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Assessment of Renal Profile (Urea and Creatinine) with Renal Impairment Among Sickle Cell Anemia Patients Attended into Kosti and Rabak Teaching Hospitals

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Abstract: *Sickle cell anaemia,a type of Haemoglobin disorder(Haemoglobinopathy) is associated with biochemical abnormalities. This study was aimed to evaluate urea and creatinine levels with renal impaired among sickle cell anemia patients attended into Kosti & Rabak teaching hospitals during period from August to October 2017.* The study subject was 75 case (50 of them were children and 25 were adults). *In 50 children (urea level were abnormal (increase) in 16 patients (32%) while its normal in 34 patients (68%) and creatinine level were abnormal (increase) in 8 patients (16%) while normal in 42 patients (84%). In 25 adult patients (the urea level were normal in 25 patients (100%) . and creatinine level , abnormal (decreased) in 4 patients (16%) while normal in 21 (84%). This study was case control study done in seventy five patients with sickle cell anemia and fifty healthy controls (adults and children).About 3ml of venous blood were collected using sterile disposable syringes and poured into lithium heparin containers then centrifuge at 3000 round per minute for five minute to obtained plasma which use to measure urea and creatinine using colorimeter AP-*101. *This study showed that normal levels of urea in child (25.8±10.5 mg/dl) and creatinine(0.5±0.2 mg/dl) and the urea of adult (31.4 ± 7.8 mg/dl) and creatinine is (0.9 ± 0.2 mg/dl) in patient with sickle cell anemia as compared with healthy controls(child urea (17.5±3.5) mg/dl , creatinine (0.4±0.2 mg/dl) and adult control (urea 25.5 ± 7.2 mg/dl creatinine (0.7 ± 0.1mg/dl).This study has explained renal profile (urea & creatinine) and their role in sickle cell anaemia which could be used in designing of the better management of sickle cell patients.*

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I. Introduction

Sickle cell disease (SCD) is an inherited blood disorder that affects red blood cells. People with sickle cell disease have red blood cells that contain mostly hemoglobin S, an abnormal type of hemoglobin. In certain situation, these red cells become sickle and have difficulty in passing through blood vessels[(1,2)]. Although sickle cell disease is present from birth, symptoms are rare before the age of 3 to 6months since a large percentage of the erythrocyte hemoglobin is of the fetal type (Hb F). As more Hb S replaces Hb F in the subject, the main symptoms; episode of anemia, pains and infections and associated crisis become manifested due to irreversible sickling of the erythrocytes when Hb S molecules polymerizes invariably leading to vaso-occlusion in the small capillaries[(3)]. In the United States, SCD affects about 72,000 people and 2 million are carriers[(4)]. In Africa, more than 200,000 infants are born yearly with SCD [(5)]. The highest prevalence of SCD in Sudanese is among the population from the Western Sudan it is believed that the sickle cell gene has brought to Sudan through immigrants from West African tribes, especially from Hausa and Bargo [(6,7)]. Sickle cell traits present with varied clinical problems including increased urinary tract infection, gross hematuria, complication of hyphema, splenic infarction with altitude hypoxia or exercise, and life threatening complications of exercise, exertional heat illness (excretional rhabdmyolysis, heat stroke or renal failure)or idiotypic sudden death Based on prevailing symptoms renal disorder in the present study considered to test Urea, creatinine, in sickle cell anemia patient[(8)]. Patients with sickle cell disease (SCD) are at increased risk of serious morbidity and mortality.

Urea is the major excretory product of protein metabolism.[(9)] It is formed in the liver from amino groups (–NH2) and free ammonia generated during protein catabolism.[(10)] This enzymatically catalyzed process is termed the urea cycle. Since historic assays for urea were based on the measurement of nitrogen, the term

blood urea nitrogen (BUN) has been used to refer to urea determination. Urea nitrogen (urea N) is a more appropriate term[11] .

