Original Article

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A Prospective & Multicentric Study of RBC Parameters in Patients of Sickle Cell Disorder

Prateek Pradeep Umrikar* and Alpesh Prahladpuri Goswami

Department of Pathology, Government Medical College, Bhavnagar, INDIA

ABSTRACT

Background: Sickle cell disease (SCD) is an inherited blood disorder caused by abnormal haemoglobin. Present study was done to study the relationship of clinical presentation & haematological findings in case of symptomatic & asymptomatic sickle cell disorder patients.

Methods: In the present study, the RBC parameters like Hb, MCV, MCH, MCHC, RDW, RBC COUNT & PCV were recorded & results of sickling test & Hb electrophoresis were used to confirm a case of sickle cell disorder.

Result: Categorical Variables (age &sex) were expressed in actual number & percentages. Continuous variables (Hb, MCV, MCH, MCHC, RDW, RBC COUNT & PCV) were presented as Mean. Continuous variables were compared between Sickle cell disease subjects, sickle cell trait subjects & normal subjects by one way Analysis of Variance (ANOVA) test.p value < 0.05 was considered to be statistically significant

Conclusion: The most number of symptomatic patients of sickle cell disorder were found in the 2nd decade of age, followed by 3rd decade. There was a greater percentage of female subjects detected as sickle cell Disease (52.7%) & Sickle cell trait (62.8%) which points towards female preponderance of sickle cell disorder. Weakness & fatigue were the predominant symptoms of presentations among both sickle cell disease & sickle cell trait subjects. The peripheral smear examination in sickle cell disorder predominantly shows normocytic to microcytic with hypochromic picture.

Keywords: *Sickle cell Disorder, RBC Parameters, Hb Electrophoresis, Sickling Test*

Introduction

Sickle cell disease (SCD) is an inherited blood disorder caused by abnormal haemoglobin. It limits the oxygenating role of haemoglobin, resulting in the damaging or the "sickling" of the red blood cells .There is high prevalence of sickle cell disease in socioeconomically backward groups in India. It is highly prevalent among schedule castes , schedule tribes & other backward classes(10 %).[1] It is a 2nd most common haemoglobinopathy next to thalassemia in India, general incidence of sickle cell disease is 1-44%. The average frequency of haemoglobin–S (HBS) is 4.3 % in India.[2][3]

Sickle cell disease refers to a group of genetic disorders, characterised by presence of sickled haemoglobin (HBS), anemia, acute & chronic tissue injury secondary to blockage of blood flow by abnormally shaped Red cells. It is one of the variants of disorders of haemoglobin inherited from both the parents in an autosomal recessive pattern. In this disease, there is single nucleotide substitution in codon 6 of beta-globin chain of haemoglobin molecule. Out of the total 287 amino acids at the position 6th of beta chain in haemoglobin molecule, there is substitution of one amino acid. This change occurs because of the substitution of Triplet GAG (guanine, adenosine, and guanine) which codes for Glutamic acid by triplet GTG (guanine, thymine, guanine) which codes for Valine. There is polymerisation of HBS molecules inside the red cells which is responsible for sickling of red cells. People with SCD have abnormal hemoglobin, called *hemoglobin S or* sickle hemoglobin, in their red blood cells. In all forms of SCD, at least one of the two abnormal genes causes a person's body to make hemoglobin S. When a person has two hemoglobin S genes, Hemoglobin SS, the disease is called *sickle cell anemia*. This is the most common and often most severe kind of SCD.

Materials and Methods:

This hospital based cross sectional study was carried out in the Department of Pathology. Sample size of this study was 100 subjects which includes Sickle cell disease, Sickle cell trait diagnosed by hemoglobin electrophoresis inclusive of Normal subjects. These 100 patients were grouped according to test results into 36 symptomatic patients of Sickle cell Disease, symptoms being: severe anemia, weakness, recurrent jaundice, recurrent fever & bone pain etc, 35 symptomatic & asymptomatic patients of Sickle cell trait & 29 Normal subjects. 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 patients. Details of the normal controls (AA) were also recorded.

Collection of blood: Under all aseptic precautions, 2 ml of blood was drawn from antecubital vein by clean venepuncture from each patient and collected in an EDTA (anticoagulant) tube for determination of investigations like Sickling test, CBC (Complete Blood Cell count), Hemoglobin electrophoresis. p value <0.05 was considered to be statistically significant. SPSS-22 trial version software was used for data analysis**.**

Result

Categorical Variables (age &sex) were expressed in actual number & percentages. Continuous variables (Hb , MCV,MCH,MCHC, RDW,RBC COUNT & PCV) were presented as Mean . Continuous variables were compared between Sickle cell disease subjects, sickle cell trait subjects & normal subjects by one way analysis of Variance (ANOVA) test. 'p' value < 0.05 was considered to be statistically significant. SPSS-22 trial version software was used for Data analysis**.**

The above table demonstrates the age of symptomatic presentationin sickle cell disease patients is predominantly between 11 & 20 years in the present study (47.2%)

The above table demonstrates Female preponderance in cases of both sickle cell disease (52.7%) & Sickle cell Trait(62.8%).

