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Prevalence of Rotavirus, Adenovirus and Enteric Parasites Among Pediatric Patients Attending Saint Camille Medical Centre in Ouagadougou

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Abstract: The present study carried out in the Saint Camille Medical Centre of Ouagadougou and related to the prevalence of Rotaviruses, Adenoviruses and enteric parasites infections among HIV-seropositive and HIV-seronegative children allowed to include 66 children aged from 2 to 60 months presenting acute diarrhea. The results revealed that 10.60% were infected by HIV. Stool samples analysis by direct microscopy and immunochromatographic tests (Rota-strip and Adeno-strip) showed 42.42% of global infections, among these, 18.18% parasitic infections and 24.24% viral infections, predominantly rotaviruses (22.73 and 1.52% for Rotaviruses and Adenoviruses, respectively). Among parasitic infections, Protozoan were most common than Helminthes (12.12% versus 6.06%). According to present results, Rotaviruses appeared as the major etiological agents in children aged from 2 to 11 months. However high rate of protozoan and helminthes was found in children aged from 12 to 60 months. Thus, virus, particularly Rotavirus must be painstaking as the principal etiologic agent of infant diarrhea in our country.

Key words: Rotavirus, adenovirus, enteric parasites, infant diarrhea

INTRODUCTION

Burkina Faso is a sub-Saharan country that shares borders with six other West African countries, Mali, Ivory Coats, Ghana, Togo, Benin and Niger. As many other developing countries, low levels of hygiene and sanitation expose its population particularly children to a wider array of microbial pathogens. In addition, malnutrition is often observed in many regions of the country. Thus, several infectious diseases such as chronic diarrhea and malnutrition are usually associated in many cases (Bonfiglio *et al*., 2002; Pignatelli *et al*., 2000). In the country, diarrhea incidence rate is estimated at 6 to 8 episodes per child per year among infants below 5 years, therefore pediatric diarrhea remains one of the major causes of death among infants (Sanou *et al*., 1999). The immediate causes are often of an infectious nature including a variety of pathogenic microorganisms or parasites. Several groups of viruses are responsible for acute viral diarrhea among children during their first years of life (Giordano *et al*., 2001). Rotaviruses are known to be the most common cause of severe acute watery diarrhea in children less than 5 years old in industrialized and developing parts of the world (Olesen *et al*., 2005). It is reported that 130 million children develop Rotavirus-related diarrhea each year, 18 million of them experiencing moderate to severe dehydration; resulting in between 418,000 and 520,000 deaths, 85% of these deaths occur in low-income countries (Luz *et al*., 2005).

Another group of virus included in children gastroenteritis is Adenovirus. Enteric adenoviruses are recognized as the second most commonly identified agent after rotavirus in stool samples of infants and young children with viral gastroenteritis (Shinozaki *et al*., 1987). Infections have been reported to occur most commonly in children less than 2 years old (Jarecki-Khan *et al*., 1993). Enteric adenovirus 40/41 has a global distribution associated with 4 to 10% of pediatric diarrhea (Giordano *et al*., 2001). Parasitic infections are most common among the poorest and disadvantaged communities. More than three billion people are infected in the world (Nematian *et al*., 2004). Nowadays, several gastroenteritis is favored by HIV infection, which causes immune depression in AIDS patients. In developing countries, most of HIV infected children die by acute and chronic diarrhea (Liste *et al*., 2000). HIV infection became pediatric preoccupation especially in sub-Saharan Africa, which harbors 90% of HIV infected children (Mbaye *et al*., 2005). Mainly death of HIV infected children is caused by infantile banal disease than AIDS itself. These deaths can

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be avoided by early diagnostic and best therapy care. The objective of the present study was to estimate the prevalence of enteric virus causing diarrhea such as Rotavirus and Adenovirus and intestinal parasites among HIV infected and non-infected children.

MATERIALS AND METHODS

Subjects: The study was carried out in the Saint Camille Medical Centre (SCMC) of Ouagadougou in Burkina Faso from January to July 2006. The enquiry allowed us to include 66 children aged from 2 to 60 months suffering from diarrhea. Among them, seven were HIV-seropositive and followed up by the Prevention of Mother-to-Child HIV Transmission (PMCT) of the medical centre.

