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Microalbuminuria in Sickle Cell Patients at the Hematology-Oncology Department of Donka National Hospital

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Abstract

Introduction: Sickle cell disease is the most common autosomal recessive genetic disorder affecting the beta chain of hemoglobin. The objective of this study was to determine the prevalence of microalbuminuria in individuals with sickle cell disease. **Methods:** This was a prospective descriptive study conducted over a 6-month period, from July 1st to December 31st, 2020. We included in this study all patients hospitalized in the hematology-oncology department who had undergone hemoglobin electrophoresis and in whom the diagnosis of Sickle cell disease was confirmed, and the patient had no history of conditions causing proteinuria, so microalbuminuria was investigated. Data analysis was performed using Epi Info 2008 version 7.1.1 software. **Results:** Of 40 patients admitted to the Hematology-Oncology department of Donka National Hospital, 15 had microalbuminuria, representing a frequency of 37.5%. The 20 - 29 age group was the most represented. Men were more affected than women, at 53% versus 47%. A serum protein concentration of 150 mg/L was the most common, occurring in 56% of homozygous SS sickle cell patients. Moderate anemia was the most frequent finding, with a prevalence of 47.5% in sickle cell patients. **Conclusion:** Microalbuminuria is a common finding in sickle cell patients. To reduce this frequency, regular monitoring of sickle cell disease is necessary.

Keywords

Microalbuminuria, Sickle Cell Disease, Hematology-Oncology, Donka University Hospital

1. Introduction

Sickle cell disease is the most common autosomal recessive genetic disorder affecting the beta chain of hemoglobin. It is characterized by an abnormal hemoglobin called hemoglobin S, which polymerizes and crystallizes, resulting in stiffening of the red blood cell and reduced deformability [1]. It is the most widespread hereditary disease worldwide. According to WHO estimates, it affects approximately 120 million people, or 2.3% of the world's population. In Africa, it is particularly prevalent in sub-Saharan Africa, where the prevalence of carriers sometimes exceeds 30% of the population, with 150,000 to 300,000 homozygous births per year [2]. In a 2023 study on sickle cell disease in Guinea, Kolié Ouo Ouo reported 134 cases of major sickle cell syndrome (117 SS, 14 SC, and 3 Sβ-thalassemia) and 48 cases of minor sickle cell syndrome (38 AS, 9 AC, and 1 thalassemia) [3]. Sickle cell nephropathy (NCN) is a major complication of sickle cell disease, clinically characterized by glomerular disease with the onset of significant proteinuria preceded by microalbuminuria (MAU) and progressively evolving into chronic kidney disease. Microalbuminuria occurs in the subclinical phase of NCN, appearing during the first decade of life and preceding the development of massive and persistent proteinuria. Microalbuminuria (MAU) has been identified as an early marker of glomerular dysfunction. The reported prevalence of microalbuminuria (MAU) varies between studies in Western countries and sub-Saharan Africa [4] [5]. In a study conducted by Dharnidharka *et al.* in the USA, the prevalence of MAU in homozygous SS sickle cell patients was 26.5% in children from 7 years of age and 46% in adults during the second decade of life [6]. In Tanzania in 2012, at Muhimbili National Hospital in Dar es Salaam, Christopher R in his study reported the prevalence of MAU was 26%, and none of the clinical features (painful crisis, blood transfusion, hypertension) were significantly related to MAU; however, 45% of subjects had severe anemia [7]. In Nigeria in 2012, Eke *et al.*, in their study conducted in a tertiary healthcare facility in Enugu, showed that the prevalence of MAU was specifically 19.8% in girls compared to 17.4% in boys [8]. In the Ivory Coast in 2005, Tia at the Yopougon University Hospital, in their study focused on microalbuminuria and glomerular filtration rate (GFR) in subjects with major forms of sickle cell disease, found that MAU was prevalent at 29.3%, and 90.90% of subjects with persistent microalbuminuria had a normal GFR [9]. Thus, the high frequency of microalbuminuria (MAU) in sickle cell patients, the diagnostic delay, and the goal of improving the management of this microalbuminuria in our context motivated the choice of this study.

