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Frequency of Pseudomonas in Community-Acquired Pneumonia

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ABSTRACT

Background: An emerging infection in CAP with important clinical ramifications is Pseudomonas aeruginosa. Optimizing treatment requires knowledge of its prevalence, risk factors, and antibiotic resistance. **Objective:** to ascertain P. aeruginosa prevalence in CAP, evaluate related risk variables, and measure how it affects clinical results. **Methods:** A qualitative study involving 120 randomly chosen CAP patients were carried out at a Quetta tertiary care hospital. Clinical features were examined when P. aeruginosa was discovered by microbiological testing. **Results:** In 12.5% of CAP patients, P. aeruginosa was found. These individuals were more likely to die, have longer hospital stays, and be admitted to the intensive care unit. Multiple antibiotic resistance was noted. **Conclusion:** This study highlights the significant impact of *Pseudomonas aeruginosa* on the prognosis of patients with community-acquired pneumonia (CAP), particularly concerning hospitalization rates and mortality. Early identification through microbiological testing and assessment of risk factors plays a crucial role in improving outcomes. Given the organism's known resistance patterns, a more targeted antibiotic therapy is essential, especially for high-risk individuals. In severe cases, combination therapy may be necessary, while empirical treatment should always align with local resistance trends. The implementation of proper antimicrobial stewardship programs is critical to prevent the emergence and spread of further resistance. **Findings:** These findings underscore the need for personalized and evidence-based treatment strategies and can contribute meaningfully to the formulation of effective CAP management protocols. In regions experiencing rising antibiotic resistance, these insights are especially valuable for guiding clinical decision-making and optimizing patient care in both outpatient and inpatient settings.

INTRODUCTION

The main features that define community-acquired pneumonia (CAP) consist of three elements. The clinical features of community-acquired pneumonia (CAP) include acute infectious lung damage that occurs to patients who acquire pneumonia in the community instead of the hospital while still being free from severe immunosuppression. Streptococcus pneumoniae stands as the primary pathogen which bacterial atypical pathogens along with viruses follow as additional causes of CAP infection. The pathogen prediction outcomes prove to be reliable when these specific three criteria are applied. Therefore, the diagnosis of CAP and the evaluation of its severity serve as a solid foundation for choices on the initial treatment settings and empirical antimicrobial treatment [1].

The concept of CAP shows overall success but researchers still need to comprehend several key aspects about it. The study population contained 10% of patients with either Pseudomonas aeruginosa (PA) or Enterobacteriaceae (EB)-related infections which primarily appeared in susceptible communities according to two epidemiological studies [2] and [3]. Research conducted by various authors found these infections in only 1-3 percent of their subjects [4–7].

The recent definition of the pneumococcal disease healthcare-associated pneumonia (HCAP) creates doubts about CAP's concept [8, 9]. This concept identifies a certain group of elderly seriously incapacitated patients who recently stayed in healthcare facilities including dialysis centers or nursing facilities or hospitals as exhibiting unique prognostic characteristics and distinct aetiology. Evidence shows that resistant infections including PA and EB infections regularly occur between patients [10–12].

Community-acquired pneumonia (CAP) stands among the foremost infectious agents that result in global morbidity and mortality [13, 14]. Three and a half million deaths occur yearly due to CAP and medical professionals diagnose approximately five to six billion

patients [13, 14, 15]. Streptococcus pneumoniae persists as the main bacterial infection in adults yet CAP manifests because of various viral and bacterial pathogens [16]. Recent research shows major changes in CAP's causes since the last few decades as hospital-based antibiotic-resistant bacteria have begun to appear increasingly in community environments [18–20]. A pathogen transformation in the ecological environment threatens the treatment stability for CAP patients [21–23].

Medical studies confirm Gram-negative Pseudomonas aeruginosa possesses natural resistance to β-lactam and various other antibiotic types [24]. Medical facility stays during the past three months together with nursing home residence (HCAP) create a high risk for P. aeruginosa infections in patients with pneumonia [25–27]. P. aeruginosa disease in patients with community-acquired pneumonia leads to severe health conditions and poor treatment results according to research [27–29]. Medical experts have attributed challenging infections to P. aeruginosa strains with elevated drug resistance patterns that are currently spreading in medical settings [18].

