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Prevalence of Sickle Cell Disease in Children Aged 0-5 years Seen at the Sacré Cœur Pediatric Medical-Surgical Center by HOPE IGNITY in the Dubreka Prefecture Using the SC Hemotype Immunochromatographic Method

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Abstract: Sickle cell disease is a clinically recessive, biologically co-dominant, autosomal dominant hereditary disorder characterized by the presence of an abnormal hemoglobin called hemoglobin S in red blood cells. This hemoglobin S is responsible for the sickling of red blood cells under hypoxia.

Given the existing prevalence of sickle cell disease in the Republic of Guinea, which is 11%, this hereditary disease is very poorly understood by the population, yet it constitutes a real public health problem affecting all age groups, sexes, and socioeconomic backgrounds. To achieve our objective, we conducted the following tests: The Immuno Chromatographic Hemotype SC method, performed on 202 patients seen at the laboratory, revealed 78 positive cases, or 39%. The most represented phenotype was homozygous sickle cell disease (85), with 46 cases (59%), followed by sickle cell trait with 32 cases (41%). 90% of patients

Patients with sickle cell disease had low hemoglobin levels; leukocytosis was observed in 76%, followed by lymphocytosis in 26% of patients; monocytosis in 9%; eosinophilia in 9%; neutrophilia in 9%; and basophilia in 2%. A hematological profile of children with sickle cell disease was performed.

Our study showed us that sickle cell disease is a significant public health problem in the Republic of Guinea, particularly in the Dubréka prefecture.

Keywords: *Sickle Cell Disease, Red Blood Cell Sickling, Hereditary Disease, Hemoglobin S.*

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I. INTRODUCTION

Sickle cell disease is a hereditary hemoglobin disorder that is widespread throughout the world. It is particularly common in Africa, especially sub-Saharan Africa, the Caribbean, North America (United States), and South America (Brazil). It is also prevalent in the Maghreb countries, Sicily, Greece, Turkey, and throughout the Middle East as far as Saudi Arabia [1]. It is also present in the Indian subcontinent. Finally, due to population movements toward Western Europe, sickle cell disease is now present in France, England, Portugal, Belgium, the Netherlands, and Germany, among other countries [1].

Sickle cell disease belongs to the family of genetic hemoglobinopathies, inherited in an autosomal recessive manner, and is biochemically characterized by the substitution of glutamic acid by valine at position 6 of the beta-globin chain. Sickle cells exhibit a distinctive shape, resembling a sickle or a crescent moon, when deprived of oxygen [2].

According to the WHO, approximately 100 million individuals carry the sickle cell trait (AS), and 100,000 children with sickle cell disease (SS) are born worldwide each year. In Africa, the prevalence of the sickle cell trait varies up to 30%, or even more, of the population in some regions. In contrast, individuals with a duplicate copy of the sickle cell gene (homozygous SS) or associated with another hemoglobinopathy (double beterozygous A/S, 5/3-thalassemia) suffer from complications of the disease [3].

In the Republic of Guinea, statistics published in 2019 estimate that 20% of the Guinean population carries the disease and that 2% of all newborns are born with it [4].

Sickle cell disease is a significant public health issue, and the management of sickle cell patients requires the involvement of the Guinean government and international institutions to curb the transmission of this disease.

II. MATERIALS AND WORKING METHODS

➢ *Working Materials*

- *Bio-Materials*

It consisted of the patient's whole blood.

- *Materials and Reagents*

✓ *Test Strip:*

- Sampling strip:
- Distilled water;
- Eppendorf tube:

✓ *Roll Rack*

- Dropper pipette (3 ml);
- Alcohol swab;
- Dry cotton:
- Reading reference sheet (HSC)
- Tourniquet:
- Syringe:
- EDTA tube,
- Gazelle container:
- Gazelle rack;
- Vortexer,
- Automatic pipette (micropipettes)
- Tips
- Gazelle fluid swab;
- Gazelle swab;
- Gazelle electrophoretic device
- XN 450 automated blood count analyzer

➢ *Methods of Study*

- *Study Area:*

Our study was conducted in the prefecture of Dubréka. Located at an average altitude of 15 meters, between 13°28' west longitude and 94°7' east latitude, the prefecture of Dubréka has an area of 5,672 km². It is bordered to the east by The prefectures of Coyah, Kindia, and Télémélé, to the west by the Atlantic Ocean, to the north by the prefectures of Fria and Boffa, and to the south by the Governorate of Conakry, the capital [5]

- *Study Setting*

Our study was conducted at the Sacré Cœur Pediatric Medical-Surgical Center by HOPE IGNITY in Yorokoguiah, specifically in the Medical Biology Analysis Laboratory.

The Sacré Cœur Center is located in Dubreka, 100 meters from National Route 3 (03) and the road leading to the Yorokoguiah sports complex owned by Antonio Souare. It offers the following services: pediatric consultations, vaccinations, nutrition, home care, pharmacy, laboratory, and imaging. [5]

The laboratory at this center is partnered, within the framework of training and scientific research, with the Biology Laboratory of the Gamal Abdel Nasser University of Conakry, the Didactic Laboratory of ISSMV in Dalaba, the Biology Research Laboratory of the University of Labé (Hafia) and the Laboratory of the NGO/Health-Education for All.

