ORIGINAL ARTICLE

CD4+ T Lymphocytes count in sickle cell anaemia patients attending a tertiary hospital

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ABSTRACT

Background: Sickle cell haemoglobin (HbS) is the commonest abnormal haemoglobin and it has a worldwide distribution. Reports have shown that patients with sickle cell anaemia (HbSS) have an increased susceptibility to infection leading to increased morbidity and mortality. Impaired leucocyte function and loss of both humoral and cell-mediated immunity are some of the mechanisms that have been reported to account for the immunocompromised state in patients with sickle cell disease. This study was carried out to determine the CD4+ T lymphocytes count in patients with sickle cell anaemia. **Materials and Methods:** A comparative cross-sectional study of 40 sickle cell anaemia patients in steady state (asymptomatic for at least 4 weeks) attending haematology clinic and 40 age and sex-matched healthy HbA control were recruited into the study. Both HbS patients and the controls were HIV negative. The blood samples obtained were analyzed for CD4+ T cell by Flow cytometry. **Results:** The study found that there was no significant difference in the number of CD4+ T lymphocyte count between individuals with sickle cell anaemia and HbA (1016 ± 513 cells/μL vs 920 ± 364cells/μL). **Conclusion:** It is recommended that the functionality of CD4+ T lymphocyte should be considered rather than the number in further attempt to elucidate the cellular immune dysfunction in patients with sickle cell anaemia.

Key words: CD4 T lymphocyte, cellular immunity, flowcytometry, sickle cell anaemia

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INTRODUCTION

Sickle cell anaemia is an autosomal inherited disorder of haemoglobin resulting from the homozygous inheritance of the sickle gene.[1,2] Sickle cell haemoglobin (HbS) is the commonest abnormal haemoglobin and it has a worldwide distribution.[1] It has variable clinical expression some of which include recurrent haemolysis, vaso-occlusive crises and recurrent infections with their attendant sequelae.

Reports have shown that patients with sickle cell anaemia (HbSS), particularly children, have an increased susceptibility to infection leading to increased mortality.[3-5] Opsonophagocytic defect due to an abnormality of the alternative complement pathway, deficiency of specific circulating antibodies, impaired leucocytes function and loss of both humoral and cell-mediated immunity are some of the other mechanisms that have been reported to account for immunocompromised state in patients with sickle cell disease.

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Thymus-derived (T) lymphocytes play an important role in cellular immunity. In the blood, T lymphocytes constitute 60-70% of peripheral lymphocytes[6] and are also found in the paracortical areas of lymph nodes and periarteriolar sheath of the spleen. About 60% of mature T cells express CD4 (Helper) and 30% express CD8 (Cytotoxic). By secreting cytokines, CD4+ T lymphocyte influence the functions of virtually all other cells of the immune system, including other T cells, B cells, macrophages and natural killer cells.[7,8]

There is paucity of data on cellular-defence system in patients with HbS especially in this sub- region, coupled with conflicting reports on the level of helper T-lymphocyte measurements in sickle cell anaemia patients,[4,9] hence this study was carried out to determine the CD4+ T lymphocytes count in patients with sickle cell anaemia.

MATERIALS AND METHODS

A total of 40 patients with sickle cell anaemia in steady state attending Haematology clinic of the University college

Hospital (UCH), Ibadan, Oyo state, South West of Nigeria in West Africa form the study group. Forty age and sex-matched HbA individuals were recruited as the control group. Both study and control groups were aged between 15 years and 40 years. The study was done between May 2010 and July 2010 and Ethical approval was obtained from the ethics committee of the hospital.

An interviewer-administered questionnaire was employed to collect information on biodata. Blood samples were collected from subjects after written informed consent was obtained from each subject or caretaker (if below 18 years). The blood samples were analyzed for CD4+ T cell by Flow cytometry using the Partec Cyflow counter. Both HbS patients and HbA control were HIV negative.

Data was entered using Statistical Package for the Social Sciences (SPSS) version 17. The biodata were summarised with frequencies and percentages, while the CD4+ T lymphocyte count was summarised with mean and also pictorially presented in Box plot. Mann-Whitney U was employed to test the difference in levels of CD4+ T lymphocyte.

RESULTS

Socio-demographic characteristics of the study subjects [Table 1].

The mean age of the SCA patients was 25.5 years which is similar to that of the control group with mean age of 27 years (P = 0.345). The age range was between 16 and 40 years for the patients and 18-38 years for the control.

There was slightly higher number of females in both HbS patients and the control population. There were 22 (55%) females in HbS group and 25 (62.5%) in control while there were 18 (45%) males in the study and 15 (37.5%) in the control group. However, there was no statistically significant difference in the proportion of males and females in both the study and the control groups (P = 0.496).

The total white cell count and differentials [Table 2].

There were significant difference in total white blood cell (WBC) count, and the differentials which were higher in HbS patients. Total white cell count in HbS (10.24 ± 3.28 × 10^9) was significantly higher than HbA controls (5.33 ± 1.57 × 10^9) (P = 0.000). The differentials follow similar pattern as shown in Table 2.

As shown in Figure 1, male HbS patients had higher mean CD4 count (935 ± 523 cells/μL) than their counterparts in the control group (778 ± 275 cells/μL); however, the difference was not significant (P = 0.300). Also the female HbS patients had higher mean CD4 count (1097 ± 503 cells/μL) than the female control subjects (1005 ± 389cells/μL), although the difference was not significant (P = 0.493). Female HbS patients and female control had higher mean CD4 count than male HbS patients and male control but no significant difference (P = 0.324 and 0.056, respectively).

