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HEMATOLOGICAL PROFILE OF PATIENT WITH SICKLE CELL ANEMIA AND IRON DEFICIENCY ANEMIA FROM RURAL VADODARA DISTRICT: A HOSPITAL BASED RETROSPECTIVE STUDY

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ABSTRACT

Background: Sickle Cell Anemia (SCA) and Iron Deficiency Anemia (IDA) are most prevalent public health problems in rural belt of Vadodara district. Sickle cell anemia is a genetic disorder which is identified by severe hemolytic anemia. Iron deficiency anemia is the primary common nutritional shortage in the world, because of when dietary iron absorption is insufficient to meet physiological requirements.

Objective: To compare hematological characteristics of patient with sickle cell anemia and iron deficiency anemia.

Method: A retrospective study was carried out at Parul Sevashram Hospital (PSH), Vadodara. Data were collected from 1st August 2021 to 31st January 2022. Records of all patients with

sickle cell anemia and iron deficiency anemia were reviewed for the study. Data from records were extracted in excel sheet. Data were analyzed using descriptive statistics.

Result: Study population constituted total number of 158 cases of anemia (55 sickle cell anemia and 103 iron deficiency anemia). Hematological profile of patients aging from 2 to 80 years of age (SCA: 2 to 45 years of age; IDA: 3 to 80 years of age) is presented. Differences in hematological profile of both SCA and IDA was noted. In terms of age, there wide difference noted (mean age: 21.32 SCA & mean age: 42.77 IDA). In SCA, Hb (8.63 ± 2.29), MCHC (31.38 ± 1.82) and RDW (20.67 ± 6.90) were dominant characteristics while in iron deficiency anemia RBC (6.79 ± 29.48), HCT (27.41 ± 4.57), MCV (83.42 ± 10.89), and MCH (25.95 ± 3.73). Very few patients (7%) were reported with SCA after age of 35, however, IDA was present in many patients (68.9%) above age of 35.

Conclusion: Major differences were noted in the hematological profile of SCA and IDA.

Keywords: Sickle cell anemia, iron deficiency anemia, hematological profile, rural hospital, western India

INTRODUCTION

Sickle Cell Anemia (SCA) and Iron Deficiency Anemia (IDA) are most prevalent public health problems in rural and tribal regions of the India. Anemia is a therapeutic condition where the number of red blood cells or their carrying capacity is inadequate to meet physiological needs **[1]**. Sickle cell anemia is genetic clutter identified by severe hemolytic anemia with diverse clinical manifestations. Sickle cell anemia is caused when transformation within a 6^{th} codon of beta globin quality with consequent substitution of glutamic corrosive for valine that leads to the production of a changed shape of hemoglobin, the hemoglobin S (HbS) **[2, 3]**. This cause them to stiffen, resulting in Vaso-occlusive cries, endothelial damage, organ dysfunction, and systemic consequence **[4]**. When oxygen level is low, HbS polymerizes, causing red blood cell (RBC) distortion, or "sickling." The lack of RBC deformability is thought to be a major cause of Vaso-occlusion and hemolysis in sickle cell anemia (SCA). There have been no laboratory tests to detect RBC deformability in SCA until recently **[5]**.

Iron deficiency anemia is the primary common nutritional shortage in the world **[6]**. According to the World Health Organization, the prevalence of anemia is highest in children group and lowest in non-pregnant women **[7]**. Nutritional iron deficiency

occurs when dietary iron absorption is insufficient to meet physiological requirements **[8]**. In red blood cells, iron is a major component of hemoglobin. Iron is required for the transfer of oxygen. While iron absorption and recycling are closely controlled by the human body, there is no physiological system that regulates iron excretion only iron regulation can prevent iron excess absorption. Dietary inadequacy, infections, and malabsorption are all major causes of iron insufficiency in children and blood loss due to hookworm infestation are also common. The best way to avoid iron shortage is to eat a balanced diet. A healthy balance of iron intake, absorption, and excretion **[9]**.

