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A Study of Red Cell Parameters in Patients of Sickle Cell Trait

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I. Introduction

The inherited disorders of blood include hemoglobinopathies which are one of the major public health problems in India.[1] Sickle cell disease is the second most common hemoglobinopathy next to Thalassemia in India.[2] The findings of the Indus valley civilization site indicate the prevalence of hereditary anemia (sickle cell disease or β thalassemia) in the Indian subcontinent from about 2000-5000 BC.[3] General incidence of Sickle cell disease in India is 1-44%.[4,5,6] The average frequency of hemoglobin S (HbS) is 4.3 % in India.[4] Sickle cell trait occurs in approximately 300 million people worldwide, with the highest prevalence of approximately 30% to 40% in sub-Saharan Africa.[7] Sickle cell disease refers to a group of genetic disorders, characterized by presence of sickle hemoglobin (HbS), anemia, and acute and chronic tissue injury secondary to blockage of blood flow by abnormally shaped red cells**.** Herrick first described a case of sickle cell disease in 1910.[8] There is a high prevalence of Sickle cell disease in the socio-economically backward groups in India. It is highly prevalent among Scheduled Caste, Scheduled Tribe, and Other Backward Class (10%).[9]

II. Material And Method

This hospital based cross sectional study was carried out in the Department of Pathology. Sample size of this study was 200 patients of sickle cell trait diagnosed by hemoglobin electrophoresis. These 200 patients were grouped into 100 symptomatic i.e. patients suffering from severe anemia, joint pain, weakness, abdominal pain etc and 100 asymptomatic i.e. patients free from any of the above symptoms. 100 age and sex matched AA pattern controls were taken. Family screening of AS pattern patient's relatives was also a source of subjects in this study.

With the informed consent of these subjects, a case record form was filled, which included all the detailed information like name, age, sex, registration number, caste, address, patients chief complaints, family history, complaints related to this disease, lab investigation, general examination etc. Then according to these clinical details, these were grouped into symptomatic and asymptomatic AS pattern patients. Details of the AA control patients were also recorded.

Method - Collection of blood- Under all aseptic precautions, 2 ml of blood was drawn from antecubital vein by clean venepuncture from each patient with a sterile plastic syringe and collected in an EDTA (anticoagulant) tube for determination of investigations like Sickling test, CBC (Complete Blood Cell count), Hemoglobin electrophoresis, Reticulocyte count.

III. Statistical Analysis Of Results:-

Categorical variable (Age and Sex) were expressed in actual number and percentages. Continuous variable (Hb, MCV, MCH, MCHC etc) were presented as Mean ±SD. Continuous variable were compared between symptomatic, asymptomatic and healthy subjects by performing one way analysis of variance (ANOVA). Post hoc comparison were made using Bonferroni multiple comparison test. Categorical variable were compared by performing chi-square statistics.. $P<0.05$ was considered to be of statistical significance. Statistical software STATA version 10.0 was used for data analysis.

IV. Results

Table 1. Distribution of AS pattern patients according to age and sex

Age group	AS pattern SYMPTOMATIC n=100		AS pattern ASYMPTOMATIC n=100	
	Male	Females	Males	Females
0-10 YEARS	7	1	6	4
11-20 YEARS	9	15	2	6
21-30 YEARS	8	38	7	54
31-40 YEARS	2	7	7	8
41-50 YEARS	2	6	2	1
51-60 YEARS	4	1	2	1
Total	32	68	26	74

Table 2: Distribution of sickle cell trait patients according to caste /tribe

CASTE/ TRIBE	TOTAL AS PATIENTS N=200	PERCENTAGE
SCHEDULED CASTE	105	52.5%
OTHER BACKWARD CLASS	51	25.5%
SCHEDULED TRIBE	20	10%
GENERAL (no specific caste)	13	6.5%
NOMADIC CASTE	11	5.5%

