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Original Research Article

Haemato-Biochemical Profile of Sickle Cell Disease patients attending Shri Sayajirao General Hospital Vadodara, Gujarat

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Abstract: There is genetic, ethnic and regional diversity in the hemoglobin variants, which emphasizes to tackle the problems of sickle cell disease at regional level. Biochemical changes are associated with sickle cell disease and they have major effect on normal functioning of human body. This study was done to analyze the clinical features and Haemato-Biochemical parameters of the patients with sickle cell disease and to correlate these parameters with the severity of disease. This was a cross-sectional study conducted on patients of sickle cell disease attending Shri Sayajirao General Hospital. Study included 41 patients over a period of 2 years based on various criteria. Data on laboratory findings were collected after written consent and analyzed using Epi-info software. Almost half (48.8%) of the patients were in the age group of 12-20 years. Almost 15% patients showed thrombocytopenia. Elevated ESR was seen in 15(36.58%) patients, while 13% of patients showed severe jaundice having S. bilirubin level more than 10 mg%. Nearly half of the patients had hepatomegaly. Almost all patients were discharged after treatment and one patient died due to sever complication of vaso-occlusive crisis.
Keywords: Sickle cell anemia, Biochemical profile, ShriSayajirao General Hospital.

INTRODUCTION

Human hemoglobin hasa characteristic of being heterogeneous[1]. Sickle cell disease is second most commonhemoglobinopathy among the inherited gene disorders of the human hemoglobin after thalassemia in India[2]. Considering Gujarat, prevalence of sickle cell disease is 6.5% with that of sickle gene being as high as 30-40% in the tribal of Gujarat including Bhil, Dodiyas, Dublas, Naikas, Gamits, Kolis, Dhanakas, Vasava, Bariyas and Rathwas[3]. A prevalence of 26% was found in Halol, Gujarat[4]. Being a genetic disorder, sickle cell disease is associated with many Hematological and Biochemical changes which lead to many systemic manifestations like Pain crisis, Avascular necrosis of Hip and leg ulcer. Studies have correlated some Biochemical findings with that of pathologicalchanges. Almost 5-50% of sickle cells are irreversibly sickled cells(ISC). Its characteristics are a low MCV, high MCHC and low HbF. Pain crisis is a predictor of early mortality[5]. They are associated with a low HbF and high PCV. A study on nocturnal oxygen saturation shows a significant correlation of low nocturnal saturation with frequent painful crisis[6]. Moderate to severe anemia, normocytic normochromic in type, is seen with values 6-10gm/dl; the mean being 8gm%. In HbSS, the mean MCV is 90 and mean MCHC is 34%. Erythrocyte Sedimentation Rate is low because sickle cells do not form the rouleux. Still some data needs to be gathered about other Biochemical changes regarding platelet count, reticulocyte count, urine albumin and bile pigments. This type of study has not been done earlier in Vadodara. So this study was undertaken to determine various laboratory parameters in patients of sickle cell anemia attending SSG Hospital Vadodara.

MATERIALS AND METHOD:

This is a cross-sectional, study to determine various laboratory parameters in the patients of Sickle cell disease attending ShriSayaji General Hospital (SSGH) Vadodara, using a structured study instrument. Large number of patients from Vadodara district with higher tribal pockets like Naswadi, Chhotaudaipur, Kwant and nearby district of Panchmahal, Narmada and Bharuch attend SSG hospital in addition to that from Baroda city. This study included 41 patients of Sickle

cell Disease who attended hospital over a period of 24 months from July 2003 to August 2005. Patients were selected based on these four criteria. i) Those who were found to have sickle cell anemia on hemoglobin electrophoresis. ii) Those who were not clearly diagnosed to be having sickle cell anemia, but had a positive sickling test. iii) Those who had sickle cell anemia by electrophoretic evidence, but clinically fitting into the diagnosis of sickle thalassemia. iv) Patients who were from tribal area and fit into the classic history of sickle cell anemia viz. fever with arthralgia and jaundice, or patients who had recurrent unexplained jaundice, and who had a positive sickling test were included. The study was focused on sickle cell anemia patients. Only three patients who had sickle cell trait were included in the study. Written informed consent was taken before collection of data. Each patient under study was subjected to clinical history including systemic manifestation and physical examination. Routine investigations were carried out in all the individuals. These included complete haemogram, urinalysis, biochemical tests, ultrasonography of the abdomen whenever indicated and 2D Echocardiography whenever indicated. X-ray chest was done in all the patients. After completion of data collection, data were entered into MS Excel and imported to EpiInfo software for analysisto look for percentage and proportion of hematological and biochemical parameters.

