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Research Article

Correlation between Dipstick Urinalysis and Urinary Sediment Microscopy in Detecting Haematuria in Children with Sickle Cell Anaemia in a Tertiary Hospital

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Abstract: Haematuria is a known symptom of sickle cell anaemia (SCA) and most renal diseases including sickle cell nephropathy. Dipstick urinalysis can detect haematuria buturine sediment microscopy confirms haematuria. The objective of this study is to correlate between dipstick urinalysis and urinary sediment microscopy in detecting haematuria in children with SCA. Urine samples were collected from 272 children (aged 6 months to 15 years) with SCA, both in steady state and in crisis. The urine samples were analysed using dipstick urinalysis and urinary sediment microscopy. Presence of ≥1+ blood in the urine on dipstick urinalysis or of ≥2+ red blood cells on urine sediment microscopy is considered significant haematuria.The mean age of the 272 children with SCA was 6.4 ±3.9 years. There were 156 (57.4%) males and 116 (42.6%) females (male to female ratio of 1.3: 1). There were 185 (68.0%)in steady state and 87 (32.0%) in SCA crisis. The prevalence of haematuriaon dipstick urinalysis was 4.4%while that on urine sediment microscopy was 8.8%. Haematuria was not associated with age, gender and social class. Haematuria on dipstick urinalysis did not significantly differ from haematuria on urine sediment microscopy. There was a direct positive correlation for haematuria found on dipstick urinalyses and at urine sediment microscopy among children with SCA both in crisis and in steady state. Dipstick urinalysis is therefore a preferred screening tool for detecting haematuria in children with SCA because it is cheap and easy to carry out.
Keywords: Correlation, Haematuria, Children, Dipstick urinalysis, Urine sediment microscopy

INTRODUCTION

Sickle cell anaemia (SCA) is one of the causes of morbidity and mortality in children and haematuria is a common feature of SCA [1]. Sickle cell anaemia is a common cause of sickle cell nephropathy in children which may manifests clinically as haematuria, proteinuria with or without nephrotic syndrome [2]. Dipstick urinalysis remains a valuable tool in the screening of haematuria but it does not confirm haematuria as does urine sediment microscopy [3, 4]. It is imperative to correlate dipstick urinalysis and urine sediment microscopy because of the cheapness, quickness and simplicity of the former procedure.

Objective

To determine the correlation between dipstick urinalysis and urinary sediment microscopy in detecting haematuria in children with SCA

MATERIALS AND METHODS

The study was a descriptive and cross-sectional one consisting of consecutively selected children with SCA (in steady state and in crisis). Their ages ranges from 6 months to 15 years. The study was conducted at the Department of Paediatrics, Ahmadu Bello University Teaching Hospital (ABUTH), Zaria, over a period of six months. Ethical approval was obtained from the ABUTH Research Committee and a written consent obtained from/ guardians of subjects. Those included for the study were: children with confirmed SCA between the ages of 6 months and 15 years in steady states and in crisis. Those excluded from the study were: children with SCA aged 6 months – 15 years who have a history of exposure to radio-opaque dye and some drugs that decrease the reactivity of dipstick reagents including nitrofurantoin, cephalexin, cephalothin, captopril, tetracycline - 4 weeks earlier [5], menstruation or vaginal/penile discharge [5] and involvement in competitive sport/exercise in the previous 24 hours [3].

Sickle cell anaemia children in steady state included the following characteristics [6]: (i) No fever at presentation and for 4 weeks preceding clinical

attendance, (ii) No complaints of skeletal and or abdominal pain at presentation and within the 4 weeks preceding the investigation (iii) Not on any medication apart from routine folic acid and proguanil (iv) Otherwise well and going about their routine activities. Those SCA children in crisis included those children found to be free of SCA crises at least 3 weeks since the last clinical event and at least 3 months since the last blood transfusion, before the start of an index clinical event [7].

Urine sample collection and laboratory method

All enrolled subjects were provided with a properly labeled universal bottle for the collection of early morning urine. Early morning urine is expected to be concentrated; most suitable for microscopy and biochemical analyses [9]. Subjects were instructed regarding the collection in early morning mid-stream urine depending on the age. For each patient that has achieved bladder control midstream urine specimen (10mL) was aseptically collected at the time of presentation into two sterile universal bottles. For adolescent girls a trained female resident doctor assisted in collection of the specimens. For infants, moribund patients and children who were not toilet trained, suprapubic bladder aspiration (SPA) was used for obtaining the urine specimens.