Creatinine is formed from creatine and creatine phosphate in muscle and is excreted into the plasma at a constant rate related to muscle mass. Plasma creatinine is inversely related to glomerular filtration rate (GFR) and although an imperfect measure, it is commonly used to assess renal filtration function.[12] Creatinine Clearance(CC) Clearance is defined as that volume of plasma from which a measured amount of substance can be completely eliminated into the urine per unit of time expressed in milliliters per minute.[13] Glomerulus filtration rate (GFR), The National Kidney Foundation recommends that estimated GFR (e GFR) be calculated each time a serum creatinine level is reported.[14]

II. Methodology

- **Urea :**

Procedure :

1. Bring the Reagent to room temperature
2. pipette into labelled test tube

	Blank	Standard	Sample
Urea standard (S)	-	10 µL	-
Sample	-	-	10 µl
Reagent (A)	1.0 mL	1.0 mL	1.0 mL

3. Mix thoroughly and incubate the tubes for 10 minutes at room temperature (16-25 ºC) or for 5 minutes at 37 ºC.
4. pipette :

Reagent (B)	1.0 ml	1.0 ml	1.0 ml

5. Mix thoroughly and incubate the tubes for 10 minutes at room temperature (16-25 ºC) or for 5 minutes at 37 ºC.
6. Read the absorbance (A) of the Standard and the Sample at 600nm against the Blank. The colour is stable for at least 2 hours.

Calculations :

The urea concentration in the sample is calculated using the following general formula:

$\frac{A\ samle}{A\ standard}$ × C standard × Sample dilution factor = C sample

Creatinine :

Procedure :

1. Bring the working reagent and the photometer to 37 ºC.
2. Pipette into a cuvette :

Working reagents	1.0 ml
Standard (S) or sample	1.1 ml

3. Mix and insert cuvette into photometer. Start stopwatch.
4. Record the absorbance at 500 nm after 30 seconds (A1) and after 90 seconds (A2).

Calculations:

The creatinine concentration in the sample is calculated using general formula :

$\frac{(A2-A1)sample}{(A2-A1)standard}$ × C standard × Sample dilution factor - Corrective factor = C samples

	Serum and plasma		
	Jaffe non compensated	Jaffecompensated	Urine
$\frac{(A2-A1)sample}{(A2-A1)standard}$	×2] = mg/dl	×2] – 0.37 = mg/dl	×100] = mg/dl
	×177] = µmol /L	×177] - 33 = µmol/l	×8840] = µmol/L

Data should be analyzed using IBM SPSS statistic, version 16.

III. Results

Sample size of study population was 125 subject,(75 case 50 control)46 (61.3%) of them were male , while the other 29(38.7%) were female as shown in table(3-1)

50 pt were in age group from 3 – 17 years(children) (9 ± 4.6) years, 32 (64%) of them were male while 18(36%) were female show in table (3-1) ,25 patients were in age group between 18-37 years (Adult) (24.6 ± 5) years , 14 of them are male (56%) while 11 of them were female (44%) show in table(3-3)

50 were control, 30(60%) of them were male while the other 20 (40%) were female show in table (3-2), 20 patients were children(9 ± 4.3) years (3-17 years) while 30 patients were adult (25 ± 4.5) years (18-37 years)show in table (3-4). The renal profile should be measured by colorimeter (AP-101).

In 50 children (urea level, abnormal (increase) in 16 patients (32%) (36.7 ± 9 mg/dl) while its normal in 34 patients (68%) and creatinine level abnormal (increase) in 8 patients (16%) (0.8 ± 0.03 mg/dl) while normal in 42 patients (84%) show in table (9) .

In 25 adult patients (the urea level were normal in 25 patients (100%) (31.4 ± 7.5) mg/dl. and creatinine level , abnormal (decreased) in 4 patients (16%) (0.5 ± 0.05 mg/dl)while normal in 21 (84%). Show in table (10)

- Mean of urea level in children (case) were normal (25.8 ± 10.5 mg/dl) show in table (3-5)
- Mean of creatinine level in children (case) were normal (0.5 ± 0.2 mg/dl) show in table (3-5)
- Mean of urea level in children (control) were normal (17.5 ± 3.5 mg/dl) show in table (3-6)
- Mean of creatinine level in children (control) were normal (0.4 ±0.1 mg/dl) show in table (3-5)
- Mean of urea level in Adult (case) were normal (31.4 ± 7.5) mg/dl show in table (3-7)
- Mean of creatinine level in Adult (case) were normal (0.9 ± 0.1 mg/dl) show in table (3-7)
- Mean of urea level in Adult (control) were normal (25.5 ± 7.2 mg/dl) show in table (3-8)
- Mean of creatinine level in adult (control) were normal (0.7 ±0.1 mg/dl) show in table (3-8).

