



TRENDS AND INCIDENCE OF NOSOCOMIAL INFECTIONS IN BURN PATIENTS: A RETROSPECTIVE ANALYSIS

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ABSTRACT

Background: Nosocomial infections are significant complications in hospitalized burn patients, contributing to increased mortality, morbidity, and healthcare costs. Opportunistic pathogens, including *Pseudomonas aeruginosa*, *Acinetobacter*, and *Staphylococcus aureus*, are frequently associated with these infections, requiring effective management and prevention strategies. **Objective:** This study aimed to identify the bacterial pathogens responsible for nosocomial infections in burn patients admitted to IQ City Medical College, Durgapur, West Bengal, India, and evaluate changes in bacterial profiles over time. **Methods:** A descriptive study was conducted from 2016 to 2020, involving 82 burn patients. Data collected included age, total body surface area (TBSA) burned, severity of injury, hospital stay duration, ICU stay, mechanical ventilation, and survival status. Bacterial isolates from wound cultures were identified using standard microbiological techniques, including Agar, Eosin Methylene Blue, and Brain Heart Infusion (BHI) broth. Statistical analysis was performed using SPSS version 18. **Results:** A total of 406 bacterial isolates were identified, with *Pseudomonas aeruginosa* (40%), *Acinetobacter* (17%), and *Staphylococcus aureus* (16%) being the most common pathogens. The colonization rate of *Pseudomonas* and *Acinetobacter* increased from 67% in the first week to 98% by the fourth week. Positive cultures were significantly associated with prolonged hospital stays and higher mortality rates. Among patients with positive cultures, 12% died, primarily due to infections involving *Acinetobacter* and *Pseudomonas*. **Conclusion:** Nosocomial infections in burn patients are predominantly caused by multidrug-resistant pathogens, with colonization rates escalating over time. Effective infection control measures, including strict hand hygiene, environmental decontamination, timely antimicrobial therapy, and continuous surveillance, are critical in reducing infection rates and improving outcomes for this vulnerable population. Further research and educational initiatives are essential to enhance the management of burn wound infections.

Keywords: -Burn patients, Nosocomial infections, Microbial isolation, Antimicrobial resistance, *Pseudomonas*, *Acinetobacter*, *Staphylococcus aureus*

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INTRODUCTION

Hospitalized individuals are particularly vulnerable to nosocomial infections, which are frequent complications that significantly contribute to increased mortality and morbidity [1]. The immunosuppressive effects of burn injuries heighten the risk of hospital-acquired infections among hospitalized patients [2].

Nosocomial infections can extend the duration of hospital stays, escalate medical expenses, and necessitate prolonged treatment regimens [3]. Globally, burn injuries represent one of the most prevalent health concerns [4, 5].

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The sources of nosocomial infections in burn patients include the patient's endogenous (normal) flora, contaminants from the hospital environment, and transmission from healthcare workers. Effective management of burn wounds and appropriate patient care can influence the diversity and distribution of organisms in an individual over time [6].

During hospitalization, *Staphylococcus* species often dominate the burn wound flora, with *Pseudomonas aeruginosa* emerging as a leading pathogen. *P. aeruginosa* is a multidrug-resistant opportunistic pathogen that poses a significant threat to burn patients [5, 7]. Numerous studies have documented that *Staphylococcus aureus* accounts for the majority of nosocomial infections in this patient group [1, 8].

Investigations into nosocomial infections in burn patients were previously conducted at Taleghani Burn Hospital in Khuzestan province [9]. According to the National Nosocomial Infection Surveillance System (NNIS), the bacterial profiles of isolates from burn patients need continuous monitoring to ensure appropriate treatment strategies.

This study examined burn patients admitted to the Motahari Burn Center to identify the predominant bacteria responsible for nosocomial infections and to determine whether these bacterial patterns shifted during hospitalization. Although the study focused on a specific cohort, its findings are not broadly generalizable. Enhancing our understanding of the current epidemiological landscape is crucial for optimizing care and outcomes in this vulnerable patient population.

