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RESEARCH PAPER

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Assessment of Hematological Parameters and Iron Status in Sudanese Children Patients with Sickle Cell Anemia

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ABSTRACT

Sickle cell anemia (SCA) is a major cause of morbidity and mortality in Africa. This study was designed to determine the hematological values and serum iron that can be used in monitoring the status and management of SCA patients.

A descriptive cross-sectional based study of fifty patients; (42%) in steady state and (58%) during vaso-occlusive crisis, and fifty control subjects seen in center in Khartoum state. Automated Coulter Counter was used to determine the hematological parameters, while the serum iron was estimated photometrically.

The results of this study showed that mean of Hb concentration, Hct percent and RBCs count were exhibited significant decreased, but mean of platelet count and WBCs count was significantly increased. Patients with sickle cell anemia also exhibited significant decreased in serum iron when compare with control group. Sickle cell anemia was associated with different degrees of reduced hematological parameters and serum iron.

This decreased in serum iron may explain presence of microcytic hypochromic picture which found in patients sickle cell anemia.
Keywords: Sickle cell anemia, Hematological parameters, Serum iron and Sudan.

INTRODUCTION

Sickle cell anemia (SCA) is an inherited disorder of hemoglobin synthesis characterized by life-long severe hemolytic anemia, attacks of pain crisis, chronic organ system damage, and a marked decrease in life expectancy (**Embury and Vichinsky, 2000**). This property is due to a single nucleotide change in the β-globin gene leading to substitution of valine for glutamic acid at position six of the β-globin chain ($\beta^{6\ glu \rightarrow val}$) (**Livingstone, 1975)**.

The sickle mutant gene has the highest frequency of occurrence in Central Africa. Sickle cell anemia is particularly common among people whose ancestors come from Sub-Saharan Africa, South America, Cuba, Central America, Saudi Arabia, India, and Mediterranean countries such as Turkey, Greece, and Italy (**Hoffbrand et al., 2010**).

In Sudan, sickle cell anaemia is one of the major types of anaemia especially in western Sudan where the sickle cell gene is frequent especially in males of migrating West African tribes to Sudan particularly Hosa, Folani and Bargo. The high prevalence was detected among the Baggara tribe group that includes Hawazma and Meseria (**Mary, 2012**).

About a third of the hemolysis in SCA is intravascular (**Embury and Vichinsky, 2000**), and the resulting excessive urinary losses of iron may lead to negative iron balance and iron deficiency. There is no evidence of iron overload in SCA, and iron deficiency may be more common than suspected, especially in men (**Davies et al., 1983 and – Rao et al., 1984**).

However, some studies have shown that iron overload may be a problem only in SCA patients on hypertransfusion programmes [(7-8)]. Most SCA patients are not hypertransfused and should not have iron overload. On the other hand, some studies have suggested that individuals with sickle cell disease particularly from developing countries, who have never been transfused, are more likely to be iron deficient rather than have iron overload [(7)].

MATERIAL AND METHODS

This was a cross-sectional descriptive study based on laboratory data of fifty children patients with sickle cell anemia (SCA) in Alkhartoum state and compared with fifty subjects age and sex matched controls. The investigations were performed on venous blood sample drawn into two tubes first one was plain tube (without anticoagulant) to obtain serum sample for iron estimation and second tube was EDTA anticoagulant tube for hematological parameters estimation.

RESULTS

Table 1. Show the mean of hemoglobin (Control/Patient).

Hb	Mean g/dl	P.value
Control	12.7 g/dl	0.000
Patient	9.9 g/dl	

This table showed that the mean of hemoglobin concentration in patient with SCA (9.9 g/dl) when compared with control (12.7 g/dl) exhibited significant low result (P. value 0.000).

Table 2. Show the mean of hematochrite (Control/Patient).

HCT	Mean %	P.value
Control	40 %	0.000
Patient	29.4 %	

This table showed that the mean of hematochrite in patient with SCA (29.4 %) when compared with control (40 %) exhibited significant low result (P.value 0.000).

Table 3. Show the mean of red blood cells count (Control/Patient).

RBCs	Mean $X10^{12}$/L	P.value
Control	4.5 $X10^{12}$/L	0.003
Patient	2.9 $X10^{12}$/L	

This table showed that the mean of red blood cells count in patient with SCA (2.9 $X10^{12}$/L) when compared with control (4.5 $X10^{12}$/L) exhibited significant low result (P.value 0.003).

Table 4. Show the mean of Platelets (Control/Patient).

Plt	Mean $X10^{9}$/L	P.value
Control	302 $X10^{9}$/L	0.003
Patient	429 $X10^{9}$/L	

This table showed that the mean of platelets count in patient with SCA (302 $X10^{9}$/L) when compared with control (429 $X10^{9}$/L) exhibited significant high result (P.value 0.003).

Table 5. Show the mean of white blood cells count (Control/Patient).

WBCs	Mean $X10^{9}$/L	P.value
Control	7.5 $X10^{9}$/L	0.000
Patient	12.0 $X10^{9}$/L	

This table showed that the mean of white blood cells count in patient with SCA (7.5 $X10^{9}$/L) when compared with control (12.0 $X10^{9}$/L) exhibited significant high result (P.value 0.000).

