

# Opportunistic Infections As Aids-Defining Conditions: Case Study Of Hiv Infected Persons In Eastern Nigeria

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## Citation

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## Abstract

The prevalence of opportunistic infections as WHO's AIDS defining illnesses was investigated microbiologically in 2199 HIV positive Nigerians using urine, stool, sputa and nasopharyngeal secretions. ANOVA and the Pearson Chi-Square tests were used for data analysis. Frequently isolated gastrointestinal bacterial pathogens included non-typhoidal *Salmonellae* species (69.5%), *Campylobacter jejuni* (64.9%), *Shigella* species (60.0); diarrhea inducing protozoa: *Entamoeba histolytica* (62.8%), *Gardia lamblia* (61.6%), *Cryptosporidium* spp (24.1); respiratory tract pathogens: *Streptococcus pneumoniae* (84.6%) > *H. influenzae* (72.8%) > *Pseudomonas aeruginosa* (27.1%); fungal pathogens: *C. albicans* (65.6%) > *H. duboisii* (54.4%) > *Aspergillus* spp (45.0%) > *Pneumocystis carinii* (4.6%) > *Cryptococcus neoformans* (4.2%). Isolated urinary tract pathogens included *Bacteriodes fragilis* (77.7%), *Klebsiella aerogene* (69.4%), *E. coli* (64.8%), *Proteus* spp (50.5%). The occurrence of each pathogen in the various anatomical sites was statistically significant ( $F_{cal} = .997$ ;  $p < 0.005$ ) indicating their possible involvement in disease causation and progression of HIV infection to AIDS.

## INTRODUCTION

Opportunistic infections in HIV/AIDS are the infections, which become clinically apparent due to the weakened immune system of the patient, otherwise they would be unapparent. These constitute the bulk of the conditions included in the 1993-revised CDC AIDS case-definition, for surveillance among person over 13 years of age (CDC, 1994). In this revised case-definition, a person is suspected to have AIDS either when the CD4+ lymphocyte count drops below 200 cells per cubic millimeter (i.e., below 14% of total lymphocyte count) and there is a laboratory confirmation of HIV infection or a diagnosis is made of one of the clinical conditions. Thus, diagnosis of disease such as candidiasis of the esophagus, Cytomegalovirus retinitis, pulmonary tuberculosis or other Mycobacteriosis, Kaposi's sarcoma, *Pneumocystis carinii* pneumonia, Toxoplasmosis of the brain, etc., are regarded as indicative of AIDS. These criteria have been employed in HIV/AIDS surveillance in the United States of America (CDC, 1995a).

Opportunistic infections are so prominent in AIDS that they are often the definitive illnesses in both adult and paediatric AIDS. Thus, most of the major and minor signs of the WHO case definition of the disease reflect underlying opportunistic infections. The CDC case definition relies on the accurate diagnosis of opportunistic infections. They tend to occur

concomitantly at unusual sites in the body of the patient, and produce abnormal tissue responses in the host, now with altered immunity. Predominance of certain opportunistic infections in one geographical location and not in others has been explained by variations in prevalence and virulence of strains of some organisms coupled with immune interaction or cross-immunity (Lucas, 1990). Hence there are significant differences between opportunistic infections prevalent in Africa and those prevalent in United States of America and Europe (Butungwanayo et al., 1990; Lucas et al., 1991). Among all HIV/AIDS associated infections or diseases, tuberculosis stands prominent as cutting across geographical boundaries. Reason for this may be obvious; it has a worldwide distribution with endemicity in certain areas and cultures (Murray et al., 1990; De Cock et al., 1992).

