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Sonographic Evaluation of Some Abdominal Organs in Sickle Cell Disease Patients in Sudan

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Original Research Article

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Abstract: Assessment of abdominal organs such as the liver, spleen and kidneys by ultrasound among SCD patients. A total of 96 SCD patients confirmed to have homozygous hemoglobin were purposively selected from the Sudan sickle cell clinic using a real-time ultrasound machine MINDRAY; DP-6600 and curvilinear probe with frequencies ranging from 1–5 MHz was used to evaluate the abdominal organs. In this study has revealed a varied remarkable changes in these organ size, In liver length the most patients was with the length 12-14 cm, spleen length most patients with length 4 cm and for right and left kidney 7-9 cm for both kidneys. The statistical shows that the mean ± STD of age was 8.40±3.93 years, and for weight, liver length, spleen length, right kidney length and left kidney length was 20.35±3.37 kg, 12.42 ±1.51cm, 5.67 ±2.29 cm, 8.13 ±1.23 cm and 8.45 ±1.22cm respectively. Correlate between liver length per cm with age per years were the rate of change for liver length increase with rate 0.2916 for each year. Correlate between spleen length per cm with age per years were the rate of change for spleen length decrease with rate 0.1156 for each year. Correlate between right kidney length per cm with age per years were the rate of change for right kidney length increase with rate 0.216 for each year. Correlate between left kidney length per cm with age per years were the rate of change for left kidney length increase with rate 0.1963 for each year. Abdominal sonography is an easy, affordable, readily available, accurate, and non-invasive diagnostic tool for early detection of organ changes for further management and follow-up of SCD patients.
Keywords: Abdominal organ, Sickle-cell disease (SCD), Sonography.

INTRODUCTION

Sickle cell disease (SCD) is the most common inherited disorder in sub-Saharan Africa (SSA) [1]. Worldwide, an estimated 300 000 children are born with SCD annually; 80% in SSA [2]. It is the most prevalent genetic disease in the WHO African Region [3]. Rates of SCA and trait varied in different areas in Sudan with the highest rates reported from Western and Eastern Sudan where one in every 123 children born in Messeryia tribe in Western Sudan is at risk of having SCD [4].

SCD is a genetic disorder in which there is an alteration in the normal globin chain that results in the production of abnormal hemoglobin chains within the RBC, which causes sickling of the cell, leading to vascular occlusion and ischemia in multiple organs [5]. Repeated vasoocclusion accounts for the majority of the clinical manifestations of the disease [6-7]. Prominent organ involvement are often the liver, spleen, and kidneys and they respond to SCD by dimensional and parenchyma changes[8].The most common abdominal manifestations include hepatomegaly, splenomegaly, autosplenectomy, cholelithiasis, renal enlargement, and increased renal echogenicity [7-9].

Real time ultrasonography is a simple, cheap, rapid, easily accessible, non-invasive, non-ionizing screening procedure in all cases of SCD patient for assessment of pathological changes occurring in the various abdominal organs [10]. Tran's abdominal ultra-sonographic imaging of patients with sickle cell anemia revealed a high prevalence of abdominal abnormalities, especially in the liver, gallbladder, and spleen with a low prevalence in the kidney and pancreas. These abnormalities are related to hemolysis, anemia, and other hemoglobin abnormalities [11]. Abdominal sonography is an easy, affordable, readily available, accurate, and non-invasive diagnostic tool for early detection of organ changes for further management and follow-up of SCD patients [12]. This study was aimed at evaluating some abdominal organs (liver, Spleen, kidneys) in SCD patients using ultrasonography.

METHODS AND MATERIALS

A total of 96 SCD patients confirmed to have homozygous hemoglobin were purposively selected from the Sudan sickle cell clinic. There were 43(45%) boys and 53 (55%) girls with age range of 2 –16 years with a mean of 8.4 ± 3.9 years were involved in the study. The average weight was 20.4 ± 7.4 kg. Age, gender, and weight were collected. Weight (kg) was measured on the day of US study.