Sample collection and laboratory procedure: From each child, a single feacal specimen was collected in the morning time for virus and parasites detection.

Virus detection: Group A Rotavirus and enteric Adenovirus type 40/41, were detected by Immunochromatographic technique with commercially available Kits (Rota-Strip test and Adeno-Stip test; Intermedical srl.ViaA. Genovesi 13-80010 Villaricca (NA)). Assays were performed according to manufacturer's instructions.

Parasites detection: Fresh stool samples were microscopically examined with saline solution (9% NaCl) and iodine wet mounts to detect the presence of Protozoan, Helminthes eggs and proglottids.

Anthropometric parameters: The weight and the height of each child were recorded after stool collection. HAZ (height for age z-score), WHZ (weight for height z-score) and WAZ (weight for age z-score) parameters were calculated as recommended by the National Centre for Health Statistics.

Statistical analysis: The data were recorded on computer with Excel software and analyzed with Epi-Info software version 6 and SPSS-12 for anthropometric data and biological data, respectively. The difference between mean values was calculated by student's t-test.

RESULTS

In the present study, anthropometric parameters of 66 children aged from 2 to 60 months (age mean: 16.38±13) with diarrhea were recorded and their stools were examined for the detection of group A rotavirus, enteric Adenovirus 40/41 and intestinal parasites. Seven of them were HIV-seropositive. Distribution and characteristic of population studied by age groups are displayed in Table 1. High incidence of diarrhea was observed among the 2 to 11 months age group with a prevalence of 46.97% (31/66). The difference between age groups for weight and height was statistically significant (Table 1). Virus detection in stool samples showed 24.24% of viral etiology with 22.73% for Rotavirus and 1.51% for Adenovirus. The overall prevalence of intestinal parasites was 18.18% within this, 12.12% were Protozoan and 6.06% were Helminthes. Rotavirus was detected only among children less than 24 months old with high frequency (38.71%) for 2 to 11 months age group (Table 2). Among the seven HIV-infected children enrolled in our study, only one (14.29%) was positive for Rotavirus. Among Protozoan founded, *Giardia lamblia* was the most frequent (7.58%) and children aged beyond 12 months old were mainly more infected by intestinal parasites. The mean ages of children with or without infectious etiology are shown in Table 3. It confirms that Rotavirus infect very young children (age mean: 9±5.37) versus intestinal parasites such as *Giardia lamblia* that infect predominantly children of about 22 months old (mean age: 22.40±8.20). In addition, the difference between mean ages and the status for Rotavirus was statistically significant (p = 0.011).

Table 1: Age, weight and height means according to effective of age groups

		Means		
Age groups (months)	No (%)	Age (months)	Weight (kg)	Height (cm)
2-11 (1)	31 (46.97)	7.32±2.340	6.15±1.58	66.13±4.91
12-24 (2)	24 (36.36)	17.17±4.770	7.73±1.35	75.45±5.14
25-60 (3)	11 (16.67)	40.18±12.29	11.02±2.93	73.68±11.07
Total	66 (100.00)	16.38±13.00	7.54±2.46	73.68±10.91

No (%) = Effective (frequency %) t-test values

Age groups	Weight	Height
1 → 2	p<0.001	p<0.001
1 → 3	p<0.001	p = 0.004
2 → 3	p<0.001	p = 0.519

Table 2: Frequency of Rotavirus, Adenovirus and intestinal parasites isolated from stool samples and prevalence of HIV in studied population, by age groups

		No. (%) of children infected with						
Age groups (months)	No.	RV	AdV	HIV	G.l.	T.i.	H.n.	S.s.
2-11	31	12 (38.71)	-	1 (3.23)	-	-	-	-
12-24	24	3 (12.5)	1 (4.17)	2 (8.33)	3 (12.5)	1 (4.17)	2 (8.33)	1(4.17)
25-60	11	-	-	4 (36.36)	2 (18.18)	2 (18.18)	1 (9.09)	-
Total	66	15 (22.73)	1 (1.52)	7 (10.60)	5 (7.58)	3 (4.55)	3(4.55)	1(1.52)
		Enteric viruses			Protozoan		Helminthes	
		16 (24.24%)			8 (12.12%)		4 (06.06%)	