The research community continues to disagree about P. aeruginosa-CAP risk factors while CAP rates linked to P. aeruginosa differ significantly between different patient groups [30, 31]. Singled-center research and flawed studies provide the current available data regarding P. aeruginosa-CAP prevalence rates and resistance patterns [15, 20 and 17, 33-35]. CHALMERS et al. [36] analyzed 22 research studies and discovered P. aeruginosa existed in 8.6% of MDR-risk patients and 4% of non-risk participants with divergent testing results between 0% to 23% across additional CAP patient groups. Most studies received inadequate methodological ratings and every investigation was performed at a single medical facility or within a regional territory [36]. No one can confirm the real worldwide occurrence of P. aeruginosa-CAP due to insufficient data.

The risk factors identified by the American Thoracic Society together with the Infectious Diseases Society of America for P. aeruginosa infection in HCAP differ from those presented in CAP guidelines [25, 37]. Researchers lack data about MDR P. aeruginosa prevalence in patients who have community-acquired pneumonia across the world.

The research investigates both Pseudomonas aeruginosa occurrence rates in community-acquired pneumonia (CAP) patients and analyzes resistance patterns and clinical outcomes of the infection.

LITERATURE REVIEW

Research on prevalence of Pseudomonas aeruginosa (PA) in community acquired pneumonia (CAP) has been much more frequent than that in nosocomial pneumonia, although prevalence varies widely. Because of the resistance mechanisms and treatment implications, it should be identified as a causal factor in CAP for PA.

Epidemiology and Pathogenesis

As an opportunistic Gram-negative pathogen, PA has acquired certain innate resistance against broad range of antibiotics including the β-lactams, making it difficult to treat in cases of CAP. It is widely reported that the prevalence of PA in CAP ranges broadly according to study design and locality, patient risk factors. One of the more recent meta analysis [38], by Chalmers et al., showed that MDR risk factors are present in 8.6% of CAP patients receiving PA and 4% among who had no risk factors. For example, PA is present in CAP more frequently in severely diseased cases, where the mortality and outcome in patients are worse [39].

Some groups are more vulnerable to CAP caused by PA, and research shows that. Among the included are people with resultant immunosuppression, those who recently had received antibiotics as well as those with chronic lung illness and prior hospitalizations [40]. Although well established risk variables such as meconium aspiration [41], the diagnosis of adult asthma pneumonia is associated with an actual prevalence of PA that remains unknown because methodological flaws in the body of current research preclude an estimation [41].

Healthcare-Associated Pneumonia (HCAP) and PA

However, the distinction between CAP and healthcare associated pneumonia (HCAP) has further added to the knowledge of PA's function in pneumonia. The original intention of HCAP was to address the epidemioletication shift in the cases of pneumonia in patients who frequently have contact with health care, namely dialysis patients and patients in nursing home. Finally, research found that pathogens, like PA, that are multidrug resistant were more often found on HCAP patients [42].

Nevertheless, there is evidence that some HCAP patients do not require broad spectrum empirical antibiotic therapy, therefore calling into question the status of HCAP as a discrete entity. A comprehensive analysis by Kalil et al. [43] including HCAP patients in the CAP cohorts may have artificially raised the estimates of PA prevalence, and PA prevalence was highly varied between studies. Indeed, since then, the Infectious Diseases Society of America (IDSA) and the American Thoracic Society (ATS) have revised the placement of these guidelines based on their position of prioritizing personal risk assessment over universal HCAP classification [44].

Antimicrobial Resistance and Treatment Challenges

It has a rather high potential of resistance in PA in CAP. Empirical treatment options caused by PA strains that show increasing resistance patterns are becoming more

and more difficult. However, the availability of other treatments has become limited due to rising resistance of cephalosporins, carbapenems and fluoroquinolones [45]. Thus, the success of therapy of PA-CAP cases will be based on choice of proper antibiotic taking into account local epidemiology and PA-CAP cases susceptibility pattern, as lower fatality rates have been shown for the patients with proper therapy during initial treatment of PA-CAP cases.

Almost universal case (Severe) needs use of an antipseudomonal β lsciin (Csfepime, Piperacillin/tazobactam) plus fluoroquinolone or aminoglycoside (almost all cases). There is the danger of developing new resistance to the extent that broad spectrum antibiotics are used, and therefore need for antimicrobial stewardship is emphasized.

RESEARCH OBJECTIVE

The aim of this study was to determine the prevalence of Pseudomonas aeruginosa in community acquired pneumonia (CAP), describe risk factors linked with this infection, evaluate the clinical outcomes in association with P. aeruginosa infection and describe patterns of antibiotic resistance. Since Confiance AMR Module is designed to report bacteria typical to CAP, it is crucial for clinicians to know the prevalence of P. aeruginosa to be able to optimize empirical antibiotic treatment regimen, in particular in context of increasing rates of multidrug resistant bacteria observed in existing populations. This study compares the clinical and demographic traits of CAP patients infected with P. aeruginosa with those of patients infected with bacterial causes of CAP.

