



Respiratory Tract Infections in Children Infected with HIV/AIDS in Minna, Niger State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Authors OOK designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript and managed literature searches. Authors MG, SYD, MEA managed the analyses of the study and literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Children with HIV/AIDS compared to immune competent ones develop respiratory tract infections in a pattern that are different in nature, severity and/or frequency. 50 children with laboratory confirmed HIV infection and 80 children with laboratory confirmation of HIV negative status were included in this study. Their ages ranged from 6 years to 14 years. All the patients were from urban areas. The study was aimed at determine the spectrum of bacterial agent that causes respiratory tract infection among HIV infected children as well as HIV uninfected children in Minna, Niger State and comparing the prevalence rate within different range of CD4 count. Sputum culture was taken to determine the profile of bacterial infection. All isolates from the cultures were identified using microbact identification kit (source: Oxoid Limited, United Kingdom). The frequency of bacteria isolates from HIV seropositive children was higher than the pneumoniae isolates from HIV Sero-negative *Streptococcus pneumoniae* 15(89%) and *Klebsiella pneumoniae* 20(89%) was the most common Gram-positive and Gram-negative bacteria identified respectively. 30% of the studied children were positive for at least one pathogenic bacterium. There was no significant difference between the prevalence rate of respiratory tract infection among HIV infected children and

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uninfected children and the rate of infection among children with CD4 count less than 100cell/ul was found to be significantly higher than those with higher CD4 counts at p level < 0.05.

Keywords: Respiratory; children; infection; Immunosuppression and HIV.

1. INTRODUCTION

Respiratory tract infections in children infected with the human immunodeficiency virus (HIV) is common among HIV infected and uninfected children and in Niger state and data on this problem are limited. Although bacterial pneumococcal infections can occur throughout the course of HIV infection, they tend to develop more frequently in individuals with advanced immunosuppression [1] Bacterial respiratory tract infections occur commonly in persons infected with the human immunodeficiency virus (HIV) [2] both more severe in children with HIV infection. The annual incidence of bacterial pneumonia in HIV-seropositive patients ranges from 5.5% to 29%, compared with 0.7% to 10% in HIV-seronegative patients [3]. In developing countries, bacterial pathogens account for a majority of respiratory infections in HIV-infected individuals [4]. Previous studies have shown variable distributions of organisms causing respiratory tract infection. The most common pathogens described have been *Staphylococcus aureus*, *Streptococcus pneumoniae* and especially non typhoidal *Salmonella species* [2]. Bacterial infections in both immunocompromised and immune-competent children have always been important causes of morbidity and mortality in developing countries, as well as developed countries. In developed countries, as a result of improvements in socio-economic status, accessible and good quality medical services and highly effective and accessible antimicrobial therapy, bacterial infections is no more a problem as it is in developing countries [5]. Bacterial infection is a frequent complication found in children which is usually associated with a poor prognosis.

2. MATERIALS AND METHODS

2.1 Study Hospital Settings

The hospital situated in Minna, North-central geopolitical zone of Nigeria. It serves as a referral center for HIV care in Niger state, in which it is situated and neighbouring communities. The clinic provides care including antiretroviral therapy for HIV-infected children

and is sponsored by the Government of Niger State. Ethical approval was obtained from the hospital research management board and informed consent from the parent of the participants. The study was conducted between June 2013 and December, 2013.

2.2 Participants

Participants of this study were children (both inpatient and outpatient) between two and sixteen years of age. The children and young adult will be in three groups,

- (i) Group one comprises of 50 children that are not infected with HIV attending the selected hospital.
- (ii) Group two children were confirmed or present with history of HIV-infection.
- (iii) Group three comprises of children that were exposed but not infected with HIV infection. Group ii and iii participants were 90 in number.

2.3 Study Procedure

Samples that are coughed up are expelled into a clean, dry, sterile, wide-necked and Leak-proof container and were transported to Microbiology laboratory in an ice pack. All samples were examined macroscopically, processed and the appearances, consistency and colour were described according to the guidelines provided by Cheesbrough [6]. All samples were processed by washing using saline-washed sputum technique, cultured blood and chocolate agar following standard microbiological procedure and identified using microbact identification kit and the Microbact™ Computer Aided Identification Package version 2.0 was consulted for the identification choices.

3. RESULTS

A total of 130 children were enrolled in this study, comprising 87 (66.9 %) males and 43 (33.1 %) females. Their ages ranged from 6 years to 14 years. The pathogenic bacteria isolated include *Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Proteus mirabilis*, *Proteus vulgaris*,

Pseudomonas aeruginosa, *Haemophilus influenzae*, *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Streptococcus pyogenes*, *Viridans Streptococcus*, *Anaerobics Streptococcus*. *Streptococcus pneumoniae* 15(89%) and *Klebsiella pneumoniae* 20(89%) was the most common bacteria identified. Table 1 shows the frequency of occurrence of different bacterial identified in relation to their HIV status.

Klebsiella pneumoniae was the most commonly identified gram-negative bacteria. The frequency of *Klebsiella oxytoca*, *Proteus mirabilis*, *Proteus vulgaris* and *Pseudomonas aeruginosa* varies. *Streptococcus pneumoniae* was the most common gram-positive bacteria followed closely by *Staphylococcus aureus*.

Table 2 shows the prevalence of respiratory tract infections among different age group in Minna. The highest prevalence rate was found among age group 12 < 14 (66%) and the lowest prevalence rate was found among 10 < 12 (24%). The difference in prevalence rate was found to be statistically different at $p < 0.05$.