2. Methodology

This was a prospective descriptive study conducted over a 6-month period, from July 1st to December 31st, 2020. Included in this study were all patients hospitalized in the hematology-oncology department who had undergone hemoglobin electrophoresis and for whom the diagnosis of Sickle cell disease was confirmed, with no history of pathologies causing proteinuria. MAU was investigated in these patients

who had agreed to participate in the study. We excluded from our study all sickle cell patients presenting with vaso-occlusive crises, acute infection, and proteinuria detected by urine dipstick, in the absence of any physical activity, transfusions, or menstrual cycles.

All registered subjects received a pre-labeled bottle for the collection of morning urine; we asked them to collect 10 ml (ten millilitres) of morning urine. Each individual's sample was labeled and submitted to the microalbuminuria screening test using the COMBINA 13 urine reactive strip. Each strip was immersed in the fresh urine sample and thoroughly mixed, then removed immediately after touching the edge of the bottle to remove excess urine. Blotting was then done lengthwise by the edge of the strip onto absorbent paper to avoid overflowing.

Microalbuminuria was defined as albuminuria < 30 mg/L [10] [11]. Data analysis was conducted in two stages: manual processing of survey forms, followed by computer analysis (using Epi Info 2008 version 7.1.1). Our data were collected anonymously, and informed consent was obtained from all patients.

3. Result

The rate of patients with sickle cell disease was low, at 40 cases (10.7%) (**Figure 1**).

In this study, 15 out of 40 sickle cell patients presented with microalbuminuria, representing a frequency of 37.5% (**Figure 2**).

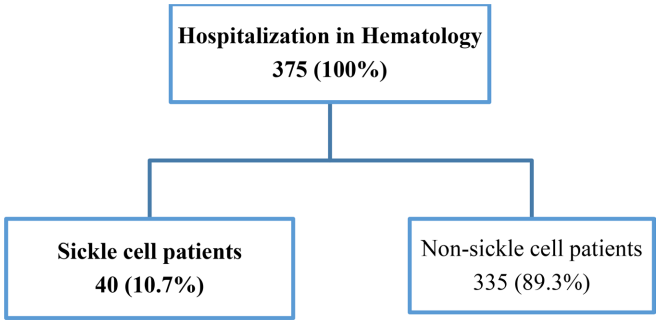


Figure 1. Patient flow diagram in internal medicine.

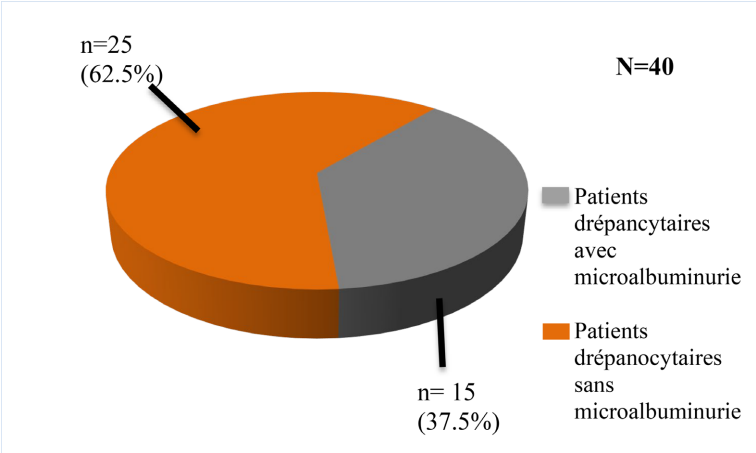


Figure 2. Frequency of microalbuminuria in sickle cell patients.

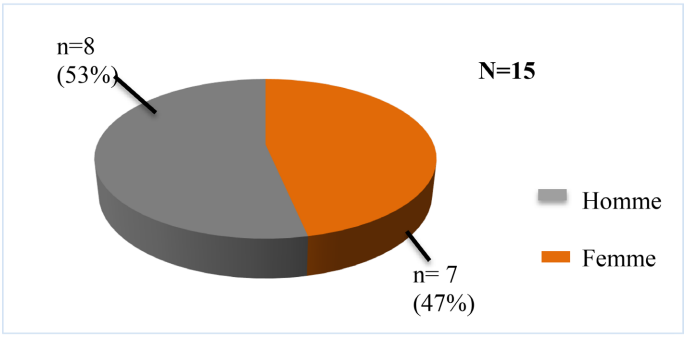
Table 1. Distribution of sickle cell patients with microalbuminuria according to age groups.