RV = Rotavirus, AdV = Adenovirus, G.l = *Giardia lamblia* T.i. = *Trichomonas intestinalis*, H.n. = *Hymenolepis nana*, S.s. = *Strongyloïdes stercoralis*

Table 3: Mean age of children infected or not by Rotavirus, HIV, *Giardia lamblia*, *Trichomonas intestinalis* and *Hymenolepis nana*

Parameters		RV	HIV	G.l.	T.i.	H.n.
Age mean (months)	Positive	9.00±5.37	33.29±19.74	22.40±8.20	35.33±21.73	24.67±10.2
	Negative	18.55±13.8	14.37±10.51	15.89±13.24	15.48±11.99	15.98±13.06
t-test.: p		p = 0.011	p<0.001	p = 0.285 NS	p = 0.009	p = 0.261

NS = Non SIGNIFICANT

Table 4: Effective of children by z-score values in connection with nutritional status of children

Parameters	HAZ	WHZ	WAZ
X<-3.00	11/66 (16.7%)	9/66 (13.6%)	21/66 (31.8%)
-2.99<X<-2.00	6/66 (9.1%)	25/66 (37.9)	20/66 (30.3%)
X>-2	49/66 (74.2%)	32/66 (48.5%)	25/66 (37.9%)

Table 5: z-score value mean by age groups

	Age groups (month)		
Parameters	2-11 (1)	12-24 (2)	25-60 (3)
Effective	31	24	11
HAZ	-0.99±1.38	-1.49±1.43	-1.65±1.34
WHZ	-4.09±13.97	-2.38±0.94	-2.19±0.75
WAZ	-2.06±1.51	-2.84±1.14	-2.72±1.29
NS = Non Significant t-test values			
Age groups	HAZ	WHZ	WAZ
1 → 2	p = 0.195NS	p = 0.553NS	p = 0.040
1 → 3	p = 0.178NS	p = 0.657NS	p = 0.205NS
2 → 3	p = 0.756NS	p = 0.560NS	p = 0.783NS

Concerning anthropometric data, the results revealed that 62.12% of children presented low weight for age z-score (WAZ) (31.82% severe and 30.30% moderate) shown in Table 4. This underweight is presented in all the age groups (Table 5).

DISCUSSION

The results of present study showed that young children are the most affected by diarrhea with 46.97% in 2 to 11 months age group. These results are in accordance with those obtained by Sanou *et al.* (1999) in Ouagadougou (Burkina Faso) and by Orlandi *et al.* (2006) in Porto Vehlo (Brasil), who found 55.7 and 53.3% in the same age group, respectively. It has been demonstrated that the infant antibodies diversity is limited during the first years of life, since his defence is still relied on the maternal antibodies (Weitkamp *et al.*, 2003). In fact, at this period, the immunity develops gradually while maternal antibodies are falling, explaining why this age group is the most affected.

