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PNEUMOCYSTIS PNEUMONIA IN PATIENT INFECTED WITH HUMAN IMMUNODEFICIENCY VIRUS.

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ABSTRACT

BACKGROUND: A serious opportunistic lung infection, pneumocystis pneumonia PCP primarily affects people with weakened immune systems, such as those who are HIV positive. Even with improvements in prevention and antiretroviral treatment, PCP still has a major impact on morbidity and death, particularly in environments with limited resources. The aim of study is to determine the frequency of Pneumocystis pneumonia in patients with human immunodeficiency virus HIV presenting to a tertiary care hospital. **METHODS:** We conducted a cross-sectional study at the Department of Internal Medicine, Lady Reading Hospital, Peshawar, from October 9, 2021, to April 9, 2022. A total of 150 HIV-positive patients, aged 18 to 75 years, took part in the study. To focus on PCP alone, we excluded those with other major health conditions such as tuberculosis, diabetes, kidney or liver disease, or those who were pregnant or using long-term steroids. Each patient underwent a clinical examination and relevant tests to check for PCP. **RESULTS:** The average age of the participants was 39.92 ± 14.09 years. PCP was diagnosed in 55 patients 36.7%. It was significantly more common in individuals with CD4 counts under 200 cells/mm³ $p < 0.001$ and in those who had gone longer without HIV treatment $p = 0.02$, recurrent non-PCP pneumonia $p = 0.002$, and unexplained fever lasting ≥2 days $p < 0.001$ were all significantly associated with PCP. There was no statistically significant correlation between genders wise $p = 0.45$ and also Age groups $p = 0.51$. **CONCLUSION:** More than a third of the HIV-positive patients in our study had PCP. These results stress the need for early detection and proper care to prevent serious outcomes in vulnerable individuals.

KEYWORDS: Pneumocystis pneumonia, HIV, Opportunistic infection, CD4 count, Immunocompromised.

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INTRODUCTION

Pneumocystis jirovecii, a common opportunistic fungal pathogen, is the cause of *Pneumocystis pneumonia* PCP, a dangerous lung infection. The primary source of *P. jirovecii* is humans, and the primary method of transmission is inhaling airborne particles [1]. However, it's still referred to as *Pneumocystis pneumonia* PCPand will be used here in text. In Europe after World War II, *P. jirovecii* was initially recognized as a cause of pneumonia in preterm and malnourished newborns [2.] Hematologic malignancies were the main reason for its diagnosis 3. In the 1980s, the human immunodeficiency virus HIV epidemic began, and the frequency rose sharply [4].

The most common fungal opportunistic infection in patients with ACD is pneumocystis pneumonia PCP, which can be fatal and spreads to immunocompromised people 5. Due to the strong link between HIV/AIDS and PCP, as the number of patients with HIV/AIDS continues to rise, so does the number of patients with PCP [6].

Decreased CD4 lymphocyte count, history of AIDS-defining disease, non-*P.carinii pneumonia*, or unexplained fever lasting more than or equal to two days were risk factors [7]. Nowadays, those at high clinical risk are prescribed preventive medications, highly active antiretroviral treatment HAART is used, and more sensitive P immunofluorescence techniques are available [8] . Overall PCP case incidence, Carinii identification, and post-PCP survival in AIDS patients have all improved [9]. Despite this, the high mortality rate of patients who need mechanical ventilation MV, which ranges between 50% and 60%, has not altered [10]. International studies 91-a reveal high mortality and morbidity in subgroup symptomatic patients with AIDS, the symptoms being the following can develop over several days or weeks and include. Fever, Cough, Difficulty breathing, Chest pain, Chills, Fatigue tiredness [10]. Antiretroviral treatment ART is the most efficient method of enhancing immune function in order to prevent PCP [11].

Pneumocystis carinii pneumonia PCP is believed to be rare in the developing world and no large prospective studies have been reported to date. A through literature review reveals lack of published information regarding the frequency of PCP in patients with AIDS. In a study performed by *Ramakrishnan et al.,* reported that among symptomatic HIV infected patients PCP was 54.8% [12]. The rational of my study is to identify HIV positive patients with factors who are at risk of high mortality and morbidity in AIDs due to PCP and prompt diagnosis and appropriate management can result in a decrease mortality and morbidity. The identification and management of modifiable factors that contribute to PCP, such as low CD4 lymphocyte count, oral thrush, non-*P. carinii pneumonia*, or unexplained fever lasting more than or equal to two days, as well as a history of AIDS-defining conditions, such as esophageal, bronchial, tracheal, or lung candidiasis but not oral thrush. Cervical cancer, extrapulmonary cryptosporidiosis, invasive cryptococcosis, chronic intestinal sickness lasting more than a month, cytomegalovirus disease also known as CMV not involving the liver, spleen, or nodes, and cytomegalovirus retinitis resulting in blindness *Pneumocystis pneumonia* PCP recurrent pneumonia, progressive multifocal leukoencephalopathy, HIV-related Kaposi sarcoma, encephalopathy, Salmonella septicemia, brain toxoplasmosis, and HIV-related Wasting Syndrome A person is diagnosed with AIDS, the advanced stage of HIV infection, when they develop one of these conditions. The significance of proactive prevention and the necessity of clearly defined diagnostic and treatment