The CDC outlined certain opportunistic infections in the United States and categorized them as AIDS related-complex (ARC), a categorization connoting them as indicators of damaged immune system (CDC, 1995a). Apparently, these infections coincide with reduction in CD4+ lymphocyte count of the patient to < 100 cells /mm. Diagnosis of some of these opportunistic infections such as Aphthous ulcers and bacillary angiomatosis prove somewhat difficult because of their resemblance to other disease conditions (CDC, 1994; AIDSLINE, 1994). Although

opportunistic infections have been associated with apparent reduction in CD4+ counts, the critical level of CD4+ count reduction at which these infections may be expected, i.e., the level of immune damage at which these otherwise non-virulent organisms seize the “opportunity” to enter, is not often well defined. For example, Aspergillosis would occur with complications in people with CD4+ cell count of  $\leq 100$  per ml of blood but has also occurred in people with higher counts (BALA, 1995). Candidiasis occurs at various CD4+ count levels but those with counts  $< 200$  cells/mm seem to be more severely affected (CDC, 1993). The importance of Coccidioidomycosis due to *Coccidioides immitis* or *Cryptococcus neoformans* in AIDS-related meningitis cannot be overlooked; nor can that of *Cryptosporidium parvum* and *Isospora belli* in AIDS-related diarrhoea (Hing et al., 1992; CDC, 1993; ATN, 1994;).

What opportunistic infections characterize HIV/AIDS in Africa? Unlike the United States and Europe, Africa has no facilities for a clinical case definition based on laboratory testing. In 1986, the WHO established a clinical case definition not requiring laboratory testing for use in Africa (WHO, 1989). The African case definition requires the existence of two major and one minor signs in the absence of known immunosuppression. This is with the exception of two conditions generally considered in themselves to define AIDS, i.e. generalized Kaposi's sarcoma and generalized *Cryptococcus meningitis* (Sonnabend et al., 1983; UNAIDS, 1998). It would be noticed that in this WHO case definition, recurrent herpes zoster, oropharyngeal candidiasis and disseminated herpes simplex were the only opportunistic infections included. Its usefulness was tested in Kinshasa, Zaire and it was found to have a sensitivity of 59%, specificity of 90% and a positive predictive value of 74% for HIV infection among hospitalized patients (CDC, 1995b). Matched with the CDC definition in a different study, its sensitivity was 79%, specificity 91% but a low positive predictive value of 30%, (WHO, 1989; CDC, 1995b; Shah, 2002). The positive predictive value of the African case definition is so low that as a surveillance tool for comparisons with AIDS reporting in the developed world, its usefulness is doubtful. The difficulty in undertaking an effective AIDS surveillance in Africa, and in deed Asia remains the limited availability of HIV testing and/or poor diagnostic facilities. Perhaps more investigations into a wider spectrum of opportunistic infections characterizing AIDS disease and the inclusion of the more prevalent ones such as tuberculosis or *Mycobacterium avium* complex

(MAC), may improve the positive predictive value of the above African AIDS case definition provided by the WHO.

It is against this background that the present study was designed to elucidate the possible aetiological agents incriminated in immune suppression, and the development of AIDS in a sample African community located in the South Eastern Part of Nigeria.

## **MATERIALS AND METHODS**

The study was carried out in specific locations in Eastern Nigeria, chosen for their peculiarities, and include the 9<sup>th</sup>- Mile-Corner (Udi Local Government Area), Eha-Alumona (Nsukka Local Government Area), Orba and Obollo-Afor (Udenu Local Government Area). Enugu and Nsukka urban centres were included as reference points for sample populations with no known risk behaviours while the groups in the major locations were selected because of their known HIV/STD risk behaviours. The study population consisted of 2199 HIV positive persons (929 males and 1290 females) in 6 clinics/health centers in the surveyed area.

Ethical consideration: Consent to carry out the study was obtained prior to the commencement from the Administrators, Proprietors or Directors of all health institutions used. Informed consent (without undue influences) was obtained from participants before their inclusion in the project.

### **Screening For Sexually Transmitted Diseases (STDs)**

The screening of syphilitic exudates for spirochetes was carried out by serological screening using the cardiolipin Antigen Test which consisted of Venereal Diseases Reference Laboratory (VDRL) test, and the Rapid Plasma Reagin (RPR) CARD TEST described by Cruickshank (1980) and (Cheesbrough, 1991). Gonococcal infections were investigated using standard procedures described by Cheesbrough (1991). Specific standard techniques were employed for the investigation of non-gonococcal infections. A smear of the pus expressed from the characteristic H. ducreyi lesion was Gram-stained and examined microscopically for negative coccobacilli exhibiting bipolar staining (Cheesbrough 1991). Serum of venous blood was heated at 56° C for 5mins in a water bath and to this inoculated pus specimen from H. ducreyi lesion and incubated at 37 ° C for 48h. Growth was indicated by turbidity of the serum culture (Cheesbrough 1991). Fungal STDs were screened for by first digesting the urethral and/or

