Low Prevalence of *Pseudomonas aeruginosa* Among Septic Burn Patients at a Tertiary Care Hospital: A Prospective Observational Study

Nashra Afaq, R. Sujatha*

Assistant Professor[1], Department of Microbiology and CRL, Rama Medical College Hospital and Research Centre, Uttar Pradesh, India.

Professor and Head[2], Department of Microbiology, Rama Medical College Hospital and Research Centre, Uttar Pradesh, India.

Corresponding Author: Dr. R. Sujatha*

Email ID: drsujatha152rama@gmail.com

Abstract

Background

Burn wound infections are a major cause of morbidity and mortality among hospitalized burn patients. Pseudomonas aeruginosa has traditionally been considered one of the most common pathogens associated with burn wound sepsis because of its multidrug resistance and virulence properties. However, recent changes in infection control practices and antimicrobial stewardship have altered the microbial profile in many burn centers.

Aim

To determine the prevalence and antimicrobial susceptibility pattern of Pseudomonas aeruginosa isolated from septic burn patients admitted to a tertiary care hospital.

Materials and Methods

A prospective observational study was conducted over a period of one year in the Burn Unit and Department of Microbiology of a tertiary care hospital. A total of 120 septic burn patients were included. Samples including wound swabs, pus, tissue specimens, and blood samples were collected under aseptic precautions. Isolation and identification of bacterial pathogens were performed using standard microbiological methods. Antibiotic susceptibility testing was carried out using Kirby–Bauer disc diffusion method according to CLSI guidelines.

Results

Out of 120 septic burn patients, only 12 (10.0%) cases showed positive bacterial culture growth. Klebsiella pneumoniae was the predominant isolate accounting for 33.3% of isolates, followed by Staphylococcus aureus (25.0%). Only one isolate (8.3%) of Pseudomonas aeruginosa was recovered, indicating very low prevalence in the present study. The isolate showed sensitivity to carbapenems, aminoglycosides, colistin, and polymyxin-B but resistance to ceftazidime and ciprofloxacin.

Conclusion

The present study demonstrated an unexpectedly low prevalence of Pseudomonas aeruginosa among septic burn patients. Strict infection control measures, improved wound management, and rational antibiotic usage may have contributed to this decline. Continuous surveillance of microbial flora and antimicrobial resistance patterns remains essential for effective burn wound management.

Keywords: Burn wound infection, *Pseudomonas aeruginosa*, burn sepsis, antimicrobial resistance, tertiary care hospital

Introduction

Burn injuries are among the most severe forms of trauma and represent a major public health problem worldwide. Patients with burn injuries are highly susceptible to infections because of destruction of the skin barrier, impaired immune response, prolonged hospitalization, invasive procedures, and extensive antimicrobial exposure.[1] Infection remains one of the

leading causes of mortality in burn patients despite advances in intensive care and wound management.[2]

Initially, burn wounds are sterile; however, microbial colonization occurs rapidly within the first few days after injury.[3] The microbial flora of burn wounds changes over time, with Gram-positive organisms appearing early followed by Gram-negative bacteria and fungi during prolonged hospital stay.[4] Among Gram-negative pathogens, *Pseudomonas aeruginosa* has traditionally been regarded as one of the most important organisms associated with burn wound infections.[5]

Pseudomonas aeruginosa is an opportunistic pathogen possessing multiple virulence factors such as exotoxins, elastases, phospholipases, biofilm formation, and intrinsic resistance to several antimicrobial agents.[6] The organism survives in moist hospital environments including sinks, ventilators, catheters, and dressing materials, making burn units particularly vulnerable to outbreaks.[7] Infection caused by *Pseudomonas aeruginosa* may progress rapidly to septicemia and multiple organ dysfunction, contributing significantly to mortality among burn patients.[8]

Several studies from different parts of the world have reported high prevalence rates of *Pseudomonas aeruginosa* ranging from 20% to 45% in burn wound infections.[9,10] However, improved infection control practices, regular environmental disinfection, antibiotic stewardship programs, and early wound excision techniques have changed the microbial epidemiology in many healthcare centers.[11]

Knowledge of local bacteriological profiles and antimicrobial susceptibility patterns is important for guiding empirical therapy and preventing the emergence of multidrug-resistant organisms.[12] Interestingly, our institution observed very few cases of *Pseudomonas aeruginosa* among septic burn patients during the study period. Therefore, the present study was conducted to evaluate the prevalence and antimicrobial susceptibility pattern of *Pseudomonas aeruginosa* in septic burn patients admitted to a tertiary care hospital.