We reviewed many studies on the topic in India, however, limited studies were from Western India and authors could not find any studies who compared hematological profile of SCA and IDA. Considering the scare literature, we conducted hospital record-based study to understand hematological profile of patients with SAC & IDA from tertiary care hospital from Western India.

METHODOLOGY:

Research design: A hospital record based retrospective study

Sample: All patients with SCA & IDA visited PSH were included in the study

Inclusion & Exclusion criteria

Inclusion criteria

- All age and gender with diagnosis of sickle cell anemia and iron deficiency patient.
- Patients who were tested for complete blood count and Hb electrophoresis, Iron and total iron binding capacity (TIBC).

Exclusion criteria

- Aplastic anemia, hemolytic anemia, pernicious anemia.

Data collection: Records of selected patients based on inclusion & exclusion criteria was reviewed as per a prior hematological and demographic characteristics for comparison. Data was collected from August 2021 to 31st January 2022.

Ethical approval

Approved from Institutional Ethics Committee (Ethical no: PUIECHR/PISMR/00/081734/4007)

Statistical analysis

All data were entered into database by using Microsoft excel sheet. Descriptive statistics (mean, SD and p value) was applied and bi-variate and multi-variate tables were prepared for presenting the study findings.

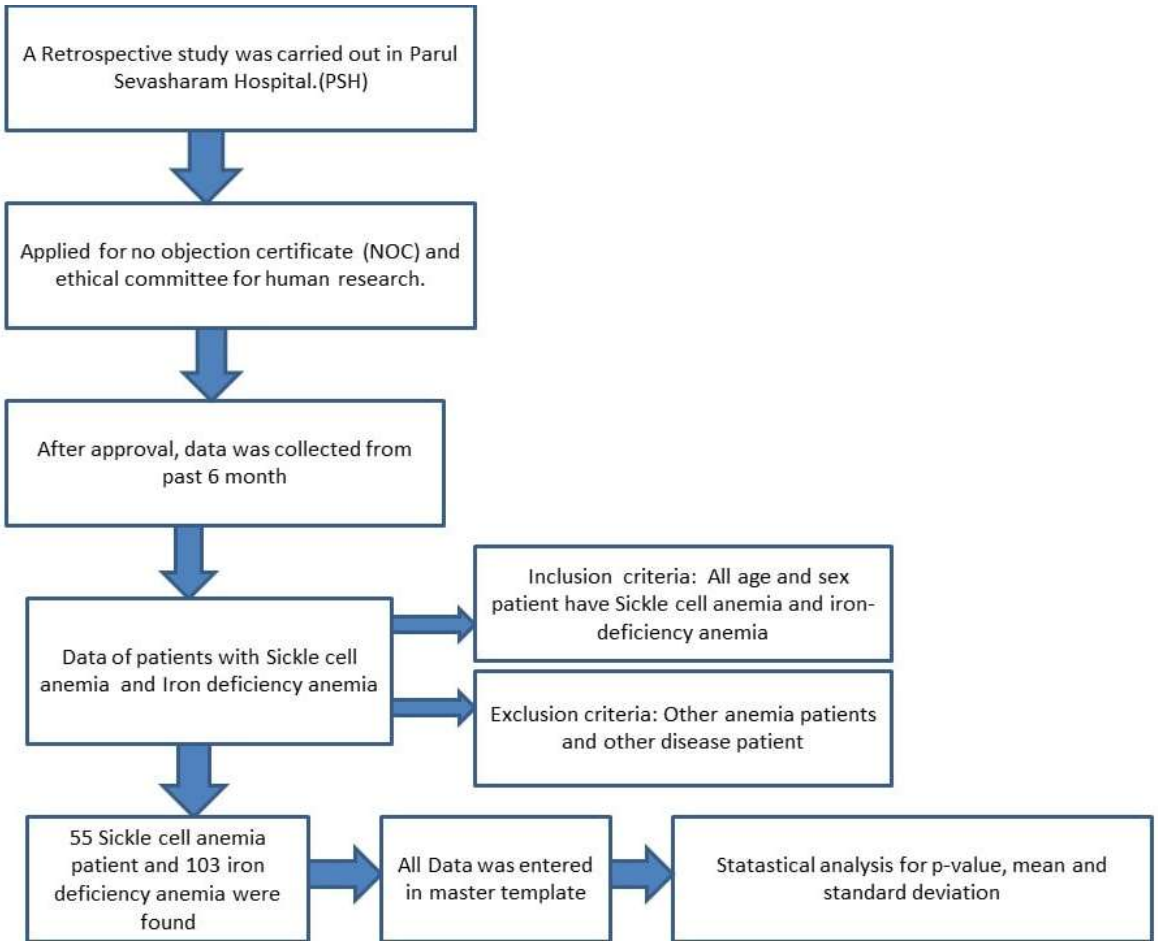

Figure 1: Flow chart of data selection

RESULT:

Age group of SCA & IDA patients ranged from 2 to 80 years of age (SCA: 2 to 45 years of age; IDA: 3 to 80 years of age).

Among sickle cell anemia 55 patients' blood test in mean hemoglobin level was 8.63 (SD = 2.29). Results of clinical finding revealed 10% (n = 6) of patients had a normal level. In 18% (n = 10) had mild anemia, 54% (n = 30) had moderate anemia, 16% (n = 9) had severe anemia **(Figure 2)**.

