

Pneumonia and HIV Types: A Case Control Study in Gadarif State, Sudan

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ABSTRACT

Background: Pulmonary infections remain one of the most important causes of morbidity and mortality among HIV patients, and the first cause of hospital admission in the HAART era. Achieving an etiological diagnosis of pulmonary infection in these patients is important due to its prognostic consequences. This is a case control study conducted at ART Center in Gedarif Teaching Hospital between the periods January 2020 to October 2021. Oro pharyngeal swabs were collected for isolation and identification of organisms from fifty HIV patients suffering from pneumonia with ages from 15 years old to 65 years old were included in this study to elicit the microorganism insulted to pneumonia among them. And also to detect types of HIV which are most associated with those pneumonic patients. **Results:** The results revealed that all pneumonic patients were type (1) HIV patients (100%), the most common microorganisms isolated were *Staphylococcus aureus* (60%), *Haemophilus influenzae* (20%), *Pseudomonas aeruginosa* (18%), and *Streptococcus pneumoniae* (2%). **Conclusion:** This study indicated that all HIV patients are type 1, and revealed that the most common cause of pneumonia in HIV infected patients was *Staphylococcus aureus*. So Accurate diagnosis, and appropriate treatment and prevention of HIV-associated opportunistic pneumonias is an important strategy for reducing the morbidity and mortality associated with HIV/AIDS.

Keywords: Pneumonia, HIV types, Bacterial opportunistic infections.

INTRODUCTION

The critically ill patients with deficient immune systems like immunocompromised patients or other immunosuppressant drugs, and patients with AIDS and duration of cancer treatments has been risen in recent years[1], and greater use of organ transplantation and introduction for the treatment of autoimmune and auto inflammatory diseases of steroid that induce specific immune defects are factors contributing to that a large number of patients are now expected to live for many years with immune deficiencies that put them at risk for severe infections.

Severe respiratory infection is the leading reason for intensive care unit (ICU) admission in immunocompromised patients, who are at risk for hypoxemic acute respiratory failure (ARF) and sepsis [2]. Failure to identify the etiology of ARF is associated with a higher risk of dying [3]. Moreover, identifying a pathogen is crucial for antimicrobial stewardship in immunocompromised patients. However, the etiological diagnosis can be extremely challenging, as the effects of the infection combine with those of the underlying disease and treatments to create extraordinarily complex clinical pictures. In addition, some patients have more than one concurrent infection, and others have non-infectious causes of ARF that mimic infection. Furthermore, fiber optic bronchoscopy and bronchoalveolar lavage (FOB/BAL) are commonly used for diagnosis, but may cause further respiratory deterioration in patients with hypoxemia [4]. The development of non-invasive diagnostic tests with high sensitivity and specificity (e.g., on blood, plasma, sputum, urine, or nasal swabs) has obviated the need for FOB/BAL in some patients [5, 6].

The first case of AIDS appeared in 1981, when five homosexual males in USA were diagnosed with *Pneumocystis jiroveci* pneumonia [7]. Since then, HIV infection has become an endemic and remains one of the most important global health problems [8]. The number of people living with HIV is increasing worldwide. There were 33.3 million people living with HIV at the end of 2009 compared with 26.2 million in 1999 [8]. Combination therapy with multiple agents against HIV, known as HAART (highly active antiretroviral therapy), became widely used between 1996 and 1997 in developed countries. As a result, the incidence of opportunistic infections has decreased and the life expectancy of HIV-infected persons has increased [9, 10]. However, this has not occurred uniformly worldwide because antiretroviral therapy (ART) was not yet available to millions of HIV infected people, mainly in resource-limited countries. Moreover, a significant percentage of patients in the developed countries are not receiving HAART because they have a delayed HIV diagnosis or they are not in active care despite the availability of HAART [11, 12]. From the first descriptions of HIV/AIDS, the respiratory tract has been the site most frequently affected by the disease. According to results of autopsy findings, the lung was affected with an incidence ranging from 70% in the early period of the epidemic to 100% in the HAART era [13–14]. Up to 70% of HIV patients have a pulmonary complication during the evolution of the disease, mainly of infectious etiology [14]. Lower respiratory tract infections are 25-fold more common in patients with HIV than in the general community, occurring in up to 90 cases per 1,000 person [15]. Currently, pulmonary infections are not only AIDS-related opportunistic infections but remain a leading cause of morbidity and mortality and one of the most frequent causes of hospital admission in HIV infected people worldwide [16]. An incidence of 20–25 episodes per 100 hospital admissions per year has been observed [17, 18]. These numbers conveyed the magnitude of the problem of pulmonary infections in HIV patients. Moreover, it has been suggested that *Pneumocystis pneumonia* (PCP), tuberculosis (TB) and bacterial pneumonia are associated with a significantly worse subsequent HIV disease course, even a permanent decline in pulmonary function [19–20], although not all studies agree with these findings [21].

MATERIAL AND METHOD

Study design

This is a case control laboratory base study.