Additionally, it will also assess the influence of P. aeruginosa in mortality, length of hospital stay and treatment response and severity of illness. Analysis of P. aeruginosa-CAP patterns of antimicrobial resistance will enable elucidation of failure in control of P. aeruginosa-CAPs and antibiotic stewardship procedures. These results will result in improvements of the CAP treatment decision making, early risk stratification and clinical guidelines for CAP patients risk of having P. aeruginosa infections.

METHODOLOGY

This was a qualitative study carried out to find out the prevalence of Pseudomonas aeruginosa in community acquired pneumonia (CAP) and to study its clinical features in Quetta tertiary care hospital. Therefore, 120 CAP patients were chosen by a random sampling method. The data collection process included in depth patient records examination, provider interviews and microbiological results from blood and sputum cultures. All parameters of laboratory results, risk variables, clinical symptoms, patient demographics were methodically recorded. Using antibiotic susceptibility testing, Pseudomonas aeruginosa was detected conventionally and the antibiotic resistance patterns were evaluated. The study sought to find risk factors, common infections and treatment difficulties for infection of P. aeruginosa in CAP patients. The findings were grouped and theme analyzed to further understand how P. aeruginosa affects CAP patient outcomes and how to inform practical treatment choices.

RESULTS

Table 1

Demographic Characteristics of CAP Patients (n = 120)

Characteristics	*P. aeruginosa* (n=15)	Non-*P. aeruginosa* (n=105)	Total (n=120)
Age < 50 years	5	50	55
Age ≥ 50 years	10	55	65
Male	9	58	67
Female	6	47	53
History of Smoking	7	39	46
Chronic Lung Disease	8	33	41

Figure 1

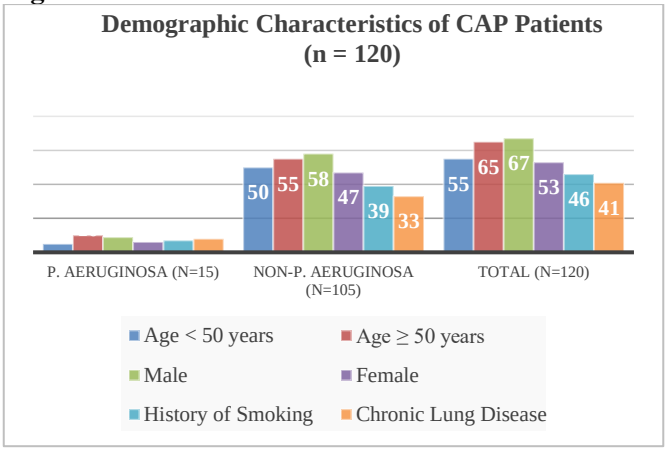

Table 2

Clinical Characteristics of CAP Patients

Clinical Features	*P. aeruginosa* (n=15)	Non-*P. aeruginosa* (n=105)	Total (n=120)
Fever	12	90	120
Cough	14	98	115
Dyspnea	13	83	96
Oxygen Saturation <90%	9	30	39
ICU Admission	6	15	21

Table 3

Microbiological Findings in CAP Patients

Pathogen Identified	Frequency (n=120)	Percentage (%)
Streptococcus pneumoniae	60	50%
Haemophilus influenzae	20	16.7%

Pseudomonas aeruginosa	15	12.5%
Klebsiella pneumoniae	10	8.3%
Other Bacteria	15	12.5%

Figure 2

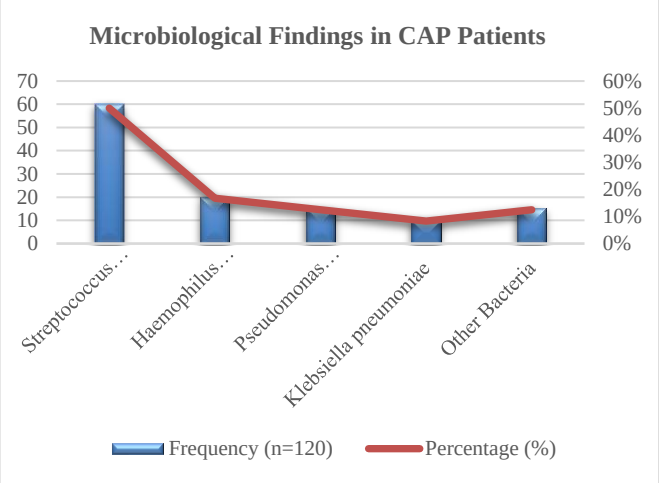

Table 4

Antibiotic Susceptibility Patterns of Pseudomonas aeruginosa

Antibiotic	Sensitive (n=15)	Resistant (n=15)
Piperacillin-Tazobactam	9	6
Cefepime	8	7
Meropenem	10	5
Levofloxacin	7	8
Amikacin	12	3

