International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Blood Pressure Indices in Children with Sickle Cell Disease attending Tertiary Care Centre in Assam

Dr. Asha Arumugam[1], Dr. Pritikar Dowerah[2], Alaka Das[3], Dr. Bhanusmitha Bhattacharya[4]

[1]Departments of Pediatrics, Assam Medical College and Hospital, Dibrugarh, Assam, India
Corresponding Author Email: *ashaarumugam93[at]gmail.com*
Ph No: 8903278245

[2]Professor, Departments of Pediatrics, Assam Medical College and Hospital, Dibrugarh, Assam, India

[3]Associate Professor, Departments of Pediatrics, Assam Medical College and Hospital, Dibrugarh, Assam, India

[4]Departments of Pediatrics, Assam Medical College and Hospital, Dibrugarh, Assam, India

Abstract: ***Background**: The commonest hemoglobinopathy is the Sickle cell disease (SCD). Studies stated that children with SCD have lower blood pressure compared to the healthy children without SCD. **Aim of the study**: The aim of the study is to assess the pattern of blood pressure in children with sickle cell anemia. **Methodology**: This cross - sectional study was done in the Department of Pediatrics, Assam Medical College, Dibrugarh from May 2021 to April 2022. Based on the inclusion and exclusion criteria the final sample size was obtained as 60. SPSS 16 software was used for analysis. Numbers and percentages were used to express Categorical variables. Mean and Standard deviation were used to express continuous variables. Pearson correlation was used to find association between two continuous variables. **Results**: Male preponderance 33 (55%) was observed in the study. The mean age of the study participants was 8.6±2.3 years in males and 8.22±2.5years in females. The mean height and weight was more in males compared to females. The mean body mass index was found to be more in females. The systolic blood pressure, diastolic blood pressure, mean arterial pressure and pulse pressure was found to be more in the female group compared to the males. The difference was found to be statistically significant. **Conclusion**: Our study concludes that majority of study participants both systolic blood pressure and diastolic blood pressure are less than 50th percentile***

Keywords: Systolic, Diastolic, Mean arterial pressure, Sickle cell disease

1. Introduction

Sickle cell disease is an inherited autosomal recessive blood condition among the Arabian, African and Indian Population. The disease is largely undocumented in India. There are two presentation: traits and sickle cell disease. Possessing only a single gene HbS is known as Sickle cell trait and it is usually harmless. When this HbS gene is obtained from both the parents then it results in Homozygous sickle cell disease. It occurs as a result of point mutation which takes place in the 6th position in the Beta globulin chain of the hemoglobin where the glutamic acid was substituted by valine and forms the hemoglobin S (HbS) [1, 2]. This homozygous Sickle cell disease was found to be highest in the Subsaharan Africa were generally 3 - 4% of the population.

The sickle cell disease was found most commonly in the area where the malaria transmission was intense. Sickle cell disease was first reported in Nilgiris of Tamil Nadu in the year 1952[3]. But now it has been widespread all over in the deccan plateau of central India and smaller focus in north of Kerala and TamilNadu[4]. In Assam state sickle cell disease is common among the tea estate workers.

Thus there is an unstable isoform produced which when deoxygenated slowly will produce sickle cell as a result of polymerization. The clinical presentation of the sickle cell disease varies from asymptomatic to severe form of crisis which is fatal. Generally it shows a mild or benign pattern in Indian population when compared to the American and African population[5]. Generally sickle cells will lack the fluidity of the normal erythrocytes which will obstruct or impede the capillary flow which eventually leads to the tissue ischemia[6].

It is found that due to the low systemic vascular resistance the blood pressure of the Sickle cell disease patients was found to be low compared to healthy people with normal hemoglobin phenotype [8, 9]. So hypertension is not common in sickle cell disease and if hypertension is present then it leads to greater risk of vasoocclusive crisis and eventually death. Thus among 15 - 18% of the Sickle Cell Anemia patients have a renal disease as a major comorbid condition and it is the most common cause of early death.5 - 18% of study participants have renal failure[10].

