haemoglobin E/F. There were 19 cases belonging to the Kachari Community. Kacharis showed a higher incidence of haemoglobin E disorders. There were 7 cases (36.84%) with haemoglobin A/E and 3 cases (15.79%) with haemoglobin A/S. Out of 15 cases belonging to tea-garden tribes, 10 cases (66.67%) had shown haemoglobin A/A.

Haemoglobin A/S and S/S were found in 2 cases (13.33%) each. Of the 3 Deori cases, 2 had shown haemoglobin A/E. Out of 9 Assamese Muslims, 1 had shown haemoglobin A/E while

others had shown haemoglobin A/A. All the above findings have been shown in Table 4.

Types	Hb A/A	Hb A/E	Hb E/E	Hb A/S	Hb S/S	Hb E/F	Total
No. of Cases	81	24	8	2	2	1	118
Percentage of Cases	68.64	20.33	6.78	1.69	1.69	.85	100

Table-1: Relative incidence of different haemoglobin types

Sex	Total	Hb A/A	Hb A/E	Hb E/E	Hb E/F	Hb A/S	Hb S/S
Male	65	49	11	3		1	1
	100%	75.38%	16.92%	4.62%	-	1.54%	1.54%
Female	53	32	13	5	1	1	1
	100%	60.38%	24.53%	9.43%	89%	1.89%	1.89%

Table-2: Distribution of haemoglobin types in relation to sex

Types	Hb A/A	Hb A/E	Hb E/E	Hb A/S	Hb S/S	Hb E/F	Total
Hindus	73	23	8	2	2	1	109
Muslims	8	1	0	0	0	0	9

Table-3: Distribution of haemoglobin types in relation to religion

Caste/Community	Total Cases No./%	Hb A/A No/%	Hb A/E No/%	Hb E/E No/%	Hb E/F No/%	Hb A/S No / %	Hb S/S No / %
Ahom	31	17	9	4	1	-	-
	100	54.84	29.03	12.9	3.23	-	-
Kachari	19	9	7	3	-	-	-
	100	47.37	36.84	15.79	-	-	-
Tea Garden Tribes	15	10	1	-	-	2	2
	100	66.67	6.67	-	-	13.33	13.33
Assamese Muslims	9	8	1	-	-	-	-
	100	88.89	11.11	-	-	-	-
Kalita	8	7	1	-	-	-	-
	100	87.5%	12.5	-	-	-	-
Koch	6	5	1	-	-	-	-
	100	83.33	16.67	-	-	-	-
Brahmin	6	6	-	-	-	-	-
	100	100					
Bengali	6	6	-	-	-	-	-
	100	100					
Chutia	5	4		1	-	-	-
	100	80		20			
Koibarta	3	2	1	-	-	-	-
	100	66.67	33.33				
Deori	3	1	2		-	-	-
	100	33.33	66.67				
Bihari	3	3	-	-	-	-	-
	100	100					
Kayastha	2	2	-	-	-	-	-
	100	100					
Mishing	2	1	1	-	-	-	-
	100	50	50				

Table-4: Distribution of haemoglobin types in different castes and communities

The level of haemoglobin in relation to the different haemoglobin types have been studied. It was observed that majority (64 Nos) of the cases with normal adult haemoglobin (Hb A/A) had normal haemoglobin levels. (T II grams per deciliter). Only 19 cases out of the total 81 with haemoglobin A/A had shown slightly lower haemoglobin levels between 9-11 grams per deciliter.

Out of the total 24 cases with haemoglobin A/E, 8 cases had haemoglobin levels more than 11 grams per deciliter, 14 cases had haemoglobin levels between 9-11 grams per deciliter and only 2 cases had shown moderate anaemia with haemoglobin levels between 6-9 grams per deciliter. Out of the 8 cases with haemoglobin E/F, 2 cases had haemoglobin levels between 9-11 grams per deciliter and 6 cases has the levels between 6-9 grams per deciliter. Both cases with haemoglobin A/S had haemoglobin levels between 6-9 grams per deciliter. One case with haemoglobin S/S had 4.8 grams per deciliter of haemoglobin and the other had 6.8 grams per deciliter of haemoglobin. The only case with E-thalassaemia (Hb E/F) had 6.6 grams per dl. of haemoglobin.

