

Prevalent opportunistic infections associated with HIV-positive children 0-5 years in Benin city, Nigeria

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ABSTRACT

A total of 620 HIV positive children 0-5 years attending University of Benin Teaching Hospital, Benin City, were examined in this study. They were grouped into less than 1 year and 1-5 years based on CDC classification system. 218 children were under 1 year and 402 were 1-5 years. The overall results showed that malaria infection recorded the highest prevalence with 71.10% in less than 1 year and 76.37% in 1-5 years. This was followed by Oral Candidiasis 38.07% in less than 1 year and 50% in 1-5 years. Bacteraemia had 23.40% and 30.60% in less than 1 year and 1-5 years respectively. Diarrhoea, 14.22% in less than 1 year and 17.66% in 1-5 years. Otitis media had 10.55% and 10.95% in less than 1 year and 1-5 years respectively. Similarly, 590 apparently healthy HIV-negative children within the same age group were evaluated for the presence of these infections. There was a statistical significance between opportunistic infections and HIV infection ($P < 0.001$). Malaria infection was the most prevalent opportunistic infection in this population and may probably be due to environmental condition of this locality as well as the low immune status of the children.

Keywords: Classification System, Malaria, Oral Candidiasis, Bacteraemia, Diarrhoea, Otitis Media

INTRODUCTION

Human Immunodeficiency Virus (HIV) infection is rapidly becoming a problem among children worldwide. An estimated 2.3 million children were living with HIV/AIDS at the end of 2006, 2 million of them in Sub-Saharan Africa. Most of these children acquire HIV from their HIV-infected mothers during pregnancy birth or breastfeeding (WHO, 2007). HIV infection in children causes a broad spectrum of disease with leads to profound immunosuppression. A hallmark of this process is the depletion of CD4⁺ lymphocytes; which predisposes the patient to develop a variety of opportunistic infections. The frequency of opportunistic infections in HIV-infected children in the absence of highly active antiretroviral therapy (HAART), vary with age, pathogen exposure and degree of immunosuppression (Chakraborty and Shingadia, 2007; Merchant and Quadir, 2002).

The depletion of T-lymphocytes which result from the proliferation of HIV causes the immune system to become severely compromised and the usually benign infectious agents become pathogenic. A number of protozoa, fungi, viruses and bacteria can be responsible for opportunistic infections in HIV-infected persons who have progressed to AIDS (Cheesbrough, 2000; Constantine *et al.*, 2005). Without HAART, the most common opportunistic infections in children include serious bacterial infections namely pneumonia and bacteraemia. The pneumonia most often manifests between 3 to 6 months of age in infants with vertically-acquired infection. Candidiasis (topical, oral, esophageal and tracheobronchial) is the

most common fungal infection in HIV-infected children (Chakraborty and Shingadia, 2007). Common mycobacterial infections include tuberculosis (*Mycobacterium tuberculosis*) and a typical extrapulmonary tuberculosis or disseminated infection caused by the *Mycobacterium avium-intracellulare* complex. Diarrhoea is a frequent problem caused by pathogens such as *Salmonella* and *Shigella*. *Septicaemia* is a usual complication (Constantine *et al.*, 2005).

Opportunistic infections continue to cause morbidity and mortality in patients with HIV infection throughout the world, with more incidence in developing countries where access to care and treatment is limited (Benson *et al.*, 2004). Hence this work is carried out to ascertain the prevalent opportunistic infections associated with HIV-positive children 0-5 years as well as measuring immune status of such children using CD4 count in Benin City, Nigeria.

MATERIALS AND METHODS

Study Population

A total of 620 HIV positive children consisting of 329 males and 291 females attending University of Benin Teaching Hospital, Benin City, were used for this study. Verbal informed consent was obtained from parents or guardians of the children. The population evaluated in this work were treatment naive HIV-positive children diagnosed by polymerase chain reaction (PCR) for children 0-18 months and serological methods for children

above 18 months of age. A total of 590 apparently healthy HIV negative children consisting of 311 males and 279 females were also evaluated in this work and these served as control. 3 millilitre of blood was collected from each patient and introduced into ethylene diaminetetraacetic acid (EDTA) bottle and mixed properly. All the samples were held at room temperature and processed within 2 hours of collection.