Among etiologic agents detected in our study, Rotavirus A was found in 22.73% cases. This frequency is higher than these reported by others. SANOU *et al.* (1999) found 14.4% in Ouagadougou, like Cardoso *et al.* (2003) in Goiânia (Brazil). Olesen *et al.* (2005) in Denmark found 13.2%. Nevertheless, similar frequencies were found in Ouagadougou in 1993 (21.5%) (Malan, 1993) and in Porto Vehlo (Brazil) in 2006 (23.6%) (Orlandi *et al.*, 2006). Therefore, our frequency is lower than that found in Korea (68%) Kim *et al.* (1990), in Ghana (40.5%) (Armah *et al.*, 2003) and in Cordoba (35.3%) (Giordano *et al.*, 2001) in Argentina. Rotavirus was the leading pathogen detected in feacal specimens of study, which confirmed that Rotavirus is the main etiological agent in children's viral gastroenteritis throughout the world (Gerba *et al.*, 1996). So, Rotavirus frequency is higher (38.75%) among 2-11 month age group than 12 to 24 month age group (12.5%). The first rotavirus infections in child rise up specific immune response to the serotypes. This response increases with multiple infections and immunity established during these first infections gives protection to the child against grave illness, at the time of ulterior exposure to different Rotavirus serotypes (OMS, 1999). That can explain frequency failure after 12 months age, according to the study of Cardoso *et al.* (2003). Adenovirus 40/41 is found in 1.5%, frequency similar to this found by Giordano *et al.* (2001), but lower than that found in both Tunisia in 2006 (6%) (Fodha *et al.*, 2006) and Bangladesh (2.8%) (jarecki-Khan *et al.*, 1993). This low frequency found because Adenovirus 40/41 were recognized as important etiologic agent of gastroenteritis in children especially in temperate climates countries (Cruz *et al.*, 1990), whereas Burkina Faso is tropical country. In addition to viral etiology, intestinal parasites were also important. Present study may actually have underestimated the true prevalence of parasitic infection because only one stool

sample was collected from every child. Intestinal parasites are found especially in children more than 11 months old because of transmission and spreading mode of theses parasites. In the same context *Giardia lamblia*, which can be transmitted orally by drinking water and which is an environmental contaminant of the water supply, remained the most common intestinal parasite among our subjects. The high frequency of Protozoan and particularly *Giardia lamblia* has been reported in previous studies. Thus, in Tehran primary school students, Nematian *et al.* (2004) found 11.5% for *Giardia lamblia*. Among Flagellates parasites isolated in Sfax (Tunisia), *Giardia lamblia* represented 85% (Ayadi *et al.*, 1991).

In the topic of HIV, seven HIV infected children were enrolled in this study, only one of them (14.29%) was co-infected by Rotavirus. Because of the very low number of HIV infected children and HIV-Rotavirus co-infected children, frequency of the two serological status could not be well compared, however some studies indicated that in children, Rotavirus epidemiology and its association with diarrhea do not vary significantly during HIV-infection (Liste *et al.*, 2000).

In fact etiology and pathogenesis of diarrhea in HIV infected children are not well understood, diarrhea causes are not always infectious, HIV itself cause nutrients malabsorption in intestine (Blossner and De Onis, 2005). In addition, endoscopic biopsies from HIV-infected patients suffering from diarrhea in the absence of enteric pathogens studied in customized using chambers demonstrated reduced barrier function of the small intestinal epithelium that was strongly associated with diarrhea (Dickman *et al.*, 2000). In Burkina Faso 38% of children less than 5 years old present low weight for age z-score (Measure DHS/ORC Macro, 2005), according to our results 62% of children are underweight, hence 62% of diarrheic children are undernourished since undernourishment may be defined as underweight (Caulfield *et al.*, 2004). Therefore, this high frequency shows co-relation between undernourishment and diarrhea. According to Sanou *et al.* (1999), undernourishment increases risk of diarrhea and diarrhea aggravates undernourishment (Sanou *et al.*, 1999). Pignatelli *et al.* (2000) also reported that it existed an uncorrectable spiral between malnutrition and infectious pathologies, which often is associated with chronic diarrhea (Pignatelli *et al.*, 2000; Simpore *et al.*, 2005). However, a significant proportion of deaths in young children worldwide are attributable to low weight-for-age (Caulfield *et al.*, 2004).

It may be concluded that diarrhea illnesses associated to undernourishment, remain a pubic health problem in Burkina Faso. In addition, group A Rotavirus was the main pathogenic agent in diarrhea especially among young children. Moreover, intestinal parasites are not less important particularly in children older than 12 months age. HIV infected children follow medical care (Triterapy) and HIV negative children in spite of their medical care in the Centre for Education and Nutritional Rehabilitation (CREN) and SMI (Santé Maternelle et Infantile) are always exposed to gastroenteritis. Therefore, improvements in socioeconomic conditions, along with the introduction of an effective safety and routine implementation of viral diagnosis have the potential to substantially reduce the occurrence of severe diarrhea.

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