RESULTS:

In the study, there were 56.1% male and 43.9% female patients of sickle cell disease. Out of total 41 patients 34 had Sickle cell anemia, 4 had Sickle β – Thalassemia and 4 were Sickle cell trait. Most (48.8%) of the patients were in the age group of 12-20 years while average age of patient of Sickle cell anemia was 22.47 years.

Table-1: Analysis of Hematological Profile.

Hematological Findings	Sickle Cell Anemia n = 34, No. (%)	Sickle β – Thalassemia n = 4, No. (%)	Sickle Cell Trait n = 3, No. (%)	Total N = 41, No. (%)
1. Hemoglobin				
< 5gm/dl	10 (29.41)	2 (50)	0 (0)	12 (29.26)
5.1 – 7 gm/dl	6 (17.64)	0 (0)	0 (0)	6 (14.63)
7.1 – 9 gm/dl	10 (29.41)	2 (50)	2 (66.66)	14 (34.14)
>9 gm/dl	8 (23.52)	0 (0)	1 (33.33)	9 (21.95)
2. Packed Cell Volume				
<20 ml/dl	4 (11.76)	2 (50)	0 (0)	6 (14.63)
20-25 ml/dl	20 (58.82)	2 (50)	0 (0)	22 (53.65)
25-30 ml/dl	9 (26.47)	0 (0)	2 (66.66)	11 (26.82)
>30 ml/dl	1 (2.94)	0 (0)	1 (33.33)	2 (4.87)
3. Mean Corpuscular Volume				
<70 fL	8 (23.52)	1 (25)	0 (0)	9 (21.95)
70-80 fL	10 (29.41)	1 (25)	0 (0)	11 (26.82)
80-90 fL	5 (14.71)	1 (25)	2 (66.66)	8 (19.52)
>90 fL	12 (35.29)	1 (25)	1 (33.33)	13 (25.49)
4. Mean Corpuscular Hemoglobin Concentration				
17-25%	6 (17.64)	0 (0)	0 (0)	6 (14.63)
26-28%	8 (23.52)	1 (25)	0 (0)	9 (21.95)
28-30%	2 (5.88)	2 (50)	0 (0)	4 (9.75)
>30%	18 (52.94)	1 (25)	3 (100)	22 (53.65)
5. Platelet Count				
<1.5 lac/mm^3	4 (11.76)	2 (50)	0 (0)	6 (14.63)
1.5-4 lac/mm^3	22 (64.71)	2 (50)	1 (33.33)	25 (60.97)
>4 lac/mm^3	8 (23.52)	0 (0)	2 (66.66)	10 (24.39)
6. Erythrocyte Sedimentation Rate (at the end of 1st hour)				
<10 mm	4 (11.76)	0 (0)	1 (33.33)	5 (12.19)
10-20 mm	18 (52.94)	2 (50)	1 (33.33)	21 (51.27)
>20 mm	12 (35.29)	2 (50)	1 (33.33)	15 (36.58)
7. Peripheral Smear				
Target Cells	6 (17.64)	0 (0)	1 (33.33)	7 (17.07)
Sickle Cells	20 (58.82)	1 (25)	0 (0)	21 (51.21)
8. Reticulocyte count				
<2.0 %	8 (23.52)	1 (25)	0 (0)	9 (21.95)
>2.0 %	26 (76.47)	3 (75)	3 (100)	32 (78.04)