Among Iron deficiency anemia 103 patients' blood test in mean hemoglobin level was 8.52 (SD = 1.46). Results of clinical finding revealed 1.94% (n = 2) of patients had a normal level. In 16% (n = 16) had mild anemia, 25.24% (n = 26) had moderate anemia, 57.28% (n = 59) had severe anemia **(Figure 3)**.

A total patients of sickle cell anemia (n = 55), in male 40% (n = 22) and female 60% (n = 33).

A total patients of iron deficiency anemia (n = 103), in male 69% (n = 32) and female 31% (n = 71).

A total participants of iron deficiency anemia patients (n = 103) with the mean age of 42.77 ± 16.58 for associates of considered for clinical parameters. Out of those IDA participants, number of males were 32, and total number of females were 71. Mean (SD) age of male is 21.38 (8.88) and female is 21.96 ± 8.32. Comparison between SCA and IDA was found to be significant in MCV [(70.61 ± 10.85) vs (83.42 ± 10.89), p-value<0.0008], MCH [(22.15 ± 4.16) vs (25.95 ± 3.73), p-value<0.0009] and WBC [(11.3 ± 4.6) vs (11.3± 4.6), p-value<0.04]. The same was found to be non-significant in Hb [(8.63 ± 2.29) vs (8.52 ± 1.46), p-value<0.41], RBC [(3.95 ± 1.23) vs (6.79 ± 29.48), p-value<0.23], HCT [(27.40 ± 7.13) vs (27.41 ± 4.57), p-value<0.28], MCHC [(31.38 ± 1.82) vs (30.71 ± 3.09), p-value<0.48] and RDW [(20.67 ± 6.90) vs (17.02 ± 2.69), p- value<0.38] **(Table 1)**.

A total genotype of 55 participants were (mean age 21.32 ± 8.81 years) for sickle cell anemia participants were studied for clinical parameters. Out of those SS participants, totally number of males were 22 and 33 females. Mean (SD) Age of male 21.38 (8.88) and female 21.96 ± 8.32. As significant value of HCT [(27.30 ± 7.15) vs (27.66 ± 7.13), p-value<0.04], RBC [(3.94 ± 1.23) vs (3.98 ± 1.22), p-value<0.04], and MCHC [(31.38 ± 1.84) vs (31.44 ± 1.52), p-value<0.04], as non-significant p-value Hb [(8.60 ± 2.30) vs (8.72 ± 2.27), p- value <0.11], MCV [(70.58 ± 10.94) vs (68.96 ± 9.40), p-value<0.33], MCH [(31.38 ± 1.84) vs (22.09 ± 3.41), p-value<0.24, HbF [(6.37 ± 7.72) vs (5.86 ± 6.70), p-value<1.3], WBC [(11.24 ± 4.58) vs (11.42 ± 4.67), p-value<0.22] **(Table 2)**.

