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Glomerular Filtration Rate of Children with Sickle Cell Disease Compared to Non-Sickle Cell Patients in Donka Pediatric Emergencies and SOS Drepano-Guinea Center

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Abstract

Introduction: Our study focused on the evaluation of renal function in children with sickle cell disease compared to children without sickle cell disease at the pediatric emergency unit of the Donka National Hospital and SOS Drepano-Guinea center. **Patients and Methods:** This was a cross-sectional descriptive and analytical study lasting 3 months (October 1 to December 31, 2020). Were included, all sickle cell and non-sickle cell children aged 0 to 15 received on an outpatient basis and had undergone an exploration of renal function (serum creatinine and urine dipstick). **Results:** We performed the urine dipstick and serum creatinine in 75 children, 45 of whom were sickle cell and 30 were not sickle cell. 27 of our patients or 36% had a reduction in GFR, among them 9 or 20% were sickle cell and 18 or 60% were not sickle cell. The most affected age group was 5 to 9 years in sickle cell (66.7%) and non-sickle cell (38.9%). In sickle cell patients, 9 cases (100%) had mild renal failure (IRL). Non-sickle cell patients, had 14 cases or 77.8% of IRL and 4 cases (22.2%) of moderate IR. Sickle cell disease and antibiotics which had the respective p-value (0.01); (0.02), were statistically significant with the onset of renal failure. **Conclusion:** Several factors including sickle cell anemia and antibiotics are believed to be involved in lowering GFR. It would be essential to detect early the children received in consultation.

Keywords

Flow, Filtration, Glomerular, Child, Sickle Cell Disease

1. Introduction

Sickle cell anaemia is the most common genetic disease in the world, with a prevalence of 7%. It kills 80% of African children who are resistant before the age of 5, and many die before diagnosis [1] [2].

The spectrum of renal disorders associated with sickle cell disease is heterogeneous, and includes tubular dysfunction with impaired urine concentration and acidification, haematuria episodes sometimes associated with papillary necrosis, episodes of acute renal failure (ARF) and, finally, a specific entity still known as sickle cell nephropathy (SCN) characterised by proteinuria, sometimes nephrotic, which may be associated immediately or later with the onset of chronic renal failure (CRF) [3] [4].

The assessment of renal function is of immense importance, not only for the detection of renal failure, but also in monitoring the change resulting from pathological processes over time and the effects of interventions. Glomerular Filtration Rate (GFR) is the most useful indicator of renal function and the progression of renal disease [5].

The high incidence of sickle cell disease and the paucity of data on the frequency of kidney disease in sickle cell and non-sickle cell children in Guinea prompted this study to assess kidney function in sickle cell children compared with non-sickle cell children in the paediatric emergency unit of the Donka National Hospital and the SOS Sickle Cell Centre in Guinea.

2. Patients and Methods

The study was conducted at the SOS sickle cell centre in Guinea, which treats sickle cell patients exclusively, and at the medical and surgical emergency department of the Donka national hospital, which houses the paediatric emergency unit. This was a descriptive and analytical cross-sectional study lasting 3 months from 1 October to 31 December 2020. All children with sickle cell disease and children without sickle cell disease aged 0 to 15 years who were seen on an outpatient basis and who had undergone a renal function test (creatininemia and urine dipstick) were included, regardless of their origin and clinical presentation. The patients were interviewed first, followed by a physical examination. GFR was calculated using the Schwartz formula. Univariate and multivariate logistic regression were performed to establish a statistically significant relationship between renal failure (RF) and presumed risk factors. Data were entered and analysed using Word, Excel and SPSS 21. Free and informed consent was obtained from the children's parents, respecting confidentiality and anonymity.

3. Results

We performed urine dipstick and creatinine measurements in 75 children, 45 (60%) of whom were sickle cell patients and 30 (40%) of whom were non-sickle cell patients. Patients with reduced GFR accounted for 36%, of whom 9 (20%) were sickle cell patients and 18 (60%) were non-sickle cell patients (Table 1). The mean age of our patients was 7.25 ± 3.55 years, with extremes of 2 and 15 years. The age group most affected by GFR reduction was 5 to 9 years for sickle cell and non-sickle cell patients, with 66.7% and 38.9% respectively (Table 2). We found that 88.9% of patients with sickle cell disease were treated with Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) and antibiotics, drugs incriminated as nephrotoxic. In non-sickle cell patients, the most common antecedents or risk factors were decoctions and urinary tract infections, with frequencies of 33.3% and 27.8% respectively (Table 3).

Of the 27 patients with reduced GFR, 9 (100%) sickle cell patients and 14 (77.8%) non-sickle cell patients had mild IR. 4 (22.2%) of the non-sickle cell patients also had moderate IR (Table 4).

Based on the factors that may favour the occurrence of IR in patients with reduced GFR, we performed a univariate and multivariate logistic regression between several categorical variables in order to determine whether or not there was a statistically significant association. This study revealed that sickle cell disease and antibiotics had a statically significant association with the occurrence of RI, with p-values of 0.001 and 0.02 respectively (Table 5).

Table 1. Distribution of children with and without sickle cell disease according to GFR.

GFR (mL/min/1.73m)²	Sickle cell		Total
	Yes	No	
Low	9 (20%)	18 (60%)	27 (36%)
Normal	19 (42.22%)	9 (30%)	28 (37.33%)
High	17 (37.78%)	3 (10%)	20 (26.67%)
Total	45 (100%)	30 (100)	75 (100%)

Table 2. Distribution of sickle cell and non-sickle cell children with reduced GFR by age group.