We intend to do this study as only limited number of studies have been done in this topic and to throw light regarding this unclear area. The aim of our study is to study the patterns of blood pressure among Children (2 - 12) years with sickle cell Anemia.

2. Methodology

Study Setting:
The study was conducted in the Department of Paediatrics, Assam Medical College, Dibrugarh which is a tertiary care center. The study was done for a period of one year from May 2021 to April 2022.

Study Design: Cross - sectional study

Sample Size:
All diagnosed cases of Sickle cell anemia aged 2 to 12 years attending the pediatrics OPD and who fulfilled inclusion and exclusion criteria were included in the study. The total sample attained was 60.

Inclusion criteria:
- Diagnosed cases of SCA from age 2 to 12 years using High Performance Liquid Chromatograph

Exclusion criteria:
- Children who present with crises
- Children on antihypertensive and steroids
- Children with coexisting Cardiovascular disease like Congenital heart disease, Rheumatic heart disease
- Parents or guardians who are not willing to enroll their children in the study

Data Collection:
After obtaining permission from the Institutional Ethical Committee, informed written consent was obtained from all the study participants. All the study participants were evaluated by thorough clinical history and anthropometric measurements were recorded.

1) Demographic details like name, age, sex, residence, parent's name, occupation, age at the time of diagnosis, presenting complaints, total number of blood transfusion and vaccination history along with HPLC, regularity in attending the hospital admissions in a year were documented.
2) Anthropometric measurements like height, weight were measured. The body mass index was calculated.
3) Standard procedure was followed for measuring the Blood pressure.
4) A semi - structured questionnaire was designed to collect the information.

Statistical Analysis
After collecting the data it was entered in MS Excel Windows 10. Statistical analysis was done in a statistical package for social sciences (SPSS) 23. Continuous data were expressed in terms of Mean ± Standard deviation and Categorical variables were expressed in terms of numbers (percentages). Anova test or student t test was used to find the association between two continuous variables. Chi square test was used for Test of Association for continuous variables. A p - value of <0.05 is considered to be statistically significant.

3. Results

All the 60 study participants were divided into two groups based on the sex distribution where male constitute 33 (55%) and that of Female 27 (45%).

Table 1: Demographic characteristics of the study participants

Demographic variables	Males	Females	P value
Mean age (years)	8.6±2.30	8.22±2.53	0.5
Height (cm)	121.58±10.79	118.07±	0.17
Weight (kg)	23.06±4.19	22.56±4.19	0.64
Body mass index (in Kg/m^2)	15.62±2.2	16.17±2.91	0.40

Among the study participants the mean age of the study participants was 8.6±2.30 years in males and 8.22±2.53 years in Females. The difference between them was found to be not statistically significant. The mean height of the study participants was more in the Male group (121.58±10.79 cm) compared to the Females and it was found to be statistically significant. Similarly, the mean weight of the children in the males (23.06±4.19) was more compared to the females group (22.56±4.19) and it was found to be not statistically significant. The mean body mass index was also more in the Females (16.17±2.91) group than in the Males (15.62±2.2) and it was found to be not statistically significant.

Table 2: Blood and Pulse Pressure Parameters

Parameters	Males	Females	P value
Pulse Pressure	45.6±1.08	46.5±1.94	<0.001*
Systolic blood pressure (mmHg)	114.82±5.32	112.93±5.3	<0.001*
Diastolic blood pressure (mmHg)	69.21±4.6	76.41±4.13	<0.001*
Mean Arterial Pressure (in mmHg)	84.4±4.8	91.9±4.7	<0.001*

The systolic blood pressure, diastolic blood pressure, Mean Arterial Pressure and Pulse pressure was found to be more in the Female group compared to Males. The differences between the two groups were found to be statistically significant.

Table 3: Percentiles of the Blood Pressure among our study participants:

BP Percentiles	Male		Female	
	SBP	DBP	SBP	DBP
<50th	25 (75%)	20 (60%)	20 (74%)	18 (54%)
50 - 90th	8 (25%)	13 (40%)	7 (26%)	9 (46%)
Total	33 (100%)	33 (100%)	27 (100%)	27 (100%)

The 50th percentile of Systolic blood pressure among the males was found to be117 and that of the female was 121. Similarly the 50th percentile Diastolic blood pressure among the males was71 and that of the female was 75. Most of the study participants among the Males 25 (75%) have<50th percentile of systolic blood pressure. Similarly among females, 20 (74%) have systolic blood pressure <50th percentile.20 (60%) among males have diastolic blood pressure less than 50 percentile and 18 (54%) among females have diastolic blood pressure less than 50 percentile.