Samples were analyzed within an hour of collection; otherwise they were kept in a refrigerator and or preserved in boric acid and analyzed within 3-5 hours. Dipstick urinalysis was done using Multistix 10SG by Bayer Diagnostic [8]. All instructions regarding the storage and handling of reagent strip were observed as stipulated by the manufacturer. The various grades of findings on color chart (and their significant quantitative values) were recorded as follows; negative, trace (10 erythrocytes/µl), small 1+ (25 erythrocytes/ µl), moderate 2+ (80 erythrocytes/ µl) and large 3+ (200 erythrocytes/ µl) [6]. Ten milliliters of the urine was centrifuged at the main microbiology laboratory of the teaching hospital at 2000 rpm for 5 minutes; a wet preparation was made from the sediment and examined under the microscope at x40 magnification [9].

The supernatant was decanted and a volume of 0.2 to 0.5ml was left inside the tube. The sediment was re-suspended in the remaining supernatant by flicking the bottom of the tube several times. A drop of re-suspended sediment was put on a glass slide and a cover slip applied. It was first examined under the lower power objective of the microscope for identification of most casts. Then examination was carried out at high power objective in order to identify the erythrocytes 10 to 15 fields were examined under each low and high power objective. Casts were recorded as average number of casts seen per low power field. Red blood cells were recorded as average of red blood cells per high power field. To enhance proper identification of the shape and sizes of urinary red cells, a Wright staining of the air dried smear of urinary sediments was carried also carried out [9].

The prevalence of haematuria was calculated and frequency table with percentages were generated for haematuria for different age groups, gender and social class. Chi square (χ^2) test was adopted to test for association between haematuria and age groups, gender and social class. Pearson's correlation coefficient (r) was adopted to test the correlation between haematuria on dipstick urinalyses and urine sediment microscopy children with SCA in crisis and in steady state. The quantitative equivalents of haematuria on dipstick urinalysis were adopted before Pearson's correlation coefficient was employed. Epi-info (version 7.1.4) and SPSS (version 17.0) Software package were used for data analysis. P value of < 0.05 was regarded as significant.

Definition of terms

Dipstick urinalysis: Haematuria; presence of trace or more blood in the urine. Significant haematuria; presence of ≥1+blood in the urine

Urine sediment microscopy: Haematuria; presence of 2 or more red blood cells. Leucocyturia; is presence of white blood cells.

RESULTS

Socio-demographic characteristics

Table 1 showed the distribution of age, gender and social class of children with SCA. The ages of the 272 subjects with SCA analyzed ranges from 6 months to 15 years with a mean age of 6.4 ±3.9 years. Most, 106 (39%), of the subjects were under 5 years of age. There were 156 (57.4%) males and 116 (42.6%) females with male to female ratio of 1.3: 1.One hundred and thirty-six (50.0%) subjects were in the lower social class, 48 (17.9) were in the middle social class and 88 (32.4%) were in the higher social class. Of the 272 SCA subjects studied, 185 (68.0%) were in steady state with mean age of 6.8 ±3.9 while 87 (32.0%) were in crisis with mean age of 5.6 ±3.7.

Prevalence of haematuriaon dipstick urinalysis and urine sediment microscopy in children with SCA

Table 2 showed the prevalence of haematuria among children with SCA both in crisis and in steady state. Of the 272 subjects studied, 12 subjects hadhaematuria on dipstick urinalysis giving prevalence rate of 4.4% while 24 subjects had haematuria on the confirmatory urinary sediment microscopy giving prevalence rate of 8.8% and the difference was not statistically significant ($\chi^2 = 3.60$, $p = 0.06$).

Six (6.9%) of the 87 SCA subjects in crisis and 6 (3.2%) of the 185 SCA subjects in steady state hadhaematuriaon dipstick urinalysis and the difference was not statistically significant ($\chi^2 = 1.11$, $p = 0.29$).

Fourteen (16.1%) of the 87 SCA subjects in crisis and 10 (5.4%) of the 185 SCA subjects in steady state had haematuria on urinary sediment microscopy and the difference was statistically significant (χ^2 = 7.12, p = 0.01).

Relationship of microscopic haematuria with age, sex, and social class

Most of the children with microscopic haematuria were among the age group 5 years and below but age did not have significant relationship with haematuria within (χ^2 = 0.78, df = 2, p = 0.68) and between the age groups (Table 3). Even though microscopic haematuria was commoner among the males, gender was not also found to have significant relationship with haematuria on urine microscopy (χ^2 = 0.01, p value = 0.92).Although there were more children with microscopic haematuria among the lower social class subjects, social class was not found to have significant relationship with haematuria on urine microscopy (Fishers exact; χ^2 = 0.75, df = 2, p = 0.69).

There was a direct positive correlation between haematuria found on dipstick urinalyses and that of urine sediment microscopy among children with SCA both in crisis and in steady state. Among children with SCA in crisis, Pearson correlation (r) was found to be +0.740 while the correlation (r) was found to be +0.520 among those children with SCA in steady state; table 4.