vaginal discharges in 10% potassium hydroxide (KOH) solution to eliminate blood and epithelial cells, and smear of the digest examined with X 40 objective for fungal hyphae, pseudohyphae and budding yeast cells. The sediment was cultured at 37° C for 24-48h, in Sabouraud Dextrose agar (SDA) supplemented with 0.02g, chloramphenicol, to suppress bacterial growth, examined for characteristic yeast and confirmed by Chlamydospores formation by subculturing on Corn-meal agar supplemented with 1% Tween 80 and by the characteristic germ tube formation on 0.5ml human serum and incubated for 3h at 37° C. Swabs of vaginal or urethral secretions (exudates) were also examined under the dark field microscope for the jerky movement of *Trichomonas vaginalis*. Examination for Chlamydia trachomatis was done by Giemsa-staining the bubos and examining for intracytoplasmic inclusion bodies (Cheesbrough (1991)). Samples were further Gram-stained and cultivated on triplicate plates of Blood, Chocolate and Mannitol-Salt agar (containing 75% Sodium Chloride NaCl), and incubated for 24h at 37° C. Discrete colonies were subjected to catalase and coagulase tests.

### **EXAMINATION OF STOOL SAMPLES FOR OCCULT BLOOD AND PATHOGENIC PROTOZOAN INFECTIONS**

Stool samples were first examined macroscopically for colour, odour, consistency, (formed unformed, watery or mucoid) and for presence of blood and worms, and then microscopically for protozoa, fungi or bacteria. Black stools samples were subjected to occult blood tests using the occult blood tablets. Cysts, larva and eggs of parasites were investigated by examination of stool samples in eosin and iodine preparations and by modified Ziehl Neelsen staining for oval *Cryptosporidium* oocysts Cheesbrough (1991).

### **BACTERIAL CULTIVATION AND IDENTIFICATION**

Faecal specimens were analysed for the presence of bacterial pathogens following emulsification on Peptone water (Oxoid, CM9), and subsequently seeding on MacConkey agar and the incubated at 37° C for 24h. Lactose fermenters were sub-cultured on Blood agar and incubated at 37° C for 24h, while non-lactose fermenters were cultivated on Salmonella Shigella agar Brilliant Green agar (Modified) Mannitol Salt Agar, Xyline-Lysine (XLD), Butzler, medium, Desoxycholate agar (DCA) and Thiosulphate Citrate Bile Salt (TCBS) according to the standard methods described by Cheesbrough (1991).

### **URINE MICROSCOPY AND CULTURE**

Centrifuged midstream urine samples were examined microscopically under X10 and X40 objective for parasites, pus cells, blood cells, yeast cells, epithelial cells and bacteria. Samples containing bacteria ( $10^5$ ) per ml, were subsequently seeded on Cystine-Lactose-Electrolyte Deficient (CLED) medium and Blood agar and incubated in a Gallenkamp incubator at 37° C for 18-48h. Isolated pathogens of medical importance were identified and characterized according to the methods of Cruickshank, (1980); Cheesbrough, (1991).

#### **Screening of Sputum, Naso-pharyngeal Secretions**

Each specimen was examined for appearance: purulent, muco-purulent, cheesy, mucoid or muco-salivary, white coloured, yellow or bloody or bloodstained and then Giemsa stained for sporozoites, trophozoites or cysts of *Pneumocystis carinii* as described by Cheesbrough (1991). Purulent, muco-purulent or cheesy specimens were first digested with Potassium hydroxide solution and incubated for 1h to liquefy as described by Stokes (1970). Acid Fast Bacilli (AFB) were then screened for using the Ziehl-Neelson Staining (Method 1), described by Cheesbrough, (1991).

