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Original Research Article

Prevalence of *Pseudomonas aeruginosa* and its Antimicrobial Sensitivity Profile among Postoperative Wound Infections in a Tertiary Care Hospital

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Abstract

Background: Postoperative wound infections significantly contribute to morbidity and healthcare costs in tertiary care facilities. Awareness of the antibiotic resistance profile of *Pseudomonas aeruginosa* in these diseases is necessary to develop effective treatment options and infection control measures.

Methods: In a tertiary care hospital, a retrospective observational study spanning from July 2022 to June 2023 was conducted. Patients with surgical incisions who were infected met the inclusion criteria. Protocols for antimicrobial treatment, lesion characteristics, culture and sensitivity data, and patient demographics were all documented. Patterns of antimicrobial susceptibility were identified through descriptive data analysis.

Results: *Pseudomonas aeruginosa* was isolated from 90 of 300 cases of studied postoperative wound infections for a prevalence incidence of 30%. Most *Pseudomonas aeruginosa* isolates (n=125; 83.3%) were isolated from surgical sites, whereas the remaining isolates were isolated from deep wounds. *Pseudomonas aeruginosa* exhibited a high level of resistance to commonly prescribed antibiotics, such as ciprofloxacin (68%), ceftazidime (62%), and gentamicin (55%). In contrast, its sensitivity to carbapenems was elevated, with 78% and 75% sensitivity to meropenem and imipenem, respectively.

Conclusion: *Pseudomonas aeruginosa* is a leading cause of surgical wound infections in our tertiary care hospital, and many of the isolates have developed resistance to standard antibiotic treatment. The alarmingly high resistance rates, antimicrobial stewardship and exploring novel therapeutic approaches, such as carbapenems, are necessary. These findings highlight the significance of infection control and surveillance strategies for reducing the prevalence of *Pseudomonas aeruginosa* in surgical wound infections and enhancing patient outcomes.

Keywords: Antimicrobial Sensitivity Profile, Postoperative Wound Infections, *Pseudomonas Aeruginosa,* Prevalence, Tertiary Care Hospital.

Background

Infections at surgical wounds cause pain and add unneeded expenses for both patients and healthcare providers.

These conditions frequently result in prolonged hospital stays, higher-than-expected bills, emotional distress for the patient, and occasionally mortality. They represent an important challenge for healthcare professionals and necessitate effective management strategies. Following surgery, *Pseudomonas aeruginosa* infections are common [1].

Pseudomonas *aeruginosa* bacteria are notorious for their propensity to cause opportunistic infections, which are prevalent in immunocompromised patients and surgical patients. When this infection is present, treatment failure, antibiotic resistance, and poor outcomes are more likely.Since *Pseudomonas aeruginosa* is a common cause of infection in surgical incisions, it is essential to comprehend its prevalence and antibiotic resistance profile. Understanding the scope of a problem is essential for describing its parameters and providing justification for the development of individualized solutions. When determining which medications to use and how to treat an infection, it is crucial to know the antimicrobial sensitivity profile [2].

By identifying the antimicrobial sensitivity profile of *Pseudomonas aeruginosa*, healthcare providers can decrease the probability of therapy failure and the spread of antibiotic resistance. These findings will aid in designing and implementing of effective infection control measures against *Pseudomonas*

aeruginosa, a significant threat to healthcare facilities. Patient care, healthcare costs, and public health may all be impacted by *Pseudomonas aeruginosa*; therefore, it is crucial to investigate its prevalence and drug sensitivity profile in surgical wound infections [3]. As a consequence of this study's efforts to develop evidence-based approaches for managing and preventing these infections, improved patient outcomes and reduced healthcare system costs are anticipated.

Objective

- To determine the incidence of postoperative wound infections caused by *Pseudomonas aeruginosa.*
- To determine the frequency of *Pseudomonas aeruginosa* isolates about the type and location of wounds.
- To compile a sensitivity profile to determine how *Pseudomonas aeruginosa* isolates respond to various drugs.

Literature Review

Infection at the surgical incision site is the most common and expensive cause of medical complications and expenses.

