e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(1); 431-436

Original Research Article

# Correlation of Haematological and Biochemical Parameters in Sickle Cell Disease in Tertiary Care Hospital

**Harsh Pandya[1], Charmi Kotak[2], Vijay Parmar[3]**

[1]Assistant Professor, Department of pathology, Parul institute of Medical Science and Research, Vadodara, Gujarat

[2]Assistant Professor, Department of General Medicine, SBKS Medical Institute and Research Centre, Vadodara, Gujarat

[3]Assistant Professor, Department of General Medicine, B.J. Medical College, Ahmedabad, Gujarat

**Received: 01-10-2025 / Revised: 15-11-2025 / Accepted: 21-12-2025**

**Corresponding author: Dr. Charmi Kotak**

**Conflict of interest: Nil**

**Abstract**

**Introduction**: The sickle cell anaemia is defined as a hemoglobinopathy due to a single point mutation in the beta-chain of human haemoglobin. The homozygous inheritance of this mutation produces haemoglobin SS and heterozygous forms stands for sickle cell trait. Individuals with this Hb-SS genotype suffer from sickle cell anaemia.

**Methodology:** Total 120 patients are included in study and the study design is observational cross sectional study. Patients having sickle cell disease (homozygous for HB-SS type) have been assessed for haematological profile like Complete blood count by Sysmex 3 part analyser and biochemistry tests like Liver function test, Serum LDH, Renal function tests, these all biochemistry tests have been assessed by using EM-200 fully automated chemistry analyser.

**Result:** Out of 120 cases in 85 patients (70.84%) values for total bilirubin are elevated. In remaining 35 patients (29.16%) of sickle cell disease total bilirubin is within normal limit. Mean value for total bilirubin is 1.8 mg%. Here in study out of 120 cases of sickle cell disease 62(51.66%) patients have serum creatinine in normal range while 58(48.44%) patients value are not in normal range. Mean value for serum creatinine is 1.18 mg%. Out of 120 patients 106(88.4%) patients have s. urea in normal range while only 14(11.6%) patients have abnormal value for serum urea. Mean for serum urea is 24.48 mg%.

**Conclusion:** It has been observed that parameters of liver function test are elevated because of event of hemolysis which happens to sickle cell disease patients. In present study 67.5%, 78.3%, 87.5% and 70.84% cases have elevated values for SGOT, SGPT, S.ALP and serum total bilirubin respectively. There is also seen that renal function is not that much altered as compared to liver function and the data suggests that by only 11.6% cases and 48.4% cases have elevated values for S. urea and S. creatinine respectively.

**DOI:** 10.25258/ijcpr.18.1.70



## Introduction

The sickle cell anaemia is defined as a hemoglobinopathy due to a single point mutation in the beta-chain of human haemoglobin. The homozygous inheritance of this mutation produces haemoglobin SS and heterozygous forms stands for sickle cell trait. Individuals with this Hb-SS genotype suffer from sickle cell anaemia [1].

The amino acid valine replaces glutamic acid in the sixth position of the B-globulin chain [2].which is the most common point mutation as far as sickle cell disorders are concerned. There are other several forms of point mutation which codes for abnormal hemoglobin other than Hb-S. Like HbE, Hb-C Sickle cell disorder denotes all genotypes that contain at least one sickle gene in which hemoglobin S makes up at least half of the hemoglobin present. Sickle cell disease (HbSS) and Sickle cell Trait (HbSA) is the major in this group globally and in India. According to ICMR survey. Sickle Cell gene is found amongst different tribal groups of India, which varies from 5 to 34 %.