All the results obtained during our study were verified by the various laboratories involved.

- *Study Type and Duration:*

Our study was a prospective, descriptive, cross-sectional study lasting 6 months, from June 20, 2025, to December 20, 2025.

- *Study Population*

The study focused on children aged zero (0) to five (5) years old received in consultation at the Sacred Coeur Pediatric Medical-Surgical Hospital during our study period.

- *Sampling:*

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Sampling was simple random sampling, and the sample size was obtained by calculating the national prevalence of sickle cell disease using the Schwartz formula where the existing prevalence was 11%.

- *Selection Criteria*

✓ *Inconsistency Criteria:*

One of the included patients (children) who were personally tested on a sample for which Honotype SC, hemogram, or Homoglobin Electrophoresis were requested.

✓ *Exclusion Criteria*

Not included in our data, the space and area are not specified.

- *Study Variables*

✓ *Biological Variables*

- Hemotype SC
- Electrophoresis
- Complete hemogram

✓ *Epidemiological Variables*

- Sex
- Age
- Marital Status
- Residence
- Occupation

- *Screening for Sickle Cell Disease Using HSG*

It is based on the principle that HSG is a rapid test kit for detecting antibodies in the blood and that the cellularity of cells for the fate of Hemoglobin A, Hemoglobin, and Homoglobin Calcium.

- *Hemoglobin Electrophoresis with Gazelle[7]*

It is based on the following principle: the use of a microchip containing acetate-impregnated paper: Gazelle uses a miniaturized version of the reference test known as electrophoresis. When the disposable cartridge containing a sample of Lysed blood is inserted into the reader, and the hemoglobin types are separated according to their charge. In approximately 8 minutes, the interpretation (normal, characteristic, diseased) as well as the hemoglobin percentage types are displayed on the screen and stored digitally. Gazelle separates the hemoglobin types in a small volume of blood on a piece of cellulose acetate paper housed in a cartridge. Gazelle's technology is based on hemoglobin electrophoresis, in which different hemoglobin types, including A (normal), S (weak), C (hemoglobin C), A2, E (hemoglobin E), and F (fetal), have different net negative charges in an alkaline solution and move across the paper at different speeds due to an applied voltage.

- *Hematological Tests (Sysmex XN 450) [8]:*

This is based on the following analytical principle:

➢ *DC Detection Method with Hydrodynamic Focusing:*

The RBC detector counts RBCs and PLTs using the DC detection method with hydrodynamic focusing. Simultaneously, the hematocrit (HCT) is calculated using the RBC pulse height detection method. Inside the detector, the nozzle is positioned in front of the orifice and centered relative to it. After the diluted sample is pushed into the conical chamber by the nozzle, it is surrounded by ammonium sheathing reagent and passes through the orifice, precisely at its center. Once through the orifice, the diluted sample is sent to the receiving tubing. This prevents blood cells in this area from drifting and avoids the generation of pseudo-platelet pulses. The hydrodynamic focusing method improves the accuracy and repeatability of blood counts. Because blood cells pass through the opening in single file, this method also prevents the generation of abnormal blood cell pulses.

- Hemoglobin is measured directly using a cyanide blood sampling method.
- White blood cells (WBCs) are counted using flow cytometry.

➢ *Interpretation:*

The parameters are measured and calculated by the system and then printed.

- *Ethical Considerations:*

Before administering any questionnaires, each patient's consent was obtained, the rationale for the study was explained beforehand, and they were assured of anonymity in the reporting of their data

III. RESULTS AND DISCUSSION

➢ *Results*

The application of the research methodology led to the results presented in tables, which were interpreted, commented on, and discussed based on available literature data. Prevalence of Sickle Cell Disease in Patients Seen in Consultation at the Sacred Coeur Pediatric Medical-Surgical Center.

Table 1 Prevalence of Sickle Cell Disease in Patients Seen in Consultation:

Hemotype SC	Numbers	Percentage
Positive	78	38.61
Negative	124	61.39
Total	202	100%

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Table 2 Distribution of Sickle Cell Patient Acording to the Phenotypes

Hemoglobine Electrophoresis	Numbers	Percentage
AS	32	41
SS	46	59
Total	78	100%

Table 3 Variation in Hematological Parameters in Sickle Cell Patients

Parameters	Value					
	Low		Normal		High	
	Number	%	Number	%	Number	%
Hemoglobine	44	95	2	5	-	-
White blood cells	-	-	11	24	35	76
Lymphocytes	-	-	34	74	12	26
Monocytes	-	-	42	91	4	9
Neutrophils	-	-	41	89	3	9
Basophils	-	-	45	98	1	2
Eosinophils	-	-	41	89	3	9

Table 4 Typology of Anemias in Sickle Cell Patients.