A real-time ultrasound machine MINDRAY; DP-6600 was used for the study. Curvilinear probe with frequencies ranging from 1–5 MHz was used to evaluate the abdominal organs. The equipment was validated for quality before the measurements; all measurements were done using the electronic clippers of the ultrasound machine.

All the patients fasted overnight or at least for 3 h before being scanned. The examinations were performed with the patients in the supine position for comfort and to obtain optimal views of the liver, the kidneys and the spleen. Right and left lateral decubitus positions were used as alternate positions if the organs were not clearly visualized in the supine position. The liver span was measured in the right lobe with the longitudinal center of the right kidney in the plane of imaging. Liver parenchyma was assessed for echo-textural abnormalities. The long axis of the spleen was measured at the level of the hilum. The spleen was also assessed for parenchymal echotextural changes. The length of the kidneys was obtained by measuring the bipolar length (long axis) of the kidneys and parenchyma were assessed for echotextural abnormalities.

RESULTS

Table-1: show statistical parameters for demographic information and abdomen content measurement

	Mean	Median	STD	Min	Max
Age	8.40	8	3.93	2	16
Weight	20.35	19	3.37	9	41
Liver length	12.42	12	1.51	10	16
Spleen length	5.67	4	2.29	3	14
R kidney length	8.13	8	1.23	5	12
L kidney length	8.45	8	1.22	6	12

Table-2: Show correlate between the liver lengths with age group

liver length		Age Group			Total
		1-5	6-10	11-16	
	10	7	4	0	11
	11	9	8	0	17
	12	6	13	6	25
	13	1	13	2	16
	14	0	3	17	20
	15	0	0	5	5
	16	0	0	2	2
Total		23	41	32	96

Table-3: Show correlate between the spleen lengths with age group

Splenic Length		Age Group			Total
		1-5	6-10	11-16	
	3	0	1	1	2
	4	7	20	20	47
	5	1	4	2	7
	6	5	8	0	13
	7	4	2	2	8
	8	3	2	2	7
	9	1	1	2	4
	10	2	1	0	3
	11	0	1	2	3
	12	0	1	0	1
	14	0	0	1	1
Total		23	41	32	96

Table-4: Show correlate between the right kidney lengths with age group

Right kidney Length	Age Group			Total
	1-5	6-10	11-16	
5	1	0	0	1
6	7	2	0	9
7	9	4	1	14
8	5	27	9	41
9	1	6	11	18
10	0	1	10	11
11	0	1	0	1
12	0	0	1	1
Total	23	41	32	96

Table-5: Show correlate between the left kidney lengths with age group

Left kidney Length	Age Group			Total
	1-5	6-10	11-16	
6	4	0	0	4
7	8	5	1	14
8	8	20	8	36
9	3	13	11	27
10	0	2	7	9
11	0	1	3	4
12	0	0	2	2
Total	23	41	32	96