International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

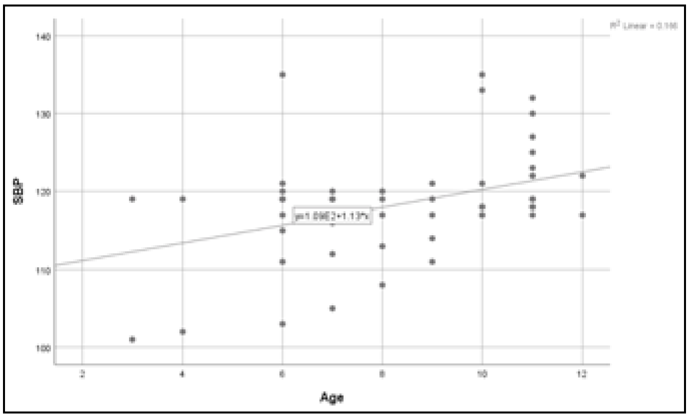

Figure 1: Correlation between systolic blood pressure and age

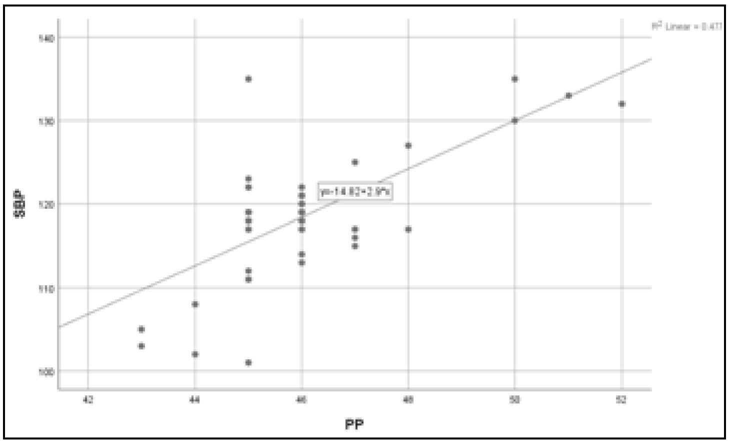

Figure 2: Correlation between systolic blood pressure and Pulse pressure

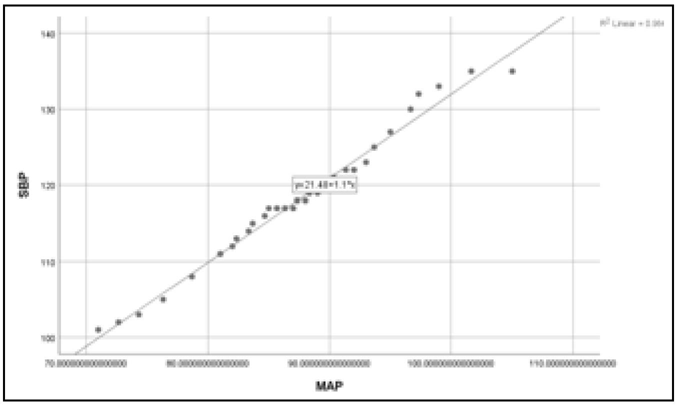

Figure 3: Correlation between systolic blood pressure and Mean arterial pressure

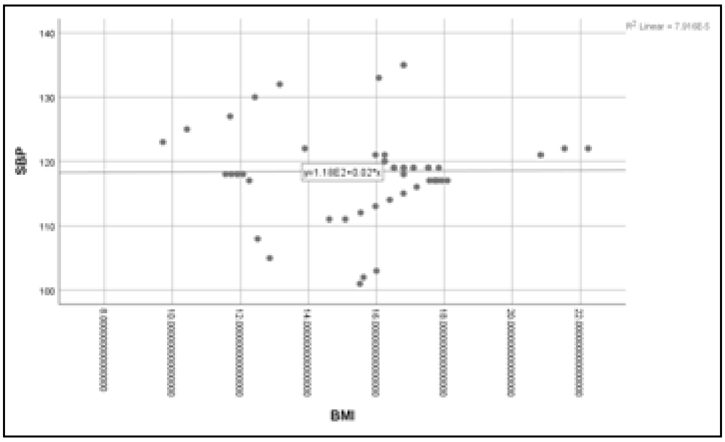

Figure 4: Correlation between systolic blood pressure and Body mass index

A weak correlation (r= 0.408) exist between the age and the systolic blood pressure and it is statistically significant (p <0.001). A moderate correlation (r=0.690) exist between the systolic blood pressure and the pulse pressure and it is found to be statistically significant (p=<0.005). A Positive correlation (r=.992) exists between the mean arterial pressure and the systolic blood pressure. The difference is statistically significant (P=<0.001). A very weak correlation (r=.009) exists between the body mass index and the systolic blood pressure and it is not found to be statistically significant (P=.992).