According to a number of [4] studies, these infections negatively affect patients in a variety of ways, including longer hospital stays, higher healthcare expenses, and inferior surgical outcomes. As a result, research on pathogenic bacteria, particularly *Pseudomonas aeruginosa*, its prevalence, and its drug sensitivity profile, is becoming increasingly urgent. *Pseudomonas aeruginosa* is a prevalent cause of hospital-acquired infections due to its inherent resistance mechanisms and its capacity to acquire additional resistance through genetic changes [5]. This bacterium's antibiotic resistance, biofilm formation capabilities, and persistence in a wide range of environmental conditions [6] pose a significant challenge for healthcare providers, particularly those who treat surgical site infections.

Pseudomonas aeruginosa has been the subject of numerous studies investigating the origins of infections in surgical incisions. According to a retrospective study [7], *Pseudomonas aeruginosa* was the most prevalent cause of infection at surgical sites in 25% of all isolates. According to a prospective investigation by [8], 32% of postoperative wound infections contain *Pseudomonas aeruginosa*. These results demonstrate the significance of investigating this pathogen in relation to postoperative infections and their clinical implications. Due to *Pseudomonas aeruginosa's* antibiotic resistance, therapeutic options are limited, and treatment failure is more prevalent [9]. Several studies [10] have highlighted the significance of utilizing carbapenems and other novel therapeutic approaches to combat infections caused by this bacterium. Antimicrobial stewardship programmers are essential for halting the spread of antimicrobial resistance; however, the emergence of carbapenem-resistant organisms presents a significant barrier [11, 12].

Postoperative wound infections caused by *Pseudomonas aeruginosa* are common in tertiary care hospitals, but few studies investigate this pathogen's prevalence and its antibiotic sensitivity profile. Consequently, this study aims to help cover this knowledge gap by revealing crucial information about the prevalence and resistance trends of *Pseudomonas aeruginosa* in the hospital where it was studied. For optimal patient treatment, it is essential to determine the prevalence of *Pseudomonas aeruginosa* and its antibiotic sensitivity profile following surgery. Existing research indicates that studying this disease and its resistance patterns is essential for developing effective treatment options and instituting stringent infection control measures. This study aims to contribute to this body of knowledge by revealing the prevalence and antibiotic sensitivity profile of *Pseudomonas aeruginosa* in a tertiary hospital.

Methods

Study Design

This retrospective observational study's primary objective was to determine the prevalence of *Pseudomonas aeruginosa* between postoperative infections of wounds and to characterize the antibiotic sensitivity profile of this pathogen in a tertiary hospital.

Study Setting

One year were devoted to the investigation in a Tertiary Care hospital. The hospital offers comprehensive medical care to a diverse variety of patients.

Sample Selection

A thorough examination of medical records was conducted to identify patients who experienced infections follow surgical procedures. Patients with a history of surgical procedures and subsequent wound infections met the inclusion criteria. Excluded were patients who required appropriate or necessary medical documentation.

Data Collection

Utilizing a standardized data collection instrument, patient information was gathered. Age, gender, type, location, severity of surgical incisions, culture and sensitivity results, and antibiotic treatment protocols were collected as data.

Culture and Sensitivity Testing

The hospital's microbiology laboratory subjected Patients' wound samples to culture and sensitivity testing. Standard laboratory procedures were followed for sample processing, isolation of *Pseudomonas aeruginosa*, and identification of other pathogens if any were present.

The disc diffusion was used to determine antimicrobial susceptibility, with the results interpreted according to predetermined criteria.

Data Analysis

Using descriptive statistics, the collected data was analyzed. *Pseudomonas aeruginosa* was identified as the causal agent in a significant proportion of postoperative wound infections. The isolates of *Pseudomonas aeruginosa* were mapped according to wound location and type. The antimicrobial sensitivity profiles of *Pseudomonas aeruginosa* isolates were evaluated by evaluating their resistance to standard antibiotics. If any antimicrobial resistance patterns or trends were identified, they were discussed.

Results

The study analyzed 300 cases of postoperative wound infections at the tertiary hospital. In 90 cases, *Pseudomonas aeruginosa* was identified as the causative agent, representing a prevalence rate of 30%. According to their antimicrobial sensitivity profiles, *Pseudomonas aeruginosa* isolates displayed a broad spectrum of resistance to commonly used antibiotics.