In the present study severe anemia (Haemoglobin-Hb<5.0gm/dl) was encountered in 10 patients (29.41%) of Sickle cell anemia, 2(50%) patients of sickle β–Thalassemia and none in sickle cell trait. The mean Haemoglobin in this study was 6.88gm/dl. Hematocrit value of lower than 20ml/dl was noted in 6 patients overall (14.63%). Packed cell volume was low in all patients, the mean being 26.43. MCV less than 70fl was seen in 9(21.95%) patients overall, 8 of whom had sickle cell anemia(23.52%). The mean MCV in all patients was 81.81fl. Overall, 22(53.65%) had MCHC more than 30%, 18(52.94%) patients of sickle cell anemia had this MCHC. On the lower side of spectrum, low MCHC was noted in 6(14.63%) patients all of them were sickle cell anemic. Mean MCHC was 29.56%. Low platelet count was seen in 6(14.63%) patients. Mean platelet count in the study was 3.01 Lakh/mm^3. Elevated ESR was noted in 15(36.58%) patients out of that 12(35.29%) had sickle cell anemia, 2 had sickle β–Thalassemia, and one was sickle cell trait. Mean ESR was 26.91 mm at the end of 1^{st} hour. In the study 21(51.21%) patients had demonstrable sickle cells on peripheral smear while target cells were seen in 7(17.07%) patients. Reticulocyte count more than 2% was seen in 32(78.04) patients while mean reticulocyte count was 5.02%. **(Table 1)**

Table-2: Analysis of Blood Biochemistry and Urinary finding.

Sickle disease	**Sickle Cell Anemia n = 34 , No. (%)**	**Sickle β – Thalassemia n = 4, No. (%)**	**Sickle Cell Trait n = 3, No. (%)**	**Total N = 41, No. (%)**
Biochemical Findings				
1. S. Bilirubin				
1.0-5.0 mg%	18 (52.94)	4 (100)	2 (66.66)	24 (58.53)
5-10 mg%	5 (14.70)	0 (0)	0 (0)	5 (12.19)
>10 mg%	5 (14.70)	0 (0)	0 (0)	5 (12.19)
2. S. Alkaline Phosphatase				
>200Ka	7 (20.58)	0 (0)	2 (66.66)	9 (21.95)
3. S. Alanine Aminotransferase (S. ALT)				
>35 IU/L	18 (52.94)	3 (75)	1 (33.33)	22 (53.65)
4. S. Aspartate Aminotransferase (S. AST)				
>35 IU/L	10 (29.41)	2 (50)	2 (66.66)	14 (34.14)
5. B. Urea				
>45 mg/dl	4 (11.76)	0 (0)	0 (0)	4 (9.75)
6. S. Creatinine				
>1.5 mg/dl	6 (17.64)	1 (25)	0 (0)	7 (17.07)
Urinalysis				
1. Albuminuria	7 (20.58)	0 (0)	1 (33.33)	8 (19.51)
2. Bile salts/pigments	9 (26.47)	0 (0)	0 (0)	9 (21.95)

As noted in table 2, hyperbilirubinemia was noted in 34(82.92%) patients. On analysis of hyperbilirubinemia 24(58.53%) had level between 1.0mg% to 5.0mg%, while 5(12.19%) were in the range of 5-10mg%, 5(12.19%) had bilirubin more than10 mg%. Results of liver enzymes showed that 22 patients (53.65%) had elevated ALT level and 14(34.14%) had elevated AST level. S.Alkaline Phosphatase was raised in only 9(21.9%) patients. In case of Renal Function test 7(17.07%) had S.creatinine more than 1.5mg% and 4(9.75%) had B.Urea more than 45mg/dl. Eight (19.51%) patients had Albuminuria. Urinary bile salts and bile pigments were seen in 9(21.95%) patients, all of whom had sickle cell disease. **(Table 2)**

Table 3: Analysis of Ultrasonography Findings.

Ultrasonography Findings	**Sickle Cell Anemia n = 29 No. (%)**	**Sickle β – Thalassemia n = 3 No. (%)**	**Sickle Cell Trait n = 2 No. (%)**	**Total N = 34 No. (%)**
1. Liver Size				
<14 cm	16 (55.17)	2 (66.66)	1 (50)	19 (55.89)
>14 cm	13 (44.82)	1 (33.33)	1 (50)	15 (44.11)
2. Spleen Size				
<12 cm	13 (44.82)	0 (0)	1 (50)	14 (41.17)
>12 cm	16 (55.17)	3 (100)	1 (50)	20 (58.83)

Ultrasonography was done in patients where indicated and feasible. Among the 34 patients in whom USG was possible, 15(44.17%) had a liver size more than normal, while 20(58.83%) had a spleen size greater than 12 cm in longitudinal diameter. Interesting was the fact that of the 3 patients of sickle β–Thalassemia who underwent USG, all 3 had splenomegaly, while only one had hepatomegaly.**(Table 3)**

X-ray chest of patients was done whenever indicated, and showed pneumonic consolidation in 9.75% of all patients. In the study, 7 patients underwent 2D echocardiography among themone patient showed significant Right Atrium and Right Ventricle dilatation and pulmonary hypertension.