Table 6. Show the mean of serum iron (Control/Patient).

Serum iron	Mean µg/dl	P.value
Control	73.6 µ g/dl	0.000
Patient	33.1 µg/dl	

This table showed that the mean of serum iron in patient with SCA (33.1 µg/dl) when compared with control (73.6 µg/dl) exhibited significant low result (P.value 0.000).

Table 7. Show the frequency and percentage of steady state and crisis state.

State	Frequency	Percentage
Crisis	29	58%
Steady	21	42%
Total	50	100%

This table showed that the frequency and percentage of SCA patients in crisis and steady state.

DISCUSSION

It is now believed that with purposeful alteration of certain hematological parameters, it is possible to improve the hematological and biological characteristics of SCA patients and consequently improve the clinical course of the disease.

In the present study the results showed that the mean of hematological parameters in patient with SCA as follows; Hb was low (9.9 g/dl), Hct was low (29.4 %), RBCs count was low (2.9 $X10^{12}$/L), PLTs count was high (429 $X10^{9}$/L) and WBCs count was high (12.0 $X10^{9}$/L) when comparison with control showed significant results (P.value 0.000, 0.000, 0.003, 0.003 and 0.000 respectively). As a comparison of these results with previous findings we found that two studies done in Khartoum, Sudan explain the same results in which the mean of Hb was low (6.0g/dl) and (6.4 g/dl), low Hct (20 %) and (20 %), low RBCs count (2.7 $X10^{12}$/L) and (2.3 $X10^{12}$/L), high PLTs count (317 $X10^{9}$/L) and (383 $X10^{9}$/L) and high WBCs count (15.7 $X10^{9}$/L) and (19 $X10^{9}$/L) [9-10].

The mean of serum iron in present study was significantly decreased (33.1 µg/dl) when comparison to control (73.6 µg/dl) (P. value 0.000). Studies done in Yemen and French also showed decreased in serum iron [11-12]. In my think the decrease of iron status is the main cause for microcytic hypochromic picture which found in patients with sickle cell anemia.

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REFERENCES

Embury, S. H. and Vichinsky, E. P. (2000). Sickle cell disease. In: Hoffman R., Benz, E. J., Shattil, S. J., Furie, B., Cohen, H. J., Silberstein, L. E., Mc Glace, P., Editors. Hematology. Basic principles and practice. New York: Churchill Livingstone; p 522.

Livingstone, F. B. (1975). Abnormal haemoglobins in human populations. Vol. 25. Chicago: Aldine; 1975. p. 1-12.

A. Victor Hoffbrand, Daniel Catovsky and Edward, G. D. Tuddenham and Anthony, R. Green (2010). Postgraduate Haematology. Sixth edition. 2010. A John Wiley & Sons, Ltd., Publication.

Mary, L. (2012). Turgeon, EdD, MT (ASCP). Clinical Hematology Theory and Procedures. Fifth Edition. Lippincott Williams & Wilkins.

Davies, S., Henthorn, J. and Brozovic, M. (1983). Iron deficiency in sickle cell anemia. *J Clin Pathol,* 36: 1012–1015.

Rao, K.R.P., Patel, A.R., McGinnis, P. and Patel, M.K. (1984). Iron stores in adults with sickle cell anemia. *J Lab Clin Med*; 103:792–797.

O'Brien, R. T. (1978). Iron burden in sickle cell anemia. *The Journal of Pediatrics*; 92 (4): 579–582. doi: 10.1016/S0022-3476 (78) 80291-1. [PubMed] [Cross Ref].

Mahony, B. S., Ambruso, D. R. and Githens, J. H. (1978). Iron studies in sickle cell anemia. *Journal of Pediatrics*; 93 (6): 1070–1074. doi: 10.1016/s0022-3476 (78) 81275-x. [PubMed] [Cross Ref].

Alaeldin, M. E. Abouh and Mahdi H. A. Abdalla (2014). D-dimer level in sudanese children with sickle cell anaemia. *International Journal of Current Research*. Vol. 6, issue, 05, pp.6599-6601.

Idris, M. M. Hamid, Rashad M. O. Mahmoud, Ghada M. Merghani, Mahdi H. A. Abdalla (2015). Assessment of hypercoagulability state among sudanese sickle cell patients. *Journal of biomedical and pharmaceutical research*. Volume 4, issue 1, 95-99.

Kassim, A., Thabet, S., Al-Kabban, M. and Al-Nihari, K. (1997). Iron deficiency in Yemeni patients with sickle-cell disease. *Afr J Med Med Sci.*; 26(1-2):39-41.

Lopez-Sall, P., Diop, P.A., Diagne, I., Cissé, A., Mahou, C.M., Sylla-Niang, M., Guéye P.M. and Diarra, M. (2014). Transferrine soluble receptors' contribution to the assessment of iron status in homozygous drepanocytic anemia. *Ann Biol Clin* (Paris). 62 (4): 415-21.

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