### **SCREENING FOR BACTERIAL AND FUNGAL PATHOGENS OF THE RESPIRATORY TRACT**

Digested sputa and nasopharyngeal secretions were cultivated on MacConkey, Blood, and Chocolate agar to which optochin discs (ethylhydrocuprein hydrochloride) were incorporated, and incubated in a carbon dioxide enriched atmosphere (10% CO<sub>2</sub>) at 37° C, for 48h, and examined for growth after overnight incubation (Cheesbrough, 1991). Isolates were identified by biochemical tests described by Cheesbrough, (1991). Fungal pathogens of the respiratory tract were screened following digestion of sputa, naso-pharyngeal secretions and high vaginal swabs (HVS) in 5ml of 10% potassium hydroxide solution and subsequent examination on physiological saline and Lactophenol cotton blue for fungal budding cells, hyphae and pseudohyphae. Samples were further Giemsa stained and examined for intracellular yeasts of *H. capsulatum* as described by Cheesbrough (1991).

#### **Fungal Cultivation and Identification**

Sputa, nasopharyngeal secretions and HVS were first inoculated onto Sabouraud Dextrose Agar (SDA)

incorporated with chloramphenicol and incubated at both ambient temperature (25-30° C), and at 37° C for 2-7days. Rapidly growing colonies on SDA were examined with a hand lens and further on drops of Lactophenol cotton blue for grayish-green, velvety powdery textured and V-shaped septate hyphal colonies of *Aspergillus* species. The growth from SDA plate was then subcultured into Corn-Meal Agar (CMA) and Brain Heart Infusion (BHI) agar supplemented with 5ml of venous blood and chloramphenicol (for ease of isolation of the tissue phase of *Histoplasma capsulatum*), and incubated at both 25-30° C and at 37° C for 2-7 days. Discrete colonies from the CMA plate were re-inoculated with a straight needle through freshly prepared CMA supplemented with 0.02g chloramphenicol, and 1% Tween 80 (Polysorbate, which reduces surface tension of the media, to allow development of pseudohyphae, hyphae and chlamydospores of yeasts), and incubated at ambient temperature for 48h, for development of the terminal chlamydospores of *Candida albicans*. The plate was examined daily for submerged growth and further examined on Lactophenol preparation using X10 and X40 objective lens for chlamydospores and pseudohyphae. Confirmation of done by the germ tube test. Suspected yeast cells from the BHI plates were stained with filtered Nigrosin and Loeffler's alkaline Methylene blue solution and observed for thick-walled, nearly spherical budding yeasts with gelatinous capsule (which repelled the stain, thereby creating a clearing – 'halo' effect around the yeast) and further confirmed by urease production by inoculation on Christensen's urea agar and incubation for 2-7 days at room temperature.

RESULTS  
PREVALENCE OF OTHER OPPORTUNISTIC INFECTIONS IN HIV POSITIVE SUBJECTS  
GASTROINTESTINAL TRACT (GIT) PATHOGENS

Some frequently occurring bacterial pathogens of the GIT were isolated during the study: Non-typhoidal *Salmonellae* species had the highest percentage prevalence (69.5%; and frequency distribution of 0.38), followed by *Campylobacter jejuni* (64.9% and frequency distribution of 0.20), and *Shigella* species (60.0% and 0.22 frequency distribution), respectively (Figure1). Non-tuberculous *Mycobacterium* species (22.0%, and frequency distribution of 0.02) were not of common occurrence in the stool samples of the subjects.

Protozoan pathogens implicated in chronic diarrheal conditions included *E. histolytica* (62.8%; frequency

distribution of 0.59), *G. lamblia*, (61.6%, frequency distribution, 0.03). *Cryptosporidium* spp (24.1 frequency distribution of 0.07). *Isospora belli* had the least prevalence rate and frequency distribution (6.7%, frequency distribution of 0.02) (Figure 2).

Figure 1  
Figure 1: Bacterial Pathogens isolated from the Gastrointestinal Tract of PLWHA