DISCUSSION:

This study was conducted on 41 patients with sickle cell disease and the Haemato-Biochemical findings were described. The mean Hb was 6.88 gm/dl while the mean value of hemoglobin in the study conducted by Meshram *et al.*[7] was 10.3 gm/dl showing significantly low Hb in present study. Hemolytic and acute sequestration crisis cause a precipitous drop in the hemoglobin. Hemolysis is enhanced by exercise and presence of hypersplenism[8]. Significant Low hemoglobin concentration among Sickle cell anemia (SCA) patients was also seen in other studies[9,10]. In the study mean MCV was 81.81fl while it was 84.5 fl and 83.6 fl in studies conducted by Juwan A[11] and Kar and Satapathy[12] respectively. Almost half of patients had MCV below 80fl. This could be accounted for by the high prevalence of α-thalassemia in our area. The mean MCHC level obtained in our study is lower than that of value in study done by Meshram *et al.*[7]; reason being a chance variation or could reflect associated iron deficiency anemia or thalassemia or due to automated red cell counter underestimating MCHC values. Platelets are usually significantly raised in SCA which was seen in study done by Meshram[7]. In this study 6 patients (14.63%) had thrombocytopenia. Massive splenomegaly with hypersplenism with hemolytic crisis could be the explanation of this in few of our patients. Ahmed YF[13] in his study found that ESR in patients of severe infection was 99.2 mm at the end of 1st hour compared to only 5 mm/hour in patients having no infection. This finding is significantly more than the mean ESR of present study. In most sickle cell case, the reticulocyte production index is more than 1, suggestive of optimal bone marrow response. Juwan A[11] reported that in hyper hemolytic crisis, the mean reticulocyte count increased from 6.41% to 14.2%. Kar and Satapathy[12] noted a positive correlation between reticulocyte count and spleen size.

In a study onhyperhemolytic crisis by Juwan A[11], the mean steady state bilirubin was 4.9mg% and that during hemolytic crisis was 9.0%. In our study, the mean S.bilirubin was 2.1mg% while it was 3.2mg% in study conducted by S. Pandey *et al.*[14]. Though alkaline phosphatase level is raised during symptomatic crisis episode; in the present study, they were elevated in only 9(21.9%) patients. The relatively insensitive assays used in our hospital could be responsible for this. Mean value of Alkaline Phosphatase was 679.2 I.U. in SCA patients in study by S. Pandey *et al.*[14]. Liver enzymes were elevated in a sizable number; though a final diagnosis of hepatopathy was made in 3 patients. Mean S.ALT and Mean S.AST level were 34.7I.U. and 69.6I.U. in a study by S.Pandey *et al.*[14]. In our study 10% Sickle cell disease (SCD) patients had increase S.Urea and 17% had increased S.Creatinine while S.Pandey *et al.*[14] reported Mean S.Urea 30.2mg% and that of S.Creatinine 1.2mg% in his study. In present study 19.51% had Albuminuria while in a study done by Franscois *et al.*[15] this figure was 40%.

Papadaki MG *et al.* [16] reported abnormal ultrasonography finding in patients of SCD. They reported hepatomegaly in 70% and Splenomegaly in 48% of SCD patients. Magic and Fishman[17], who carried out Computerized Tomography abdomen in 30 patients in crisis, found that all had splenic abnormalities; whether infarction, hemorrhage of calcification. Hepatomegaly was noted in 64% and 50% of SCD patients in the studies done by Yetunde A[18] and Karayalcin *et al.*[19] respectively while splenomegaly was noted in 34% and 23% of SCA patients conducted by the same respectively.

CONCLUSION:

From the study it can be concluded that haemoto-biochemical changes are significantly present in the patients of Sickle cell Anemia and they should be correlated with pathological changes. The ESR, classically low in sickle cell disease, was elevated in 37% of the patients, indicative of infection. Contrary to other studies, a high MCV was seen in 26% of our patients. Contributors to it could be patients having hyperhemolytic crisis and severe anemia with megaloblstic changes. These variation in classical changes need to be explored with further studies taking samples from various regions.