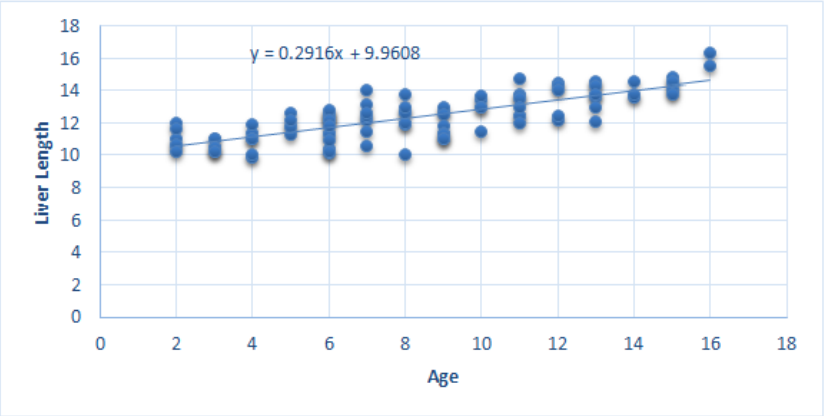

Fig-1: Show scatter plot between the liver length and patients age

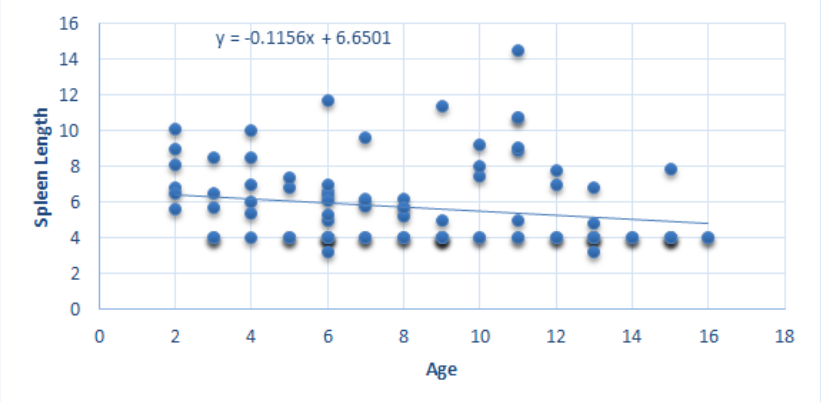

Fig-2: Show scatter plot between the spleen length and patients age

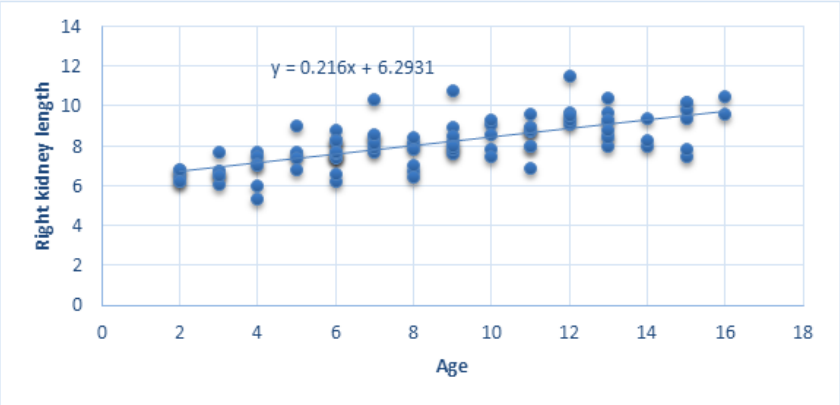

Fig-3: Show scatter plot between the right kidney length and patients age

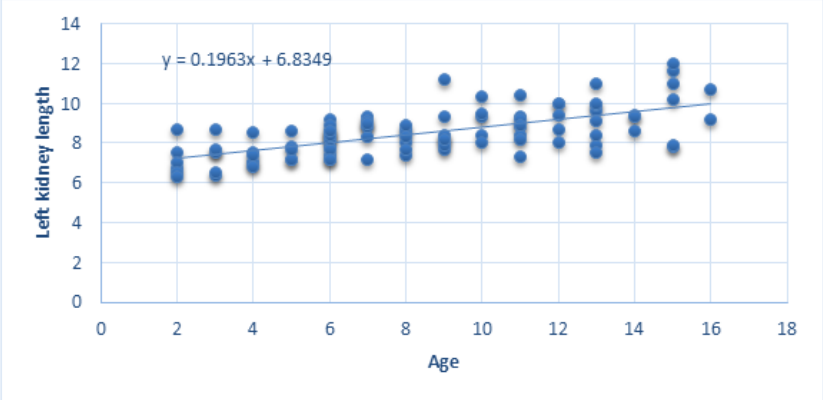

Fig-4: Show scatter plot between the left kidney length and patients age

DISCUSSION

Evaluate of abdominal organs such as the liver, spleen and kidneys by ultrasound among SCD patients. Table 1 show statistical parameters for all patients were presented as mean, median standard deviation, minimum and maximum, for the age the mean ± STD was 8.40±3.93 years, and for weight, liver length, spleen length, right kidney length and left kidney length was 20.35±3.37 kg, 12.42 ±1.51cm, 5.67 ±2.29 cm, 8.13 ±1.23 cm and 8.45 ±1.22cm respectively.