The mean, and standard deviation of haemoglobin A/A, A/E and E/E were studied. The other haemoglobin types A/S, S/S and E/F found in the present study were not taken up for finding the mean and standard deviation as the number of cases with these haemoglobin types were very few. The mean haemoglobin level in cases with haemoglobin A/A was 12.04 gm/dl with a standard deviation of 1.16. The mean haemoglobin level in cases with haemoglobin A/E was 10.60 gms/dl with a standard deviation of 1.15.

DISCUSSION

Flatz et al observed that the highest incidence of haemoglobin E in India is found in Assam. In his study, he found 27.8% cases with heterozygous haemoglobin E and 11.8% cases with homozygous haemoglobin E.⁵ Gogoi B.C. found an incidence of 28.8% haemoglobin heterozygous and 23.7% homozygous haemoglobin E disease.⁶ Das and Deka found the frequency of haemoglobin E in indigenous Assamese community to vary from 23% to 78%.⁷

Out of the 65 males in the present study haemoglobin A/A was detected in 49 cases (73.38%) irrespective of caste, or religion and out of the 53 females, 32 cases (60.38%) were detected with haemoglobin A/A of haemoglobin A/A (84.48%) Non-Mongoloids showed a higher incidence than Mongoloids (53.33%). Flatz et al has also found the lowest frequency of haemoglobin E disorders among the mixed Aryan and non-Mongoloid population of Assam (Haemoglobin A/E - 15.9% and E/E 9.8%).⁵

In Assam, Dunlop and Majumdar had found a high incidence of haemoglobin S among tea garden labourers.³

Chernoff et al found haemoglobin percentage ranging from 3.2 grams/deciliter to 16.5 grams per deciliter in their 36

cases of heterozygous haemoglobin E,⁸ Chatterjea J.B. found a mean haemoglobin concentration of 14.4 grams/deciliter in males and 12 grams/deciliter in females with haemoglobin A/E.⁴ The mean haemoglobin level for males aged around 15 years was 13.4 gms/deciliter and females aged around 15 years was 12.1 gms/deciliter as reported by Fairbank, V.F. Lanchant, N.A. and de Gruchy observed that haemoglobin percentage remains normal in haemoglobin E trait people.⁹ Lanchant, N.A. (1987) reviewed and concluded that haemoglobin concentration in haemoglobin E disease cases were normal or slightly decreased.¹⁰ In the present study the mean haemoglobin level in haemoglobin E trait cases was found to be 10.60 grams/deciliter with standard deviation of 1.15. The range was from 7.8 - 12.4 grams/deciliter 14 cases out of the 24 cases with haemoglobin A/E had mild type of anaemia, and 2 cases had moderate type of anaemia.

In the present study, the haemoglobin level in cases with haemoglobin E disease was found to be in the range of 6.9 - 9.4 grams/deciliter with a mean of 8.3 grams/deciliter and a standard deviation of 0.82. Out of 8 cases with haemoglobin E disease, 6 cases were found to have moderate type anaemia and 2 cases were found to have mild type of anaemia. Chernoff et al in his study had found haemoglobin level in cases with E thalassaemia to range from 7.9 to 13.2 grams/deciliter.⁸ Chatterjea reported that haemoglobin level in haemoglobin E thalassaemia was 9.2 grams/deciliter.⁴

In the present study, the lone case of haemoglobin E thalassaemia had a haemoglobin concentration of 6.6 grams/deciliter. Studies conducted by Dunlop and Majumdar (1952), found lower levels of haemoglobin in persons with haemoglobin S.³ In the present study, the 2 cases with haemoglobin S trait showed moderate anaemia with haemoglobin levels 6.7 grams/deciliter & 7.6 grams/deciliter per deciliter. There were 2 cases with haemoglobin S disease and 1 case showed moderate anaemia (haemoglobin level 6.8 grams/deciliter) while the other had severe anaemia with haemoglobin level 4.8 grams/deciliter.

CONCLUSION

The highest incidence of the abnormal variants was of haemoglobin E - disorders. The present study had shown highest incidence of haemoglobin E disorders among the Kachari community followed by the Ahom Community. Haemoglobin S disorders were found to be have a higher incidence among the tea-garden tribes of Assam. No frequency of abnormal haemoglobins were detected in the Brahmins and Kayasthas. Haemoglobin parameters showed marked reduction in haemoglobin S disease. Moderate anaemia was observed in haemoglobin E disease E- thalassaemia and haemoglobin S-trait. Haemoglobin E trait showed lower normal or slightly less than normal levels of haemoglobin.

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