India has also a very huge populations of tribal community about 18 crore and expected to have 1.80 crore sickle cell trait and 14 lakhs of sickle cell disease. The most prominent clinical feature of sickle cell anaemia is painful crisis, pathophysiology of vaso-occlusive phenomenon is the causative for painful crisis. Hepatic injury can

be directly related to the sickling process, acute hepatic crisis and hepatic sequestration crisis combinely (causes sickle cell hepatopathy [3]. Most common events of sickle cell disease pathogenesis can be categorised into haemolytic events and vaso-occlusive crisis. Serum enzymes (AST, ALT) and s.bilirubin are significantly increased whereas renal functions are not altered significantly. Hepatic dysfunction is a commonly recognised complication of sickle cell disease due to multiple factors such as intrahepatic sinusoidal sickling, bilirubin gallstones, transfusion related hepatitis infections or excess iron deposition [4]. Hemolysis occurs in Sickle cell anaemia disease is due to phagocytosis of red cells that have undergone sickling. These events are responsible for significant reduction in PCV%. Homozygous sickle cell disease patients have lower value of haemoglobin and higher value of total WBC and platelet counts [1].

In sickle cell patients serum creatinine level is associated with renal insufficiency. Elevated level of seum creatinine is an indicator of having disease to an advanced stage and can lead to renal failure.

**Results**

**Table 1: Mean Value for CBC in 120 Cases**

| Test | Mean of 120 cases |
|---|---|
| Total leucocyte count | 10100/mm$^3$ |
| PCV | 28.4 % |
| MCV | 65.35 fl |
| MCH | 20.83 pg |
| MCHC | 31.66% |
| RDW | 18.0% |
| Total RBC count | 4.42 mil./microleter |
| HB | 8.98 gm% |
| Platelet count | 2.53 lakh/mm$^3$ |

**Table 2: Age and Sex Distribution in Sickle Cell Disease.**

| Age Group (in Years) | Male | Female | Total |
|---|---|---|---|
| 0-10 | 08 | 15 | 23 |
| 11-20 | 7 | 41 | 48 |
| 21-30 | 10 | 30 | 40 |
| 31-40 | 1 | 3 | 4 |
| 41-50 | 1 | 4 | 5 |
| Total | 27 | 93 | 120 |

Here among 120 cases 27 cases are male whereas 93 cases are that of female. So here M:F ratio for incidence of sickle cell disease is 1:3.44. Analysis from above results is that also female numbers are on a higher side because of high prevalence among ante natal women for sickle cell disease and the selected study site is near sickle cell belt. Chances of female getting diagnosed for sickle cell disease is may be on higher side as compare to male because of routine ante natal visits during pregnancy. Highest number of cases are observed in second decade of life i.e. 11-20 year age group. After certain age the chances of getting diagnosed by the means of HPLC for sickle cell disease is reduced and that we can see also a reduced number of cases in after 30 year age group.

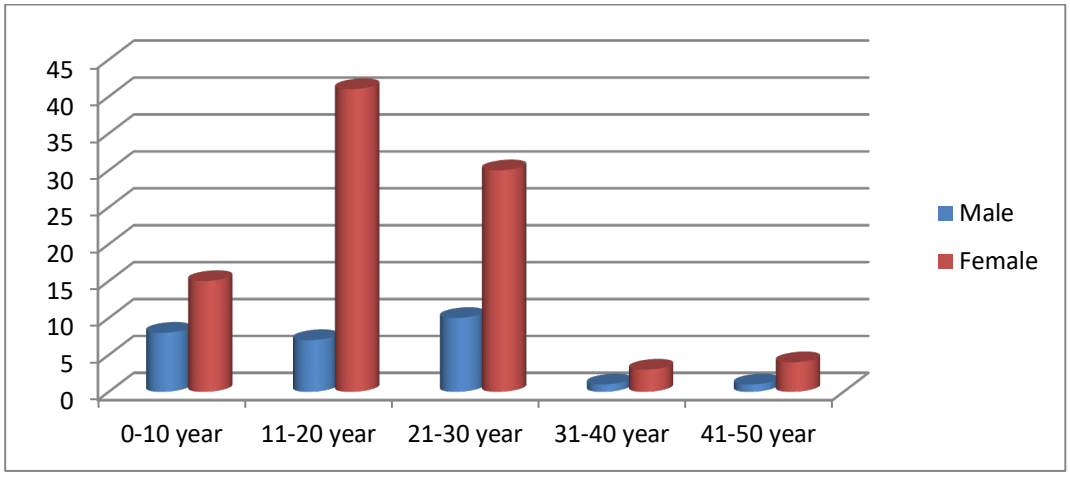


**Chart 1: Age and Sex Distribution of Sickle Cell Disease.**

This chart shows number of case in male and female cases on y axis in different age groups(x axis).