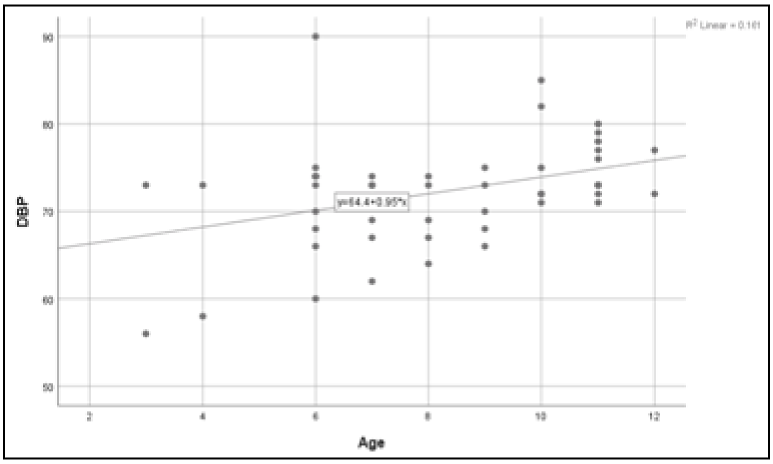

Figure 5: Correlation between diastolic blood pressure and age

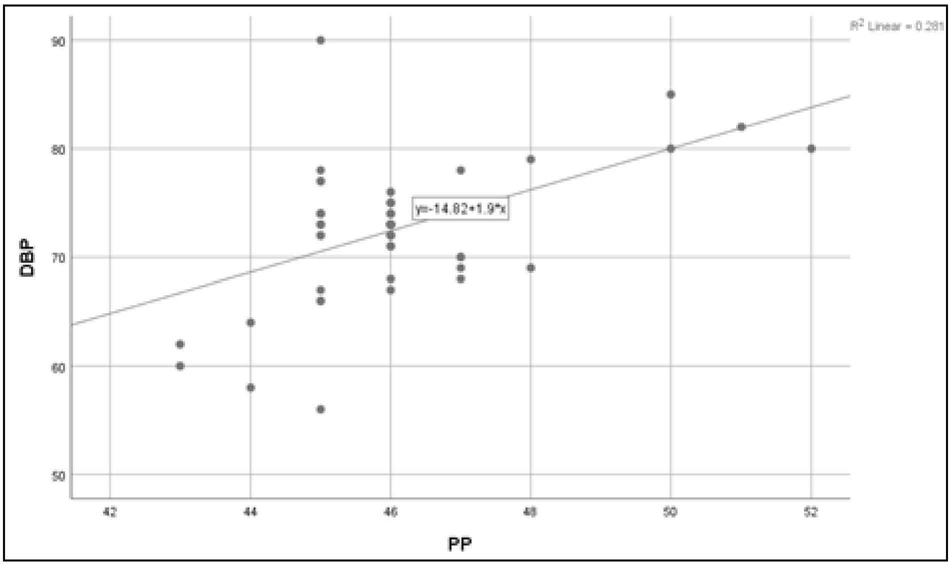

Figure 6: Correlation between Diastolic blood pressure and Pulse pressure

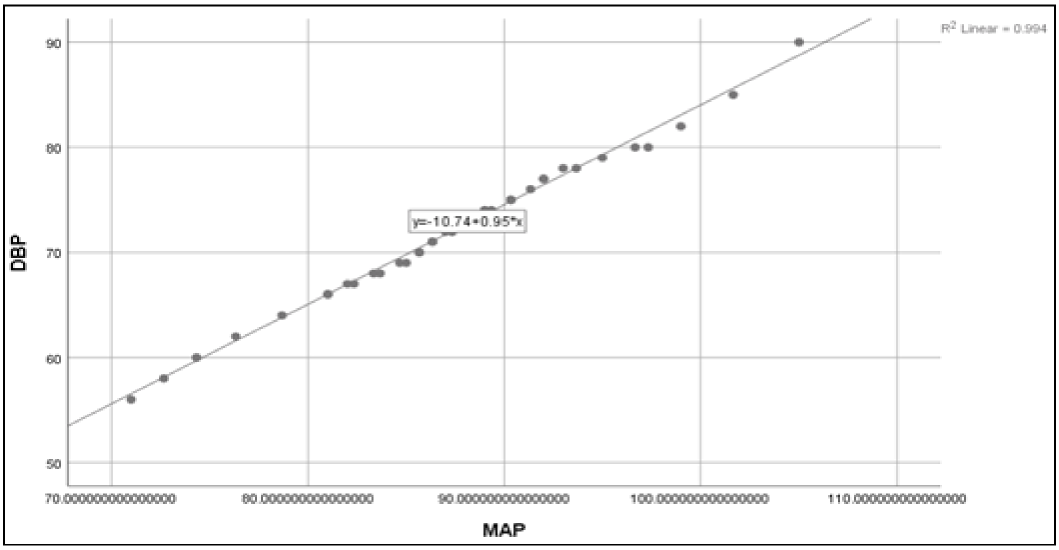

Figure 7: Correlation between Diastolic blood Pressure and Mean Arterial Pressure