Determination of CD4 Count and Percentage

The CD4 cell count and percentage of the HIV positive children were analyzed by flow cytometry (Partec Cyflow Counter) made in Germany. The results obtained were recorded appropriately and was then categorized based on CDC classification system. For children less than 1 year, CD4 count greater than 1,500 cells/ μ L or CD4 percentage greater than 25% was categorized into group 1 (no immunosuppression). CD4 count of 750-1,499 cells/ μ L or CD4 percentage of 15-24% was categorized into group 2 (moderate immunosuppression). CD4 count less than 750 cells/ μ L and CD4 percentage less than 15% was categorized as group 3 (severe immunosuppression). However, for children 1-5 years, CD4 count greater than 1,000 cells/ μ L or CD4 percentage greater than 25% was categorized into group 1 (no immunosuppression). CD4 count of 500-999 cells/ μ L or CD4 percentage of 15-24% was categorized as group 2 (moderate immunosuppression). CD4 count less than 500 cells/ μ L or CD4 percentage less than 15% was categorized as group 3 severe immunosuppression (CDC, 1994). However, no CD4 count and percentage was performed on the HIV-negative children.

Laboratory Diagnosis of Infections

Infections were diagnosed in the laboratory by standard methods as follows:

- (i) **Malaria Parasitaemia:** Thin and thick blood films were made for each patient and stained with Field's stain at appropriate concentrations. The slides were examined microscopically using X100 objective.
- (ii) **Diarrhoea:** Stool culture was carried out for each patient and inoculated into selenite-F broth, MacConkey agar and Desoxycholate citrate agar (DCA). They were incubated at 37 °C for 24 hours. The isolates were further identified using biochemical and cultural characteristics (Cowan and Steel, 1985).
- (iii) **Otitis Media:** Ear swab was collected from each patient and cultured into blood agar, MacConkey agar and Chocolate agar. Plates were incubated at 37 °C for 24-48 hours. The isolates were identified by biochemical and cultural characteristics (Cowan and Steel, 1985).
- (iv) **Bacteraemia:** Blood culture was carried out in each patient and inoculated into glucose broth and thioglycollate broth. The broths were incubated at 37 °C for 1-10 days. Sub-cultured was made into solid media when growth was observed in the broth. The

isolates were identified by biochemical and culture characteristics (Cowan and Steel, 1985).

- (v) **Oral Candidiasis:** This was first observed macroscopically on the tongue of the patient. Swab was then taken and examined microscopically for the presence of yeast cells.

Data Analysis

The statistical significance of difference between HIV positive children and HIV negative children was tested using Chi-square (X^2) test, to show their relationship with various infections.

RESULTS

A total of 620 treatment naïve HIV-positive children were examined in this study. 218 (35.16%) were less than 1 year while 402 (64.84%) were between 1 and 5 years. The overall result showed that malaria parasite infection had the highest occurrence in all the categories irrespective of age group. This was followed by oral candidiasis and bacteraemia (Table 1a). Similarly, a total of 590 apparently healthy HIV-negative children were also examined in this study. 205 (34.75%) were less than 1 year while 385 (65.25%) were between 1 and 5 years (Table 1b). The overall distribution of opportunistic infections with respect to the different immunologic categories showed that single infections were more prevalent than mixed infections in the HIV-positive population studied (Table 2).

DISCUSSION

It was observed in this study with HIV-positive children that malaria infection had the highest prevalence in all the categories with an overall percentage of 71.10% among children less than 1 year and 76.37% in children between 1 and 5 years. This could be attributed to the fact that malaria constitutes the most public health problems in tropical Africa such as Nigeria. Similarly, the centre for disease control (CDC, 2006) reported that in children, HIV infection increases rates of malaria fever, severe disease and coma, with parasite density higher in children with advanced immunosuppression. Onifade *et al.* (2007) reported that HIV positive children within the age group 0-9 years recorded the highest prevalence of malaria infection with 66.7% in a study conducted in Ondo State of Nigeria. Thus there is a close relationship between Onifade *et al.* and this present work as regards the prevalence of malaria infection. However, this was followed by oral candidiasis, with an overall percentage of 38.07% among children less than 1 year and 50% in children 1-5 years. Dull *et al.* (1991) reported that oral candidiasis is common during the acute stage of HIV infection and that it occurs most commonly with falling CD4⁺ T-cell count in middle and late stage of HIV disease. It was observed in this study that the prevalence of oral candidiasis increases as immunity of the subjects

decreases (Table 1a). This tends to agree with the report of Dull *et al* (1991).