Study area

This study was conducted from January 2020 to October 2021 at Gadarif ART Center in Gadarif Teaching Hospital in Gadarif state, Eastern of Sudan neighboring Ethiopia and Eritrea countries

Study population

The study population from different ages and sex enrolled in this research those who were attending to Outpatients Clinic at Gadarif Teaching Hospital suffering from pneumonia, and HIV associated with pneumonia patients who were attending Gadarif ART center.

Inclusion criteria

Case group were patients have HIV associated with pneumonia, and the control group were patients have pneumonia and not infected with HIV.

Exclusion criteria

Any HIV patient who was not suffering from pneumonia.

Data collection and Sampling

Socio-demographic characteristics of patients were collected using a questionnaire form through face-to-face interview with the patients. A total of 100 oropharyngeal swabs were collected for culture and microorganism identification. Furthermore 100-serum samples were collected and subjected for detection of HIV type either type1 or type2.

Laboratory Procedure

One hundred oropharyngeal swabs were collected and processed for isolation and identification of microorganism, by using flocked swab tube, or pharyngeal swab were collected by position patient head slightly back and depress the tongue so that the back of the throat can be seen and the swab rub up and down against the back of throat ,avoiding the touch of tongue and cheeks.

Immediately the swab was inoculate on three plate, one in blood agar plate with gentamycin and incubate anaerobic in the presence of co2 at 37c, by using anaerobic jar with candle, the second plate were incubated on blood agar and macConkey agar plates and incubated aerobically at 37c overnight incubation.

The bacteria were identified by colony morphology, gram staining, test for motility, catalase test, oxidase test and other biochemical tests. *Staphylococcus aureus* was identified by colony morphology, pigment production, gram staining, and catalase test, Coagulase test fermentation of mannitol.

Also 100 serum blood samples were collected in EDTA anticoagulant, and preceded for serology to detect the serotype of HIV by using SD biosensor kit, the result is the entire sample is positive for serotype 1.

Ethical consideration

Ethical approval of the study was obtained from Faculty of Medical Laboratory Science, University of Gezira and Gedarif State Ministry of Health. A written informed consent was obtained from each participant regardless of their ART status.

Data analysis

The information related to patients and research results were first entered in Microsoft Excel and later analyzed using SPSS version 20 computer program. The significance of the association between variables was measured by Chi-square test, and a p value of less than 0.05 was considered significant.

RESULT

Socio-demographic characters of the study population

The comparison in case group between participant have pneumonia associated with (HIV) and (demographical variables) (gender male 64%, female 36%) among The level of age range of the population is: from 9 up to 14 years was 14%. between 15 to 29 years was 24%, from 30 to 44 years 28%. more than 44 years 34%. Social status (married 68% unmarried 32%) residence (in rural was 24 % and in urban was 76 %).

In control group the comparison participant have pneumonia without HIV (gender male 56%, female 44%) among level of age range up to 14 years was 28%, between 15 to 29 years was 26%, between 30 to 44 years was 8%, more than 45 years was 30%.

The result of isolated bacteria

Table 1: Isolated microorganism in cases of pneumonia with HIV

NO	Microorganism	percentage
30	<i>Staphylococcus aureus</i>	60%
10	<i>Haemophilus influenzae</i>	20%
9	<i>Pseudomonas aeruginosa</i>	18%
1	<i>Streptococcus pneumoniae</i>	2%

Table 2: Isolated of microorganism in cases of control

NO	Microorganism	percentage
25	<i>Hemophilus influenza</i>	50%
15	<i>Staphylococcus aureus</i>	30%
10	<i>Klebsiella pneumonia</i>	20%

Table (1) the comparison between (HIV) and (demographical variables) among the study participants (n=100)

Variables	HIV patients and control		Total
	With HIV(n=50)	Without HIV(n=50)	
Gender			
Male	32 (64%)	28 (56%)	60
Female	18 (36%)	22 (44%)	40
Residence			
Rural	12 (24%)	12 (24%)	24
Urban	38 (76%)	38 (76%)	76
Age group			
9-14	7 (14%)	14 (28%)	21
15-29	12 (24%)	13 (26%)	25
30-44	14 (28%)	8 (16%)	22
More than 45	17 (34%)	15 (30%)	32
Mean	34.64	30.74	
Median	38	24	
SD	16.37	19.49548	
Social status			
Married	34 (68%)	25 (50%)	59
Unmarried	16 (32%)	25 (50%)	41
Siblings			
Yes	46 (92%)	49 (98%)	95
No	4 (8%)	1 (2%)	5

Table (2) the comparison between (HIV) and (clinical variables) among the study participants (n=100)