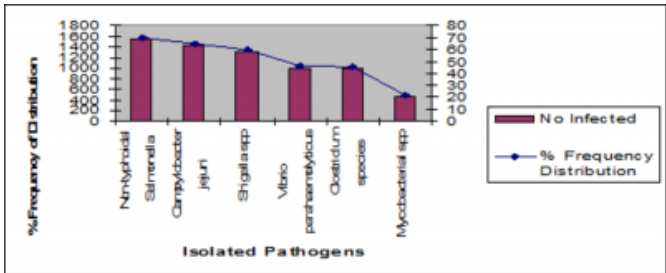
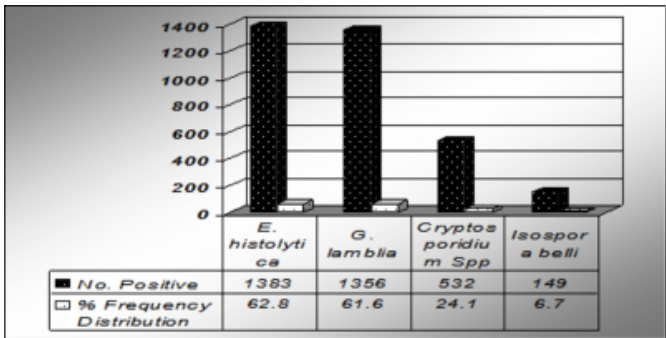


Figure 2  
Figure 2: Frequently Isolation Protozoan pathogens from HIV-Positive individuals with Chronic Diarrhea



RESPIRATORY TRACT INFECTIONS  
BACTERIAL INFECTIONS OF THE RESPIRATORY TRACT

The most important respiratory tract bacterial pathogens encountered outside the Acid Fast Bacilli were *Streptococcus pneumoniae* (84.6%), with frequency distribution of 0.35 and *H. influenzae* (72.8%), frequency distribution of 0.21. The least occurring bacterial pathogen was *Pseudomonas aeruginosa* (27.2% and frequency distribution of 0.11) (Figure 3).

Figure 3

Figure 3: Isolated Bacterial Pathogens of the Respiratory Tract of PLWHA

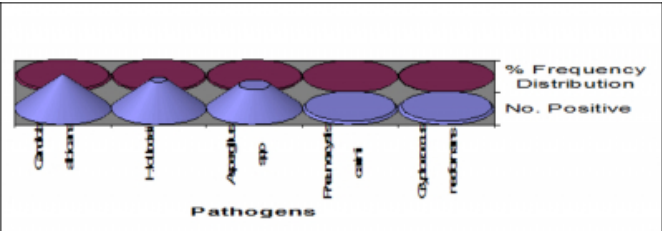


FUNGAL INFECTIONS

The most frequently isolated fungal pathogens were *C. albicans* (65.6%), *H. duboisii* (54.4%), *Aspergillus* spp (45.0%) and *Pneumocystis carinii* (4.6%), *Cryptococcus neoformans* (4.2%) (Figure 4).

Figure 4

Fig. 4: Fungal Organisms of the Respiratory Tract

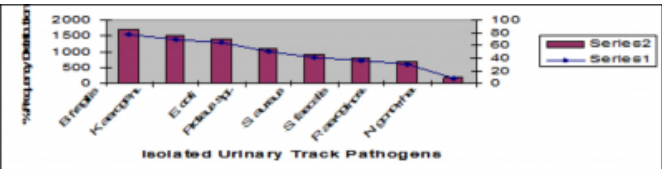


BACTERIAL PATHOGENS OF THE URINARY TRACT

The bacterial pathogens isolated from the urinary tract specimens included *Bacteriodes fragilis* (77.7%), *Klebsiella aerogene* (69.4%), *E. coli* (64.8%), *Proteus* spp (50.0%), *Staph aureus* (41.3%), *Strept. faecalis* (36.4%), *Pseudomonas aeroginosa* (30.5%) and *Neisseria gonorrhea* (8.5%) (Figure 5). All infections concomitant with HIV and their various sources of isolation are shown in Table 1.

Figure 5

Fig. 5: Bacterial Isolates From the Urinary Tract



DISCUSSION

Prevalence of other opportunistic infections was also observed during the study. These infections occurred possibly as a result of compromised immunity of the subjects. Gastrointestinal disorders resulting from opportunistic infections of the gastrointestinal tract (GIT)