Bacteraemia was the next with 23.40% among children less than 1 year and 30.60% in children 1-5 years.

Table 1a: Opportunistic Infections in HIV-Positive Children 0-5 years

Age Group (years)	No. (%) Treatment Naïve HIV-Positive Children	Opportunistic Infections					
		Diarrhoea	Oral Candidiasis	Otitis Media	M.P	Bacteraemia	
< 1	Category 1	142 (65.14)	12 (8.45)	45 (31.69)	8 (5.63)	96 (67.61)	22 (15.49)
	Category 2	63 (28.90)	14 (22.22)	31 (49.21)	12 (19.05)	48 (76.19)	20 (31.75)
	Category 3	13 (5.96)	5 (38.46)	7 (53.85)	3 (23.08)	11 (84.62)	9 (69.23)
	Total	218 (100.0)	31 (14.22)	83 (38.07)	23 (10.55)	155 (71.10)	51 (23.40)
1-5	Category 1	185 (46.02)	16 (8.65)	66 (35.68)	13 (7.03)	136 (73.51)	32 (17.30)
	Category 2	138 (34.33)	23 (16.67)	79 (57.25)	16 (11.59)	110 (79.71)	40 (28.99)
	Category 3	79 (19.65)	32 (40.51)	56 (70.89)	15 (18.99)	61 (77.22)	51 (64.56)
	Total	402 (100.0)	71 (17.66)	201 (50.00)	44 (10.95)	307 (76.37)	123 (30.60)

Key: M.P = Malaria Parasite

Table 1b: Similar Infections in HIV-negative Children 0 – 5 years

Age Group (Years)	No. of HIV Negative children	Infections (%)				
		Diarrhoea	Oral candidiasis	Otitis media	M.P	Bacteraemia
< 1	205	3(1.46)	5(2.44)	2(0.98)	22(10.73)	2(0.98)
1 – 5	385	4(1.04)	5(1.30)	4(1.04)	35(9.09)	3(0.78)

Key: M.P = Malaria Parasite

Table 2: Distribution of Opportunistic Infections with respect to the different Immunologic Categories

Age Group (years)	Immunologic Category	No. (%) with Single Infection	No. (%) with Mixed Infection	Total
< 1	Category 1	101 (71.13)	41 (28.87)	142
	Category 2	32 (50.79)	31 (49.21)	63
	Category 3	3 (23.08)	10 (76.92)	13
	Total	136 (62.39)	82 (37.61)	218
1-5	Category 1	136 (73.51)	49 (26.49)	185
	Category 2	73 (52.90)	65 (47.10)	138
	Category 3	23 (29.11)	56 (70.89)	79
	Total	232 (57.71)	170 (42.29)	402

It was observed in this work that the severe immunosuppressed categories had more incidence of bacteraemia than the moderate and immunocompetent group. This could be attributed to the depressed immunity of the subjects. Nchabeleng *et al.* (2000) reported 15.5% prevalence in HIV positive children in a study conducted in a rural Kwa-zulu Natal Hospital in South Africa. Diarrhoeal infection recorded 14.22% among children less than 1 year and 17.66% in children between 1 and 5 years.

The lowest prevalence was otitis media with 10.55% in children less than 1 year and 10.95% in children 1-5 years. The overall distribution of opportunistic infections showed that single infection was more than mixed infection. However, mixed infection was more in the severe immunosuppressed categories and this group recorded the highest percentage of opportunistic infections.

However, apparently healthy HIV-negative children within the same age group were also evaluated for the presence of these aforementioned infections (Table 1b). This was done to ascertain if there is a relationship between the said infections and HIV infection. Statistical analysis using Chi-square showed that there is a relationship between opportunistic infection and HIV infection ($P < 0.001$). The prevalence of opportunistic infections recorded in this study could be attributed to the fact that the study population was treatment naïve and their immune system must have been subjected to series of attacks by the presence of the virus as can be seen from their CD4 count results (Table 1a).

In conclusion, the study showed that malaria infection is more prevalent among treatment naïve HIV-positive children in Benin City.

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