**Table 3: Correlation of Liver Function Test with Incidence of Aberrated Values and Mean**

| Test | No of cases in normal range | No of cases with aberrated values. | Mean of 120 cases | % of cases in normal range | % of cases with aberrated values |
|---|---|---|---|---|---|
| Direct bilirubin | 39 | 81 | 0.64 mg% | 32.5 | 67.5 |
| Indirect bilirubin | 46 | 74 | 1.09 mg% | 38.33 | 81.66 |
| Total bilirubin | 35 | 85 | 1.8 mg% | 29.16 | 70.84 |
| SGOT | 39 | 81 | 44.8 IU/l | 32.5 | 67.5 |
| SGPT | 26 | 94 | 46.7 IU/l | 21.7 | 78.3 |
| ALP | 15 | 105 | 223.8 u/l | 12.5 | 87.5 |

- Here in 81 patients (67.5%) values of direct bilirubin are not in a normal range. While in remaining 39 patients (32.5%) values of direct bilirubin are in normal range. Mean for direct bilirubin is 0.64 mg%.
- In 74 patients (81.66%) values of indirect bilirubin are not in normal range while in remaining 46(38.33%) patients values are in normal range. Mean for indirect bilirubin is 1.09 mg%.
- Out of 120 cases in 85 patients (70.84%) values for total bilirubin are not in a normal range. In remaining 35 patients (29.16%) of sickle cell disease total bilirubin is within normal limit. Mean value for total bilirubin is 1.8 mg%.
- Here in 81 patients (67.5%) values of SGOT are not in normal range. While in remaining 39 patients (32.5%) values of SGOT are in normal range. Mean for SGOT is 44.8 IU/l.
- Here in 94 patients (78.3%) values of SGPT are not in normal range. While in remaining 26 patients (21.7%) values of SGPT are in normal range. Mean for SGPT is 46.7 IU/l.
- Only 15(12.5%) patients have reported with ALP in normal range. Rest of 105 cases have varying degree of values for ALP which is not in normal range.
- Mean value for ALP is 223.8 u/l.

