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Phenotype and Epidemiological Profile of Children with Sickle Cell Disease Followed-Up at the Mother and Child Hospital of N'Djamena

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Abstract

In Africa, sickle cell disease is still a public health issue. In Chad, a high prevalence area, it may represent a silent disease. To study the quality of care provided to children with sickle cell disease within the framework of a hospital initiative launched in 2011 and in the absence of a national program in Chad, we conducted this research in the pediatric sickle cell disease center of the Mother and Child Hospital of N'Djamena. This was a cross-sectional study, involving 364 children with sickle cell disease out of 12,500 children followed up from May 2011 to December 2014 (3.9%). The sex ratio was 1.3. The average age at diagnosis was 17 months, often in the context of vaso-occlusive crisis (34.6%). The follow-up protocol included monthly appointments following diagnosis of disease. We observed 80% non-compliance among cases; characteristics associated with non-compliance included families with several children, inaccessible anti-pneumococcal prophylaxis based on Penicillin V and very low anti-pneumococcal vaccine coverage (4.4%). These results suggest that there is a need to rapidly implement a national sickle cell disease program including preventive and curative care in Chad.

Keywords

Sickle Cell Disease, Pediatrics, National Program, Chad

1. Introduction

Sickle cell disease is a hereditary genetic disease with autosomal recessive transmission. It is characterized by a sickling of red blood cells, which causes the microthrombi for-

mation responsible for pain crises, anemia and infections [1] [2].

The prevalence of sickle cell disease in Africa is the highest worldwide, but it is unequally distributed, ranging from 1% - 2% in North Africa up to 20% - 30% in Sub-Saharan Africa [3].

In Chad, this genetic defect is often unrecognized and rarely studied. Due to a hospital initiative, a cohort of children has received follow-up since May 2011 in the Pediatric Unit of the Mother and Child Hospital of N'Djamena. This study identifies the sickle cell phenotypes and quality of care of children in this cohort.

2. Methodology

Mother and Child Hospital is a referral and teaching hospital classified 3rd level according to the health pyramid of the country. It receives an average of 12,500 patients per year followed up at external consultation with 86% of medical pathologies; and 40,000 children per year at emergency department, otherwise 109 patients per day.

This was a cross-sectional and descriptive study including 364 children out of 12,500 (3.9%) followed up in the Mother and Child Hospital of N'Djamena and conducted from May 2011 to December 2014. The diagnosis was established on the basis of hemoglobin electrophoresis at alkalin pH. The sex ratio was 1.3. The research methodology included analysis of the medical records of study subjects. The files not containing enough or accurate data were removed. Also, those with Test d'Emmel positive without electrophoresis of hemoglobin were withdrawn.

Variables collected include the patient's age, diagnostic circumstances, sickle cell phenotype, parents' occupation and follow-up quality. The influence of parental occupation on the course of illness was assessed using chi-square and Fisher's tests. Confidence intervals are estimated at 5%.

This study was submitted to the ethics committee of Medicine faculty and obtained its approval. The anonymity of all patients was respected in data collection.

3. Results

3.1. Age at Diagnosis of Sickle Cell Disease

The mean age at diagnosis of sickle cell disease in children was 17 months, with a range of 6 to 60 months (Table 1).

3.2. Circumstances of Sickle Cell Diagnosis

Among the commonly reported diagnostic circumstances, vaso-occlusive pain crises

Table 1. Age at diagnosis of disease.

Age at disease occurrence	Numbers	%
6 - 30 months	210	57.7
31 - 5 years	154	42.3
Total	364	100.0

and severe anemia predominated, as shown in Table 2.

3.3. Sickle Cell Disease Phenotype

The most common sickle cell phenotype was Sβ + thalassemia (65.4% of the cases), followed by the SS phenotype, as indicated in Figure 1.

3.4. Quality of Follow-Up among Children with Sickle Cell Disease

Follow-up was performed on a monthly basis following diagnosis of disease, regardless of age at diagnosis. During follow-up consultations, the child's anthropometric parameters, including weight, size and head circumference, were measured; medical events occurring since the last consultation were identified; and a complete clinical examination was performed. A prescription for repeated systematic treatment with folic acid and hydroxyurea was provided to parents, as well as a sheet detailing complete blood count, HbS antigen, rhesus blood group and X-rays to be performed, as needed on a case by case basis. Therapeutic education completed the consultation.