Table 5

Clinical Outcomes of CAP Patients

Outcomes	*P. aeruginosa* (n=15)	Non-*P. aeruginosa* (n=105)	Total (n=120)
Length of Hospital Stay > 7 days	10	25	35
ICU Admission	6	15	21
Need for Mechanical Ventilation	4	9	13
Mortality	3	7	10

DISCUSSION

The purpose of this study was to determine the clinical impact of Pseudomonas aeruginosa and prevalence of Pseudomonas aeruginosa in community acquired pneumonia. Demographics, clinical features, microbiology, antibiotics resistance patterns, and patient outcomes of CAP due to P. aeruginosa differ significantly from other pathogens.

Demographic and Clinical Characteristics

Twelve-point five percent (15/120) of CAP cases were due to P. aeruginosa as found in this study. Older patients were more susceptible, the majority of these patients were aged 50 or older (10/15). In addition, there was a higher percentage of P. aeruginosa cases in males (9/15) and those with a smoking history (7/15). More of the P. aeruginosa infected patients also had chronic lung disease (8/15) than did those infected with other bacteria (33/105).

P. aeruginosa cases presented symptoms of common pneumonia such as fever (12/15), cough (14/15) and dyspnea (13/15). This was significant in that more P. aeruginosa patients had oxygen saturation levels below 90% (9/15), indicative of more serious respiratory impairment. In addition, the P. aeruginosa infected patients (6/15) also tended to require ICU admission more frequently than non-P. aeruginosa (15/105).

Microbiological Findings

When we defined the pathogen, we found, the most common pathogen for all CAP patient was Streptococcus pneumoniae (50%) and Haemophiles influenzae (16.7%). Twelve-point five percent of cases is caused in P. aeruginosa; although P. aeruginosa is not the most common pathogen, its contribution to causing CAP was significant. Other bacteria such as Klebsiella pneumoniae were found in smaller amounts.

Since P. aeruginosa is mainly identified as a cause of hospital acquired infections, the occurrence is alarming in the CAP patients. The result is consistent with new patterns of antibiotic-resistant bacteria occurring more outside of places associated with healthcare.

Antibiotic Resistance Patterns

There was resistance to antibiotic testing at different levels. These are thanks to the highest sensitivity to meropenem (10/15), amikacin (12/15) and amikacin (12/15). However, for Levofloxacin (8/15) and cefepime (7/15) significant resistance was evidenced, so these antibiotics would be less effective. Piperacillin–tazobactam (6/15) is of concern because piperacillin–tazobactam is commonly used empirically.

The results imply the role of local antimicrobial stewardship interventions. In terms of resistance trends, it is recommended to change the regimens of empirical CAP therapy on the basis of precepts which allow offering adequate antibacterial cover for P. aeruginosa, particularly for high-risk patients.

Clinical Outcomes

Clinical results for P. aeruginosa patients were inferior to that of non-P. aeruginosa patients. Among other CAP patients (25/105), P. aeruginosa cases (10/15) stayed in the hospital longer than seven days. The infarctions were also serious as the greater ICU admission rates (6/15 vs 15/105) demonstrated.

The 4 of 15 P. aeruginosa cases required mechanical ventilation as compared to 9 of 105 non-P. aeruginosa cases. In addition, P. aeruginosa cases (3/15) had significantly higher mortality rate compared to other CAP cases (7/105). These results show that the infection is aggressive and that early detection and proper therapy are needed for P. aeruginosa infections.

All CAP patients, but more especially high-risk individuals, require selection of a more specialized approach to antibiotic selection because of P. aeruginosa presence. Clinicians should be aware of the substantial influence P. aeruginosa has on causing illness severity, mortality, and hospitalization.

CONCLUSION

As a result, this study focuses on how Pseudomonas aeruginosa an influence on prognosis has following community acquired pneumonia (CAP): hospitalization and mortality. The early diagnosis by means of microbiological tests and risk factor analysis are highlighted by the results. Due to its resistance patterns, an approach to antibiotic therapy that involves using a more focused approach is required, in particular, for individuals at high risk. In severe cases, combined therapy may be required, and empirical therapy will consider local resistance patterns. Things need to be done to stop the spread of new resistance and that's the proper antimicrobial stewardship. These findings can be used to aid in the decision making and development of CAP management plans in environments where antibiotic resistance is increasing.

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