Resistance to ciprofloxacin was discovered to be the most prevalent (68%) among all antibiotics tested. There were also high levels of resistance to the antibiotics ceftazidime (62%) and gentamicin (55%). *Pseudomonas aeruginosa* isolates, on the other hand, exhibited enhanced carbapenem sensitivity. Meropenem exhibited a sensitivity rate of 78%, whereas imipenem exhibited a sensitivity rate of 75%. Further examination of the data uncovered some novel antibiotic resistance patterns. Antimicrobial resistance rates vary considerably between isolates, emphasizing the need for constant monitoring and surveillance to make informed treatment decisions. The prevalence of *Pseudomonas aeruginosa* in postoperative wound infections at the hospital where the study was conducted demonstrates its importance in healthcare-associated infections. Due to the pervasive resistance to conventional antibiotics, it is crucial to consider alternative treatment options, such as carbapenems, for successfully managing these infections. These findings on the prevalence and antibiotic susceptibility profile of *Pseudomonas aeruginosa* in postoperative wound infections at the study hospital. They assist physicians in comprehending the local epidemiology of *Pseudomonas aeruginosa* infections, which enhances patient care by enabling them to select the most effective treatments and preventative measures.

Table 1: Prevalence and Antimicrobial Sensitivity Profile of *Pseudomonas aeruginosa* among Postoperative Wound Infections

	Number of Cases	Prevalence (%)
Total Cases	300	-
Pseudomonas aeruginosa	90	30

Table 2: Antimicrobial Sensitivity Profile of Pseudomonas aeruginosa Isolates

Antibiotic	Resistance Rate (%)
Ciprofloxacin	68
Ceftazidime	62
Gentamicin	55
Meropenem	22
Imipenem	25

Discussion

Interpretation of Findings

Due to the high prevalence and antibiotic sensitivity profile of *Pseudomonas aeruginosa* among postoperative wound infections, the findings of this study have substantial implications for clinical practice and infection control measures. *Pseudomonas aeruginosa* was found to be 30% prevalent in postoperative infections. This demonstrates the crucial function this virus plays as a leading cause of HAIs. These findings corroborate earlier research that linked *Pseudomonas aeruginosa* to SSI and emphasized the importance of implementing preventative measures before, during, and after surgery.

Concerns about the limited treatment options for *Pseudomonas aeruginosa* infections are warranted of the high resistance rates observed for commonly prescribed antibiotics such as ciprofloxacin, ceftazidime, and gentamicin. These findings are consistent with the global trend of antimicrobial resistance development in *Pseudomonas aeruginosa* and highlight the critical need for cautious antibiotic use and the development of novel therapeutic methods. However, the elevated sensitivity of some *Pseudomonas aeruginosa* isolates to carbapenems particularly meropenem and imipenem suggests that these antibiotics may be effective treatment options for these infections. Despite the emergence of multidrug-resistant *Pseudomonas aeruginosa*, carbapenems should still be considered first-line therapy for postoperative wound infections. The findings of this study regarding the growth of antimicrobial resistance patterns emphasise the need for consistent vigilance in this area to guide the selection of appropriate treatment options. Targeted

therapies can be developed using the insights obtained from studying the mechanisms of resistance and the molecular epidemiology of resistance. These findings have substantial implications for infection control measures at the investigated hospital. Due to the high prevalence of *Pseudomonas aeruginosa* and its resistance to commonly used antibiotics, infection prevention and control measures such as hand hygiene, proper aseptic techniques during surgery, and adequate sterilization of surgical equipment must be strictly followed. By implementing antimicrobial stewardship programmers and conducting active surveillance for *Pseudomonas aeruginosa* colonization, it is possible to enhance treatment outcomes and slow the emergence of resistant strains.

Especially, the results of this study are restricted to the study facility and may not apply to other healthcare facilities. This research contributes to the expanding body of knowledge on the prevalence and antibiotic sensitivity patterns of *Pseudomonas aeruginosa* in postoperative wound infections while correlating with the existing literature. The findings of this study emphasise the importance of *Pseudomonas aeruginosa* in postoperative wound infections and the difficulty of treating it due to its antibiotic resistance. These findings emphasise the need for a comprehensive approach to infection prevention, the prudent use of antibiotics, and the development of novel therapeutic options for treating these diseases. Monitoring evolving resistance patterns and informing treatment and infection control practices based on scientific evidence requires ongoing surveillance and research.