were established. Bacterial opportunistic pathogens incriminated in diarrheal diseases among the HIV positive subjects included non-typhoidal *Salmonellae* (69.5%). This result is confirmed by the reports of Celum et al. (1987), which indicated that people with advanced HIV disease in San Francisco had a 20-fold increased incidence of non-typhoidal *Salmonellae*, thus presenting *Salmonella* bacteraemia as an important complication of the GIT in people living with HIV/AIDS (PLWHA). Similarly, the US Center for Disease Control and Prevention (CDC, 1987) established *Salmonella* bacteraemia as an AIDS-defining illness. *Campylobacter jejuni* (64.9%) was observed in black diarrheal stool samples particularly among individuals with full-blown AIDS, thus suggesting the involvement of this organism in HIV disease progression. Shigellosis, induced by *Shigella* species and characterized by blood tingled diarrheal stool was also observed in 60% of the HIV positive subjects, while *Clostridium difficile* (observed in blood tingled diarrhea of sudden onset) occurred in 49.2% of the people (Figure 1). Most of the individuals from whom *C. difficile* was isolated indicated over-indulgence in homeotherapy and antibiotic misuse, circumstances which favour the growth of the organism as reported in the findings of Hutin (1993). *Vibrio parahaemolyticus* (45.9%), signaled by unusual overt flaky stool was observed among the HIV-infected patients. Though the actual mechanism by which these organisms induce diarrhoea was not established during the study, it could however be inferred that the motility of the organism aided by the presence of the flagella, could have triggered colon irritation; while the elaboration of cholera enterotoxin (CT or cholera-gen) could have activated the adenocyclase enzymes to secrete large amounts of fluid and electrolytes into the lumen, resulting in the profuse bloody diarrhea and the associated cramp observed.

The association of non-tuberculosis *Mycobacterium* species (22%) in HIV disease was confirmed in this study. These organisms were isolated from diarrheal stool samples thus incriminating them as possible opportunistic pathogens of the GIT as earlier reported by Hawkins et al. (1986). The involvement of these organisms with diarrhea could be attributed to the infiltration of infected macrophages into the lumen of the GIT, and subsequent effect of released cytokines by the macrophages, resulting in thickening of the proximal intestine. Massive colonization of the intestine and attachment via adhesions could then have aided invasion of the mucosal and sub-mucosa, resulting in the observed release of pus and epithelial cells, malabsorption and watery

stool, characteristic of the diarrhea (Dworkin et al., 1985).

The identified parasitic protozoa outlined in the result include *Entamoeba histolytica* (62.8%), *Giardia lamblia* (61.6%), *Cryptosporidium* species (24.1%) and *Isospora belli* (6.7%) among others. Their diagnosis was confirmed by stool analysis particularly for ova and cysts. The significance of this result is the involvement of the parasites in enhancing the progression of HIV to full blown AIDS by elaboration of chronic diarrhea which results in drastic loss of water and electrolytes and the subsequent dehydration and weight loss observed in HIV disease. The frequency of occurrence of the parasite nevertheless indicated the level of immune suppression; thus serving as good predictor of advanced HIV disease or full-blown AIDS at which period severity of, and gross manifestation of every infection is observed. The observed frequency of *Giardia lamblia* (61.6%) however contradicts previous reports by Smith et al. (1988), which indicated that Giardiasis appears to be no more severe in HIV-infected patients than in immunocompetent persons. Prevalence of *Entamoeba histolytica* occurred at about 62.8% frequency. The observed high frequency could indicate that the parasite might have acted as a commensal, only becoming highly pathogenic with such frequency occurrence following the suppression in immune function. It is further suggested that the frequency observed might have been occasioned by some predisposing factors, such as poor sanitation, and poor personal hygiene. On the other hand, infection with *Cryptosporidium* species was also recorded mostly among patients presenting with severe and protracted voluminous diarrhea with acute weakness (probably denoting acute immunosuppression), at a frequency of (24.1%). The observed severity of the infection could be attributed to the alteration of the architecture of the small intestinal epithelium as a result of immunosuppression as well as the frequency of treatment with immunosuppressive drugs in AIDS patients among whom *Cryptosporidium* infection is common. This view is confirmed by the findings of Flanigan et al. (1992), who reported the association of *Cryptosporidium* species with immunodeficiency.