Table 3 shows that among the HbS in the age group less than 20 years, the mean CD4 count 1091 ± 517 cells/μL was lower than the control 1217 ± 456 cells/μL. These values are not statistically different from each other (P = 0.737). This same pattern were observed in age group 21-30 years. However, the mean CD4 count was higher among HbS patients in the age group 31-40 years though not stastically different. Overall, the total CD4 count did not differ significantly between HbS (mean = 1016 ± 513 cells/μL) and HbA controls (mean = 920 ± 364 cells/μL), P = 0.338.

Table 1: Socio-demographic characteristics of the HbS and HbA Subjects

Variables	HbS *n* = 40 No (%)	HbA *n* = 40 No (%)	Total *n* (%)	*P*-value
Age (years)				
<20	13 (32.5)	5 (12.5)	18 (22.5)	
21-30	18 (45)	22 (55)	40 (50)	0.354
31-40	9 (22.5)	13 (32.5)	22 (27.5)	
Sex				
Male	18 (45)	15 (37.5)	33 (41.3)	
Female	22 (55)	25 (62.5)	47 (58.7)	0.496

Table 2: Total white cell count for HbS and HbA subjects

Variables	HbS *n* = 40	HbA *n* = 40	*P*-value
White Blood Cell (10^9/L)	10.04±3.28	5.28±1.57	0.000
Differential count (10^9/L)			
Neutrophils	5.06±2.24	2.31±0.78	0.004
Lymphocyte	4.03±1.66	2.51±0.77	0.002
Monocytes	0.65±0.52	0.35±0.27	0.001
Eosinophils	0.20±0.14	0.08±0.06	0.001
Basophils	0.19±0.12	0.04±0.03	0.018

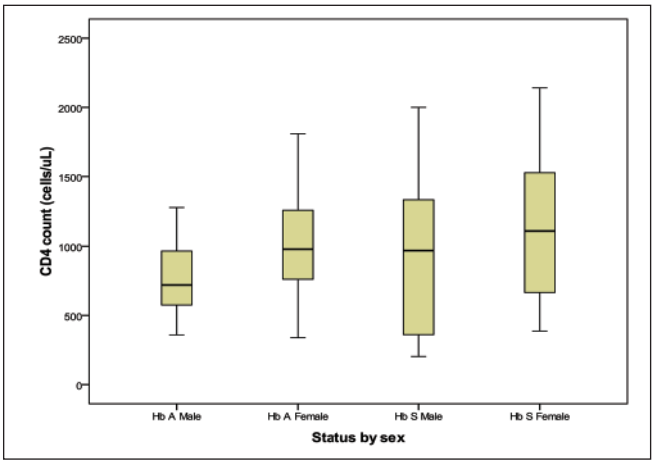

Figure 1: CD4 count profile of the HbS patients and the control HbA subjects by gender

Table 3: CD4 count profile of the HbS patients and the control HbA subjects by age groups

Variable	*n* (%)	HbS Mean ± SD cells/μL	*n* (%)	HbA Mean ± SD cells/μL	*P*-value
Age (years)					
<20	13 (32.5)	1091±517	5 (12.5)	1217±456	0.737
21-30	18 (45)	958±532	22 (55)	959±420	0.553
31-40	9 (22.5)	944±507	13 (32.5)	857±308	0.635
Total	40	1016±513	40	920±364	0.338

DISCUSSION

The white blood cell counts and the differential counts of HbS patients were significantly higher than those of HbS controls. The overall mean white blood cells count of 10.04 ± 3.35 × 10^9/L among homozygous sickle cell disease patients doubles value obtained in HbA controls 5.06 ± 2.24 × 10^9/L. This pattern is similar to the findings from other studies of Omoti and Akinbami.[10,11] Bacterial infection associated with leucocytosis is a known predisposing factor to sickle cell disease crises. Re-distribution of the white cells between the marginal and circulating pools, pain, nausea and vomiting and anxiety have been reported to cause leucocytosis in the absence of infection.[12,13]

Undoubtedly, leucocytosis is associated with poor prognosis[14-16] while reducing neutrophil count is associated with good prognosis. Many complications of sickle cell disease such as silent cerebral infarction, clinically overt stroke, acute chest syndrome and early sickle cell disease–related death are associated with leucocytosis.[14-17]

In this study, the mean CD4+ T lymphocytes count in both control subjects (920 ± 364 cells/μL) and HbS patients (1016 ± 513 cells/μL) was lower than the mean CD4+ T lymphocytes count reported by Koffi *et al*.,[18] in Cote d'Ivoire in control (1215 cells/μL) and HbS (1656 cells/μL) population but similar to the value reported in healthy Nigeria adults (847 cells/μL) by Oladepo *et al*., (2008).[19] This study showed that there was no significant difference between mean values of CD4+ T-cells in patients with SCA and in the controls ($P = 0.338$). This was in accordance with previous report by Koffi *et al*., (2003)[18] but in contrast to the study by Kaaba *et al.* (1989)[9], where decreased number of CD4 cells were reported in SCA patients compared with HbA controls.

There was no significant difference in CD4+ lymphocyte count when compared by age groups in both HbS and HbA individuals. However, a decline in CD4+ T lymphocytes count was found with increasing age in both the control and study groups. Previous studies have shown a decline in CD4+ T lymphocytes count with age which may account for tendency in older age group to be prone to illness.[19,20]

Females have been shown to have a higher CD4+ T lymphocytes count than their male counterparts which has been said to be due to ability of females to withstand psychological stress and hormonal factor.[19] This same pattern was observed among the HbA individuals and HbS patients[20] in this study. However, there was no significant difference overall in the CD4+ T lymphocytes count of both the study and control groups based on gender.

CONCLUSIONS

It is recommended that in addition to the CD4+ T lymphocytes count, the functionality of CD4 T lymphocyte should be considered, as the later would provide greater insight into the cellular immune dysfunction in patients with sickle cell anaemia.

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