

Cryptosporidiosis Among Human Immunodeficiency Virus-Tuberculosis (HIV-TB) Co-infected Adult Patients Attending a Specialist Hospital in Imo State, South Eastern Nigeria

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Abstract

The pattern of cryptosporidiosis in Human Immunodeficiency Virus (HIV)-related mixed opportunistic infections has not been widely reported among adults in Imo State, South Eastern Nigeria. The study was conducted between the month of October 2014 through March 2015. Stool samples of consenting subjects assessing health care in the major referral centre in the area were collected, prepared and examined applying standard parasitological techniques. The result shows that out of 424 Human Immunodeficiency Virus-Tuberculosis (HIV-TB) co-infected patients examined for the presence of *Cryptosporidium* oocyst, 194 (45.8%) yielded positive result for *Cryptosporidium parvum* (*C. parvum*) while 230 (54.2%) were only positive for HIV-TB co-infection but negative for *Cryptosporidium* oocyst. Male patients were infected most (47.2%) than the female (43.2%). Conversely, most female (56.8%) yielded positive result only for HIV-TB co-infection than the male (52.8%). According to age groups, *Cryptosporidium* oocyst was recovered most (79.4%) in subjects aged 60 years and above. Infection rates of 27.8%, 37.6% and 36.8% were also noted for age groups of 18-30 years, 31-45 years and 46-60 years respectively ($p < 0.05$). More so, *Cryptosporidium* mixed infection occurred most among drivers (70.9%), followed by artisans (60.4%), while the least infection was noted among students (22.6%). Significant difference exist in rates of infection among the various occupational groups ($p < 0.05$). This result revealed that immunosuppressive diseases like HIV, in most cases precedes such diseases as tuberculosis and cryptosporidiosis, and therefore underscores *Cryptosporidium parvum* as a notable opportunistic parasite among HIV-TB co-infected individuals. Thus, adequate holistic steps should be adopted by health care providers and relevant stakeholders to ensure proper management of HIV related mixed infections, especially cryptosporidiosis since the present result has shown that *Cryptosporidium parvum* is one of the expectant opportunistic parasite in HIV infected individuals.

Keywords

Pattern, Cryptosporidiosis, HIV-TB-Cryptosporidium Mixed Infection, Adults, Referral Centre

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1. Introduction

Mixed opportunistic infections and the associated

complications remain the major cause of mortality in individuals suffering from Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS)

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especially in underdeveloped countries. AIDS has been noted as a pandemic of the 21st century presenting with severe immunodeficiency in which infected individuals present with symptoms of different opportunistic infections¹. Previous researchers^{2, 3} have recorded high prevalence of 81.8%, and incidence rate of 56.5% for *Cryptosporidium parvum* (*C. parvum*) in HIV/AIDS patients which is an indication that it is a major parasitic opportunist in immunocompromised individuals. It has also been documented that people infected with HIV develop into a case of full blown AIDS by appearance of variety of opportunistic infections and malignancies¹ which *M.tuberculosis* and *Cryptosporidium parvum* are among the notable pathogens, posing serious public health challenge in infected individuals. Thus, People living with HIV have the increased susceptibility to active tuberculosis⁴ and opportunistic parasitic infections like cryptosporidiosis⁵. The risk of pulmonary tuberculosis in HIV infected individuals has been reported to be 16 times higher than that of general population⁶ and HIV infection is found more frequently in patients with tuberculosis (2.92%), in comparison to those with non-tuberculosis chest diseases (1.66%)⁷. Some studies in sub-Saharan Africa, the Caribbean and in some urban areas of USA have shown that about 20-60% of tuberculosis patients are HIV positive⁸⁻¹⁴.

HIV infection being an immunosuppressive disease has continued to be a militating factor towards control of opportunistic infections such as tuberculosis and cryptosporidiosis especially in areas where health facilities are inadequate^{4, 15}. High prevalence of cryptosporidiosis has also been noted among HIV/AIDS infected individuals⁵. Cryptosporidiosis may manifest as gastrointestinal infection and eventually results to death in immunocompromised individuals¹⁵. Pets, farm animals, infected individuals, water and contaminated foods are potential source of infection while transmission is through fecal-oral route¹⁵.

Though the prevalence and public health importance of cryptosporidiosis has been reported in Imo State^{5, 15}, yet inadequate data exists on its association with Human Immunodeficiency Virus-Tuberculosis (HIV-TB) mixed infection in the area, hence this study is warranted which aims at highlighting the pattern of cryptosporidiosis among HIV-TB co-infected adult patients. Information from the study will help in holistic and better management of HIV-associated mixed infections.