Paper ID: SR23402232718 DOI: 10.21275/SR23402232718

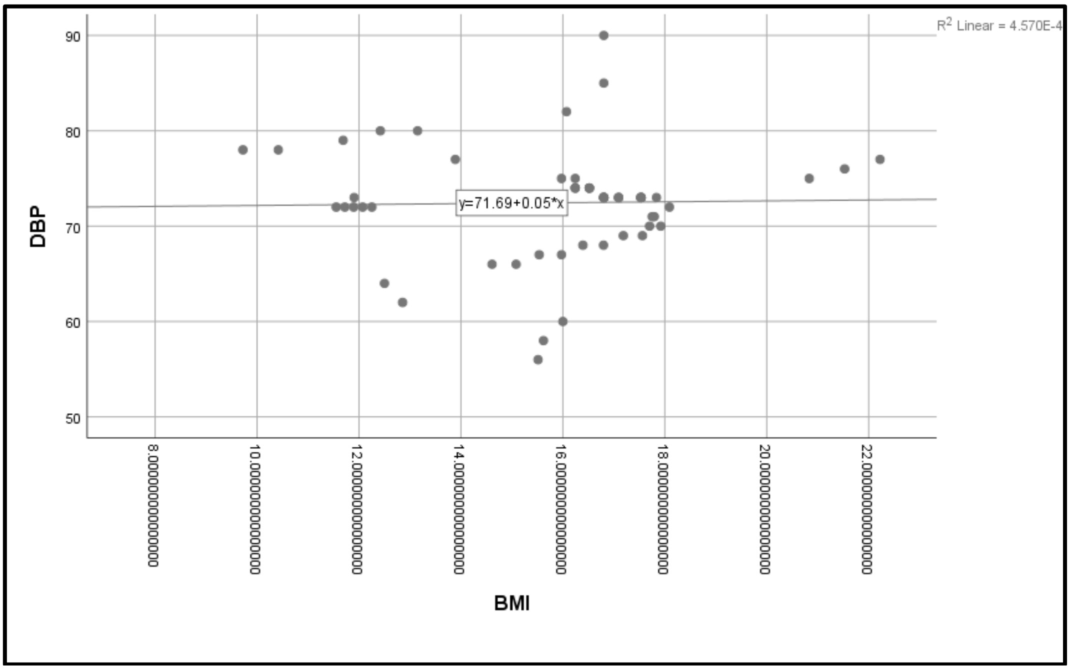

Figure 8: Correlation between Diastolic blood Pressure and Body mass index

A weak correlation (r=.401) exist between the age and the diastolic blood pressure and it is statistically significant (p <0.001). A weak correlation (r=0.530) exist between the Diastolic blood pressure and the pulse pressure and it is found to be statistically significant (p=<0.001). A Strong Positive correlation (r=.997) exists between the mean arterial pressure and the Diastolic blood pressure. The difference is statistically significant (P=<0.01). A weak positive correlation (r=.021) exists between the body mass index and the Diastolic blood pressure and it is not found to be statistically significant (P=.087).

4. Discussion

In our study the mean age of the study participants was found to be 8.64±2.30 in males and 8.22±2.53 among females thus the age was ranging from 2 - 12 years. In Bodas et al [10]study the mean age was found to be 12 ± 3 which is higher compared to our study and the age ranges from 3 - 17 years. Male preponderance was observed in our study. Similarly in the Ajite et al[11] study male preponderance was observed with the ratio of M: F as 3.25: 1.

In our study the mean body mass index was found to be 15.62±2.2 in males and 16.17 ±2.9 in Females whereas in the Becker et al[12] study the mean body mass index was found to be 18±3 in males and 20±3 in females which is slightly higher than our study this was because he included the study participants upto 17 years. In our study, among males systolic blood pressure of 25 (75%) of the study participants were less than 50th percentile and 8 (25%) were between 50 - 90 th percentile. Among females systolic blood pressure of 20 (74%) were below 50th percentile and 7 (26%) were between 50 - 90th percentile. Similarly in Ajite et al study among males systolic blood pressure of 21 (53.8%) were below 50 percentile, 13 (33.3%) were between 50 - 90th percentile and 2 (5.1%) were in the 50th percentile. Among females systolic blood pressure of 10 (83.3%) were less than 50 th percentile and 2 (16.7%) were between 50 - 90th percentile.

