Renal Impairment In Sickle Cell Children In Ouagadougou: Socio-Demographic, Clinical And Associated Factors

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Abstract

Introduction: This work was aimed to analyze the socio-demographic and clinical profiles and factors associated with renal damage during major sickle cell disorders in urban health facilities in South Sahara. Sickle Cell SS and Sickle Cell SC are two different conditions that relate to abnormal protein mutations in blood cells.

Methods: We conducted a prospective descriptive and analytical study of a cohort from February 1st to May 31st, 2015 at the pediatric university hospital Charles de Gaulle and Saint Camille hospital in Ouagadougou.

Results: We included 70 children, of whom 36 patients (51.4%) had at least one renal impairment that was chronic in 21 cases (58.3%) and acute in 15 cases (41.7%). The average age of the 36 children was 72 months [4.180] months. More than half of the SC 16 patients (57.1%) had renal impairment compared to 18 (46.1%) SS patients. The type of renal involvement was dominated by proteinuria (20 or 28.6% of all children with sickle cell disease), followed by leukocyturia (14 cases, 20%) and renal failure (14 cases, 20%). Isolated renal impairment was the most common 61.1% versus 38.9% of associated renal impairment. According to the evolution, the chronic renal damage was the most frequent, 21c ases or 58.3%. There was poor quality of follow-up and number of crises of SC patients and hospitalization was associated with renal impairment.

Conclusion: An action plan must be implemented at national level to improve the quality of management of renal disorders in major sickle cell syndromes.

INTRODUCTION

Burkina Faso is a West African country where sickle cell disease is a public health problem. Major sickle cell disorders have a fairly high prevalence because they affect 8.42% of patients [1; 2]. A disabling disease, sickle cell disease has an evolution characterized by acute and chronic complications [3; 4]. Chronic complications concern almost all the noble organs of the body, the most serious of which are renal damage due to vaso-occlusive phenomena [4]. In Burkina Faso, this subject is very little documented. The lack of knowledge of these complications and the poor quality of their management compromise the functional prognosis of the child's vitality. The study of socio-demographic, clinical and renal impairment profiles is the basis for strengthening and better targeting health interventions for this at-risk group.

METHODS

This was a cross-sectional study with a descriptive and analytical purpose. Data were collected during the period of 1 February to 31 May 2015. The study concerned children aged 0 to 15 years. Children were either hospitalized or seen in an outpatient clinic at the Pediatric University Hospital Charles de Gaulle (CHUP-CDG) or Saint Camille Hospital of Ouagadougou (HOSCO). We included children with major sickle cell syndrome (SS hemoglobin, SC, Sß thal, SO Arab) and in whom renal impairment was detected. The variables studied were sociodemographic, clinical signs and

associated factors of renal impairment. Renal impairment was defined by the presence of at least one of the following elements:

- renal impairment (glomerular filtration rate or GFR according to the modified SCHWARTZ formula less than 80 mL / min / 1.73 m²) [5];
- hyperfiltration (GFR greater than 140 mL / min / 1.73 m²) [6];
- significant albuminuria (for "+" or more at the urine test strip);
- significant glomerular suspected hematuria ("+" or more at the urinary strip). The existence of significant albuminuria and / or suspected glomerular hematuria was considered a glomerular syndrome;
- significant leukocyturia ("+" or more at the urinary strip) aseptic apart from any recent antibiotic therapy. Such leukocytury and / or the existence of an abnormality of the contour of the kidneys on ultrasound allowed the definition of tubulointerstitial nephritis.

Renal involvement was considered acute when it disappeared in less than three
months, and chronic if it persisted in the third month. Informed verbal consent from parents was required before inclusion. The data was analyzed using the software Epi info 3.5.1 with a threshold of significance for $p < 0.05$

RESULTS

Socio-demographic data

Of 70 children treated for Sickle Cell Disease, 36 (51.4%) had kidney disease. The latter was of one type in 22 cases (61.1%), or associated at least two in the other 14 cases (38.9%). It was chronic in 21 cases (58.3%) and acute in 15 cases (41.7%).

The average age of 36 children was 72 months [4,180] months. All socio-demographic characteristics are shown in Table 1

Clinical aspects

Table 2 presents the anthropometric evaluation of sickle cell patients with renal
impairment.