2. Methods

2.1. The Study Area and Subjects

The cross sectional study was carried out in Imo State which is located in South Eastern Nigeria between Latitude 5°10'

and 5° 51' North, Longitude 6° 35' and 7° 28' East and comprises of 27 Local Government Areas. The study spanned through the month of February 2014 to March 2015. The study population comprised of 424 (269 male and 155 female) adult HIV-TB co-infected patients who had Human Immunodeficiency Virus as a primary infection preceding tuberculosis and were receiving treatment in a major referral centre in the area. Information concerning their HIV and TB status was obtained from hospital records. While demographic data was obtained using pretested researcher administered questionnaires. Informed consent was obtained from the subjects prior to data and sample collection.

2.2. Inclusion Criteria

Only patients, who according to medical record had HIV infection prior to tuberculosis were studied, vice versa.

2.3. Specimen Collection and Processing for *Cryptosporidium* Oocyst

Diarrhoeal stool samples used for the study were collected using a dry sterile specimen containers containing 10% buffered formalin or storage medium containing aqueous potassium dichromate (2.5%w/v final concentration) and transported to the laboratory for analysis. Proper precautionary measures were also adopted. In order to maximize oocyst recovery, the specimens were concentrated applying formalin-ethyl acetate sedimentation technique¹⁶. Then a drop of the deposit from the concentration technique was placed on a glass slide, air-dried, fixed with alcohol and stained with modified acid-fast staining and examined under microscope using oil immersion objective for the presence of oocyst. Oocyst of *C. parvum* if present appears as red round bodies against a blue-green background.

2.4. Ethical Consideration

Ethical committee of Federal Medical Centre Owerri approved the study.

2.5. Data Analysis

Data was analyzed using SPSS statistical software version 20.0. Level of significance was fixed at 5%.

3. Results

The result of this cross sectional study shows that out of 424 HIV-TB co-infected patients examined for the presence of *Cryptosporidium* oocyst, 194 (45.8%) yielded positive result for *Cryptosporidium parvum* while 230 (54.2%) were positive for HIV-TB co-infection but negative for *Cryptosporidium* oocyst (Table 1). Gender related prevalence of HIV-TB-*Cryptosporidium* mixed infection shows that the

male patients were infected most (47.2%) than the female (43.2%). Conversely, most female (56.8%) yielded positive result only for HIV-TB co-infection than the male (52.8%). Details are shown in table 1.

Table 1. Gender related prevalence of TB-HIV-*Cryptosporidium* mixed infection.

| GENDER | N | Nn(%) | n(%) |
|--------|-----|-----------|-----------|
| Male | 269 | 142(52.8) | 127(47.2) |
| Female | 155 | 88(56.8) | 67(43.2) |
| TOTAL | 424 | 230(54.2) | 194(45.8) |

N=Number of HIV-TB patients examined for *Cryptosporidium parvum*.
 Nn=Number of HIV-TB patients negative for *Cryptosporidium parvum*.
 n =Number of HIV-TB patients positive for *Cryptosporidium parvum*.

Table 2 shows the age distribution of the mixed infection amongst the subjects.60 years and above were infected most (79.4%) by *Cryptosporidium parvum* infection. In the same vein, prevalence rates of 27.8%,37.6% and 36.8% were also noted for age groups of 18-30years, 31-45years and 46-60 years respectively.While only HIV-TB co-infection yielded various prevalence rates of 72.2%, 62.4%, 63.1% and 20.6% amongst the age groups of 18-30years, 31-45years, 46-60years and 61years> respectively. Statistical difference exist in infection rates of the various age groups (p<0.05).

Table 2. Age distribution of HIV-TB-*Cryptosporidium* mixed infections amongst the population studied.

| AGE | N | Nn(%) | n(%) |
|-------|-----|-----------|-----------|
| 18-30 | 97 | 70(72.2) | 27(27.8) |
| 31-45 | 117 | 73(62.4) | 44(37.6) |
| 46-60 | 103 | 65(63.1) | 38(36.8) |
| 61> | 107 | 22(20.6) | 85(79.4) |
| TOTAL | 424 | 230(54.2) | 194(45.8) |

N=Number of HIV-TB patients examined for *Cryptosporidium parvum*.
 Nn=Number of HIV-TB patients negative for *Cryptosporidium parvum*.
 n =Number of HIV-TB patients positive for *Cryptosporidium parvum*.

Table 3. Prevalence of infection according to occupation.

| OCCUPATION | N | Nn(%) | n(%) |
|---------------|-----|-----------|-----------|
| Civil servant | 34 | 21(61.8) | 13(38.2) |
| Farmer | 61 | 28(45.9) | 33(54.1) |
| Student | 93 | 72(77.4) | 21(22.6) |
| Driver | 103 | 30(29.1) | 73(70.9) |
| Trader | 59 | 40(67.8) | 19(32.2) |
| Artisan | 48 | 19(39.6) | 29(60.4) |
| Others | 26 | 20(76.9) | 6(23.1) |
| Total | 424 | 230(54.2) | 194(45.8) |

N=Number of TB-HIV patients examined for *Cryptosporidium parvum*.
 Nn=Number of TB-HIV patients negative for *Cryptosporidium parvum*.
 n =Number of TB-HIV patients positive for *Cryptosporidium parvum*.