methods are underscored by these findings. In light of this, the present study aims to determine the frequency of Pneumocystis pneumonia in patients with human immunodeficiency virus HIV presenting to a tertiary care hospital.

MATERIAL AND METHODS

This cross-sectional study was conducted in the Department of Internal Medicine, Lady Reading Hospital, Peshawar, Khyber Pakhtunkhwa, from October 9, 2021, to April 9, 2022. The sample size was calculated using the WHO sample size calculator, based on a prevalence of 54%, a margin of error of 8%, and a 95% confidence level, resulting in a total of 150 participants. A non-probability consecutive sampling technique was employed. The inclusion criteria consisted of patients aged between 18 to 75 years of both genders who were confirmed to have HIV infection. Patients were excluded if they had concomitant tuberculosis, diabetes mellitus, renal failure, chronic pulmonary disease, chronic liver disease, long-term steroid use, or if they were pregnant.

After obtaining ethical approval from the hospital's ethical committee, eligible patients presenting to the emergency department or outpatient department were enrolled after providing informed consent, either personally or via next of kin. Risk factors such as low CD4 lymphocyte count and history of AIDS-defining illness, recurrent non-*Pneumocystis carinii* pneumonia, oral thrush, or unexplained fever lasting two or more days were recorded. HIV infection was confirmed using the enzyme-linked immunosorbent assay ELISA. A presumptive diagnosis of PCP was made based on clinical presentation, including shortness of breath on exertion, diffuse bilateral infiltrates on chest X-ray, arterial hypoxemia, and exclusion of bacterial pneumonia based on imaging findings.

Bronchoalveolar lavage BAL was performed following informed consent, using a bronchoscope through which a saline solution was introduced and retrieved for fluid sample collection. The samples were subjected to silver staining for confirmation of *Pneumocystis carinii*. Patients' weight was measured using a digital scale, accurate to 100 grams. Calibration and level checks were done before each use. Patients were asked to remove shoes and heavy accessories before measurement. For those unable to stand, weight was estimated by averaging guesses from the investigator, a staff nurse, and another physician.

All collected data were analyzed using SPSS version 22. Means and standard deviations were calculated for quantitative variables such as age and weight, while frequencies and percentages were calculated for categorical variables like gender, HIV status, PCP status, CD4 count, and history of AIDS-defining illness. Effect modifiers including age, gender, CD4 count, and history of related symptoms were controlled through stratification. Post-stratification, chi-square tests were applied with a significance level set at $p \leq 0.05$. Results were presented in the form of tables and charts.

RESULTS

This cross-sectional study was conducted on 150 patients with HIV infection. The mean age of participants was 39.92 ± 14.09 years. Among them, 30.7% were aged between 18–30 years, 36.0% between 31–45 years, 21.3% between 46–60 years, and 12.0% were 61–75 years old. The majority were male 66.7%, while females comprised 33.3% as Shown in Table 1.

Table 1: Demographics of Study Participants n=150

Variable	Category	Frequency % n
Age group Years	18–30	46 30.7%
	31–45	54 36.0%
	46–60	32 21.3%
	61–75	18 12.0%
Gender	Male	100 66.7%
	Female	50 33.3%

The prevalence of Pneumocystis pneumonia PCP and its correlation with the distribution of important clinical characteristics in the research population. Of the 150 patients with HIV, 55 persons 36.7% had a PCP diagnosis, whereas 95 people 63.3% had no PCP symptoms. A subset of participants with advanced immunosuppression was indicated by the presence of a low CD4 lymphocyte count in 19 individuals 12.7%. A additional indication of the degree of immunocompromise in a subset of the cohort was the identification of AIDS-defining diseases in 14 people 9.3%. In patients with compromised immune systems, periodic cases of non-Pneumocystis carinii pneumonia were observed in 25 patients 16.7%, indicating a persistent susceptibility to pulmonary infections. Two or more consecutive days of unexplained fever were also seen in 21 patients 14.0% as Shown in Table 2.