In the present study , Weakness & fatigue has been observed to be the predominant presenting symptom amongst subjects of sickle cell disease (94.4%) & Sickle cell trait (77.1%) ,followed by recurrent jaundice (66.6%) in Sickle cell disease subjects & (2%) in sickle cell trait subjects as the second most predominant symptom

The above table displays the mean values & 'p' values of all the RBC Parameters. The 'p' values of all RBC parameters in patients of Sickle cell Disease & Sickle cell Trait are < 0.001 which indicates that these values are statistically significant.

Table 1: Age distribution of symptomatic presentation in patients of sickle cell disease.

Age of Presentation (Years)	No. Of Sickle cell disease Patients
below 10	7 (19.4%)
11-20	17(47.2%)
21-30	10(27.7%)
31-40	02(5.5%)
41-50	00
51-60	00
61-70	00

Table 2: Sex distribution of sickle cell disorder.

	Males	Females
Sickle Cell Disease	17(47.2%)	19(52.7%)
Sickle cell Trait	13(37.1%)	22(62.8%)
Total	**30**	**41**

Table 3: Clinical presentation of sickle cell disorder.

	symptoms	Sickle cell disease	Sickle cell trait
1	Weakness & fatigue	34 (94.4%)	27(77.1%)
2	Recurrent fever & cough	15(41.6%)	02(5%)
3	Recurrent fever & bone pain	09(25%)	01(2%)
4	Breathlessness	18(50%)	07(20%)
5	Recurrent jaundice	26(72.2%)	01(2%)
6	Recurrent hospitalisation	24(66.6%)	01(2%)
7	h/o frequent blood transfusions	24(66.6%)	01(2%)

Table 4: Mean values & 'p' values of all RBC Parameters in Sickle cell disease & Sickle Cell trait subjects.

Parameters	Mean Value		
	Sickle cell Disease	Sickle cell Trait	'P' value
Hb (gm/dl)	7.43	7.97	<0.001
MCV (fl)	73.69	75.08	<0.001
MCH (pg)	23.62	23.52	<0.001
MCHC (gm/dl)	31.76	31.37	=0.005
RDW (%)	20.07	18.02	<0.001
RBC Count (million/ul)	3.23	3.45	<0.001
PCV (%)	24.50	29.82	<0.001