Table 3: Clinical features of symptomatic AS patients

Age group	Anemia	Recurrent fever	Abdominal pain	Recurrent jaundice	Repeated abortion	Joint pain	Small for age(for child)
0-10 years N=8	3	5	2	3	---	---	2
11-20 years N=24	16	10	4	4	----	2	5
21-30 years N=46	38	2	6	3	7	1	---
31-40 years N=9	5	2	---	---	2	---	---
41-50 years N=8	3	1	3	---	---	3	---
51-60 years N=5	3	3	---	2	---	2	---
Total=100	68	23	15	10	9	8	7

Table 4. Red cell parameters of three groups

	Healthy	Asymptomatic	Symptomatic
Hb gm%	13.26± 1.38	12.98 ±2.02	7.71± 2.11
RBC in millions/mm^3	3.67 ± 0.54	3.88 ±0.69	3.18±0.99
HCT in %	39.80± 4.63	38.76 ±5.99	24.60± 6.56
MCV in fl	83.4± 5.46	83.92± 9.81	79.37± 12.79
MCH in pg	29.96± 2.49	29.99± 4.19	25.78± 5.68
MCHC in gm/dl	34.76± 1.74	33.98± 2.74	34.78 ±2.70
RDW	14.24± 1.09	14.75 ±2.30	17.76± 4.50
RETIC in %	0.45±0.12	0.78± 0.31	1.15 0±.41

Table 5. P-value of Red cell parameters
(NS= not significant, HS= highly significant)

Multiple comparison by Bonferroni test.	Healthy vs Asymptomatic	Healthy vs Symptomatic	Symptomatic vs Asymptomatic
p-value for Hb	P=0.802, NS	P<0.001,HS	p<0.001,HS
p-value for RBC	P=0.115, NS	P<0.001,HS	p<0.001,HS
p-value for HCT	P=0.836, NS	P<0.001,HS	p<0.001,HS
p-value for MCV	P=1.000, NS	P=0.006,HS	P=0.003,HS
p-value for MCH	P=1.000, NS	P<0.001,HS	p<0.001,HS
p-value for MCHC	P=0.052, NS	P=1.00,NS	P=0.058,NS
p-value for RDW	P=0.586, NS	P<0.001,HS	p<0.001,HS
p-value for RETIC	P=0.078, NS	P<0.001,HS	p<0.001,HS

V. Discussion

The present study demonstrates the hematological profile of Sickle Cell Trait individuals. Total 200 patients of AS (Symptomatic) and AS (Asymptomatic) were studied (Table number-1). The most number of patients were found in the third decade followed by the second decade. There were more males in the first decade, whereas more females were found in the third decade that is, reproductive age group. The present findings are similar to the study done by Pathak et al[10], Yasmin et al[11] and Shrikhande et al[12].

Maximum number of cases in our study were of scheduled caste (Table number 2, shows 105 cases) of which most of them are Mahar, followed by Bouddha, and a small proportion in Matang. Among other Backward Class, 51 cases were found of which maximum number of patients belonged to Teli, followed by Kunbi and a small proportion to Powar. Among Scheduled Tribe, 20 cases were found of which maximum number of patients belonged to Pardhan, followed by Gond and a small proportion to Gowari. Our study correlates with the studies of Kate SL[9], Shukla RM[13], BC Kar et al[14],Patra et al[15], Sahu et al[16], Deshmukh et al[17], AA Dani et al[18], Ghatge[19], Blake[20], in which all have stated that the Sickle Cell Disease is present in Scheduled caste, Scheduled tribe and Other Backward Class.

Kaur et al[21] stated in their study that some carriers of sickle cell gene complained of painful crisis. They also stated that sickle cell trait patients are asymptomatic except few cases of painless haematuria, which we did not find in our study. In our study maximum number of cases came with complains of weakness, fatigue, breathlessness that is, features of anemia (Table no- 3). In the age group 11-20 years, anemia is common, probably due to increased demand for growth and also repeated infection. In the reproductive age group, most of the females came with history of pregnancy; where there is more requirement of hemoglobin. Also in this age group 7 cases of repeated abortion were found. Taylor MY[22] et al stated that sickle cell trait women appear to be at an increased risk for fetal loss compared with women with normal hemoglobin levels. Kate et al[9] also stated that repeated abortions occur in sickle cell trait patients. Small proportion of patients complained of other features like recurrent fever, recurrent jaundice, joint pain etc.