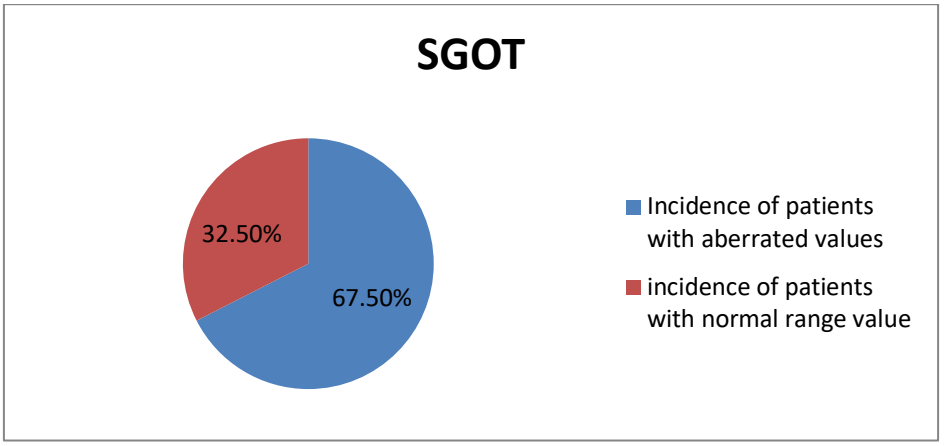


**Chart 2: Incidence for Aberrated Value of SGOT**

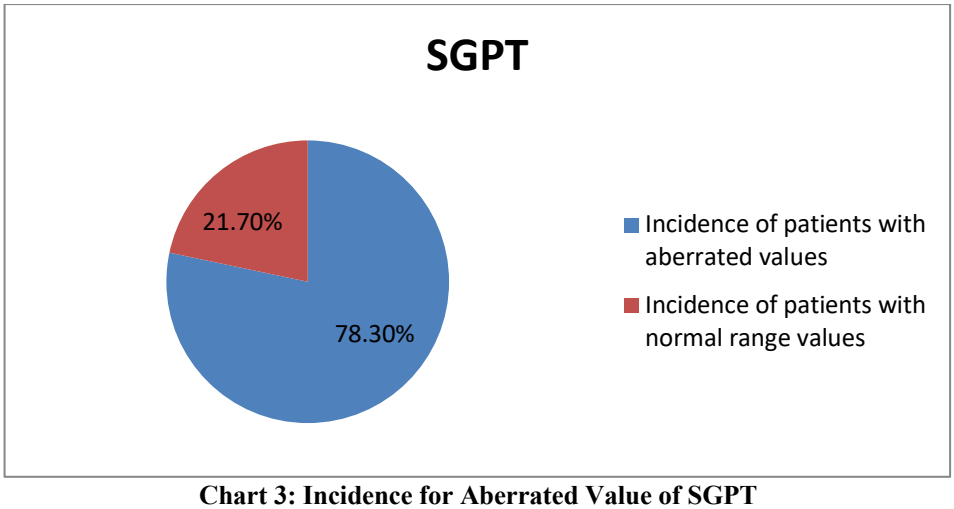


**Chart 3: Incidence for Aberrated Value of SGPT**

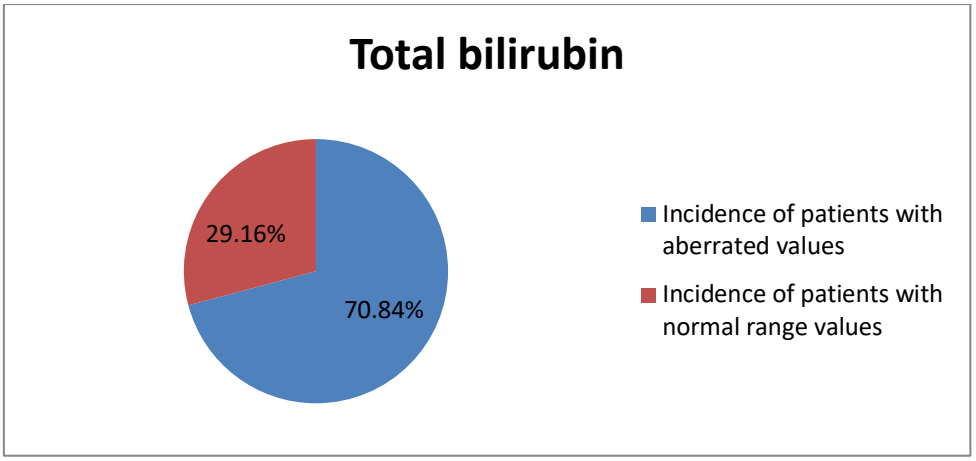


**Chart 4: Incidence for Aberrated Value for Total Bilirubin**

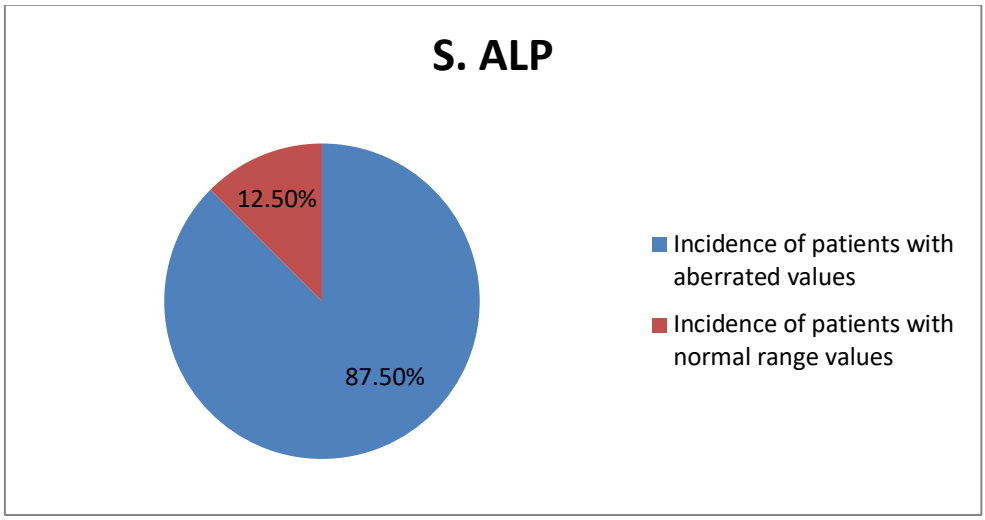


**Chart 5: Incidence for Aberrated Value of S.Alp**

**Table 4: Study of S.Ldh with Mean Value.**

| Test | No of cases in normal range | No of cases with aberrated values | Mean of 120 subjects | Incidence of aberrated value for S.LDH | Incidence of normal value for S.LDH |
|---|---|---|---|---|---|
| S.LDH | 22 | 98 | 550.4u/l | 81.7% | 18.3% |

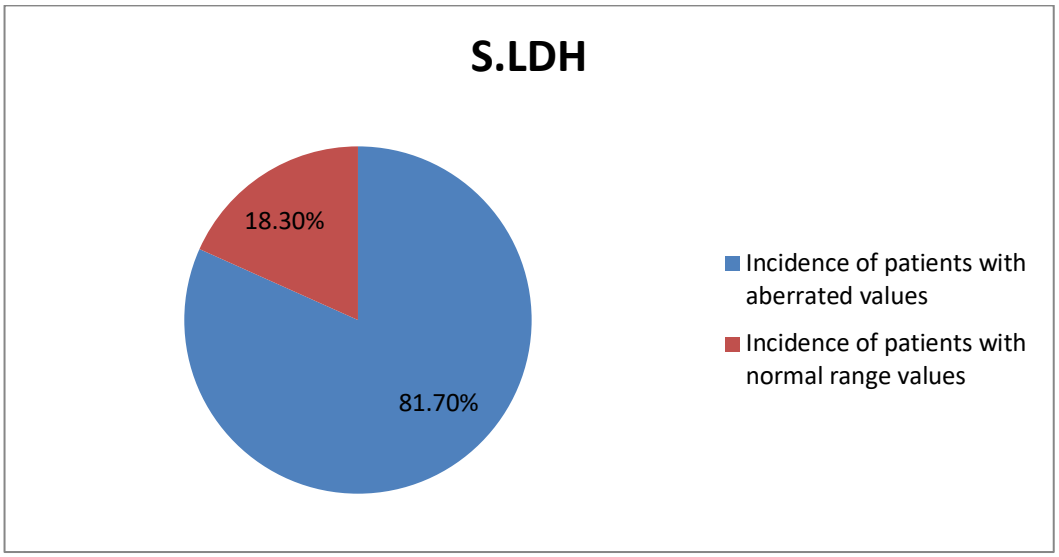


**Chart 6: Incidence for Aberrated Value of S.Ldh**

Here, for serum LDH 18.3% patients (22 cases) have values within normal range. While rest of 98 patients (81.7%) have values for S.LDH elevated. Mean value S.LDH of 120 patients is 550.4 u/L.

**Table 5: Study of Renal Function Test with Mean Value.**

| Test | No of cases in normal range | No of cases with aberrated values | Mean of 120 cases. |
|---|---|---|---|
| S. Creatinine | 62 | 58 | 1.18 mg% |
| S. Urea | 106 | 14 | 24.48 mg% |

Here in study out of 120 cases of sickle cell disease 62(51.66%) patients have serum creatinine in normal range while 58(48.44%) patients value are not in normal range. Mean value for serum creatinine is 1.18 mg%. Out of 120 patients 106(88.4%) patients have s. urea in normal range while only 14(11.6%) patients have abnormal value for serum urea. Mean for serum urea is 24.48 mg%.

**Table 6: Incidence for Aberrated Values of Renal Function Test.**

| Test | % of cases in normal range | % of cases with aberrated values |
|---|---|---|
| S. Creatinine | 51.6 | 48.4 |
| S. Urea | 88.4 | 11.6 |

Above table shows that incidence of cases having values both for serum urea and serum creatinine in normal range is higher than that of cases having aberrated values for serum creatinine and serum urea.