4. DISCUSSION

Despite major efforts in scientific understanding of effective interventions that reduce complications due to children's HIV infection, over the last year, global estimates for newly acquired HIV infections in this population remain high [7]. The respiratory tract infection plays a key role in HIV/AIDS pathogenesis and mortality, because of suppressed immunologic responses [5]. In the infantile population, the resultant respiratory infections complications from HIV infections can contribute to nutritional deficiency with consequent aggravation of the immunologic conditions [8]. In developing countries, the most common causes of respiratory infections could be as a result of huge geographical variation, overcrowded settlement and unhygienic personal hygiene.

In this study of HIV-infected children, *S. pneumoniae* and *Klebsiella pneumoniae* were the most common cause of respiratory tract infection resulting in high morbidity and reduction of CD4 count among HIV infected children. There was a frequent coincident respiratory infection among the studied group as shown in table. There are higher frequency of *Streptococcus pneumoniae* and *Klebsiella pneumoniae* because the participants were from out-patient department

of the hospital and these organism were always considered as community acquired organisms. This is consistent with other HIV-infected paediatric cohorts described from both developing and developed settings [9,10]. The relative prevalence of most bacterial pathogens is similar to that of HIV-uninfected children. In a large Kenyan study *Streptococcus pneumoniae* and *H. influenzae* were more common in HIV-infected children [11]. These organisms were commonly seen in malnourished children in the pre-HIV era. *S. pneumoniae* is the most common bacteria in other cohorts, with *S. aureus* and *Viridian Streptococcus* occurring frequently as reported by [12-15] and *P. aeruginosa* was occasionally reported. The proportion of *H influenzae* is influenced by the introduction of the *H. influenzae* type B (Hib) vaccine, in 1999 in South Africa.

Table 2 shows the prevalence of respiratory tract infection in relation to age group. The age group 12 < 14 19(66%) participants had higher prevalence of respiratory infection among all the selected age group because most of the number of the participants selected and high expose rate of these participants in most of their overcrowded schools. At this age group, there are high interaction among their peer groups and play groups and this could also increase prevalence rate especially among immunocompromised children. At this period, children are rarely under the parental control, they play around with their friends both at home and in the school and they are at higher risk of been exposed to these bacterial [9]. Poor over crowded settlements, inadequate personal hygiene and poor environmental sanitation could also contribute to the high infection rate. Most children below the age of five years were been protected and stayed mostly at home with their parents and these could prevent them against been exposed to some community acquired infection.

When comparing the prevalence rate within the ranges of CD4 counts, as shown in Table 3 participants whose CD4 counts are below 100 cells/ul had highest prevalence rate in all the selected local government, follow strictly by participants whose CD4 counts are within the ranges of 101 cells/ul – 200 cells/ul. Although according to CDC in 2014, HIV seropositive individual with CD4 count lesser than 200 cells/ul are progressing rapidly to AIDS disease and are at higher risk of acquiring opportunistic infection which agrees with the result of this study. Participants from hospital a slight higher

Table 1. Frequency of occurrence pathogenic bacteria isolated from sputum

Organism	HIV infected		HIV uninfected		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
<i>Klebsiella pneumoniae</i>	8	21.05	12	23.53	20	22.47
<i>Klebsiella oxytoca</i>	6	15.79	0	0.00	6	6.74
<i>Proteus mirabilis</i>	2	5.26	5	9.80	7	7.87
<i>Proteus vulgaris</i>	0	0.00	8	15.69	8	8.99
<i>Pseudomonas aeruginosa</i>	2	5.26	3	5.88	5	5.62
<i>Haemophilus influenzae</i>	2	5.26	2	3.92	4	4.49
<i>Staphylococcus S. aureus</i>	4	10.53	7	13.73	11	12.36
<i>Streptococcus pneumoniae</i>	8	21.05	7	13.73	15	14
<i>Streptococcus pyogenes</i>	1	2.63	3	5.88	4	4.49
<i>Viridans streptococcus</i>	1	2.63	4	7.84	5	5.62
<i>Anaerobics Streptococcus</i>	4	10.53	0	0.00	4	4.49
Total	38		51		89	

Table 2. Prevalence of respiratory infections among different age group in Minna

Age group (Years)	No. examined	No. positive	% positive	Sign
6 < 8	19	7 ^b	36.84	0.08
8 < 10	16	9 ^b	56.25	0.59
10 < 12	25	6 ^b	24.00	0.22
12 < 14	29	19 ^a	65.52	0.03
Total	89	42 ^{ab}	47.19	0.04

Means on the same column with different superscripts are significantly different ($p < 0.05$)

Table 3. Distribution of respiratory infections in relation to CD4 count in HIV positive samples in Minna

CD4 count (cell/ul)	No. examined	No. positive	% positive	Sign
<100	3	3	100.00	.01
100 – 200	10	6	60.00	.03
201 – 400	3	0	0.00	.27
401 – 600	10	2	20.00	.58
> 600	24	8	33.33	.15
Total	50	19	38	.05

prevalence rate which could be attributed to the fact that Minna General Hospital is a referrer hospital. The presence of higher prevalence of infections among children with lower CD4 counts could be as a result of compromised immune system. However, severe immunosuppression, established according T CD4 cell count, showed

to be an important factor related to this respiratory tract infection [16].

5. CONCLUSION

The number of isolates identified in sputum of the asymptomatic HIV-sero positive children was

high, and the frequency of bacterial isolates observed was similar to that one observed for the non-HIV-infected children in south western part of the country. The percentage prevalence of respiratory infection among children with low CD4 count was relatively high and these data raise the pressing necessity of additional studies in different regions of the country, aiming at the clarification of the importance of each of these agents in the etiology of the respiratory tract infection among HIV sero-positive children population.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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