Table No (1): The frequency Sex (case)

Child			
	Frequency	Percent	
male	32	64.0	
female	18	36.0	
Total	50	100.0	
Adult			
Male	14	56.0	
Female	11	44.0	
Total	25	100.0	

Table (2) the frequency of sex (Control)

Child			
	Frequency	Percent	
male	12	60.0	%
female	8	40.0	%
Total	20	100.0	%
Adult			
Male	18	60.0	%
Female	12	40.0	%
Total	30	100.0	%

Table No (3): Frequency of Age (Case)

Age	N	Mean	Std. Deviation
Child	50	9 years	4.6
Adult	25	24.6 years	5
Total	75	14.2 years	9

Table(4): Frequency of Age (Control)

Age	Mean	Std. Deviation	Frequency	Percent
Child	9 years	4.3	20	60%
Adult	25 years	4.5	30	40%
Total	33 years	8.8	50	100%

Table (5):concentration of Urea and creatinine in child : (case)

Urea	**N**	**Mean** mg/dlmmol/l		**Std. Deviation**
	50	25.8 mg/dl	4.3mmol/l	10.5
Creatinine	50	0.5 mg/dl	0.04 mmol/l	0.2

Table (6):concentration of Urea and creatinine in child : (control)

concentration	**N**	**Mean** mg/dl	mmol /l	**Std. Deviation**
Urea	20	17.5	2.9	3.5
Creatinine	20	0.4	0.03	0.1

Table (7):concentration of Urea and creatinine in Adult : (case)

Concentration	N	Mean mg/dl	mmol/l	Std. Deviation
urea	25	31.4	5.2	7.8
Creatinine	25	0.9	0.07	0.2

Table (8):concentration of Urea and creatinine in Adult : (control)

Concentration	**N**	**Mean** **(**mg/dl**)**	(mmol/)l	**Std. Deviation**
Urea	30	25.5	4.2	7.2
Creatinine	30	0.7	0.06	0.1

Table (9) The normal and abnormal concentration of Urea and creatinine in children (%) :

	Urea (mg/dl)	**Creatinine(mg/dl)**
Abnormal	16 (32%) (36.7 ± 9)	8 (16%) (0.8 ± 0.03)
Normal	34(68%) (25.8 ± 10.5)	42(84%) (0.4 ± 0.1)
Total	50 (100)	50 (100%)

Table (10) The normal and abnormal concentration of Urea and creatinine in adult (%) :

Adult	**Urea (mg/dl)**	**Creatinine(mg/dl)**
Abnormal	0 (0%)	4 (16%)(0.5 ± 0.05)
Normal	25(100%)(31.4 ± 7.5)	21(84%)(0.9 ± 0.1)
Total	25 (100%)	25 (100%)

IV. Discussion

Sickle cell anemia affected many organs function and change it, these changes seen in patients with homozygous sickle cell anemia more than those with compound heterozygous states and the sickle cell trait.

This study was conducted from August 2017-to December 2017, in both homozygous and heterozygous SCA with study population of 75 patients with S.C.A consist 46 male&29 female .

The differences between patients mean for urea and creatinine levels (case) were compared with the mean of a normal group (control) In children (Case) : urea level (25 ± 7.8) and in control (17.5 ± 3.5), creatinine level (case) (0.5 ± 0.2) and in control (0.4 ± 0.1) In Adult : urea level (case) (31.4 ± 7.8) and in control (25.5 ± 7.2), creatinine level (case) (0.9 ± 0.2) , in control (0.7 ± 0.1). these results show renal impaired.

Abnormal of renal profile occur due to complication of S.C.A such as glomerular abnormalities , tubular disease and other .

This study was supported by Brazilian study that made by G.B. Silva Junior at 2012 in Adult with Sickle cell Anemia age (33.8 ± 13.3) Urea (27±17) mg/dl creatinine (0.8 ± 0.2) mg/dl

Also supported by Indian study made by Dr.Bhavana B.Lakhar at 2015 in children patients urea (25 ± 4.32 mg/dl) creatinine (0.39 ± 0.18 mg/dl)

The variation of results between this study and other studies that reported should be due to :The envirnment of the study and Types of methods , instruments and reagents.

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