A total subjects of iron deficiency anemia (n = 103), in total number of male (n = 71) and total number of female (n = 32). Their hematological comparison with parameters of male and female as significantly of MCV [(82.72 ± 10.89) vs (82.41 ± 10.88), p-value<0.03], MCH [(25.73 ± 3.73) vs (25.59 ± 3.74), p-value<0.02], as non-significantly of Hb[(8.60 ± 2.30) vs (8.36 ± 1.47), p-value<0.09], RBC [(7.38 ± 29.48) vs (10.1 ± 29.48), p-value<0.25], HCT [(27.45 ± 4.57) vs ±(26.94 ± 4.61), p-value<0.14], MCHC [(30.65 ± 3.09) vs (30.31 ± 3.13), p-value<0.41], RDW [(17.02 ± 2.69) vs (17.24 ± 2.72) p-value<17.1], WBC [(8.4 ± 3.2) vs (8.5 ± 3.28) p-value<0.48], iron [(44.7 ± 12.36) vs (47.9 ± 12.35), p-value<0.43] **(Table 3)**.

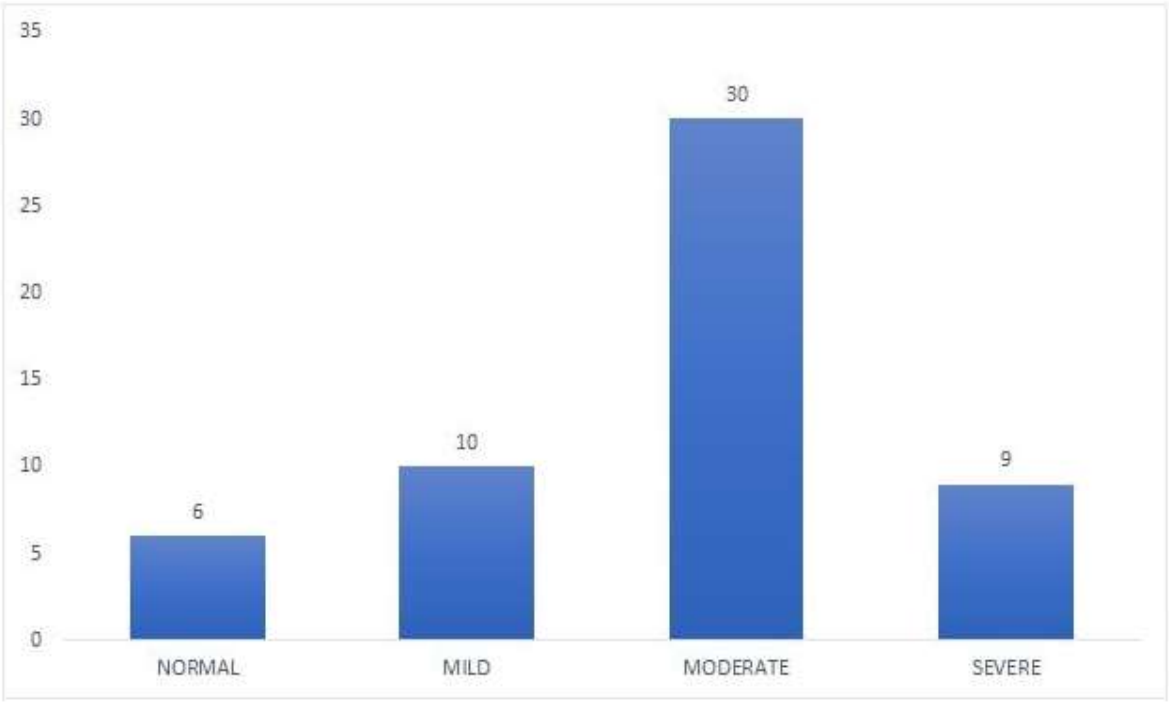