Age Range (Years)	Effective	Proportion (%)
10 - 19	4	26.6
20 - 29	**10**	**66.6**
30 and Over	1	6.6
Total	**15**	**100**

The 20 - 29 age group was the most represented, with an average age of 22 years and extremes of 10 and 32 years (Table 1).

We found a male predominance with a sex ratio of 1.14 (Figure 3).

We found a predominance of the homozygous SS form (Figure 4).



Sex ratio = 1.14.

Figure 3. Distribution of sickle cell patients with microalbuminuria by sex.

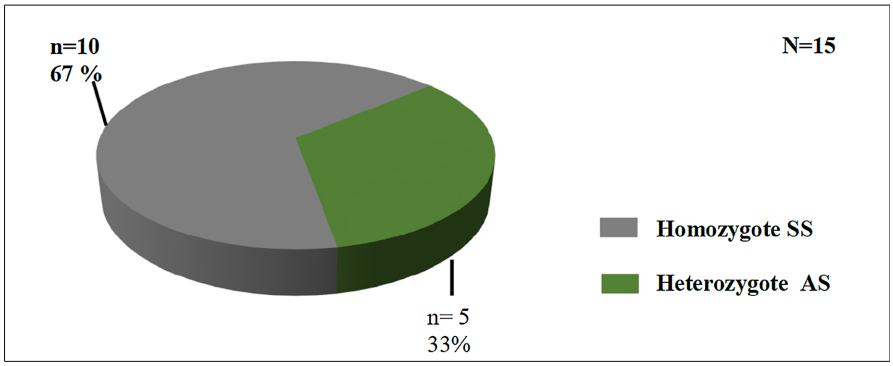


Figure 4. Patient distribution of sickle cell with microalbuminuria depending on the type of sickle cell disease.

The density of 150 mg/L was the most represented, with a predominance in homozygous SS sickle cell patients (Table 2).

The socio-professional category most affected in our study was that of pupils/students, with 12 cases (80%) (Table 3).

During our study, we observed that the majority of our patients had lived with sickle cell disease for more than 10 years since its diagnosis by a healthcare professional (Table 4).

Our study revealed that the dominant physical signs were pallor (86%) and jaundice (60%) (Table 5).

The average hemoglobin level was 6.6 g/dl, with extremes of 4 g/dl and 10 g/dl (Table 6).

Table 2. Distribution of microalbuminuria density according to the type of sickle cell disease.

Microalbuminuria Density	Type of Sickle Cell Disease				Total (%)
	SS	(%)	AS	(%)	
10 mg/l	4	(80)	1	(20)	33
30 mg/l	1	(100)	0	(00)	7
150 mg/l	5	(56)	4	(44)	60
Total	**10**		**5**		**100**

Table 3. Distribution of sickle cell patients with microalbuminuria according to socio-professional categories.

Socio-Professional Strata	Effective	Proportion (%)
Pupil/Student	12	80
Housewife	1	6.6
Civil Servants	1	6.6
Merchant	1	6.6

Table 4. Distribution of sickle cell patients with microalbuminuria according to the time to diagnosis of sickle cell disease.

Discovery Time	Effective	Percentage (%)
<1 year	1	6.6
1 to 5 years	4	26.6
6 to 10 years old	2	13.3
>10 years	8	53.3
Total	**15**	**100**

Table 5. Distribution of sickle cell patients with microalbuminuria according to the physical signs observed.

Physical Signs	Effective (n/15)	Proportion (%)
Pallor	13	86
Jaundice	9	60
Splenomegaly	4	26.6
Edema of the Lower Limbs	3	20
Hepatomegaly	2	13.3
Leg Ulcer	2	13.3

Table 6. Distribution of sickle cell patients according to the severity of anemia.

Severity of Anemia	Microalbuminuria		Total (%)
	Positive (%)	Negative (%)	
Severe	8 (57)	6 (43)	35
Moderate	4 (21)	15 (79)	47.5
Lightweight	3 (43)	4 (57)	17.5
Total	**15 (37.5)**	**25 (62.5)**	**100**

Average Hb: 6.6 g/dl. Extremes: 4 g/dl and 10 g/dl.

