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Haematimetric Parameters in Sickle Cell Patients in a Critical and Interictal Period at the National Sickle Cell Reference Center in Brazzaville, Republic of the Congo

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Abstract: ***Background: Sickle cell disease is the world's leading genetic disease, affecting 300,000 births per year in its major form. Africa has over 200,000 cases of sickle cell disease. Haematological parameters are routinely used in the follow-up of patients with sickle cell disease and may vary during the critical and intercritical period. The aim of our work is to determine the variation in haematological parameters of patients routinely followed at the national sickle cell reference centre. Methods: This is a cross-sectional study of 127 sickle cell patients regularly followed at the National Reference Centre for Sickle Cell Disease in steady or crisis state. Five milliliters of venous blood sample were collected by venipuncture in EDTA tubes. A complete blood count was performed, using a SYSMEX XN/350 machine. Results: Haemoglobin (Hb) and haematocrit (HCT) levels for patients in stable condition were 7.24±1.62 g/dl and 21.15±4.50%, while in crisis condition they were 4.73±1.14 g/dl and 14.64.15±3.70. The total white blood cell count (WBC) in the steady state and in the crisis state was 8.58±3.07 and 9.64±4.34. The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) in steady state were 79.39±8.03 fl and 33.94±1.99 while in steady state they were 80.61±11.79 and 35.06±4.40. Conclusion: The present study found a high mean WBC value and lower Hb and HCT levels in patients in crisis. In addition, RBC levels were high in patients in stable condition.***

Keywords: Crises, Haematimetric parameters, sickle cell, steady state

1. Introduction

Sickle cell disease (SCD) is the leading genetic disease in the world, affecting 300,000 births per year in its major form. Africa has more than 200,000 cases of sickle cell disease with a mortality rate of 5% of children under five years of age per year [1]. Congo is no exception with a frequency that varies between 0.9% and 1.25% for the homozygous form [2] [3]. Its physiopathology is linked to two anomalies : the cellular and vascular anomaly associated with genetic traits [4].These abnormalities result in the reduction of the life of the RBC on the one hand and the obstruction of the microcirculation leading to complications such as infarcts in various organs (acute pain ; acute pulmonary syndrome, hyposplenism, osteonecrosis, nephropathy, vasculopathies etc.) and on the other hand to the chronic anaemic state that characterises these patients [5]. Hematological parameters are routinely used in the follow-up of these patients who can vary from a critical or inter-critical state [6]. The objective of our work is to determine the variation of haematological parameters of patients regularly followed up at the national reference centre for sickle cell disease (CNRDr).

2. Materials and Methods

This is a cross-sectional study involving 127 sickle cell patients either in steady or crisis state followed regularly at the National Reference Centre for Sickle Cell Disease and Rare Diseases "Antoinette SASSOU N'GUESSO" (CNRDr) in Congo covering the period from November 2019 to March 2020. All patients admitted to the CNRDr in crisis or steady state were included. Written and/or oral informed consent was obtained from adults and parents/guardians of children recruited into the study. Crisis state was defined clinically as abdominal pain, bone pain, chest pain, priapism and haemolytic crisis requiring immediate management, steady state was defined as any patient coming for regular medical follow-up with an interval of 3 months, who had not been in crisis for at least 2 weeks and whose transfusion was more than 3 months old. Excluded were patients transfused recently ≤ 3 months and in a gestational state. Five millilitres of venous blood sample was collected by venipuncture into EDTA tubes. A complete blood count with reticulocyte count was performed within minutes for patients in crisis and hours for patients coming for their medical check-up, following using a SYSMEX XN/350 Automat. Data were analyzed using the statistical software SPSS version-22. The Student's t-test was used to compare the differences in means in order to establish the different

association between the parameters studied, P<0.05 was considered statistically significant

3. Results

A total of 127 patients (62 in crisis and 65 in stable state) were included in this study, 70 were female (55.1%) and 57 male (44.9%) with a sex ratio of 0,81. The mean age of the study population was 19.55±12.84 with extremes ranging from 1 to 60 years. The distribution of patients by age group shows that the age group of 10 to 19 years (29.1%) was the most represented (Table I).

Table I: Socio-demographic characteristics of the study population

Socio-demographic variables	Patients (n=127)	
	n	%
Gender		
Female	70	55.1
Male	57	44,9
Age groups		
<10	32	25.2
10-19	37	29.1
20-29	31	24.4
30-39	15	11.8
≥40	12	9.4

The haematimetric parameters of the patients according to gender are presented in Table II. TheWhite blood cell (WBC) level in males and females was 10.36±4.49 and 7.93±2.49 respectively. Comparison of the means of the WBC rate shows a statistically significant difference (t=3.51, p<0.05). Hematocrit(HCT) and Reticulocyte (RET) levels were significantly higher in males (19.13±5.44 and 0.29±0.12, p<0.05) than in females. Comparison of other haematological parameters in the two groups (males and females) showed no significant difference (p>0.05).