In the case of the detection of intercurrent disease, a follow-up visit was scheduled, and appropriate treatments were prescribed. Then, the patient was examined again one week later to assess his or her current health condition prior to scheduling a routine monthly appointment.

An analysis of follow-up using the children's medical records suggested 80% non-compliance among the cases; non-compliance was particularly common among families

Table 2. Circumstances of sickle cell diagnosis.

Circumstances of diagnosis	Numbers	%
Vaso-occlusive crisis	126	34.6
Foot and mouth disease	72	19.8
Severe anemia	112	30.8
Infection	54	14.8
Total	364	100.0

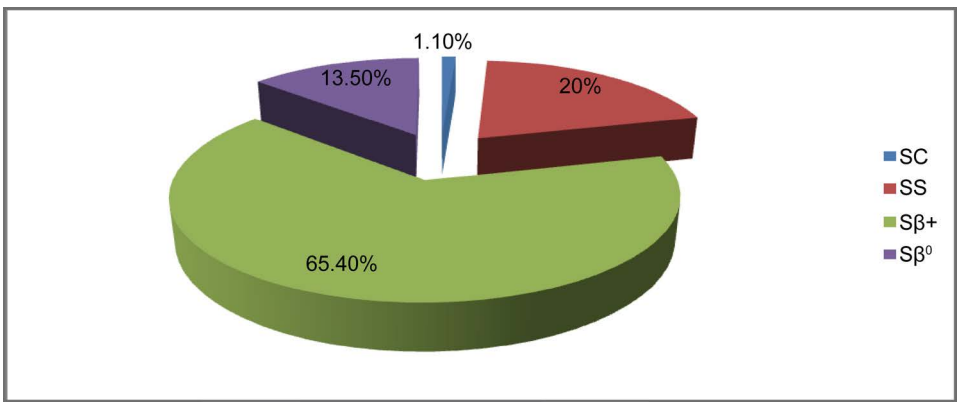

Figure 1. Distribution according to sickle cell phenotype.

with many dependent children or who came back to hospital only in case of vaso-occlusive pain crisis. Anti-anemic prophylaxis based on folic acid was observed in 100% of the cases and anti-pneumococcal vaccine coverage in 4.4%.

3.5. Influence of Parents' Occupation on Diagnosis of Disease, Occurrence of Complications and Follow-Up Quality

Overall, disease diagnosis occurred earlier in children whose fathers were civil servants (Table 3).

Complications were most commonly observed in children whose fathers were traders or mothers were housewives (Table 4 and Table 5).

4. Discussion

Sickle cell major syndromes known are mostly SS, SC, Sβ^0 thalassemia and Sβ + thalassemia. These four types of phenotype differ from their clinical presentation and their electrophoretic profil. Clinically, SS and Sβ^0 thalassemia patients have crisis more severe

Table 3. Fathers' occupation and age at diagnosis of disease.

Father's occupation	Age at diagnosis			
	6 - 30 months		31 - 60 months	
	Number	%	Number	%
Civil servant	116	55.2	66	42.9
Worker	22	10.5	30	19.5
Trader	60	28.6	54	35.1
Jobless	8	3.8	2	1.3
Unavailable	4	1.9	2	1.3
Total	210	100.0	154	100.0

$Chi^2 = 11.199$, $p = 0.024$.

Table 4. Fathers' occupation and occurrence of complications.

Father's occupation	Complications			
	No		Yes	
	Number	%	Number	%
Civil servant	176	51.5	6	27.3
Worker	50	14.6	2	9.1
Trader	100	29.2	14	63.6
Jobless	10	2.9	0	0.0
Deceased	6	1.8	0	0.0
Total	342	100.0	22	100.0

$Chi^2 = 11.699$; $p = 0.020$.

Table 5. Mothers' occupation and occurrence of complications.

Mother's occupation	Complications			
	No		Yes	
	Number	%	Number	%
Civil servant	40	11.7	2	9.1
Worker	4	1.2	0	0.0
Trader	10	2.9	0	0.0
Housewife	288	84.2	18	81.8
Deceased	0	0.0	2	9.1
Total	342	100.0	22	100.0

$Chii^2 = 32.127$, $p = 0.000$.

whereas SC and Sβ + thalassemia have generally forms more moderate. Biologically, they differ from the rate of hemoglobin A that is null with SS, SC and Sβ^0 thalassemia patients while with Sβ + thalassemia it is less than the rate of hemoglobin S, associated with the microcytosis and a high rate of hemoglobin A2 [1].