Materials and Methods

Study Design

The present study was a prospective observational study conducted to determine the prevalence and antimicrobial susceptibility pattern of *Pseudomonas aeruginosa* among septic burn patients admitted to a tertiary care teaching hospital.

Study Setting

The study was carried out in the department of Microbiology of a tertiary care hospital.

Study Duration

The study was conducted over a period of 12 months.

Study Population

A total of 120 burn patients clinically suspected of sepsis were included in the study.

Inclusion Criteria

- Patients of all age groups and both genders with burn injuries.
- Patients clinically diagnosed with septic burn wound infection.
- Patients admitted for more than 48 hours after burn injury.
- Patients willing to participate in the study.

Exclusion Criteria

- Patients already receiving prolonged antibiotic therapy before admission.
- Patients with non-infected burn wounds.
- Patients discharged within 48 hours of admission.
- Patients unwilling to provide consent for participation.

Sample Collection

Clinical samples including wound swabs, pus aspirates, tissue specimens, and blood samples were collected from burn patients under strict aseptic precautions. The wound area was cleaned with sterile normal saline before sample collection to avoid contamination. Samples were immediately transported to the microbiology laboratory for further processing.

Isolation and Identification of Organisms

Samples were inoculated onto Blood agar and MacConkey agar plates and incubated aerobically at 37°C for 24–48 hours. Identification of bacterial isolates was performed using standard microbiological methods including:

- Colony morphology
- Gram staining
- Oxidase test
- Pigment production
- Motility testing
- Biochemical reactions

Identification of *Pseudomonas aeruginosa* was confirmed by characteristic bluish-green pigment production, oxidase positivity, grape-like odor, and growth at 42°C.

Antibiotic Susceptibility Testing

Antimicrobial susceptibility testing was carried out by Kirby–Bauer disc diffusion method on Mueller–Hinton agar according to Clinical and Laboratory Standards Institute (CLSI) guidelines.

The antibiotics tested against *Pseudomonas aeruginosa* included:

- Piperacillin-tazobactam
- Ceftazidime
- Cefepime
- Ciprofloxacin
- Amikacin
- Gentamicin
- Imipenem
- Meropenem
- Colistin
- Polymyxin-B

Results were interpreted as sensitive or resistant according to CLSI recommendations.

Quality Control

Standard control strain *Pseudomonas aeruginosa* ATCC 27853 was used for quality control during culture and antibiotic susceptibility testing.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS software version 25.0. Results were expressed in frequencies, percentages, mean, and standard deviation wherever applicable. Data were presented in tables and paragraph form.

Results

Table 1: Demographic Distribution of Burn Patients

Age Group (Years)	Male	Female	Total
0–20	12	10	22
21–40	28	34	62
41–60	14	12	26
>60	6	4	10
Total	**60**	**60**	**120**

Among 120 septic burn patients, equal gender distribution was observed with 60 males and 60 females. The majority of patients belonged to the 21–40 years age group (51.7%), followed by 41–60 years age group (21.7%). Young adults were more frequently affected due to increased domestic and occupational exposure to burn injuries.

Table 2: Culture Positivity Among Burn Patients

Culture Result	Number	Percentage
Positive Culture	12	10.0%
No Growth	108	90.0%
Total	**120**	**100%**

Out of 120 septic burn patients, only 12 cases (10.0%) showed bacterial culture positivity, while 108 cases (90.0%) showed no bacterial growth. The low culture positivity observed in the present study may be related to early administration of empirical antibiotics, improved wound care

practices, and strict infection prevention measures in the burn unit.

Table 3: Distribution of Bacterial Isolates

Organism	Number of Isolates	Percentage
Klebsiella pneumoniae	4	33.3%
Staphylococcus aureus	3	25.0%
Acinetobacter baumannii	2	16.7%
Escherichia coli	1	8.3%
Pseudomonas aeruginosa	1	8.3%
Others	1	8.3%
Total	**12**	**100%**

Among the 12 bacterial isolates recovered, *Klebsiella pneumoniae* was the predominant organism accounting for 33.3% of isolates, followed by *Staphylococcus aureus* (25.0%). Only one isolate of *Pseudomonas aeruginosa* was obtained, demonstrating a remarkably low prevalence of the organism among septic burn patients.