Growth was normal in 25 cases (69.4%) but eight patients were severely emaciated (22.2%).

Types of sickle cell syndromes

The types of sickle cell syndromes noted were:

- Ss Sickle cell anemia: 18 cases or 50.0%;
- SC sickle cell disease: 16 cases, i.e. 44.4%;
- other sickle cell disease: two cases, i.e. 5.6%. This was a case (2.8%) of SB thalassemia and one case (2.8%) of SO Arab.

Types of kidney impairment

The most frequent renal involvement was proteinuria (20 cases or 55.6%). Other types of renal involvement were leukocyturia (14 cases, 38.9%), renal failure (14 cases, 38.9%), glomerular hyperfiltration (three cases, 8.3%), and hematuria (two cases, 5.6%).

Evolutionary mode of renal impairment

The evolutionary mode of renal impairment in children with major sickle cell syndrome is shown in Table 3.

The six patients with chronic renal failure accounted for 16.7% of the 36 patients with renal impairment and 8.6% of the 70 children with sickle cell disease. As for persistent or chronic hyperfiltration, it concerned 1.4% of subjects.

The type of renal involvement was dominated by proteinuria (20 or 28.6% of all children with sickle cell disease), followed by leukocyturia (14 cases, 20%) and renal failure (14 cases, 20%).

The mean serum creatinine was 57.6 µmol / L at inclusion and 56.2 µmol / L after 3 months. The DFG estimated by modified Schwartz formulas distinguished three types of patients (Table 4).

The 14 cases of renal failure, ie 20% of all patients and 38.9% of patients with renal impairment, involved children with hemoglobin SS (eight cases) or SC (six cases).

The presumed nephropathy was identified in 20 out of 36 cases with a renal impairment of 55.6%. It was a chronic glomerular nephropathy in the 20 identified cases (10 and nine cases respectively with a hemoglobin SC and SS, and a case Sβ Thal) that is 28.6% of 70 sickle cell children. We noted one case of nephrotic syndrome among 10 patients with a SC hemoglobin.

Factors Associated with Renal Impairment During Major Sickle Cell Disorder

Factors associated with renal impairment in Sickle Cell Disease are shown in Table 5. The poor quality of follow-up, the number of SS patients crisis and hospitalization were associated with renal impairment.

Table 1

Socio-demographic characteristics of children with major sickle cell syndrome and renal impairment. n = 36

Characteristics	Number	Percentage (%)
Age groups (months)		
≤ 60	15	41,7
] 60 ; 180]	21	58,3
> 180	0	00,00
Gender		
Boys	25	69,4
Girls	11	30,6
Level of schooling		
None	8	22,2
Preschool	8	22,2
Primary	18	50,00
Secondary	2	05,6
Origin		
Urban area	28	77,8
Semi-urban area	3	08,3
Rural area	5	13,9
Socio-economic level of parents		
Low	16	44,4
Average	10	27,8
High	10	27,8

Table 2

Anthropometric evaluation of patients with major sickle cell syndrome and renal impairment. n = 36

Anthropometric evaluation	Absolute frequency (n)	Relative frequency (%)
Significant growth retardation	5	13,9
Growth retardation	6	16,7
No growth retardation	25	69,4
Severely emaciated	8	22,2
Emaciated	5	13,9
No malnutrition	22	61,1
Possible risk of overweight	0	00,00
Overweight	1	02,8

Table 3

Evolutionary mode of renal impairment in children with a major sickle cell syndrome.

Type of kidney impairment	Evolutionary mode		
	Transitory ***n (%)***	***Chronic*** ***n (%)***	***unknown*** ***n (%)***
Proteinuria	3 (15,0)	16 (80,0)	1 (5,0)
Renal failure	8 (57,1)	6 (42,9)	0
leukocyturia	14 (100)	0	0
Glomerular hyperfiltration	2 (66,6)	1 (33,4)	0
Microscopic hematuria	2 (100)	0	0

Table 4

Distribution of patients by glomerular filtration rate (DFG) estimated using the modified Schwartz formula at inclusion and at three months (n = 36).