The electrophoretic profiles of the children with sickle cell disease followed up at the Mother and Child Hospital of N'Djamena indicated that the majority of patients had S and β + thalassemia (65.4%), followed by the SS disease phenotype (20%). Previous studies in Chad found that the SS phenotype was mostly commonly observed, constituting 95.6% and 90.2% of identified phenotypes in studies conducted in 2001 and 2012 respectively [3] [4]. These findings may be associated with insufficient technical equipment during this period to identify the thalassemia phenotype. The Emmel test and qualitative hemoglobin electrophoresis performed during previous research works could not quantitatively identify the different hemoglobin fractions. The heterozygous AS and heterozygous composite Sβ + thalassemia phenotypes may lead to confusion when quantitative determination of the different fractions is not available. In this case, Sβ + thalassemia traits may be confused with AS traits which are generally not associated with sickle cell disease [5]. SS and Sβ + thalassemia phenotypes are associated with sickle cell disease characterized by chronic hemolysis with acute exacerbations, susceptibility to infections and vaso-occlusive crises. However, SS trait distinguishes itself from heterozygous composite Sβ + thalassemia and SC trait through the severity of its clinical course in the stationary phase, including more severe anemia and increased risk for cerebrovascular accident [1] [6].

Most children followed up in this study were diagnosed in early childhood due to a complication such as a vaso-occlusive or severe anemia crisis. These results are similar to those found in other Sub-Saharan African countries without screening programs. In these countries, most children with sickle cell disease are diagnosed prior to the age of 5 years as a result of vaso-occlusive crises associated with osteoarticular pain, foot and mouth disease, abdominal pain and infections [6]-[8]. The diagnosis criteria of sickle cells disease in our context remains essentially the osteoarticular pain, the hemolytic

anemia and the exploration of splenomegaly; confirmed by the electrophoresis of hemoglobin done at least 3 months after a blood transfusion.

There are several factors that may have contributed to the high rate of follow-up non-compliance. Similar results were observed in Bamako and the Congo [7] [8]. Economic hardship may contribute, as follow-up management is not free of charge. The follow-up protocol for children with sickle cell disease in the Mother and Child Hospital (HME) of N'Djamena includes potentially costly consultations, medicines and paraclinical tests; this may result in parents abandoning follow-up too early. Other potential hypotheses include that it reflects parental neglect in the monitoring of chronic disease or relates to a lack of information and education on the part of the healthcare staff. No interventions to reduce the high rates of non-compliance, similar to efforts in developed countries, such as France and the United Kingdom, were implemented [9]. On the one hand, sickle cell disease care and management in the HME of N'Djamena are limited by delayed diagnosis of disease as a result of non-existent screening during the neonatal period and a lack of adequate technical equipment. On the other hand, they also limited by the non-existence of a network of skilled staffs specializing in sickle cell disease management, as exists in countries with a national care program.

Anti-pneumococcal prophylaxis is often insufficient due to the low availability of penicillin V and high cost of anti-pneumococcal vaccine, which is not included in the national immunization program. In these difficult living conditions, parents' occupation has been suggested to have a negative influence on the age at disease diagnosis and management of hospital complications [7].

The mother's occupation, which is often as a housewife, has a statistically significant influence on the diagnosis of complications. Parental involvement in the care provided to children with sickle cell disease may be undermined by a limited knowledge of the disease. Studies conducted in Mali and Togo have demonstrated that many parents may be unaware of the triggering factors, complications and preventive methods associated with sickle cell disease. Approximately 64% of the mothers interviewed in these studies were not aware of the complications associated with this disease, with a statistically significant difference in knowledge between educated and uneducated mothers [10] [11]. However, a study in Benin suggested that appropriate care and management practices were not associated with educational background. The provision of information and education of parents and children may improve rates of early screening and management of complications [12].

5. Conclusions

Sickle cell disease is the most common genetic disease in the African region. Despite its serious impact on children, it is still a neglected disease.