In our study, among the males, the diastolic blood pressure of 20 (60%) were below 50th percentile and 13 (40%) were between 50 - 90thpercentiles. Among females the diastolic blood pressure of 18 (54%) were less than 50th percentile and 9 (46%) were between 50 - 90th percentiles. In Ajite et al[13] study the diastolic blood pressure recorded for males were 19 (48.7%) less than 50th percentile and 17 (43.6%) were between 50 - 90th percentiles and in females 9 (75%) will be less than 50th percentile and 1 (8.3%) between in 50th - 90thpercentile. In our study majority of all the study participants had both systolic blood pressure and diastolic blood pressure less than 50th percentile.

Correlation of age with systolic blood pressure was found to be r=.408, which was weak and the difference was found to be (p<0.001) statistically significant. Correlation for Body mass index and systolic blood pressure was r=.009 which was very weak and the difference was found to be not statistically significant (p=0.992). Similarly Hussain AA et al[14]in his study when correlating the age (r=0.591), height (r=0.632) and weight (r=0.703) to the systolic blood pressure found that it was statistically significant. Similarly in our study the correlation of age with diastolic blood pressure was r=.401, which is weak correlation and was statistically significant (p<0.001). There exist a weak correlation r=.021 for diastolic blood pressure and body mass index and it was also not statistically significant (p=0.087). Whereas in Hussain et al Age (r=0.726), height (r=0.686), weight (r=0.664) were positively correlated with the diastolic blood pressure and it was found to be statistically significant. Similar results of positive correlation was observed in the BMI and the SBP and DBP[15, 16].