Regarding to liver echogenicity was two categories normal and increase echogenicity were the patients with normal liver echogenicity were 83 patients and 13 patients have increase liver echogenicity. With the spleen echogenicity there was two categories of echogenicity normal, increase spleen echogenicity, were the patients with normal spleen echogenicity was 95 patients and one patient with increase splenic echogenicity.

For the right kidney was just normal echogenicity and increase echogenicity were the patients with normal echogenicity were 67 patients and the increase right kidneys echogenicity were 29 patients. While the left kidney shows two categories of echogenicity normal and increase echogenicity, were the normal patients 68, the increase echogenicity 27 patients.

Correlate between liver length with age group shows the length 12 and 14 cm was a dominant with 45 patients and the length 15 and 16 cm was lowest with 7 patients, we notice that the age group 1-5 years their length in range 10-12 cm, from 6-10 years the dominant length 12-13 cm and 11-16 years was 14cm were the length of liver increase by the age as shown on table 2.

Correlate between spleen length with age group shows the length 4 cm was a dominant with 47 patients and the length 10,11,12 and 14 cm was lowest with just 8 patients, we notice that the most of patients with age group 6-10 and 11-16 years had spleen length 4 cm were the length of spleen decrease by the age as shown on table 3.

Correlate between right kidney length with age group shows the length 7,8 and 9 cm was a dominant with 73 patients and the length 5,11 and 12 cm was lowest with just 3 patients, we notice that the age group 1-5 years their length in range 6-7 cm, from 6-10 years the dominant length 8 cm and 11-16 years was 9 and 10 cm were the length of right kidney increase by the age

as shown on table 4. Correlate between left kidney length with age group shows the length 7,8 and 9 cm was a dominant with 77 patients and the length 6,11 and 12 cm was lowest with 10 patients, we notice that the age group 1-5 years their length in range 7-8 cm, from 6-10 years the dominant length 8-9 cm and 11-16 years was 9 cm were the length of right kidney increase by the age as shown on table 5.

Correlate between liver length per cm with age per years were the rate of change for liver length increase with rate 0.2916 for each year fig 1. Correlate between spleen length per cm with age per years were the rate of change for spleen length decrease with rate 0.1156 for each year fig 2. Correlate between right kidney length per cm with age per years were the rate of change for right kidney length increase with rate 0.216 for each year fig 3. Correlate between left kidney length per cm with age per years were the rate of change for left kidney length increase with rate 0.1963 for each year fig 4.

CONCLUSION

Assessment of abdominal organs such as the liver, spleen and kidneys by ultrasound among SCD patients in this study has revealed a varied remarkable changes in these organ size, In liver length the most patients was with the length 12-14 cm, spleen length most patients with length 4 cm and for right and left kidney 7-9 cm for both kidneys.

Correlate between liver length per cm with age per years were the rate of change for liver length increase with rate 0.2916 for each year. Correlate between spleen length per cm with age per years were the rate of change for spleen length decrease with rate 0.1156 for each year. Correlate between right kidney length per cm with age per years were the rate of change for right kidney length increase with rate 0.216 for each year. Correlate between left kidney length per cm with age per years were the rate of change for left kidney length increase with rate 0.1963 for each year.

Abdominal sonography is an easy, affordable, readily available, accurate, and non-invasive diagnostic tool for early detection of organ changes for further management and follow-up of SCD patients.

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