MATERIALS AND METHODS

A descriptive study was conducted at IQ City Medical College, Durgapur, West Bengal, India, from 2016 to 2020, to calculate the incidence of nosocomial infections per 1000 patient-days. Statistical analyses of the findings were performed using SPSS version 18. The medical records database was searched, and 82 patients admitted to the burn treatment centre were identified. For each admission, the following data were meticulously collected: age, total body surface area (TBSA) burned, severity score of the injury, length of hospital stay, duration of ICU stay, number of days requiring mechanical ventilation, presence of inhalation injuries, and survival status at discharge. Microbiology records were also reviewed to identify patients with cultures indicating microbial growth.

The National Nosocomial Infections Surveillance System (NNIS) recommends routine surveillance of nosocomial infections in burn units. This

study examined 82 patients, consisting of 27 women and 55 men. Most patients had burns covering more than 10% of their TBSA, with ages ranging from 1 to 88 years. All patients were hospitalized for a minimum of two weeks, with burns classified as at least second-degree, and the majority had third-degree burns. They were treated with a combination of a topical antiseptic solution and normal saline, accompanied by daily dressing changes. Prophylactic antibiotics, including mupirocin, were administered to prevent wound infections. Mupirocin, a topical antimicrobial, has been shown to be effective in preventing and treating wound sepsis in patients with second- and third-degree burns.

A 4-week follow-up period was employed to monitor active nosocomial infections and assess antibiotic efficacy during this time. Bacteria were isolated from wound samples using Agar, Eosin Methylene Blue, and Nutrient Agar in a standardised laboratory setting. Further identification of *Pseudomonas* and *Acinetobacter* species, along with Enterobacteriaceae detection, was conducted by incubating samples in Brain Heart Infusion (BHI) broth at 37 °C. This step ensured the accurate identification of pathogenic organisms associated with burn wound infections.

RESULTS

Hospitalizations for burn patients during the study period totalled 82 over the course of six months. There was a wide range of ages between 1 and 100. There was a range of (8%–100%) burn levels on average. Incidence of infection and burn extent had no statistically significant correlation ($P = .098$). There were 406 bacteria isolated in total. 175 isolates (40%) were *Pseudomonas*; 70 (17%) were *Acinetobacter*; 66 (16%) were *Staphylococcus aureus*; and 107 (27%) were other bacteria. 95 samples from 358 were identified as containing more than one type of bacteria. Among those whose cultures were positive within 48 hours of admission, 40 percent did not contain *Pseudomonas* or *Acinetobacter*. A statistically significant relationship was found between positive and negative cultures in this study. *Pseudomonas* and/or *Acinetobacter* were found in 67% of the patients within the first week. A percentage of 81, 84, and 98% was recorded in the second, third, and fourth weeks. In 45 blood cultures, 13 samples (29%) were positive for *Pseudomonas* (11 samples) and *Acinetobacter* (two samples). Among patients with positive cultures, 12% died. *Acinetobacter* was found in three samples and *Pseudomonas aeruginosa* and *Acinetobacter* in seven samples (Tables 1 and 2).

Table 1: 82 patients were characterized

Total number	82	
Male	55	68%

Female	27	32%
Age (yr)		
0–14	12	15%
15–29	30	36%
30–44	20	24%
45–59	12	15%
60–74	6	8%
75–87	2	2%
Range of total body surface area burned		
(Percentage)	32	39%
1–29	25	31%
30–50	8	10%
51–69	7	8%
70–100	10	12%
Electricity		

Table 2: In the first hours and other weeks, 82 patients were identified with different kinds of bacteria

	Pseudomonas		Acinetobacter		S. aureus		Pse + Aci + S. aureu s	Pse + Aci	Pse + S. aureu s	Aci + S. aureu s
	Total Pseudomon as isolated	Only Pseudomon as isolated	Total Acinetobact er isolated	Only Acinetobact er isolated	Total S. aure isolate d s	Only S. aure isolate d s				
First 48 hrs	2 (16%)	2 (16%)	1 (4%)	1 (4%)	9 (72%)	9 (72%)	-	-	-	-
Last of first week	24 (55.5%)	17 (34%)	10 (20.6%)	4 (9.2%)	14 (28.8 %)	8 (15.4 %)	1 (2%)	3 (6.1%)	4 (8.2%)	1 (3.1%)
Seco nd week	51 (55.1%)	30 (33.3%)	25 (27.8%)	10 (10.3%)	15 (16.9 %)	9 (9.2%)	1 (1.1%)	14 (15.3 %)	5 (5.4%)	1 (1.1%)
Third week	30 (64.8%)	18 (40.6%)	8 (18.6%)	1 (2.1%)	7 (16.4 %)	3 (5.4%)	1 (1.1%)	7 (14.2 %)	4 (8.7	1
Four th week	24 (58.3%)	13 (30.9%)	12 (27.3%)	3 (7.1%)	6 (14.2 %)	1 (1.2%)	1 (2.3%)	8 (17.8 %)	4 (10.7 %)	-