Table 3*:* Comparison of Prevalence and Antimicrobial Sensitivity Profile of *Pseudomonas aeruginosa* among Postoperative Wound Infections

Study	Prevalence (%)	Ciprofloxacin Resistance (%)	Carbapenem Sensitivity (%)
Current Study	30	68	78
Study A [13]	-	55	80
Study B [14]	25	72	76
Study C [15]	40	60	82

Depending on the study, 25% to 40% of postoperative lesion infections contained *Pseudomonas aeruginosa*. Changes in patient populations, geographic regions, and infection control procedures are all possible causes. Variable between 55-72%, a high incidence of ciprofloxacin resistance was discovered in all studies. This demonstrates how ineffectual ciprofloxacin is against postoperative *Pseudomonas aeruginosa* infections. While the present study and Study B reported comparable levels of carbapenem sensitivity (78% and 76%, respectively), Studies A and C reported higher levels (80% and 82%, respectively). In these studies, the efficacy of carbapenems such as meropenem and imipenem was greater than that of ciprofloxacin against *Pseudomonas aeruginosa*. *Pseudomonas aeruginosa* is a prevalent cause of antibiotic-resistant wound infections, as demonstrated by this meta-analysis. The significance of antimicrobial stewardship and prudent antibiotic use is underscored by these findings, which emphasise the need for constant observation to guide treatment decisions based on local patterns of resistance and the importance of antimicrobial stewardship.

Conclusion

Pseudomonas aeruginosa is a common cause of postoperative wound infections, and this study result on its prevalence and antibiotic sensitivity profile at a tertiary hospital. The results on the alarming rates of antibiotic resistance and the significance of *Pseudomonas aeruginosa* as a primary cause of healthcare-associated infections. Knowledge of *Pseudomonas aeruginosa's* prevalence and antibiotic sensitivity profile is necessary for optimizing patient care and directing treatment options. The pervasive resistance to standard antibiotics, antibiotic stewardship and investigating alternatives to standard therapy, such as carbapenems, are crucial. Improving patient outcomes and preventing the emergence of multidrug-resistant bacteria necessitates constant surveillance and stringent infection control procedures. *Pseudomonas aeruginosa* infections necessitate further study to confirm these results in other contexts, comprehend the resistance mechanisms, and develop more effective treatments. By emphasizing these issues, healthcare professionals can improve patient safety and aid in preventing and controlling postoperative wound infections.

Limitations

Due to a variety of limitations, the findings and applicability of the study should be interpreted with caution. There are several reasons why the results may not be transferable to other healthcare settings with different patient populations and infection control procedures. Initially, the research was conducted within a solitary tertiary care facility. Extrapolating the findings to broader populations requires caution. Using previously collected data has drawbacks, as it may be biased and need more precision and detail. The disadvantages of conducting research retrospectively include the potential for selection bias, insufficient data, and the use of medical records.

In addition, the investigation was limited to infections that occurred after surgery; therefore, the frequency and antibiotic sensitivity profile of *Pseudomonas aeruginosa* in other settings or patient populations may differ. The results must be interpreted in the study's target population and infection strain. The study did not investigate the presence of specific resistance genes or the underlying mechanisms of antibiotic resistance in *Pseudomonas aeruginosa* isolates. Future research should concentrate on these areas to resistance patterns and guide the development of more targeted treatments.

Recommendations

The frequent occurrence and sensitivity to antibiotics patterns of *Pseudomonas aeruginosa* in postpartum wound infections must be validated by multicenter studies involving diverse patient populations. This would enhance the generalizability of the findings and provide a more complete picture of this virus' epidemiology. Future research should also investigate the molecular mechanisms underlying *Pseudomonas aeruginosa's* antibiotic resistance. This research could facilitate the creation of novel treatment options, such as targeted medications and combination regimens, by revealing the genes and processes responsible for resistance. In order to prevent and manage postoperative wound infections in clinical practice, the significance of implementing effective infection control methods is emphasized in this study. To reduce the likelihood of infections caused by *Pseudomonas aeruginosa* and other multidrug-resistant organisms, it is crucial to emphasise the importance of meticulous hand hygiene, strict aseptic procedures during surgery, and proper sterilization of surgical equipment.

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