Many pediatric patients with the sickle cell anemia were thought to have low blood pressure. Most of the studies stated that they have both prehypertension and hypertension. In our study it was confirmed that blood pressure pattern changes with increasing age and majority of participants blood pressure less than 50th percentile.

5. Limitations

The main limitation is Small sample size of the study. We did a cross sectional study, so we know the systolic blood pressure and diastolic blood pressure at that point of time. We need to do a long term follow up study to find out the pressure changes and further complications. We didn't do a 24 hour ambulatory blood pressure which is the gold standard test.

6. Conclusions

Majority of our study participants both systolic blood pressure and diastolic blood pressure are less than 50th percentile. There is positive correlation of BP with age.

Funding
Funding was not given to any of our authors

Conflict of Interest: Nil

Author's contribution:
All authors approved the submission of the final manuscript and contributed to our study.

Acknowledgment
The authors like to thank the Principal and Head of the Department of Paediatrics, Assam Medical College, Dibrugarh.

References

[1] Michael R DBEV. Hemoglobinopathies: Nelson Textbook of Paediatrics, RE Berman, RM Kilegman, HB Jenson, BF Station.18th ed. Philadelphia 2007.
[2] Adekile AD AO. Hemoglobinopathies. Paediatrics and Child health in tropical region.2nd ed.373 - 390.
[3] Lehmann H CM. Sickle cell trait in southern India. Br Med J.1952; 404–5.
[4] Colah R, Mukherjee M GK. sickle cell disease in India. Curr Opin Hematol.2014; 21: 215–23.
[5] Rees DC, Williams TN GM. Sickle cell disease. Lancet L Engl.2010; 376 (9757): 2018–31.
[6] Guasch A, Cua M, You W MW. Sickle cell anaemia causes a distinct pattern of glomerular dysfunction. Kidney Int.1997; 51: 826–33.
[7] Karayaylali I, Onal M, Yildizer K, Seyrek N PS et al. Low blood pressure, decreased incidence of hypertension and renal cardiac and autonomic nervous system functions in patients with sickle cell syndrome. Nephron.2002; 91: 535–7.
[8] CS J. Arterial blood pressure in adults with sickle cell disease. Arch Intern Med.1981; 141: 891–3.
[9] Saborio P SJ. Sickle cell nephropathy. J Am Soc Nephrol.1999; 10: 187–92.
[10] Prasad Bodas, Alex Huang, MAry Ann O Riordan, John RSedor KMD. The prevalence of hypertension and abnormal kidney function in children with sickle cell disease - a cross sectional review. BMC Nephrol.2013; 14: 237.
[11] Adebukola Ajite, Ezra Ogundare, Oludare Oluwayemi, Oluwasalo Oke, Kayode Tolorunju EO. The Pattern of blood pressure and renal function among children with Sickle cell Anemia presenting in a tertiary health institution in Nigeria. J Clin Nephrol.2019; 3: 083–92.
[12] Amy M Becker, Jordan H Goldberg, Michael Buchanan Henson, Chul Ahn, Liyue Tong, Michel Baum GR. Blood Pressure Abnormalities in Children with Sickle Cell Anemia. Pediatr Blood Cancer.2014 (61): 518–22.
[13] Ajite A, Ogundare E, Oluwayemi O, Olantunya O, Oke O, Kayode Tolorunju EO. The pattern of blood pressure and renal function among children with sickle cell Anemia presenting in the tertiary health institution in Nigeria. J Clin Nephrol.2019; 3: 083–92.
[14] Hussain AA HM. Blood pressure of Children and Adolescents with sickleCell Anemia in Basra, Iraq. IJBC.2017; 9 (4): 101–7.
[15] Pegelow CH, Colangelo L, SteinbergLM, Wright EC, Smith J PG. Natural history of blood pressure in sickle cell disease: risks for stroke and death associated with relative hypertension in sickle cell anemia. Am J Med.1997; 102 (2): 171–7.
[16] Oguanobi NI, Onwubere A, Ibegbulam OG, Ike SO, Anisiuba BC EE. Arterial blood pressure in adult Nigerians with sickle cell anemia. J Cardiol.2010; 56 (3): 326–31.