Figure 2: Hemoglobin participants among Sickle Cell Anemia

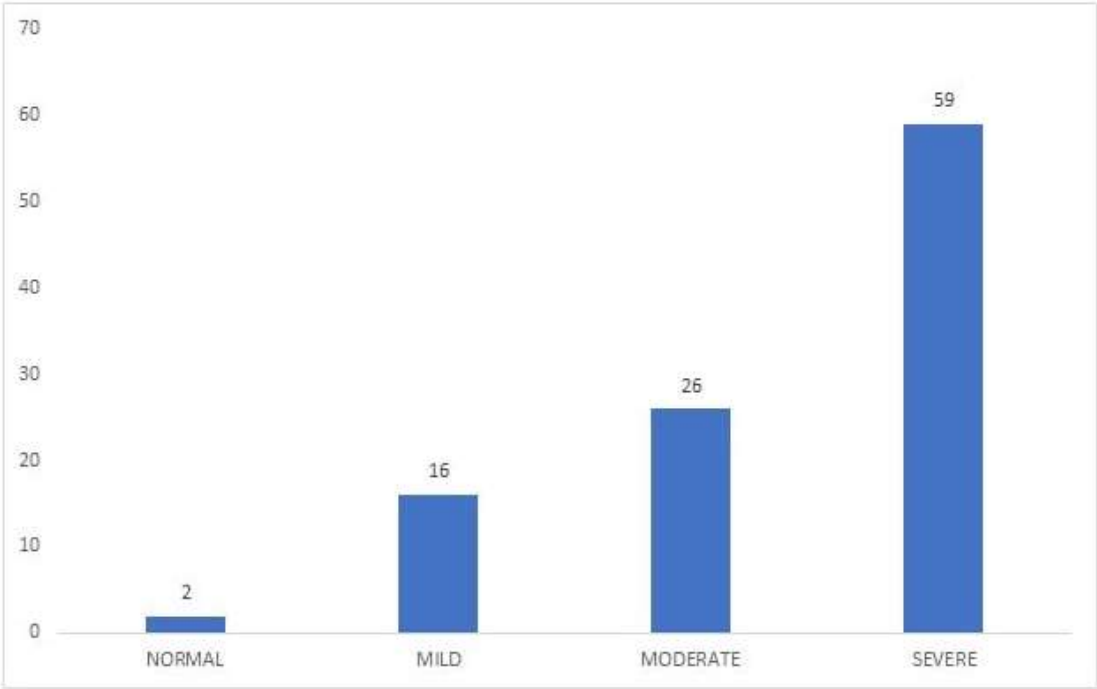

Figure 3: Hemoglobin participants among Iron Deficiency Anemia

Table 1: Hematological Comparison of Iron deficiency anemia (n=103) and Sickle cell anemia (n=55) patient

Clinical Parameters	Normal range	SCA (n=55)	IDA (n=103)	p-value
HB	M/13-17 F/12-15 g/Dl	8.63 ± 2.29	8.52 ± 1.46	0.41
RBC	M/4.5-5.5 F/3.8-4.8 10^12/L	3.95 ± 1.23	6.79 ± 29.48	0.23
HCT	36-40 %	27.40 ± 7.13	27.41 ± 4.57	0.28
MCV	83-101 fl	70.61 ± 10.85	83.42 ± 10.89	0.0008*
MCH	27-32 pg	22.15 ± 4.16	25.95 ± 3.73	0.0009*
MCHC	31.5-34.5 g/dL	31.38 ± 1.82	30.71 ± 3.09	0.48
WBC	4000-10000 /cmm	11.3 ± 4.6	11.3± 4.6	0.04*
RDW	11.5-14 %	20.67 ± 6.90	17.02 ± 2.69	0.38