Table 4: Antibiotic Susceptibility Pattern of *Pseudomonas aeruginosa*

Antibiotic	Sensitive n (%)	Resistant n (%)
Piperacillin-Tazobactam	1 (100%)	0
Ceftazidime	0	1 (100%)
Cefepime	1 (100%)	0
Ciprofloxacin	0	1 (100%)
Amikacin	1 (100%)	0
Gentamicin	1 (100%)	0
Imipenem	1 (100%)	0
Meropenem	1 (100%)	0
Colistin	1 (100%)	0
Polymyxin-B	1 (100%)	0

Only one isolate of *Pseudomonas aeruginosa* was recovered during the study period. The isolate demonstrated complete sensitivity to carbapenems, aminoglycosides, cefepime, colistin, and polymyxin-B, while resistance was observed against ceftazidime and ciprofloxacin.

Discussion

Burn wound infections continue to be a major therapeutic challenge in hospitalized patients.[13] Loss of skin integrity, impaired immunity, prolonged hospitalization, and invasive interventions predispose burn patients to microbial colonization and septic complications.[14]

Traditionally, *Pseudomonas aeruginosa* has been considered one of the predominant pathogens in burn wound infections because of its ability to survive in hospital environments and resist multiple antimicrobial agents.[15] Several earlier studies reported high prevalence rates of *Pseudomonas aeruginosa* ranging from 25% to 45% among burn wound isolates.[16,17]

Interestingly, the present study demonstrated a very low prevalence of *Pseudomonas aeruginosa*, with only one isolate (8.3%) recovered among 12 culture-positive cases. Similar declining trends have been observed in some recently published studies, where improved infection control practices and antibiotic stewardship programs have altered the microbial epidemiology of burn units.[18]

The low culture positivity rate observed in the present study may be explained by early empirical antibiotic administration, strict aseptic wound care protocols, frequent dressing changes, and enhanced environmental disinfection measures.[19] Improved surveillance systems and adherence to infection prevention guidelines may also reduce cross-transmission of hospital-acquired pathogens including *Pseudomonas aeruginosa*.[20]

In the present study, *Klebsiella pneumoniae* emerged as the predominant isolate. Similar findings have been reported by Gupta et al., who observed increasing prevalence of Enterobacteriaceae in burn units.[21] The shift from *Pseudomonas* dominance to other Gram-negative organisms may reflect selective antibiotic pressure and changing hospital flora.[22]

The antimicrobial susceptibility pattern of the isolated *Pseudomonas aeruginosa* strain revealed sensitivity to carbapenems, aminoglycosides, colistin, and polymyxin-B, while resistance was noted against ceftazidime and ciprofloxacin. Similar resistance patterns have been documented in previous studies.[23] The increasing resistance to cephalosporins and fluoroquinolones is concerning because these drugs are commonly used for empirical therapy.[24]

Resistance mechanisms in *Pseudomonas aeruginosa* include efflux pumps, beta-lactamase production, porin mutations, and biofilm formation.[25] Irrational antibiotic use accelerates emergence of multidrug-resistant strains, emphasizing the importance of antimicrobial stewardship and periodic surveillance.[26]

The present study highlights the importance of continuous microbiological monitoring in

burn units because microbial flora and resistance patterns may vary across institutions and over time.[27]

Conclusion

The present study demonstrated a remarkably low prevalence of *Pseudomonas aeruginosa* among septic burn patients admitted to a tertiary care hospital. Only one isolate of *Pseudomonas aeruginosa* was recovered during the study period. *Klebsiella pneumoniae* was the predominant bacterial isolate. The isolated *Pseudomonas* strain showed sensitivity to carbapenems, aminoglycosides, colistin, and polymyxin-B. Strict infection control practices, improved wound care, and rational antibiotic usage may have contributed to the reduced prevalence of *Pseudomonas aeruginosa*. Continuous surveillance of microbial profiles and antimicrobial susceptibility patterns remains essential for effective management of burn wound infections.

Declarations:

Conflicts of interest: There is no any conflict of interest associated with this study

Consent to participate: There is consent to participate.

Consent for publication: There is consent for the publication of this paper.

Authors' contributions: Author equally contributed the work.

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