The mean Hemoglobin%, was statistically significant. In the study of Walke et al[23], mean Hb% in SCT was 10.08, but they didn't divide this into symptomatic and asymptomatic and their study group was of pediatric patient in 0-6years age group. When they compared this Hb with control, this value had come out to be significant. In our study, there was a direct correlation of the clinical feature of the patient and the hemoglobin level. Patients who presented with the history of weakness, fatigue, breathlessness etc, have low hemoglobin level, compared to the Asymptomatic individuals. However we also had eight asymptomatic AS patients with hemoglobin levels less than 8g%. They were probably well adapted to their hemoglobin levels and hence asymptomatic.

RBC Count of the Asymptomatic and Symptomatic patients were found to be statistically significant. Our study correlates with the study of Pathak et al[10], in which they observed that the mean RBC Count of AS patient and AS control was statistically significant. In Patel et al[24] study, RBC count was 4.51million/cmm, which is in the normal range and greater than RBC count of our study In a study by Yasmin et al[11], RBC Count of AS patient was 3.87million/cmm, which was almost equal to our RBC Count.In Walke and Walde[23] study, mean RBC Count was 5million/cmm, and it was not significant statistically (Sickle Cell trait versus control). However, the cases which they studied were 0-6 years of age.

HCT values of Asymptomatic and Symptomatic AS patients was found to be statistically significant. The study of Pathak et al[10], also compared the HCT values of AS patient, AS control and AA control, and found to be statistically significant. In the study of Walke and Walde[23], the HCT value between Sickle cell trait and Control subjects were not statistically significant.

MCV values in our study, although within the normal range, were found to be statistically significant. In the study of Patel et al[24], mean MCV value was 73.98fl. In the study of Yasmin et al[11], mean MCV value was

89.4fl. Brittenham et al[25] observed a significant difference in the mean MCV values. Pathak et al[10] concluded that MCV values are significantly altered in sickle cell trait with lower concentration of HbS.

MCH values between Asymptomatic patient and Symptomatic was statistically significant, which is correlating with the study of Pathak et al[10]. In the study of Patel et al[24], mean MCH value was 22.32pg, which is low as compared to our symptomatic group. In the study of Yasmin et al[11], the mean MCH value was 26.3pg, which is correlating with our symptomatic patients MCH.

There was no statistical difference found in the values of MCHC between the three groups. For this our study correlated with the study of Pathak et al[10], Yasmin et al[11] and Patel et al[24].

In the study of Patel et al[24], mean RDW was 16.43, which is higher than our Asymptomatic AS patients value and lower than Symptomatic AS patients value. The RDW was found to be statistically significant between Asymptomatic and Symptomatic patients.

Reticulocyte count was within normal limits in all three groups, but was found to be statistically significant. Our study correlated with the study of Pathak et al[10], and they concluded that this may be due to compensatory hyperplasia, the cause of which may be either hematinic treatment given for nutritional deficiency or due to decreased red cell survival in AS trait.

It is important to be aware of the presence of sickle cell trait, as these people, irrespective of being symptomatic or asymptomatic are prone to complications after strenuous exercise, dehydration or at high altitudes. Antenatal screening and family screening of affected Sickle cell trait patients is an important way to screen the population to make them aware of this disease and its possible complications.

VI. Conclusion

Our study found Sickle cell trait to be most common in the third decade for Symptomatic and Asymptomatic patients .A female predominance of Sickle cell trait was seen (F=71 %, M= 29 %). The AS pattern was more prevalent in SC, ST and OBC categories.

The most common symptom was due to Anemia, in the Symptomatic category of AS patients.

There was statistically significant variation in the red cell indices (except MCHC) of Symptomatic and Asymptomatic Sickle cell trait patients. In the Asymptomatic AS patients and Control AA patients, Red cell indices variation was not statistically significant.

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