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Evaluation of Plasma Creatine Kinase Activity and Inorganic Phosphate among Sudanese Patients with Sickle Cell Disease in Khartoum and White Nile State

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Abstract
Background: *CK and phosphorus are helpful biomarker for detection of early renal abnormality particularly CK which has been shown to be abetter predicator of acute renal failure.*
Objectives: *This is a descriptive cross-sectional study. Conducted in Khartoum and White Nile state from March to June 2016.The aim of this study to assess serum creatine kinase (CK) activity and inorganic phosphate concentrations in Sudanese patients with sickle cell anemia. 80 subjects were enrolled in this study they were classified into 40 with sickle cell disease (SCD) as casegroup and 40 healthy apparently as control group. CK activity and phosphorus level was measured by using Spectrophotometry method.*
Results: *The results showed significantly higher Ck activity in patients with SCD when compared with control group with (P = 0.021), and not significant differences in mean of serum phosphorus concentration in case when compared with control with (P = 0.547). Also show serum CK activity in patients used hydroxyurea when compare with the mean of patients not used hydroxyurea it is significantly decrease with (P= 0.006).*
Conclusion: *The studies conclude that Sickle cell disease is a predictor for high serum CK activity and low serum concentration of inorganic phosphate.*

I. Introduction

Sickle cell disease (SCD) is an inherited form of hemolytic anemia [1].About (5–7%)of the global population carries an abnormal haemoglobin gene[2.3] .Highestprevalence of (SCD)occursinMiddle East, Mediterranean regions, Southeast Asia, and subSaharanAfrica [4,5,6,7].In Sudan the first case was reported in 1950 [8],andconsidered as the major haemoglobinopathy seen Khartoum, the capital of Sudan.This may be due to the migration of tribes from western Sudan as a result of drought and desertification in the 1970s and 1980s, and the conflicts in Darfur in 2005. These tribes are with thehighest rate of (SCD)in Western Sudan particularly Messeryia tribes in Darfur and Kordofan regions [9].(SCD) has so, various complications, including Vaso-occlusive crisis (VOC), the hallmark of which is vascular occlusion and tissue ischemia which lead to organ damage [10, 11].Patients with sickle cell disease (SCD) may suffer from renaldysfunction from early childhood [12],usually; the renal medulla is not able to concentrate the urine due to episodesof ischemia affecting the area [13].Creatine kinase (CK) is an enzyme with a molecular weight of approximately 82,000 [14],it has a various isoforms. Serum levels of the muscle (MM) isoform have been found to be increased in conditions associated with tissue hypoxia and muscle necrosis and considered as a better predictor of acute renal failure due to rhabdomyolysis than creatinine and Urinary myoglobin[15,16].Inorganic phosphate is the measured fraction in serum orplasma by clinical laboratories [17].It is found free in plasma, and actively re-absorbed by the renal tubules so that serum concentrations are dependent on renal function, as a result high level of phosphate in the blood is usually caused by a kidney problem [14, 18].Hydroxyurea (HU)is an effective therapy for adults with sickle cell anemia;HU had a lower rate of painful events, acute chest syndrome, and need for transfusion compared with patients taking placebo [19, 20].Several small studies have reported the short-term toxicity and efficacy of HU for children with sickle cell anemia [21-24].
The aim of this study was to evaluate serum CK activity and serum inorganic phosphate levels in Sudanese patients with sickle cell disease.

II. Materials and Method

Patients:

This is a Descriptive cross sectional study, was conducted at Fath El Rahman El Basheir hospital Khartoum state -Sudan and Tandalti hospital White Nile state-Sudan. Approximately three months during the period from March to June 2016. 40 Sudanese patients with sickle cell disease (SCD) were in rolled in this study

as a test group, and 40 a consecutive healthy individual was taken as control for each case. Patient with renal failure, diabetes mellitus, hypertension, were excluded from cases and controls.After signing an informed consent the medical history was taken from each participant (cases and controls) using questionnaire. Then five ml of venous blood was taken under septic condition from each group of the study, the sample allowed to clot, centrifuged at (3000rpm) for 5 minutes.The determination of creatine kinase (CK), and phosphorus levelsdone by using Quantitative spectrophotometric method.

Statistical analysis:

Data were entered into a computer using SPSS for windows (version 16.0). Significant differences between two groups were used student (*t*) test. Data was presented as mean ± S.D. The results were expressed in the form of tables, scatter. P value of <0.05 was consideredsignificant.

Ethics:

Ethical clearance was obtained from the research board at the Faculty of medical laboratory science, Alzaiem Alazhari University.

III. Results

This study was conducted in Fath El Rahman El Basheir hospital, Khartoum state -Sudan and Tandalti hospital White Nile state-Sudan.In order to evaluate CK, andPhosphorus level and its relationship with sickle cell anemia,the study was include 80 individual,40 patients with sickle cell anemia and another 40 healthy individual as control group. As in table (1) which compare the mean differences of CK in case (255.2500±123.50122) and control group (203.5000±63.06244) with (P = 0.021). Also compare the mean differences of Phosphorus in the case (5.080±1.3434) and control group (5.250±1.1671) with (P = 0.547) .In the result showed in table (2) the mean differences of CK in male (222.1500±126.63137) and female of in case(288.3500±113.86755) with (P = 0.090). Thecomparison of Phosphorus in male (4.970±1.0883) and female of in case(5.190±1.5794), (P = 0.611).The result was found significantly lower CK level among users of hydroxyurea (220.9643±105.29060) than non-users (335.2500±129.96862) (P = 0.006) as in Table (3).There were no significant differences of Phosphorus among users of hydroxyurea (5.325±.9493) and non-users was (4.508±1.9174, (P = 0.078),as in table (3). Scatter (1, and 2)showed no correlation between Ck,Phosphorusand age withR-value= +280 and (P = 0.080), and(R-value= -.319) and (P = 0.045) respectively.

