

EPIDEMIOLOGY OF INFECTIONS IN BURN PATIENTS: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Burns constitute a significant global health problem, with infections remaining a leading cause of morbidity and mortality despite advances in critical care and wound management. Burn injuries predispose patients to infections due to loss of the skin barrier, immune suppression, and prolonged hospitalization. **Materials and Methods:** A prospective observational study was conducted on 100 burn patients admitted over one year (February 2023–January 2024). Demographic variables, burn etiology, total body surface area (TBSA) involvement, infection types, and causative organisms were analyzed. Pus, sputum, and urine samples were cultured and subjected to antibiotic sensitivity testing. Data were analyzed using SPSS version 25, with p-values <0.05 considered statistically significant. **Result:** Out of 100 patients, 56% were male and 44% female, with most patients aged 18–29 years. Flame burns accounted for 60% of cases. The most common infections were pneumonia (45%), burn wound infections (40%), and urinary tract infections (10%). The predominant organisms isolated were *Klebsiella pneumoniae* (45%), *Pseudomonas aeruginosa* (25%), and *Staphylococcus aureus* (15%). Gram-negative bacilli exhibited high resistance to β -lactam antibiotics but retained sensitivity to aminoglycosides and fluoroquinolones. Seventeen percent of patients died, with septicemia (47%) as the leading cause of death. **Conclusion:** Infections remain a major cause of morbidity and mortality in burn patients. *Klebsiella pneumoniae* was the most common pathogen isolated. The study highlights the emergence of multidrug-resistant organisms and underscores the need for strict infection control practices and regular surveillance to guide empirical antibiotic therapy.

INTRODUCTION

Burn injuries represent one of the most devastating forms of trauma, causing extensive tissue damage, prolonged hospitalization, and complex complications such as infections and sepsis. Globally, more than 100,000 deaths annually are attributed to fire-related burns, disproportionately affecting low- and middle-income countries where healthcare infrastructure is limited.^[1] In India, burn injuries remain a major public health problem, ranking among the top five causes of disability-adjusted life years lost due to injury.^[2]

Infection is the most frequent and serious complication in burn patients, accounting for 50–75% of burn-related deaths.^[3] With advances in fluid resuscitation and critical care, the initial causes of death (shock and hypovolemia) have been largely replaced by sepsis as the dominant mortality factor.^[4] Burn wounds provide an ideal environment for

bacterial colonization due to necrotic tissue, protein-rich exudate, and immune suppression.^[5] Common infections include pneumonia, burn wound infection, urinary tract infection (UTI), and catheter-related sepsis.^[6]

The spectrum of infecting microorganisms varies geographically and temporally. *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Klebsiella pneumoniae* are among the predominant pathogens isolated in burn units,^[7] with rising multidrug resistance complicating empirical therapy.^[8] Understanding the local microbiological profile is essential for optimizing antibiotic stewardship and infection control.

Despite numerous studies worldwide, regional data from Eastern India remain limited. Hence, this study aimed to analyze the epidemiology, microbial pattern, and antibiotic sensitivity of infections in burn patients admitted to the burn unit of MGGMCH, Jamshedpur.

MATERIALS AND METHODS

Study Design and Setting: This was a prospective observational study conducted in the Burn Unit, Department of General Surgery, MGM Medical College and Hospital, Jamshedpur, Jharkhand, over one year (February 2023–January 2024).

Sample Size: Based on an estimated national burn prevalence of 8% and a permissible error of 5% at a 95% confidence level, the sample size was calculated as 100 patients.

Inclusion Criteria

- Patients aged ≥ 1 year with flame, scald, electrical, or chemical burns.
- Patients admitted within 24 hours of burn injury.
- Those who developed any clinical or microbiologically confirmed infection during hospitalization.

Exclusion Criteria

- Outpatients with minor burns not requiring admission.
- Patients with pre-existing systemic infections or chronic comorbid infections (e.g., tuberculosis, HIV).
- Patients unwilling to participate.

Data Collection: A structured proforma was used to record demographic details, etiology of burn, percentage of total body surface area (TBSA) involved (using the “Rule of Nines”), degree of burn injury, and type of infection.

Microbiological Evaluation: Pus, wound swabs, sputum, urine, and blood samples were collected aseptically after 48–72 hours of admission or at the onset of infection signs. Samples were cultured on MacConkey and blood agar media. Organisms were identified using standard biochemical methods, and antibiotic sensitivity was determined by the Kirby–Bauer disc diffusion method according to CLSI guidelines.

Parameters Studied

- Demographic data (age, sex).
- Burn characteristics (etiology, degree, TBSA).
- Type and site of infection.
- Microbial isolates and their antibiotic sensitivity pattern.
- Mortality and cause of death.

Statistical Analysis: Data were analyzed using SPSS v25. Categorical variables were presented as frequencies and percentages; continuous variables as mean $\pm$ SD. Chi-square tests compared categorical data, with $p < 0.05$ considered statistically significant.

RESULTS

Demographic and Clinical Profile: Out of 100 patients, 56 (56%) were male and 44 (44%) female. The majority (40%) were aged 18–29 years. Flame burns were the most common cause (60%), followed by scald (20%), electrical (10%), and chemical burns (6%) [Table 1].