Type of anemia	Number	Percentage
Severe (<7 g/dL)	21	46
Moderate (7-9)	23	50
Subtle (>9 <12)	2	4
Total	46	100%

Table 5 Pathophysiological Variation of Platelet Count in Sickle Cell Patients

		Thrombocytopenia		Normal		Thrombocytosis	
Numbers	%	Numbers	%	Numbers	%	Numbers	%
46	100	2	4	36	78	8	18

Table 6 Pathophysiological Variation of MCV in Sickle Cell Patients

Total		VGM			
		Microcytic		Normocytic	
Numbers	%	Numbers	%	Numbers	%
46	100	22	48	24	52

Table 7 Pathophysiological Variation of MCHC in Sickle Cell and Anemic Patients

Total		VGM			
		Microcytic		Normocytic	
Numbers	%	Numbers	%	Numbers	%
46	100	00	00	46	100

Table 8 Distribution of Sickle Cell Patients by Sex

Sex	Number	Percentage
Male	49	63
Female	29	37
Total	78	100

Table 9 Distribution of Sickle Cell Patients by Residence

Residence	Number	Percentage
Dubreka	51	65
Conakry	19	24
Coyah	8	11
Total	78	100%

➢ *Discussions*

Sickle cell disease screening performed on the 202 patients seen at the laboratory revealed 78 positive cases (38.61%) and 124 negative cases (61.39%). This high prevalence of sickle cell disease could be explained by the lack of early detection of the disease and, above all, by the lack of awareness regarding premarital testing (Table 1). Our results showed a higher prevalence than those obtained by

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Fatoumata Bah in 2022 at the laboratory of the Camayenne camp infirmary in Conakry, with a prevalence of 10% (Table 1) [9].

Among the 78 sickle cell cases, 46 were of the SS phenotype (59%) and 32 were of the AS phenotype (41%). Our results were similar to those found by Fatoumata Bah in the hematology department at the Camayenne camp infirmary in Conakry in 2022. She obtained the SS phenotype in 57% of cases, compared to the AS sickle cell trait phenotype in 43% [9]. The high number of sickle cell patients (78 patients, 46 of whom had the SS phenotype) is explained by the fact that the Sacré-Cœur pediatric medical-surgical hospital is the only pediatric center in the country; it has a large number of specialist staff dedicated to the management of the disease and is actively involved.

From the 46 sickle cell patients with the SS phenotype, 44 had low hemoglobin levels (95%). Leukocytosis was noted in 35 individuals (76%), lymphocytosis in 26%, neutrophilia in 9%, monocytosis in 99%, eosinophilia in 9%, and basophilia in 2% (Table 3) [8].

We found that half of the sickle cell patients (50%) had moderate anemia, followed by 46% with severe anemia. It is worth noting that only 4% of sickle cell patients had subclinical anemia (Table 4) [8].

We found that more than half of the sickle cell patients (78%) had a normal platelet count; therefore, 18% had a high platelet count and 4% had a low platelet count (Table 5) [8].

We found that almost half of the sickle cell patients (48%) had microcytic anemia, while 24% (52%) had normocytic anemia (Table 6) [8].

We found that all 46 SS sickle cell patients had normocytic anemia (100%) (Table 7)[8]. We found a prevalence of sickle cell disease in both sexes. We observed that males were more affected, with 49 out of 78 patients (63%).

Our results differ significantly from those found in 2022 by Fatoumata Bah during her master's thesis in the hematology department of the Camayenne camp infirmary, which reported that 52% of sickle cell patients were female (Table 8)[9].

We observed that more than half of our patients (51, or 65%) were from the urban commune of Dubréka, followed by 19 patients (24%) from Conakry and 8 patients (11%) from Coyah.

This high prevalence in Dubréka is explained by the fact that this prefecture is the main site of our research (Table 9).

IV. CONCLUSION

At the end of our study on the prevalence of sickle cell disease in children aged 0-5 years seen in consultation at the Sacré Cœur Pediatric Medical-Surgical Hospital using the HSC immunochromatographic method from June 20 to December 10, 2025, the following conclusion emerges.

The HSC performed on 202 patients seen at the laboratory revealed 78 positive cases, or 39%. The most represented phenotype was homozygous sickle cell disease (SS) with 46 cases (59%), followed by sickle cell trait with 32 cases (41%). 90% of the sickle cell patients had a low hemoglobin level; leukocytosis was observed in 76%, followed by lymphocytosis in 26% of patients; monocytosis in 9%; eosinophilia in 9%; neutrophilia in 9%; and hasophilia in 2%. The hemoglobin level of the sickle cell patients was low, with a moderate anemia typology: 50%; Severe anemia (46%) and subclinical anemia (4%). 18% of sickle cell patients had thrombocytosis, compared to 4% with thrombocytopenia, and 48% had microcytic anemia. Males were more affected, with 63% of positive cases.

The prefecture of Dubréka (the research site) recorded the highest percentage of positive cases (65%).

This study demonstrated that sickle cell disease is a significant public health issue and that the management of sickle cell patients, the determination of hematological parameters, and early detection are crucial.

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