Table 1: Socio-demographic distribution of the study population

	Number of cases	Per cent	95% Conf. Limit
Age (Years)			
< 5	106	39.0	33.1
5-9	102	37.5	31.7
10-15	64	23.5	18.6
Sex			
Male	156	57.4	51.2
Female	116	42.6	36.7
Social class			
Upper	88	32.4	24.5
Middle	48	17.6	13.3
Lower	136	50.0	40.6
Total	272	100.0	

Table 2: Prevalence of haematuriaondipstick urinalysis and urine sediment microscopy in children with SCA both in crisis and in steady state

Urinalysis			
Urine dipstick	**In crisis, n (%)**	**In steady state, n (%)**	**Total, n (%)**
Haematuria	6 (6.9)	6 (3.2)	12 (4.4)
No haematuria	81 (93.1)	179 (96.8)	260 (95.6)
χ^2 = 1.11, p = 0.29			
Urine sediment microscopy			
Haematuria	14 (16.1)	10 (5.4)	24 (8.8)
No haematuria	73 (83.9)	175 (94.6)	248 (91.2)
χ^2 = 7.12, p = 0.01			
Total	87 (100.0)	185 (100.0)	272 (100.0)

Table 3: Distribution and relationship of microscopic haematuria with age, sex, clinical state and social class among children with SCA

Age (years)	Haematuria, n (%)	No haematuria, n (%)	Total, n (%)	p value
<5	11 (45.8)	95 (38.3)	106 (39.0)	
5 – 9	7 (29.2)	94 (37.9)	101 (37.1)	0.40
10 – 15	6 (25.0)	59 (23.8)	65 (23.9)	0.98
Sex				
Male	13 (54.2)	143 (57.7)	156 (57.4)	
Female	11 (45.8)	105 (42.3)	116 (42.6)	0.92
Social class				
Upper	6 (25.0)	81 (32.7)	87 (32.0)	
Middle	4 (16.7)	44 (17.7)	48 (17.6)	0.50
Lower	14 (58.3)	123 (49.6)	137 (50.4)	0.54
Total	24 (100.0)	248 (100.0)	272 (100.0)	

Table 4: Correlation between dipstick urinalysis and urine sediment microscopy among children with SCA both in crisis and in steady state

Haematuria	Pearson correlation (r)	p-value
Children with SCA in crisis	+0.740	0.06
Children with SCA in steady state	+0.520	

DISCUSSION

The prevalence of haematuria of 8.8% among SCA children observed in this study was higher than the 2.1% prevalence reported by Konotey-Ahulu [8] among 1,347 sickle cell anaemia patients. However, the observed in this study was lower than the 13.0% prevalence reported by Anigilaje *et al*. [9] in Ilorin, Nigeria. The prevalence of haematuria among SCA children observed in this study also differed from those of Ocheke [10] and Aikhionbare *et al*. [11] who did not detect haematuria in any of the 22 and 101 sickle cell anaemia patients respectively. The reason for the disparity in prevalence of haematuria between this study and that of Aikhionbare *et al*. [11] could not be ascertained. However, genetic variation and the small sample size, 22, in the study of Ocheke [10] may be responsible for the absence of haematuria among the sickle cell anemia children. Although there was an apparent decrease in prevalence of haematuria with increasing age in this study, this was not significant. This finding was different from that reported by Anigilaje *et al*. [9], Ugwu and Eke [12] and Konotey-Ahulu [8] where they reported increased prevalence of haematuria in children older than 5 years, even though Ugwu and Eke [12] and Konotey-Ahulu [8] did not set out to study the relationship between age and haematuria.

Even though haematuria apparently occurred more among male than female subjects, the difference was not significant, a finding similar to what was reported by Anigilaje *et al*. [9]. This finding could be due to the fact that the patho-physiology of sickle cell nephropathy is similar regardless of gender. The reason for the apparent increase of haematuria among the male than female subjects may probably reflect the fact that more male than female subjects were seen during the study period.

Lower social class was apparently associated with haematuria as compared to the middle and higher social class in this study although the difference was not significant within and between the different social classes. This may be explained by the fact that SCA crisis was commoner among the lower socio-economic status which could be precipitated by infection (UTI) in this group of children. The significant positive correlation between haematuria found on dipstick urinalyses and that found on urine sediment microscopy among children with SCA in steady state is in keeping with what was reported by Anigilaje and Adedoyin in Ilorin [9].

CONCLUSION

The significant positive correlation between haematuria found on dipstick urinalyses and that found on urine sediment microscopy among children with SCA suggests the use of dipstick urinalysis be used as a screening tool for haematuria because of its cheapness, quickness and simplicity.

Since microscopic haematuria was significantly higher among SCA subjects in crisis as compared to those in steady state, it is worthwhile confirming haematuria by urine sediment microscopy after dipstick urinalysis in children coming with SCA crisis.

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