Table 2: Hematological Comparison between Male and Female in Sickle Cell Anemia

Clinical Parameter	Male (n=71)	Female (n=32)	Total (n=103)	P-value
	Mean ± SD	Mean ± SD	Mean ± SD	
Hb	8.60 ± 2.30	8.36 ± 1.47	8.52 ± 1.46	0.09
RBC	7.38 ± 29.48	10.1 ± 29.48	6.79 ± 29.48	0.25
HCT	27.45 ± 4.57	26.94 ± 4.61	27.41 ± 4.57	0.14
MCV	82.72 ± 10.89	82.41 ± 10.88	83.71 ± 3.09	0.03*
MCH	25.73 ± 3.73	25.59 ± 3.74	25.95 ± 3.73	0.02*
MCHC	30.65 ± 3.09	30.31 ± 3.13	30.71 ± 3.09	0.41
RDW	17.02 ± 2.69	17.24 ± 2.72	17.02 ± 2.69	17.1
WBC	8.4 ± 3.2	8.5 ± 3.28	8.43± 3.28	0.48
IRON	44.7 ± 12.36	47.9 ± 12.35	43.83 ± 12.36	0.43

Table 3: Hematological Comparisons between Male and Female in Iron Deficiency Anemia Patient

Clinical Parameters	Male (N=22)	Female (N=33)	Total (N=55)	P-Value
	Mean ± SD	Mean ± SD	Mean ± SD	
Hb (g/dl)	8.60 ± 2.30	8.72 ± 2.27	8.63 ± 2.29	0.11
HCT (gm/dL)	27.30 ± 7.15	27.66 ± 7.12	27.40 ± 7.13	0.04*
RBC (mill/mm³)	3.94 ± 1.23	3.98 ± 1.22	3.95 ± 1.23	0.04*
MCV (fl)	70.58 ± 10.94	68.96 ± 9.40	70.6 ± 10.85	0.33
MCH (pg)	24.35 ± 4.19	22.09 ± 3.41	22.15 ± 4.15	0.24
MCHC (g/dl)	31.38 ± 1.84	31.44 ± 1.52	31.38 ± 1.82	0.04*
HbF (%)	6.37 ± 7.72	5.86 ± 6.70	6.80 ± 7.65	1.3
WBC (×10³µL)	11.24 ± 4.58	11.42 ± 4.67	11.34 ± 4.60	0.22

DISCUSSION

Differences in hematological profile of patients with SCA & IDA were noted. There were more female as compare to male in the sickle cell anemia. And in iron deficiency anemia male were more as compare to female. Total hemoglobin is very low in SCA of female and in IDA of male hemoglobin is low due to hemolysis so it is statistically not significant ($p>0.05$) and also due to dietary sorbent because of socio-economics. In India anemia is common nutritional deficiency due to low absorbance of iron, according to national health survey. In our SCA study, total red cell count, mean cell volume (MCV), mean cell hemoglobin (MCH), and mean cell hemoglobin concentration (MCHC) are low when compared to other

studies. In sickle cell disease patients, a high level of mean cell volume (MCV) is primarily responsible for a large amount of erythropoiesis. MCV is low in our study as compare to other study it may be due to co-existing in iron deficiency anemia and it related to sickle cell disease **[10-12]**.

This study also found in IDA patients had significantly lower mean of MCV, MCH level as well as non-significantly increase of Hb, RBC, HCT, MCHC, WBC, RDW and Iron level. In severe IDA patients had usually decrease production of Hemoglobin level and RBC and as result in generation of microcytic RBC **[13, 14]**. In our study severe anemia were (57.28%), moderate anemia (25.24%), mild anemia (16%) and normal anemia were (1.94%) as compare to other study severe anemia more seen. Because of that patient had hemoglobin level were below <8g/dl. Only few patients have hemoglobin level were normal but its iron level is low so it's considered as iron deficiency **[1]**.

CONCLUSION

Major differences were noted in the hematological profile of SCA and IDA.

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