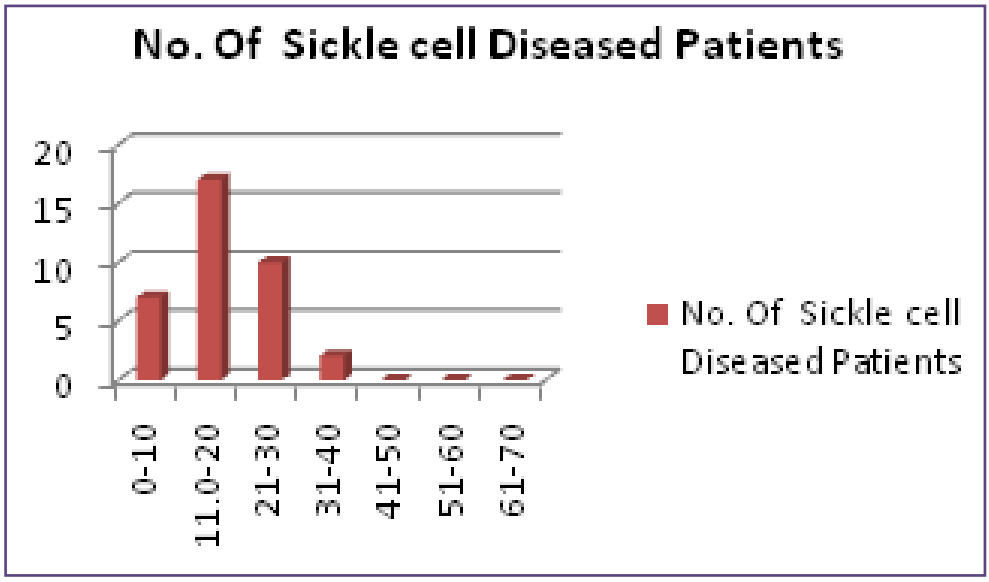

Fig.1

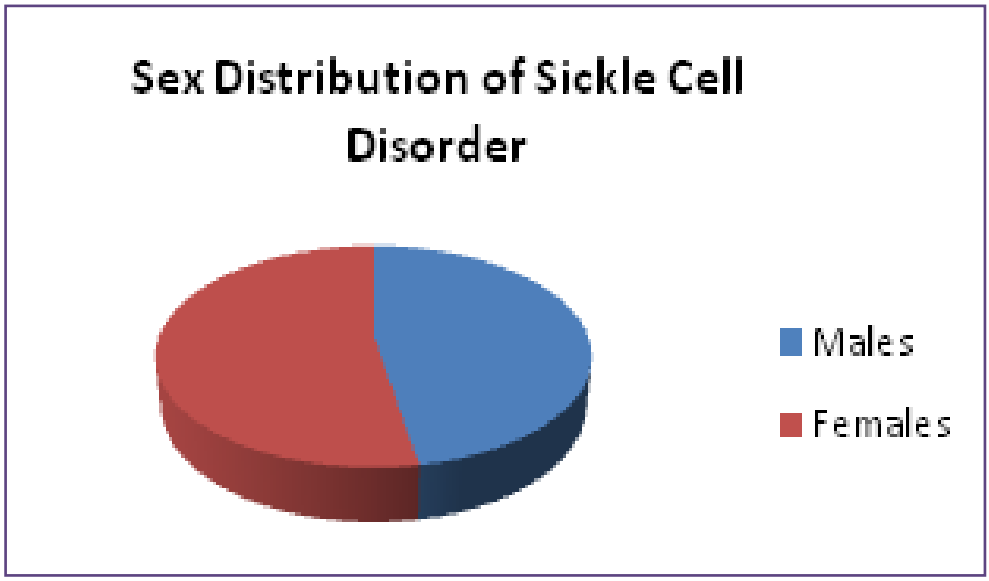

Fig.2

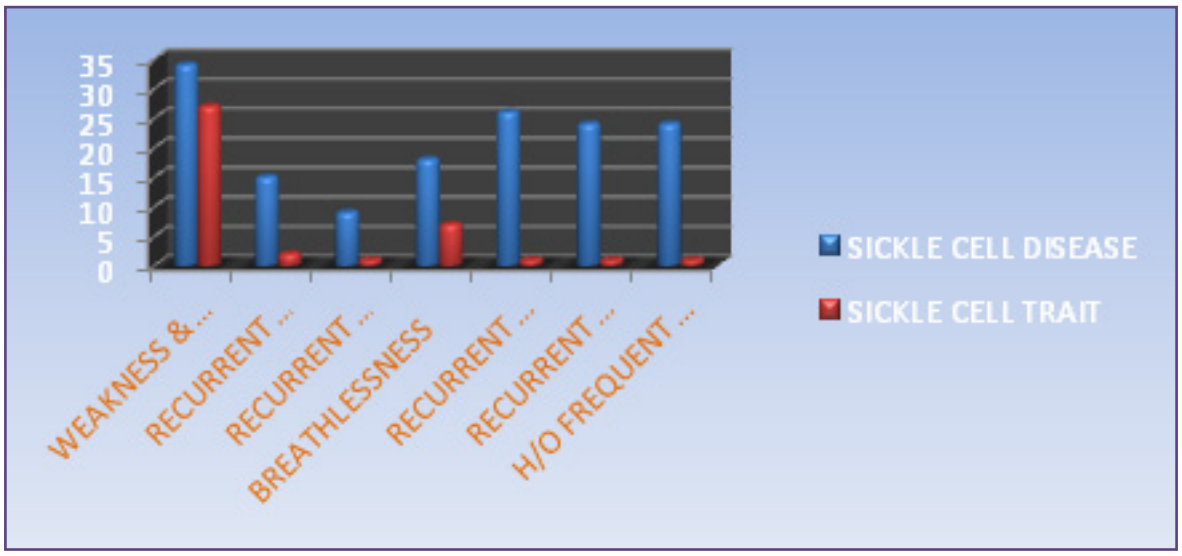

Fig.3

Discussion

The present study demonstrates the haematological profile of sickle cell Disease patients & Sickle cell Trait patients. Total 100 subjects were taken in our study which included 36 cases of Sickle cell Disease, 35 cases of Sickle cell Trait &29 cases of Normal Control subjects.