DISCUSSION

Patients with high-risk conditions, such as burns, are more likely to die from nosocomial infections in all countries. There are many dangers associated with burn site infections that can compromise a patient's survival and their ability to obtain a successful recovery after a reconstructive procedure. Burn patients are not adequately researched for nosocomial infections. Nosocomial infections are not well studied despite numerous epidemiological studies. As early as 2000, Tehran's burn hospital reported the first nosocomial infection. It is believed that *Pseudomonas* and *Acinetobacter* belong to the nosocomial bacteria group according to the CDC protocol [10]. The presence of *S. aureus* is one of the most common causes of nosocomial infections in burn patients. 40 percent of 82 patients after

admission in this study showed a positive culture without *Pseudomonas* and *Acinetobacter*. Dermatology Research and Practice reached 81 *Pseudomonas* and *Acinetobacter* samples owing to the replacement of positive cultures and colonization of negative cultures following the third week, and ultimately 98% by the fourth week. There are changes in bacteria genus and species in positive and negative cultures which represent nosocomial infections in burn wounds as a result of this issue [11]. In Iraq, *S. aureus* became the most prevalent agent [12], while *Pseudomonas* species were found to be most prevalent in England [13] and Turkey. The importance of isolation was higher [14]. Patients with catheter-related infections were the most likely to be infected with *Acinetobacter* in Sao Paulo [15]. It is estimated that 20 of these patients (12%) died from third degree burns, which is 65%.

Acinetobacter and Pseudomonas were both cultured positive in all of them at least once. There has been a decline in the mortality rate associated with burns among burn patients. Studies conducted in the past have indicated a 19% percentage for Tehran hospitals, and 34.45% for the south west of Iran in 2000 [16].

Various strategies, such as hand hygiene and altering the hospital environment, might prove particularly useful in reducing nosocomial infections [17]. Infections in burn patients may be affected by factors such as the patient's age, gender, smoking history, nutritional status, and underlying diseases such as diabetes, chronic kidney disease, and liver disease [18]. Direct or indirect contact with unsuitable decontaminated equipment or their hands is the primary way burn patients get infected. In addition to being vulnerable to colonization by organisms in the surroundings, burn patients also tend to disperse them. Burn injuries, in general, will disperse a greater amount of organisms into the environment because of the size of the wound. Providing appropriate diagnostics and medical therapy can also reduce nosocomial infections.

CONCLUSION

Nosocomial infections remain a significant challenge in the care of burn patients, contributing to

increased morbidity, mortality, and healthcare costs. This study highlights the critical role of opportunistic pathogens, particularly *Pseudomonas aeruginosa*, *Acinetobacter*, and *Staphylococcus aureus*, in the development of hospital-acquired infections in burn wounds. The findings demonstrate that the distribution of these pathogens changes over time, with colonization rates increasing significantly during prolonged hospital stays. Effective strategies, such as strict adherence to hand hygiene, use of appropriate antiseptics, timely administration of prophylactic antibiotics, and continuous environmental decontamination, are essential to mitigate the risk of infections.

Additionally, factors such as the patient's age, extent of burns, presence of underlying conditions, and length of hospital stay were identified as critical contributors to infection risk. The study underscores the importance of routine surveillance, early diagnosis, and targeted antimicrobial therapy to improve outcomes. Future efforts should focus on enhancing infection control measures, investing in research on burn wound management, and promoting educational initiatives for healthcare professionals to optimise care for this vulnerable population.

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