Table (1) Comparison the mean differences of CK and Phosphorus among case and control group.

	Case	Control	P value
CK U/L	255.2500±123.50122	203.5000±63.06244	0.021
Phosphorus mg/dl	5.080±1.3434	5.250±1.1671	0.547

- *t*-test was used to calculate P value
- P value less than 0.05 considered significant
- Mean± Std. Deviation

Table (2) comparison the mean differences of CK and Phosphorus among male and female of in case.

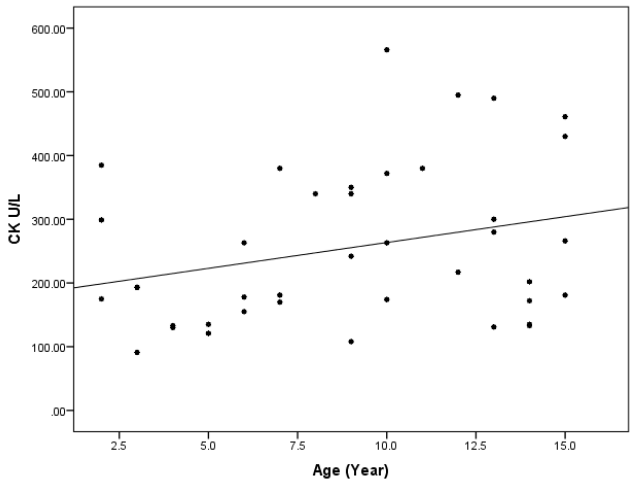
Study group			Mean± Std. Deviation	P value
Case	CK U/L	Male	222.1500±126.63137	.090
		Female	288.3500±113.86755	
	Phosphorus mg/dl	Male	4.970±1.0883	.611
		Female	5.190±1.5794	

- *t*-test was used to calculate P value
- P value less than 0.05 considered significant

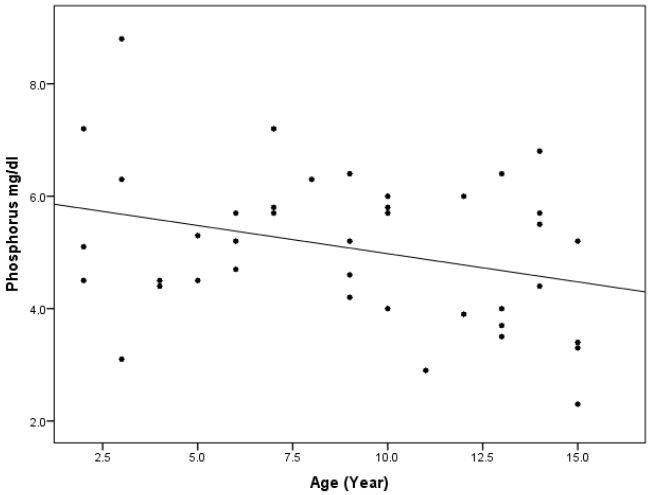
Table (3) Comparison the mean differences of CK and Phosphorus among users and non-users of hydroxyurea in case group.

	Use	Not use	P value
CK U/L	220.9643±105.29060	335.2500±129.96862	0.006
Phosphorus mg/dl	5.325±.9493	4.508±1.9174	0.078

- *t*-test was used to calculate P value
- P value less than 0.05 considered significant
- Mean± Std. Deviation



- Scatter (1): Correlation of age and CK in case group.
- R-value = 0.280
- P- Value = 0.080



- Scatter (2): Correlation of age and phosphorus in case group
- R-value = - 0.319
- P- Value = 0.045

IV. Discussion

The current study showed the mean of serum CK was significantly higher (P = 0.021)in patients with SCD than control group (table -1). This finding agree with previous study conducted by Nnadi et al [25].The mean of serum phosphorus concentration showed a non-significant decrease (P = 0.547) when compared with the control group(table -2), this agree with the previous study of Al harbi et al [27], Nnadi et al [25],and this is in contrast with the study conducted by Oladipo et al[26],who reported high level in adult and children .The study showed no significant difference in mean serum Ck level in male when compared to female with (P = 0.090), also there is no significant difference in mean serum phosphorus in male when compared to female (P = 0.611).The study also revealed significantly decrease in serum CK (P = 0.006) in patients used hydroxyurea when compare with the patients not used hydroxyurea. While serum phosphorus showed no significant difference (P = 0.078) between the patients used hydroxyurea and not used hydroxyurea. There is no correlation between Ck and age with (R-value +0.280 and (P = 0.080) also there is no correlation between phosphorus and age with (R-value - 0.319).

V. Conclusion

From the current study the sickle cell disease is a significant predictor of higher CK activity, while it is not significant predictor in serum concentration of inorganic phosphate.Monitoring of serum CK activity is advocated to enable early detection of rhabdomyolysis, a complication which may lead to renal damage, and eventually renal failure.

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