Age groups	Sickle cell		Total
	Yes	No	
1 - 4	2 (22.2%)	5 (27.8%)	7 (25.9%)
5 - 9	6 (66.7%)	7 (38.9%)	13 (48.1%)
10 - 15	1 (11.1%)	6 (33.3%)	7 (25.9%)
Total	9 (100%)	18 (100%)	27 (100%)

Mean age: 7.26 ± 3.55 years, extremes: 2 and 15 years.

Table 3. Distribution of sickle cell and non-sickle cell children with reduced GFR according to risk factors (RF)/antecedents (ATCD).

FDR/ATCD	Sickle cell		Total	OR	CI (95%)	p value
	Yes	No				
Decoction						>0.05
Yes	1 (11.1%)	6 (33.3%)	7 (25.9%)	3	0.42 - 21.2	
No	8 (88.9%)	12 (66.7%)	20 (74.1%)	0.75	0.50 - 1.19	
Sepsis						>0.05
Yes	0 (00%)	2 (11.1%)	2 (7.4%)	-	-	
No	9 (100%)	16 (88.9%)	25 (92.6%)	0.88	0.75 - 1.04	
Urinary tract infection						>0.05
Yes	0 (00%)	5 (27.8%)	5 (18.5%)	-	-	
No	9 (100%)	13 (72.2%)	22 (81.5%)	0.72	0.52 - 0.92	
Nephrotoxic drugs						<0.01
Yes	9 (100%)	1 (5.6%)	10 (37%)	0.56	0.08 - 0.37	
No	0 (00%)	17 (94.4%)	17 (63%)	-	-	
NSAIDS						<0.01
Yes	8 (88.9%)	1 (5.6%)	9 (33.3%)	0.63	0.09 - 0.42	
No	1 (11.1%)	17 (94.4%)	18 (66.7%)	-	-	
Antibiotics						<0.01
Yes	8 (88.9%)	1 (5.6%)	9 (33.3%)	0.63	0.09 - 0.42	
No	1 (11.1%)	17 (94.4%)	18 (66.7%)	-	-	

Table 4. Distribution of sickle cell and non-sickle cell children with reduced GFR by stage of kidney disease.

Stage of renal disease (mL/min)	Sickle cell		Total	OR	CI (95%)	p-value
	Yes	No				
30 - 60 (Moderate)	0 (00%)	4 (22.2%)	4 (14.8%)	-	-	0.17
60 - 98 (Light)	9 (100%)	14 (77.8%)	23 (85.2%)	0.77	0.68 - 0.99	

Table 5. Distribution of presumed risk variables in univariate and multivariate logistic regression.

Variables	UNIVARIEE			MULTIVARIEE		
	OR	CI (95%)	p-value	OR	CI (95%)	p-value
Sickle cell disease			<0.01			0.01
No	Reference	2.10 - 16.8		Reference	1.46 - 60.8	
Yes	6			9.45		

Continued

Leukocyturia			0.02		0.63
No	Reference	1.20 - 11.4		Reference	0.18 - 2.79
Yes	3.72			0.71	
Decoction			0.23		0.50
No	Reference	0.15 - 1.50		Reference	0.14 - 2.59
Yes	0.48			0.61	
BMI			0.03		0.07
Normal	Reference	1.22 - 80.9		Reference	0.80 - 69.6
Underweight	9.94			7.42	
NSAIDS			0.07		0.84
No	Reference	0.95 - 6.36		Reference	0.19 - 1.47
Yes	2.42			1.19	
Antibiotics			0.02		0.02
No	Reference	0.12 - 0.87		Reference	0.16 - 7.26
Yes	0.32			0.10	

4. Discussion

The results of the study enabled a comparison to be made between the renal function of children with sickle cell disease and those without. The study was limited not only by the lack of cooperation from some parents, but also by the low socio-economic status of the families, who were sometimes unable to afford the cost of urine dipstick tests and creatinine levels.

The majority of children with sickle cell disease in our sample is justified by the fact that they are much more exposed to consultations because of their constant medical follow-up.

Children aged between 5 and 9 years were the most represented in the two groups studied. Similar data have also been reported by other authors in the subregion [6].

Sickle cell children with reduced GFR in our series were being treated with numerous drugs known to have adverse and sometimes harmful effects on renal function and the kidney. These data demonstrate the considerable but necessary risks to which children with sickle cell disease are subjected by their regular treatment. The possible risk factors, dominated by traditional practices and self-medication found in non-sickle cell children in this study, can be explained by ignorance of the effectiveness of modern medicine, attachment to tradition and the high poverty line.

We reported mild IR in 85.2% of patients with a fall in GFR. This is thought to be related to a transient fall in GFR in the context of an infection. On the other hand, confirmation of a moderate RI in 14.8% of non-sickle cell patients could

reflect more serious kidney damage, probably secondary to traditional practices and uncontrolled medication, from which most of these children would have benefited from their parents.

Sickle cell disease and antibiotics had a statically significant association with the occurrence of IR, with p values of 0.001 and 0.02 respectively, all below the 5% threshold. The fact that antibiotics are used as a long-term treatment in sickle cell disease would favour a fall in GFR.

5. Conclusion

This study showed that the fall in GFR was present in less than half the patients and was much more frequent in children without sickle cell disease. Several factors, including sickle cell disease and antibiotics, are thought to be involved in this drop in GFR. It would therefore be vital to screen children seen in consultation at an early stage to avoid possible complications, by checking creatinine levels.

Conflicts of Interest

The authors declare no conflict of interest.

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