Estimated DFG Class (mL/min/1,73 m²)	Schwartz Formula	
	At the inclusion n (%)	Three months later n (%)
< 80	14 (38,89)	6 (16,66)
[80-180]	22 (61,11)	30 (83,34)
>180	00	00
Total	36(100)	36(100)

Table 5

Study of the association of various factors with renal impairment in children with sickle cell disease.

Factors associated with renal impairment	AR yes (n)	AR no (n)	p
Regular follow-up			0.0016
Yes	22	8	
No	14	26	
Sickle Cell Disease at SC Patient			0,0010
None	13	2	
Multiple	3	10	
Number of crises > 20/year in SS patient			0,008
Yes	10	3	
No	8	18	
Gender			NS
Male	24	15	
Female	12	19	
Low social-economic level of parents			NS
Yes	22	19	
No	14	15	
Hospitalization			0,04
Yes	17	8	
No	19	26	

AR: Renal impairment NS: non-significant

DISCUSSION

Limits and merits of the study

Renal biopsy puncture was not yet feasible in our context at the time of the study. It was therefore impossible for us to characterize with certainty the renal lesions, particularly renal disorders specific to sickle cell disease. Moreover, the non-regularity of the follow-up of the children, partly related to the lack of financial means and / or the ignorance of the parents was at the origin of the incompleteness of certain data collected. For the same reasons, tubulopathies could not be explored. Our study, however, has the merit of being the initial work on the theme in children. It has enabled us to obtain results whose exploitation will guide subsequent studies to contribute to the fight against chronic kidney disease in our country.

The prevalence of renal impairment in our sample was 51.4%. This prevalence is certainly underestimated in the absence of tubular functional exploration. In fact, tubulopathies, expressed by a lack of concentration and / or acidification of the urine, or potassium excretion are very frequent during the sickle cell disease [6].

The high prevalence of renal impairment in our context could be related to the low socioeconomic level of parents; which would affect the regularity and the quality of the medical follow-up. Under these conditions, the child is more exposed to the degenerative involvement of certain noble organs such as the kidney [7,8]. In our sample, the renal damage was almost as observed in the patients with a hemoglobin SC (16 cases) than among the SS (18 cases). However, in the literature, it is reported a higher frequency of degenerative complications in composite heterozygotes (SC for example) than in SS homozygotes [6].

Chronic kidney failure accounted for 8.6% of 70 sickle cell children. This prevalence is already high and augurs its progression to adulthood in these children in case of long survival. This can be attested by the Fongoro study [9] et al in Mali which reported 13.4% of cases of IRC in their series composed of sickle cell subjects aged 5 to 64 years. For example, sickle cell disease is a major provider of end-stage renal disease, which is extremely expensive and difficult to manage in the context of sub-Saharan Africa. It is therefore undeniable that good management of sickle cell disease would contribute to a reduction in the prevalence of chronic kidney disease.

Persistent glomerular hyperfiltration was found in one case or 1.4% in our study. In adult sickle cell subjects, Girot et al, in Paris [10] reported a 57% increase in glomerular hyperfiltration in adult sickle cell patients. Its prevalence is low in our sample because in children, sickle cell disease is still early and its prevalence will tend to increase with age.

Glomerular hyperfiltration is an evolutionary symptom of sickle cell nephropathy of which it is the initial phase [11,12].

Proteinuria was present in 28.6% of patients and was persistent in 80% of cases. Proteinuria is a common symptom of renal impairment during sickle cell disease and often reflects sickle cell nephropathy. The frequency of proteinuria during sickle cell disease increases gradually with age [13,14].

After univariate analysis, the high frequency of sickle cell crises in SS homozygotes was identified as a factor associated with renal impairment. This is typical because the link between episodes of ischemia-reperfusion during vaso-occlusive crises is well established [15,16]. However, the rate of significantly elevated renal impairment in SC-free heterozygotes was unexpected.

CONCLUSION

The frequency of renal involvement during sickle cell disease is very common in our context. Its spectrum is very wide ranging from chronic and silent abnormalities such as proteinuria to acute complications such as IRA. The poor quality of the follow-up, the hospitalization, the multiple crises in the SS subject and the absence of crisis in the SC patient are factors associated with the occurrence of the renal damage in the child sickle cell. It is therefore important for the sickle cell child to be regularly and attentively monitored to prevent the development of low-noise, life-threatening renal complications.

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