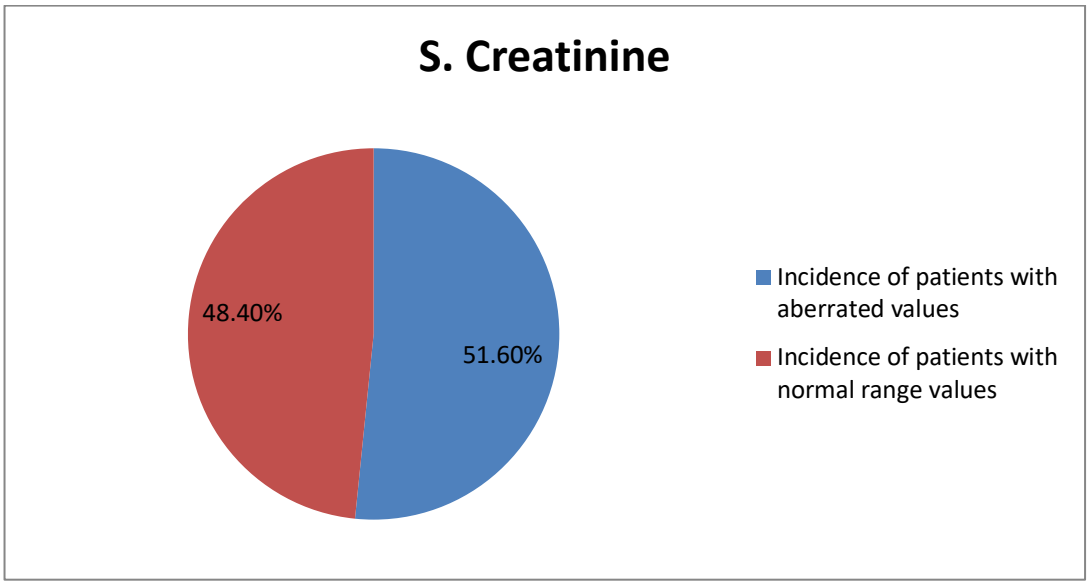


**Chart 7: Incidence for Aberrated Value of S.Creatinine**

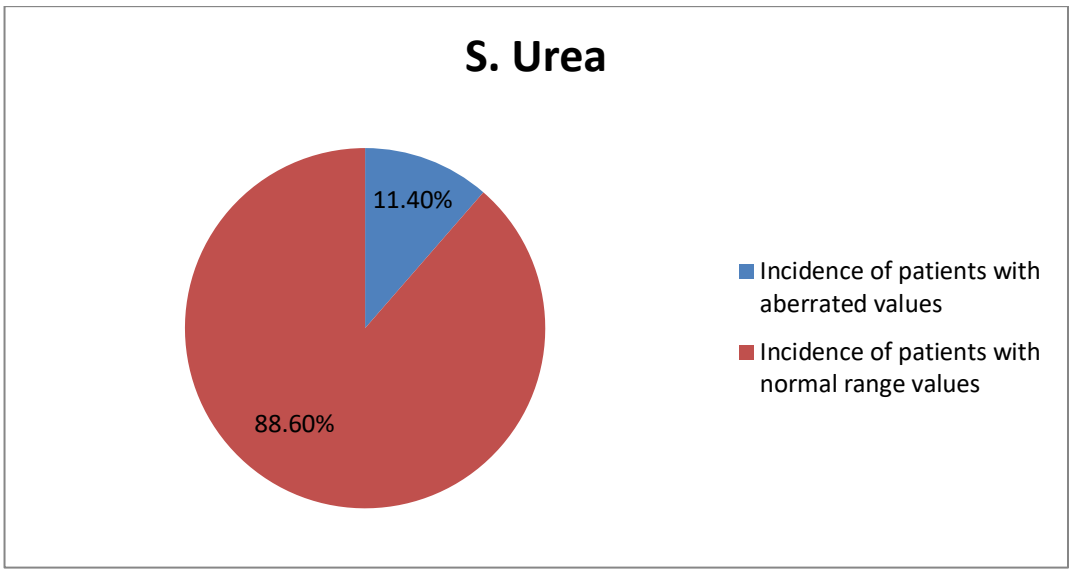


**Chart 8: Incidence for Aberrated Value of S.Urea**

## Conclusion

Total 120 cases of HPLC confirmed sickle cell disease are included in current study. Amongst 120 cases M: F ratio in current study is 1:3.44. Whereas maximum number of patients are in second decade of life that is 11-20 year age group. Mean value for MCV is observed which is on lower side (65.35 fl) from normal range and it can be postulated by the fact of concurrent incidence of iron deficiency anemia in study group and by the fact that most number of cases are in study are of female which have higher prevalence of iron deficiency anaemia along with sickle cell disease. So reduced MCV is because of this iron deficiency anaemia which is known for its peripheral blood smear picture of microcytic hypochromic anaemia. It has been observed that parameters of liver function test are elevated because of event of hemolysis which happens to sickle cell disease patients. In present study 67.5%, 78.3%, 87.5% and 70.84% cases have elevated values for SGOT, SGPT, S.ALP and serum total bilirubin respectively.

There is also seen that renal function is not that much altered as compare to liver function and the data suggests that by only 11.6% cases and 48.4% cases have elevated values for S.urea and S.creatinine respectively. Serum LDH is associated with hemolysis and it is quite frequent event of hemolysis as far as SCD is concerned. So in current study we also have 81.7% cases with elevated S.LDH. So it is mainly due to hemolytic pathology in SCD. Serum alkaline phosphate is also elevated in majority of study population. Which is also a sign of elevated liver function parameters in sickle cell disease. 87.5% cases have elevated (aberrated) values for serum alkaline phosphatase. So, with these we can conclude that in sickle cell disease because of complications or the pathological events which takes place causes aberrated values in LFT, RFT, S.LDH.