Table 1: Demographic and Clinical Characteristics of Burn Patients (n=100)

Variable	Category	Frequency (%)
Gender	Male	56
	Female	44
Age Group (years)	1–17	18
	18–29	40
	30–49	26
	≥ 50	16
Type of Burn	Flame	60
	Scald	20
	Electrical	10
	Chemical	6
	Others	4
Degree of Burn	First degree	11
	Second degree	52
	Third/Fourth degree	37

Extent of Burn Injury: Sixty percent of patients had $<20\%$ TBSA burns. Fifteen percent each had 21–40%

and $>60\%$ TBSA burns, while 10% had 41–60% TBSA involvement [Table 2].

Table 2: Distribution of Patients by Total Body Surface Area (TBSA) Involved

TBSA (%)	Frequency (%)
$\leq 20\%$	60
21–40%	15
41–60%	10
$>60\%$	15

Pattern of Infections: Pneumonia was the most frequent infection (45%), followed by burn wound infection (40%), UTI (10%), and catheter-related

infections (4%). The mean onset time for pneumonia was 72 hours after admission. Infection rates were higher among females and patients aged 18–29 years.

Table 3: Distribution of Infections and Causative Organisms

Infection Type	Prevalence (%)	Predominant Organism(s)	Most Affected Group
Pneumonia	45	Klebsiella pneumoniae	Males (18–29 yrs)
Burn wound infection	40	Pseudomonas aeruginosa, Staph. aureus	Females (18–49 yrs)
Urinary tract infection	10	E. coli, Proteus	Females (18–29 yrs)
Catheter-related infection	4	Staph. aureus	Females (18–29 yrs)

Microbiological Profile: Among 100 cultures, Gram-negative bacilli accounted for 85% of isolates. The most frequent organism was *Klebsiella pneumoniae* (45%), followed by *Pseudomonas aeruginosa* (25%), *Staphylococcus aureus* (15%), *E. coli* (10%), and *Proteus* (5%).

Antibiotic Sensitivity

- ***Klebsiella pneumoniae*:** Resistant to β -lactams and carbapenems; sensitive to gentamicin and levofloxacin.
- ***Pseudomonas aeruginosa*:** Sensitive to piperacillin-tazobactam, amikacin, and fluoroquinolones.
- ***Staphylococcus aureus*:** Sensitive to gentamicin and levofloxacin but resistant to cephalosporins.
- ***E. coli* and *Proteus*:** Variable resistance; retained sensitivity to aminoglycosides.

Mortality: Seventeen percent of patients died during hospitalization. Septicemia (47%) was the most common cause, followed by hypovolemic shock (18%), toxemia (17%), ARDS (12%), and renal failure (6%).

DISCUSSION

This study demonstrated that infections remain a major complication among burn patients, consistent with global trends.^[9] The predominance of young adults (18–29 years) and flame burns aligns with studies from other Indian centers, reflecting domestic accidents and unsafe cooking practices as leading causes.^[10]

The overall infection rate (≈ 45 –50%) parallels reports by Keen et al,^[11] and Oncul et al,^[12] who found infection-related morbidity in 40–70% of burn cases. Pneumonia was the most common infection, as prolonged immobilization, inhalational injury, and mechanical ventilation predispose burn patients to respiratory infections.^[13]

Klebsiella pneumoniae and *Pseudomonas aeruginosa* dominated the isolates, consistent with prior Indian studies.^[14,15] Gram-negative bacilli flourish in hospital environments and colonize burn wounds due to compromised skin integrity and antibiotic exposure.^[16] The emergence of multidrug-resistant *Klebsiella* strains, resistant to cephalosporins and carbapenems, poses a therapeutic challenge.^[17] The retained sensitivity to aminoglycosides and fluoroquinolones offers limited but crucial options for empirical therapy.^[18]

The high resistance rates observed reflect global trends of antimicrobial misuse and hospital cross-transmission.^[19] Studies from tertiary centers in India have similarly reported >70% resistance to third-generation cephalosporins in burn isolates.^[20]

Regular surveillance and antibiotic stewardship programs are critical to contain resistance.

Septicemia was the leading cause of death, as reported in other burn studies.^[21] Mortality was associated with extensive TBSA involvement and deep burns. The study reinforces the need for early infection recognition, aseptic wound care, and rational antibiotic use.

A study by Taneja et al,^[22] from North India reported *Pseudomonas* (35%) and *Klebsiella* (25%) as leading pathogens, closely matching the present findings. Similarly, Ramirez-Blanco et al,^[23] emphasized that infections now account for nearly three-quarters of burn-related deaths globally.

The study was limited by its single-center design and modest sample size. Only commonly used antibiotics were tested due to resource constraints, and fungal infections were not evaluated.

CONCLUSION

Infections remain a predominant cause of morbidity and mortality among burn patients. *Klebsiella pneumoniae* was the most frequently isolated organism, exhibiting multidrug resistance. Continuous monitoring of microbial patterns and antibiotic sensitivity is essential for guiding empirical therapy. Strengthening infection control measures, antimicrobial stewardship, and burn care protocols can significantly improve patient outcomes in tertiary care centers.

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