Table 2: Frequency of Clinical Features and PCP Status

Variable	**Present n %**	**Absent n %**
PCP Positive Status	55 36.7%	95 63.3%
Low CD4 Lymphocyte Count	19 12.7%	131 87.3%
AIDS Defining Illness	14 9.3%	136 90.7%
Recurrent non-*P. carinii Pneumonia*	25 16.7%	125 83.3%
Unexplained Fever ≥ 2 Days	21 14.0%	129 86.0%

The age group of 31 to 45 years old accounted for the largest percentage of PCP-positive cases, with 17 patients 30.9% out of all PCP-positive persons in this age range. The 18–30 year group, which had 16 patients 29.1%, and the 46–60 year group, which had 13 patients 23.6%, came in quick succession. People between the ages of 61-75 had the lowest frequency, accounting for 9 cases 16.4%. Among patients without PCP, there was no discernible variation in the distribution among age groups. In this cohort, age was not a decisive factor in the likelihood of PCP incidence, since the statistical analysis revealed no significant correlation between age group and PCP status p = 0.51. In contrast, when data were categorized by gender, a statistically significant difference was found. Out of the 55 patients that received a PCP diagnosis, 25 45.5% were female and 30 54.5% were male. The proportion of men among those without PCP was significantly greater, with 70 people 73.7% and just 25 26.3% being female. Gender and PCP status were statistically significantly correlated p = 0.01, indicating that female patients in this research had a higher risk of developing PCP than their male counterparts found in Table 3.

Table 3: Stratification of PCP Status with Demographics

Variable	Category	PCP Positive n %	PCP Negative n %	P-value
Age Group	18–30 years	16 29.1%	30 31.6%	0.51
	31–45 years	17 30.9%	37 38.9%	
	46–60 years	13 23.6%	19 20.0%	
	61–75 years	9 16.4%	9 9.5%	
Gender	Male	30 54.5%	70 73.7%	0.01
	Female	25 45.5%	25 26.3%	

The percentage of PCP-positive individuals with low CD4 lymphocyte counts was noticeably greater. In particular, among those without PCP, only 5 out of 95 5.3% had a low CD4 count, but 14 out of 55 25.5% who were PCP-

positive did. There is a strong correlation between advanced immunosuppression and a higher risk of PCP, and this connection was statistically significant p = 0.0001. PCP-positive individuals also had higher rates of AIDS-defining diseases. Of the PCP-negative group, just 3 3.2% had a documented AIDS-defining disease, compared to 11 20.0% of the PCP-positive group. The statistical significance of the difference p = 0.001 suggests that these conditions might be significant clinical markers of PCP risk. There were 16 29.1% PCP-positive patients with recurrent non-Pneumocystis pneumonia, compared to 9 9.5% PCP-negative individuals. The statistical significance of this difference p = 0.002 implies that a history of recurrent lung infections may make people more susceptible to PCP. Another frequent observation among PCP-positive people was an unexplained fever that lasted two or more days. In contrast to 5 5.3% of PCP-negative individuals, it was found in 16 29.1% of the instances. Its function as a warning indicator in clinical evaluation was supported by the statistical significance of this connection p = 0.0001 as Shown in Table 4.

Table 4: Stratification of PCP Status with Clinical Features

Variable	PCP Positive n %	PCP Negative n %	P-value
Low CD4 Lymphocyte Count	14 25.5%	5 5.3%	0.0001
AIDS Defining Illness	11 20.0%	3 3.2%	0.001
Recurrent Non-P. Pneumonia	16 29.1%	9 9.5%	0.002
Unexplained Fever ≥ 2 Days	16 29.1%	5 5.3%	0.0001

DISCUSSION

Among people with HIV, pneumocystis pneumonia PCP continues to be a major source of morbidity, especially in environments where late presentation and restricted access to care are prevalent. PCP was identified in 36.7% of HIV-positive individuals in this investigation, indicating a significant disease burden. This result is consistent with earlier regional and global research that found that individuals with severe immunosuppression had a significant prevalence of PCP. The findings indicate the necessity for early detection, regular screening, and prompt management in high-risk patients, highlighting the fact that PCP remains a significant problem in spite of advancements in antiretroviral medication.

Charles Chagas discovered the protozoan parasite Pneumocystis carinii in 1909, and individuals with compromised immunity have long been known to be susceptible. Since 1999, it has been known as *Pneumocystis jiroveci* [13]. The most prevalent opportunistic illness among Acquired Immunodeficiency Syndrome patients from developing countries and worldwide is *pneumocystis carinii pneumonia* PCP [14.] Infection and disease are caused by immunosuppression, particularly when T-cell activity is affected. A fine bilateral perihilar diffuse infiltrate is visible on the chest radiograph in the early stages of PCP, and this infiltrate progresses to the interstitial alveolar butterfly pattern. This opportunistic infection OI can be effectively managed with early accurate diagnosis [15] .