## Summary

Here 120 cases have been included in the study. Patients' blood sample were tested initially for sickling solubility test.

Positive test from these are confirmed with HPLC. Only HPLC positive for sickle cell disease have been included in current study.

Excluded ones are either sickle cell trait or having double heterozygous for sickle cell and beta thalassemia trait.

Then Hematological test CBC has been done for every patient and other biochemistry profile in form of LFT, RFT and S.LDH were done. CBC have been tested by using sysmex kx-21 3 part cell counter. While for biochemistry tests EM-200 has been used. Mean value for 120 cases have been obtained for every individual test parameter and correlation of such parameters in sickle cell disease have been done. Incidence rate has also been calculated for every parameter.

Spectrum of deviation from normal range can be estimated by this. Incidence for aberrated values have been obtained which are mainly on higher side range than normal for biochemistry parameters.

Data pointing towards hemolytic crisis have been obtained in form of aberrated liver function test parameters. Raised S.LDH also an indicator of having hemolytic events in such included cases.

## References

1. Obimba Kelechukwu Clarence. Biochemicaland haematological diagnostic indices of homozygous sickle cell anemia patients in steady state. International journal of medicine and medical sciences, December, 2015; 5(11):299-306. ISSN 2167-0404
2. Abdelrahim Osman Mohamed. Sickle Cell Disease in the Sudan: Clinical and Biochemical Aspects, Upsala Journal of Medical Sciences, 97:3, 201-228, DOI: 10.3109/03009739209179297.
3. Tripathi P., Tripathi M. Biochemical assessment of liver in sickle cell disease patients at a tertiary care hospital of north India. Int J Res Med Sci., 2016; 4:57-60.
4. Garg D., Satam N., Nimisha N., Marar N.T., Patil V.W. Studies on the hepatic and renal status of patients with sickle cell disease from western zone of Maharashtra, India. Int J Res Med Sci. 2018; 6:1224-7.
5. Elliott P. Vichinsky, M.D., et al., for the National Acute Chest Syndrome Study Group. N Engl J Med., 2000;342:1855-1865DOI: 10.1056/NEJM200006223422502