The most number of patients were found in the 2nd decade of age followed by 3rd decade. There were a greater percentage of female subjects detected as sickle cell Disease (52.7%) & Sickle cell trait (62.8%) in their respective groups which points towards female preponderance of sickle cell disorder. In the present study weakness & fatigue are the predominant symptoms of presentations among both sickle cell disease & sickle cell trait subjects. This finding is comparable with many other reference studies

In our study concerned with haematological parameters of sickle cell disease & trait subjects ,showed an overall decrease in the level of haematological indices as similarly reported by study done by Kohchale et al (2015).[4] Our study shows decreased levels of RBC count , MCV , Hematocrit (PCV) which correlates with the study done by Kar et al (1986).[5] Balgir et al (2000)[3] in his study showed lower MCV levels (60-113 fl).Rao et al (2012) [6] showed lowering of above parameters in their respective studies, thus supporting our study.

In our study, it is observed that the mean MCV levels were low in sickle cell disease as compared to the levels in Sickle cell trait. One more significant observation in our study results are that ,with the decrease of MCH , MCHC , there is increase in Red cell Distribution Width (RDW) in both the groups ,which correlates well with the similar studies done by Kar et al (1986) ,[5] Balgir et al (2000).[3] Mean PCV level in our study in sickle cell disease is 24.52 which is comparable with mean PCV level of 20.0 in study conducted by Ifeanyi et al. [7]

Sickle cell Disease is associated with anemia in majority of cases. The mean haemoglobin value in sickle cell disease subjects in present study is 7.43 g/dl. Study by Sameer et al [8]& Study by Lagos State University Teaching Hospital Ikeja, Nigeria [9] observed Haemoglobin levels (7.93 g/dl), while Kohchale and Raja[4] et al observed lower levels of Mean haemoglobin levels (5.454g/dl) . Thus all the studies demonstrate that there is a net significant fall in Haemoglobin levels in Sickle cell disease cases.

The mean MCV levels in present study & study done by Sameer et al[8]&Kohchale and Raja[4] et al are lower than normal range & indicate an overall normocytic with mild microcytic picture in sickle cell disease. This finding comes close to the fact that usually the anemia in sickle cell disease is normocytic. The study by Lagos State University Teaching Hospital Ikeja, Nigeria ,[9] supports this finding.

The mean MCH & MCHC Values in all the studies including the present study show an overall slightly lower value which are on borderline in some of the above studies. This indicates hypochromic picture in sickle cell disease patients, which can be due to the chronic anemia in them &also can be due to concomitant iron deficiency.

The RDW levels show persistent elevation in all the studies which is a consistent finding related with sickle cell disease which generally shows an increase in RDW levels which indicates an increased variation in the red cell sizes, which is expected to occur in case of sickle cell disease due to

recurrent hemolysis & ineffective erythropoiesis, resulting in anisocytosis.

Hematocrit & RBC Counts are consistently lower in all the above studies including our study with a higher reduction observed in study by Kohchale et al.[4] As with case of any anemia, reduction in PCV & RBC count are the most obvious findings & likewise also in sickle cell disease which presents with severe haemolytic anemia.

Sickle cell trait patients are usually associated with normal levels of Haemoglobin or slight reduction which comes below the normal range. The present study shows slightly lower levels of Hb levels due to the fact that all the sickle cell trait subjects in our study have presented with symptoms related to crisis or some concomitant stressful event which has lead to the deoxygenating event leading to an occasional sickling which has reduced the mean Hb levels. The MCH & MCHC levels show slight reduction in all studies due to the overall reduced reservoir of haemoglobin in the RBCs in sickle cell trait subjects related to recurrent & occasional mild sickling episodes during the stressful events which reduce the overall haemoglobin concentration inside the RBCs. The consistent reduction in RDW levels in all the above studies is related with the variation in the cell size (anisocytosis) associated with sickle cell trait patients.

Similarly RBC count & haematocrit show a slight reduction in sickle cell trait patients in all the studies & this reduction corresponds with the mild anemia seen in sickle cell trait which is less severe as compared to sickle cell trait patients.

Conclusion

In this study we have correlated the clinical presentations of sickle cell disorder with the haematological parameters. Even one more step ahead, our results can be helpful in encouraging the high risk families of sickle cell disorder to go for proper genetic counselling, in which patients or relatives at risk of an inherited disorder , are advised of the consequences & nature of the disorder, the probability of developing &transmitting the disease & the options open to them in management & family planning in order to prevent, avoid or ameliorate it. This includes the neonatal screening programs, which demonstrates the benefit to small babies regarding morbidity & also premarital marriage counselling. The purpose of the study is that the clinics involved in supervision of sickle cell anemia patients would become more up to date & make use of results of this study in their practice ranges. This study would make experts involved in inspecting Sickle cell anemia patients to make use of these findings in their skill to manage this genetic menace in the region.

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***Corresponding author:**
Dr. Prateek Umrikar, 3rd year Resident, Department of Pathology, Govt. Medical College, Bhavnagar, Gujarat-364001 India
Phone: +91 9925243016
Email: prateekeuro21@gmail.com

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