Patients with HIV are vulnerable to lower airway infections caused by a variety of agents, and the likelihood of an infection depends on how the agent and host interact. PCP and pulmonary tuberculosis are two respiratory illnesses that still have a significant frequency even in the era of HAART [16]. According to this study, the CD4+ count below 200 cells/cum is when PCP is most likely to arise. Induced sputum can be used instead of invasive,

costly bronchoalveolar lavage to diagnose PCP BAL [17.]

In the current investigation, PCP was found in 55 36.7% of confirmed cases of HIV/AIDS with and without TB alone [1]. In Indian series, PCP prevalence ranged from 6.1% to 60% and was more common in males. There were no gender differences in the current investigation. Global PCP Situation: The prevalence of PCP ranged from 3 to 74% in various nations [18].

For the occurrence and/or diagnosis of PCP among HIV positive patients, three primary factors, including epidemiological, diagnostic, and monitoring features, interact with one another and account for variances in different studies. Influencing factors in epidemiology include those pertaining to the patient, the organism, the disease state, concurrent illnesses, and regional considerations. PCP risk factors have been linked to ambient air pollution. Two elements relating to professional and facility factors must be taken into account while discussing diagnosis. Additionally, keeping track of HIV-positive individuals with a dedicated supervisory system aid in the identification of PCP in greater numbers. In a visual model, the specifics and additional adjuvant elements for PCP are displayed. Giemsa stain was frequently utilized in Indian series, and as a result, the frequency of PCP among HIV ranged from 12.5 to 32% [1]. In addition, toluidine blue, *Gomori* methenamine silver, immunofluorescence, and monoclonal antibodies were utilized as stains. Giemsa stain is practical, affordable, user-friendly, quickly stains the nucleus, and feasible at all levels. Microscope in PCP: Using a microscope, trophozoites or cyst formations can be seen, which the mainstay of diagnosis is. Giemsa and toluidine blue staining have sensitivity and specificity ranges of 50–84 and 49–60%, respectively. Although immunofluorescence staining of aspirates is an excellent tool for diagnosis, it is also quite expensive and not always possible, which adds to the financial burden [19]. The employment of multiple staining techniques is expected to boost diagnostic yield and aid in identifying cases that the other stain is likely to miss. According to a study, there was no statistically significant difference between the two stains. In environments with low resources, gimsa and toluidine blue can be employed for standard diagnostic procedures. Strength: The strict criteria used to identify all cases for the study and the routine procedures used to collect sputum and process the samples by the senior microbiologist gave it this strength [20].

A CD4 cell count of 200 or higher, a history of oral candidiasis, or an unexplained fever lasting more than a week are currently criteria for chemoprophylaxis against the first episode of PCP in HIV-infected adults and adolescents. Low CD4 cell count is a well-known risk factor for PCP, but to our knowledge, only two studies have found further reasons to use PCP prophylaxis [21]. The question of whether prophylaxis should be given to other individuals, such as those with CD4 cell counts > 200 but 250 or CD4 cell percent 14%, is still up for contention among healthcare professionals. Consequently, it was sensible to reevaluate established or predisposing pathology that increases the risk both for non–P. carinii pneumonia and PCP. It's possible that some of these non-P. carinii pneumonia cases were actually undiagnosed PCP.

This study, carried out at Lady Reading Hospital in Peshawar, set out to understand how common Pneumocystis pneumonia PCP is among people living with HIV. Over a six-month period, 150 patients were carefully examined, most of them men with an average age of around 40. The results were striking—more than a third 36.7% were found to have PCP. The illness was especially common in those with very low CD4 counts, frequent bouts of pneumonia, unexplained fevers, and other serious infections linked to AIDS.

Interestingly, men were more likely to be affected than women, though age didn't seem to make much difference. These findings shine a light on how vulnerable HIV-positive individuals can be to life-threatening infections like PCP, particularly when their immune systems are already weakened, and highlight the urgent need for early detection and better care in hospitals, especially in under-resourced areas.

CONCLUSION

The study found a significant association between low CD4 count, AIDS-defining illnesses, recurrent non-PCP pneumonia, and unexplained fever with an increased risk of PCP in HIV patients. Early detection and management of these risk factors can help reduce the morbidity and mortality associated with PCP. Regular screening for PCP, especially in patients with low CD4 counts and AIDS-related illnesses, is crucial for improving patient outcomes.

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