Prevalence rates of infection according to occupational groups are shown in table 3. HIV-TB co-infection occurred most (77.4%) among students while the least (29.1%) was noted among drivers. Conversely, *Cryptosporidium* mixed infection occurred most among drivers (70.9%), followed by artisans (60.4%),while the least infection was noted among

students (22.6%). Details are shown in table 3. Significance difference exist in rates of infections among the occupational groups (p<0.05).

4. Discussion

The result of this study revealed that immunosuppressive diseases like HIV, in most cases precedes such diseases as tuberculosis and cryptosporidiosis.A total prevalence rate of 45.8% was recorded for *Cryptosporidium parvum* among the 424 HIV-TB co-infected adult patients examined while 230 (54.2%) patients were only co-infected with HIV and TB but did not yield oocyst of *Cryptosporidium parvum*.This result hews that proliferation of opportunistic infections in HIV infected individual is a progressive step determined probably by level/status of immunity .Similar result which recorded a high prevalence of 81.8% and incidence of 56.5% for *Cryptosporidium parvum* among HIV/AIDS patients has been reported ^{2, 3}.Infection rates of 47.2% and 43.2% were recorded for *C. parvum* among male and female patients respectively, which implies that rate of infection is not a function of gender. More so, 52.8% and 56.8% of the male and female respectively, were only co-infected with HIV and tuberculosis. This particular result also depicts that TB is also a key opportunistic infection in HIV infected individuals.However, the present finding which underscores *Cryptosporidium parvum* as a notable opportunist among HIV-TB co-infected individuals corroborates the results of previous researchers ^{1, 4, 5}.Thus,adequate holistic steps should be adopted by health care providers and relevant stakeholders to ensure proper management of HIV related mixed infections,especially cryptosporidiosis, since the present result has shown that *Cryptosporidium parvum* is one of the expectant opportunistic parasite in HIV infected individuals.

Cryptosporidium infection rates of 27.8%, 37.6%,36.8% and 79.4% were recorded for the age groups of 18-30years, 31-45years, 46-60years and above 60 years respectively. Highest infection rate of 79.4% was observed among the elderly patients who were above 60years.This result which shows that morbidity is a function of age may be attributed to degenerating immunity, ignorance of proper control measures and human habits that favour the propagation and proliferation of the pathogen. This is hinged on the fact that most of the patients especially the elderly ones (as noted during researcher-patients interaction) tend to disregard some of the health instructions given by health educators in the hospital .Therefore it will also be pertinent to back health instruction with proper follow up, probably through telephone conversation so as to ensure strict adherence.

Furthermore, significant difference exists in rates of infection among various occupational groups.Highest rate of

Cryptosporidium infection was recorded for Drivers (70.9%) followed by Artisans (60.4%) and Farmers (54.1%). This could be attributed to the fact that these occupational groups probably indulge in activities that favour oocyst propagation which possibly presented them as carriers prior to HIV infection. Pattern of HIV-TB co-infection and HIV-TB-*Cryptosporidium* mixed infection also varied significantly.

Summarily, the result of this study revealed that *Cryptosporidium parvum* is highly associated with mixed infections due to immunosuppressive diseases like HIV/AIDS. This implies that the pathogen continues to pose a public health challenge and therefore should not be neglected especially in this part of the world, since it has the potential of aggravating morbidity among HIV infected individuals. This finding also corroborate the report of Benjamin *et al*¹⁰ who noted that *Cryptosporidium* is a growing parasitic disease in Imo State. Thus proper enlightenment on the public health significance of *Cryptosporidium parvum* should be ensured and sustained in the area. Health education, using holistic approach on basic preventive measures should be designed and extended to grass root level especially to rural communities where health information and basic amenities are inadequate. HIV Patients assessing services in health facilities should also be enlightened properly, as part of health services, on opportunistic infections and possible control and preventive measures. If these measures are adopted, morbidity will be reduced and longevity will be ensured in HIV related mixed opportunistic infections.

5. Affirmation

1. This manuscript has not been sent or published in any journal.
2. The manuscript is the original work of the Authors.
3. All data are real and authentic.
4. Our profound gratitude goes to the management of chest clinic of Federal Medical Medical Centre for co-operation while this work lasted.
5. There is no conflict of interest among the authors.

Abbreviations

HIV=Human immunodeficiency virus.

TB=Tuberculosis.

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