REFERENCES:

1. Windrobe MM, Lee GR, Boggs DR, *et al.*. ED(s). Hemoglobin and erythrocyte function in : Clinical Haematology. 10th edition. Philadelphia : Lea and Febiger. 2001;88-103.
2. Balgir R.S. The genetic burden of hemoglobinopathies with special reference to community health in India and the challenges

ahead. Indian Journal of Hematology and Blood Transfusion. 2002; 20(1):2-7.
3. Patel A, Naik M, Shah N, Sharma N, Parmar P. Prevalence of common hemoglobinopathies in Gujarat: an analysis of a large population screening program. Natl J Community Med 2012; 3(1):112-6
4. Shah MD, Patel RZ, Screening for G6PD deficiency and beta thalassemia in Lohana Commnity in: The MD (Branch I) dissertation submitted to the M.S. University of Baroda, 1992;45-50.
5. Parfrey NA, Moore GW, Hutchins GM. Is pain crisis a cause of death in sickle cell disease? Am J ClinPathol, 1985 Aug; 84[2]: 209-12.
6. Hargrave DR, Wade A, Evans JP, Hewes DK, Kirkham FJ. Nocturnal oxygen saturation and painful sickle cell crisis in children, Blood 2003; 101(3):846-848
7. Meshram AW, Bhatkulkar PA, Khare R, Pazare K. Haematological indices & electrolyte status in sickle cell disease at rural hospital of Central Maharashtra. Int J Med Sci Public Health 2014;3:1410-1412.
8. Serjeant GR., Sickle cell disease, Second Edition, Oxford University Press, Oxford, 1992.
9. Omoti CE. Haematological Values In Sickle Cell Anaemia In Steady State And During Vaso-Occlusive Crisis In Benin City, Nigeria. Ann Afr Med 2005;4:62 – 7.
10. Iwalokun BA, Iwalokun SO, Hodonu SO, Aina AO, Agomo PU. Serum levels of leptin in Nigerian patients with sickle cell anaemia. BMC Blood Disorders 2011;11:2.
11. Juwan AL, Nlemadim EU Types of anemic crisis in pediatric patients with sickle cell anemia in Enugu, Nigeria. Arch Dis Child 2004;89(2):572-76
12. Kar BC, Satapathy RK, Sickle cell Disease in Orissa state India, The Lancet. 1986 (11);198-202.
13. Ahmed YF, Abbag FI. Erythrocyte sedimentation rate during steady state painful crisis and infection in children with sickle cell disease. Saudi Med J. 2000; 21(5): 461-3
14. Pandey S, Sharma A, Dahia S, Shah V, Sharma V, Mishra RM, Pandey S, Saxena R. Biochemical Indicator of Sickle Cell Disease: Preliminary Report from India. Indian Journal of Clinical Biochemistry. 2012;27(2):191-195.
15. Kaze FF, Kengne AP, Atanga LC, Monny Lobe M, Menanga AP, Halle MP, ChetchaChemegni B, Ngo Sack F, Kingue S, Ashuntantang G: Kidney function, urinalysis abnormalities and correlates in equatorial Africans with sickle cell disease. Clinical Kidney J. 2012,6(1):15-20.
16. Papadaki MG, Kattamis AC, Papadaki IG, Menegas DG, Georgakopoulou TP, Mavrommati-Metaxotou A, Kattamis CA. Abdominal ultrasonographic findings in patients with sickle-cell anaemia and thalassaemiaintermedia. Pediatric radiology. 2003 ;33(8):515-21.
17. Magid D, Fishman EK, Charache S, Siegelman SS. Abdominal pain in sickle cell disease: the role of CT. Radiology. 1987 May;163(2):325-8.
18. Yetunde A. Anyaegbu CC. Profile of Sickle cell anemia patients above 30 years age in Nigeria. Cent Afr J Med 2001 ; 47(4): 108-11
19. Karayalcin G, Rosner F, Kim KY, Chandra P, Aballi AJ. Sickle cell anemia-clinical manifestations in 100 patients and review of the literature.The American journal of the medical sciences. 1975 ;269(1):51-68.