Variables	HIV patients and control		total
	With HIV	Without HIV	
Antibiotic			
Yes	27 (54%)	43 (86%)	70
No	23 (46%)	7 (14%)	30
Vacation			
Yes	1 (2%)	2 (4%)	3
No	49 (98%)	48 (92%)	97
Smoking			
Yes	25 (50%)	17 (34%)	42
No	25 (50%)	33 (66%)	58
Season			
Winter	24 (50%)	16 (32%)	40
Autumn	6 (13%)	5 (10%)	11
Winter and autumn	17 (35%)	15 (30%)	32
Winter and summer	1 (2%)	13 (26%)	14
All season	0 (0%)	1 (2%)	1
Isolation microorganism			
Staphylococcus aureus	30 (60%)	15 (30%)	45
Haemophilus influenza	10 (20%)	25 (50%)	35
Pseudomonas aerugnosa	9 (18%)	0 (0%)	9
Streptococcus pneumonia	1 (2%)	0 (0%)	1
Klebesiella pneumonia	0 (0%)	10 (20%)	10

Table (3) the relationship between (isolation microorganism) and (demographical variables) among the study participants (with HIV n=50)

variables	<i>Staphylococcus aureus</i> (n=30)	<i>Haemophilus influenzae</i> (n=10)	<i>Pseudomonas aeruginosa</i> (n=9)	<i>Streptococcus pneumoniae</i> (n=1)	p-value
Gender					
Male	17 (53%)	6 (19%)	9 (28%)	0 (0%)	0.055
Female	13 (72%)	4 (22%)	0 (0%)	1 (6%)	
Residence					
Rural	6 (50%)	4 (33%)	2 (17%)	0 (0%)	0.573
urban	24 (63%)	6 (16%)	7 (18%)	1 (3%)	
Age group					
9-14	0 (0%)	6 (86%)	0 (0%)	1 (14%)	0.000
15-29	8 (67%)	4 (33%)	0 (0%)	0 (0%)	
30-44	11 (79%)	0 (0%)	3 (21%)	0 (0%)	
45<	11 (65%)	0 (0%)	6 (35%)	0 (0%)	
Social status					
Married	25 (74%)	0 (0%)	9 (26%)	0 (0%)	0.000
Unmarried	5 (31%)	10 (63%)	0 (0%)	1 (6%)	
Siblings					
Yes	29 (63%)	8 (17%)	8 (17%)	1 (2%)	0.384
no	1 (25%)	2 (50%)	1 (25%)	0 (0%)	

Table (4) the relationship between the isolated microorganism and clinical variables among the study participants (with HIV n=50)

Variables	Isolation microorganism in cause of pneumonia with Hiv(n=50)				p- value
	Staphylococcus areus (n=30)	Haemophilusinfluenzea(n=10)	Pseudomonas aerugnosa(n=9)	Streptococcus pneumonia(n=1)	
Antibiotic use					
Yes	18 (67%)	5(18%)	4(15%)	0 (0%)	0.572
No	12 (52%)	5(22%)	5(22%)	1(4%)	
Vaccination					
Yes	1(100%)	0 (0%)	0 (0%)	0 (0%)	0.878
No	29 (60%)	10 (20%)	9 (18%)	1 (2%)	
Smoking					
Yes	15 (60%)	1 (4%)	9 (36%)	0(0%)	0.001
No	15 (60%)	9 (36%)	0(0%)	1 (4%)	
Season					
Winter	17 (71%)	2 (8%)	4(17%)	1(4%)	0.529
Autumn	3(50%)	2(33%)	1(17%)	0(0%)	
Winter and autumn	10(59%)	4(24%)	3(18%)	0(0%)	
All season	0(0%)	1(100%)	0(0%)	0(0%)	
Viral load					
Low	29(72%)	10 (25%)	0(0%)	1(3%)	0.000
high	1 (10%)	0 (0%)	9 (90%)	0(0%)	

Table (5) type of HIV human virus

Type	Frequencies	Percent %
Type 1	50	100
Type 2	0	0
Total	50	100

DISCUSSION

No previous studies about the relationship between bacterial pneumonia and types of HIV were held in Sudan as to compare with.

My results also corresponded to Klndu Alem findings, who found bacterial pneumonia is a major public health problem and it is the leading cause of morbidity and mortality in HIV-seropositive patients in East Africa.

Tanzania exhibited the highest level of bacterial pneumonia in HIV-seropositive patients at 59.76%, while Rwanda had the lowest level at 5.6%. The different risk factors identified, such as intravenous drugs, cigarette smoke and unvaccinated were associated with the development of bacterial pneumonia in HIV-seropositive patients. [22]

My study also agreed with Bento and Gordin results that bacterial pneumonia is the most frequent infection in HIV-infected patients, as well as the most common admission diagnosis [17, 18, 23].

Though Authors found all pneumonic patients were HIV type 1, they don't find ones who specify pneumonia to HIV types for comparing their results with.

This study also agreed with Feikin and Morris studies who found HIV infection is associated with a >10-fold increased incidence of bacterial pneumonia [15, 24].

CONCLUSION

This study indicated that all pneumonic patients were HIV type (1) (100%), and the most common opportunistic microorganisms isolated among them were *Staphylococcus aureus*, *Haemophilus influenza*, *Pseudomonas aeruginosa*, and *Streptococcus pneumonia* considering them a major cause of morbidity and mortality for HIV infected persons. Furthermore, identification of bacterial pneumonia among HIV patients allows them and healthcare providers to reduce morbidity from this illness.

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