Among the respiratory tract bacterial organisms isolated during the study included *S. pneumoniae* (84.6%) and *H. influenza* (72.8%). *S. pneumoniae* was principally isolated from patients presenting with lobar pneumonia, bronchitis and broncho-pneumonia. The prevalence of this organism in the population could be associated with abnormalities in the humoral immune system and phagocytic cells following

immune suppression (which could have increased susceptibility of the encapsulated bacteria).

Evaluation of the opportunistic organisms of the urinary tract (by both urinalysis and urine culture) was aimed at establishing the etiology and pathogenicity of the organism. This was indicated by abnormalities in electrolyte and renal function as well as the effect on HIV progression to AIDS. Urine analysis (Urinalysis), carried out with the Urilastic (Combi 9), served as a major identification parameter in establishing the etiology of urinary tract infection (UTI), as abnormalities in HIV disease were identified. However, it was considered unnecessary during the study to culture normal urine with microbial count less than ( $10^4$ ) per ml of urine because these produced no growth after more than 2-3 days of incubation. This was based on the consideration that under normal physiological conditions, the kidneys, urethra and urinary bladder of man remain sterile; hence, the sterility of urine produced as a result of the low pH, the presence of urea, and other metabolites such as uric acid, fatty acids, mucin; enzymes, indican, etc., which are cidal to a wide range of bacteria. In addition, the hypertonic nature of the medulla cannot support many microorganisms. Potential pathogens are equally flushed with urine and mucus about 4-10 times daily, thus ensuring further sterility of the area. However, isolated organisms included *Bacteriodes fragilis* (53.3%). These pathogens are found mainly as commensal in the GIT, but as pathogens in the genitourinary tract, causing puerperal sepsis. Association of this with HIV infection was assumed to be the result of immune suppression and weakening of the urinogenital tract pseudomembrane during HIV infection. Furthermore, prevalence of coliform bacilli: *E. coli* (64.8%), *Proteus* species (50%), *Klebsiella aerogene* (69.4%) (Figure 5), was observed from the urinary tract, and were strongly associated with the dysfunction of the tract in the HIV infected people surveyed. This view is confirmed by the findings of Kathleen and Wizburg (1996), on the conventional bacterial infections associated with immunosuppression. These infections were assumed to be associated with sexual contact, general unhealthy sanitary habits, formite contamination or ascending infection from feces on contact with urethral opening. The possibility of nosocomial infection with the organism is also inferred considering the level of immune suppression in HIV disease.

Infection of the urinary tract with *Staphylococcus aureus* (41.3%), *Streptococcus faecalis* (36.4%), and *Pseudomonas aeruginosa* (30.5%) were also apparent from the study, in



conformity with the findings of Duguid et al. (1978) and Jacobson et al. (1988). Staph aureus was identified by Duguid et al. (1978), as a normal flora of the skin, urethra and vagina of about 10-30% healthy individuals. Strept faecalis (36.4%), on the other hand was described as almost constantly inhabiting the intestinal tract of mammals (Duguid et al. 1978). The opportunism of these pathogens in the urinary tract was therefore observed to further the course of pyogenic infections, vaginitis and urethritis with pyuria among the HIV infected subjects. The opportunistic potential of *P. aeruginosa* was indicated by its prevalence rate (30.5%). The organism typically causes skin infections especially at burn sites, wounds, ulcers, etc. as secondary invader. The infectivity of this organism could have been furthered in the immunocompromised patients especially following catheterization or superimposed infection with other pathogens. Because of its high resistance to a wide range of disinfectants, and antibiotics, the ease of infectivity was thus established. The results of this study indicated the prevalence of *B. fragilis* (with frequency occurrence of 66.4%) as the most frequently isolated urinary tract pathogen among the surveyed population. This report however contradicts the findings of Kathleen and Wizburg (1996), who noted *S. aureus* as the most frequent pathogen associated with HIV disease. The isolation of *Neisseria gonorrhea* (8.5%) from urine samples was also reported in this study, it is incriminated in chronic ulceration and inflammation of the vagina (vaginitis) and urethra (urethritis) respectively.

Taken together, this study has demonstrated the involvement of various opportunistic organisms as aetiologic agents in the progression to AIDS in people living with HIV/AIDS in South Eastern Nigeria. In the light of these findings, we strongly proffer that such opportunistic infections should be strongly considered in the development of case definition of HIV/AIDS in Africa.

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