In Chad, the national prevalence of sickle cell disease remains unknown. The hemoglobin phenotype most frequently identified is Sβ + thalassemia. The initiative described here, which aims to ensure follow-up of a child cohort in the Mother and Child Hospital of Chad, emphasizes the difficulties associated with the absence of a national

care program. The high cost of vaccines, inaccessibility of medicines, lack of technical equipment and, a network of skilled staff and a societal melting pot complicating the provision of therapeutic education to parents and children all, create challenges to ensure quality follow-up. This research work emphasizes the urgent need to establish a dialogue between healthcare staff, political policy-makers and the community to implement a program for the effective management of sickle cell disease, as recommended by the World Health Organization [13].

References

[1] French High Health Authority (HAS) (2010) Major Syndromes in Child and Adolescent with Sickle Cell Disease: National Diagnosis and Care Protocol for a Rare Disease. HAS, Saint-Denis La Plaine.
http://www.has-sante.fr/portail/upload/docs/application/pdf/2010-04/ald_10_pnds_drepano_enfant_web.pdf

[2] Carod, J.F., Ramparany, L., *et al.* (2011) Characteristics of Hemoglobin Electrophoresis of Patients Attended in the Clinical Biology Centre, Antananarivo. Study Carried out in the Institut Pasteur of Madagascar on a Sample of 1616 Subjects. *Médecine d'Afrique Noire*, **58**.

[3] Nehoulme, G. (2003) Hemoglobinopathies Associated with Sickle Cell Disease: Epidemiological and Clinical Aspects, and Exposure Factors in the Pediatric Unit of the National Referral General Hospital of N'Djamena. Doctoral Thesis in Medicine (MD), Faculty of Human Health Sciences, N'Djamena.

[4] Allatombaye, B. (2012) Hemoglobinopathies Associated with Sickle Cell Disease: Management and Challenge among the Arabs of Chad. Doctoral Thesis in Medicine (MD), Faculty of Human Health Sciences, N'Djamena.

[5] Girot, R. (2012) Biological Diagnosis of Inherited Hemoglobin Disorders. Clinical Biology Day, 16-18/01/2012 in Paris.
www.jbcneckerpasteur.fr/wp-content/.../JBC12_lundi7_Girot.pdf

[6] Nacoulma, E.W.C., *et al.* (2006) Hematological and Biochemical Profile of Patients with SS and SC Sickle Cell Disease in Stationary Phase in the National Yalgado Ouedraogo Hospital of Ouagadougou. *Mali Médical*, **21**.

[7] Mbika Cardorelle, A., Okoko, A., Mouko, A., *et al.* (2009) Prise en charge de l'enfant drépanocytaire: Expérience de Brazzaville. *Médecine d'Afrique Noire*, **56**, 421-424.

[8] Diarra Assitan, D. (2009) Epidemiological Aspects of Children with Sickle Cell Disease Followed-Up in the Pediatric Unit from 2005 to 2008. Doctoral Thesis in Medicine, Faculty of Medicine, Pharmacy and Dentistry, University of Bamako, Mali.

[9] Lobe, C. (2013) Treatment and Follow-Up of Children Suffering from Major Signs and Symptoms Associated with Sickle Cell Disease. Comparative Overview of Treatment and Follow-Up Protocoles. National Institute for Excellence in Health and Social Services (INESSS), Quebec.

[10] Hamadoun, S., Haoua, D.K., *et al.* (2009) KAP Household Survey on Care for Children with Sickle Cell Disease in Bamako. *Mali Médical*, **24**.

[11] Guédéhoussou, T., Gbadoé, A.D., *et al.* (2009) Knowledge of Sickle Cell Disease and Prevention Practice among the Population of an Urban District of Lomé, Togo. *Bulletin de la Société de Pathologie Exotique*, **102**, 247-251.

[12] Rahimy, M.C., Gangbo, A., Codo, M., *et al.* (2003) Knowledge about Sickle Cell Disease and Practices of Pregnant Women Carrying Hemoglobin S or C in Cotonou. *African Child*

Health Journal, 59-64.

[13] World Health Organization (2015) Sickle Cell Disease in the African Region: Current Situation and Perspective. Regional Director's Report. AFR/RC60/8. www.afro.who.int/fr/downloads/doc_download/1572-afrrc5617-.html