Table II: Hematological parameters according to the gender of the patients

Hematological parameters	Patients		*t*	P
	Females	Males		
WBC (10^3/ul)	7.93±2,94	10.19±4,34	3.51	0.001*
RBC (10^6/ ul)	2.62±0,85	2.78±0,67	1.20	0.23
HGB (g/dl)	5.49±1.87	6.31±2.09	1.96	0.05
HCT (%)	16.77±5,17	19.13±5,44	2.22	0.03*
MCV (fl)	80.26±9,43	80.33±10,74	0.03	0.97
MCH (pg)	27.68±3,58	27.28±3,81	0.56	0.57
MCHC (g/dl)	35.01±4,59	33.99±1,97	1.31	0.19
PTL (10^3/ul)	359.72±135,25	373.23±162.38	0.45	0.65
PCT (%)	1.05±3.76	1.39±5.34	1.55	0.12
RET (10^6/ul)	0.26±0.11	0.29±0.12	2.11	0.03*
RET (%)	10.23±5,22	13.19±9,21	0.38	0.70

WBC: White blood cell, Hb: Hemoglobin, HCT: Hematocrit, MCV: Mean corpuscular volume, MCH: Mean corpuscular hemoglobin, MCHC: Mean corpuscular hemoglobin concentration, RBC: Red blood cell, PLT: Platelet, RET: Reticulocyte, SCA: Sickle cell anemia

Table III compares the haematological parameters of the patients in steady and crisis state. For HBG and HCT levels, the results show a statistically significant difference (p<0.001). The mean levels of WBC, RBC, MCV, PTL and RET index and RET count were higher in the crisis patients. No statistically significant difference was observed (P>0.05). Comparison of the mean RBC, MCV, MCH, PTL levels in the two groups showed no significant statistical difference (P>0.05). The means of these haematological parameters were higher in the control subjects than in the crisis subjects.

Table 3: Hematological parameters of stable and crisis patients

Hematological parameters	Patients		*t*	p
	Steady	Crisis		
WBC (10^3/ul)	8.58±3.07	9.64±4.34	2.52	0.12
RBC(10^6/ ul)	2.70±0.74	2.73±0.84	0.85	0.84
HGB (g/dl)	7.24±1.62	4.73±1.14	1.79	<0,001*
HCT (%)	21.15±4.50	14.64.15±3.70	0.28	<0.001*
MCV (fl)	79.39±8.03	80.61±11.79	0.05	0.50
MCH (pg)	27.48±3.35	27.32±4.03	0.76	0.81
MCHC (g/dl)	33.94±1.99	35.06±4.40	1.92	0.07
PTL (10^3/ul)	344.41±127.06	384.27±163.74	0.55	0.10
PCT (%)	1.81±6.20	0.84±3.37	0.33	0.73
RET (10^6/ul)	0.27±0.10	0.28±0.12	0.98	0.62
RET (%)	10.62±4.83	12.21±9.27	1.78	0.24

The degree of anaemia was highly variable in both groups, (53.1%) of patients in stable condition had normochromic microcytic anaemia. The majority of patients in crisis (67.8%) had normocytic normochromic anaemia.

4. Discussion

Sickle cell disease is a genetic disease of autosomal recessive inheritance, linked to a qualitative abnormality in the structure of haemoglobin, which results in the formation of haemoglobin S (HbS) [7]. Changes in haematological parameters may explain the complications observed in patients with sickle cell disease [7]. The aim of this study was to evaluate the haematological parameters of sickle cell patients. The mean MCV value was higher in males than in females. This result is similar to that reported by Nagose and Rathod [8], although no statistically significant difference was observed in our study (p>0.05).The study conducted bySerjeant and *al*., however, found higher MCV in females than males [9].High Hb and RBC levels were found in male patients compared to female patients. No significant difference was observed (P >0.05). These results could be explained by blood loss due to hematuria,repeated infections, and nutritionaldeficiencies because of low socio-economicstatus [10]. Similar results have been reported by many authors[6], [11]. The mean MCHC was low in males. This mean is comparable to those obtained in several other studies [11], [12], [13]. The results of our study show that patients in crisis state had lower mean HCTand Hb compared to patients in steady state which is comparable to other studies [14], [8]. The effects of anaemia, infections and haemolysis could explain the lower values observed in crisis patientscompared to steady patients. The mean of WBClevel found among patients in crisis state was significantly higher than that patients in steady state, consistent with that observed in the work of Yakubu et al, [12]. In line with with the work of Omoti [15], the mean values of MCV, MCH and MCHC were higher in patients in crisis compared to patients in steady state. This result could be explained by the fact that sickle cell disease is a chronic

haemolytic condition that stimulates haemopoiesis and haemopoietic activity is much higher in patients in crisis. The majority of patients in the present study had normochromic normocytic anaemia. These results are in agreement with the literature which shows mainly normocytic normochromic anaemia [19, 20, 21].

5. Conclusion

The present study found a high mean WBC value as well as lower Hb and HCT levels in patients in crisis. In addition, RBC levels were high in patients in stable condition. These haematological parameters present more descriptive data on patients in crisis in Congo and may also help clinicians in the management of sickle cell patients in Congo.

6. Conflicts of interest

The authors declare no conflicts of interest.

7. Acknowledgements

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