4. Discussion

The limitations of this study were the small sample size (from a single department, namely the hematology-oncology department), the use of a single urine sample, the semi-quantitative screening method, and the lack of analyses adjusted for factors associated with albuminuria. Despite these limitations, we obtained the following results: 15 out of 40 sickle cell patients presented with microalbuminuria, representing a frequency of 37.5%. Our results are superior to those of Ahmed *et al.* [12] in Saudi Arabia in 2017, who found a 25% prevalence of microalbuminuria in sickle cell patients in a hospital setting, and King *et al.* [13] in Jamaica in 2011, who found a prevalence of 18.4% of microalbuminuria in children with homozygous sickle cell disease (HbSS). This high frequency in our study could be explained by the age variation and the absence of nephroprotective treatment in our subjects. The 20 - 29 age group was the most represented, with a mean age of 22 years and a range of 10 to 32 years. This result is similar to those of Tia *et al.* [9] in the Ivory Coast in 2005, who reported a frequency of 45% in subjects aged 20 to 29 years with an average age of 16.51 years. The similarity of these results could lead to the conclusion that the frequency of microalbuminuria increases with age in sickle cell patients. We found a male predominance with a sex ratio of 1.14. Our results differ from those of Imuetinyan *et al.* [14] in 2007 in Nigeria and Aloni *et al.* [5] in the DRC in 2012, who found a female predominance in their series, with sex ratios of 0.67 and 0.60, respectively. The sex ratio remains variable and depends on the studies. We found a predominance of the homozygous SS form. Drawz *et al.* [15] in 2016 noted 44% of the homozygous SS form, and 23% of the heterozygous forms. In Morocco [16] in 2008, a study carried out on the kidney and sickle cell disease showed that 80% of patients with microalbuminuria were homozygous versus 13.6% of heterozygous subjects. This high frequency in homozygous forms would be linked to the early onset of renal involvement in this form compared to other forms. The density of 150 mg/L was the most represented, with a predominance in homozygous SS sickle cell patients. The socio-professional group most affected in our study was that of pupils/students. During our study, we found that the majority of our patients had a duration of sickle cell disease of more than 10 years since the discovery of this disease by a healthcare pro-

fessional. Our study revealed that the predominant physical signs were pallor and jaundice. These results are similar to those of Camara *et al.* [17] in Guinea in 2018, who found a frequency of 87.50% of pallor and 68.75% of jaundice in sickle cell patients. According to the literature, in sickle cell patients, there is significant hemolysis, where the spleen plays a fundamental role in the storage of sequestered hemoglobin, hence the observation of these signs. In our study, we found a predominance of moderate anemia in sickle cell patients. The average hemoglobin level was 6.6 g/dl, with extremes of 4 g/dl and 10 g/dl. Our results are comparable to those of Christopher *et al.* [7] in Tanzania in 2012, who noted a frequency of 52.5% of moderate anemia and an average hemoglobin level of 5.9 g/dl in sickle cell patients. The high frequency of moderate anemia could be explained by the fact that sickle cell disease is linked to the sickling of red blood cells, which promotes their massive destruction.

5. Conclusion

Our study revealed that microalbuminuria is common in sickle cell patients seen in the Hematology-Oncology department. It is most prevalent in young individuals, with males being more frequently affected. To reduce this incidence, regular monitoring of urinary albumin excretion is necessary, as it is one of the early markers of kidney damage. Early screening, starting at age 10, should be performed annually using the first morning urine sample and the urinary albumin/creatinine ratio. A larger sample size analysis would be important to better understand the factors associated with microalbuminuria, to consistently calculate the urinary albumin/creatinine ratio, and to develop a treatment protocol.

Author Contributions

Summary, Introduction, Methods, Results, and Conclusion: Dr. Kalil Nouny Sidibé, Dr. Mohamed Cissoko, and Dr. Mamadou Diakhaby. First proofreading with suggestions and remarks: Dr. Mohamed Lamine Conté, Maomy Jacques, Dr. lanciné Kourouma, Dr. Aboubacar Dioubaté, Dr. Sâa joseph Téliano, Dr. Mohamed Adama Oularé, Dr. Amara Magassouba, Dr. Kanté Mamadou Aliou II, Dr. Diallo Mamadou Tafsir, Dr. Idrissa Diallo, Dr. Abraham Geopogui, Dr. Oumar Camara, Dr. Abdou-rahmane Diallo, Dr. Elhadj Salmana Diallo, Dr. Amadou Baillo Barry, and Dr. Fatoumata Bah. Second proofreading with advice: Pr. Djibril Sylla and Pr. Amadou Kaké.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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