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Bacterial Profiles and Antibiotic Susceptibility Pattern of Wound Infections Admitted at Tertiary Teaching Hospital in Dhaka City of Bangladesh

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Abstract

Background: Wound infections remain a significant health concern, often developing or worsening when harmful microorganisms invade the injured tissue and are complicated by antimicrobial resistance. Knowledge of the microbial profile and antibiotic susceptibility patterns is essential for effective management. **Objective:** The purpose of the present study was to determine the prevalence, microbial profile, and antibiotic susceptibility patterns of bacteria isolated from wound infections in patients attending ZH Shikder Women's Medical College Hospital, Dhaka, Bangladesh. **Methodology:** This observational study was carried out in the Department of Microbiology at Zainul Haque Sikder Medical College Hospital, Dhaka, Bangladesh over six months from July to December 2024. A total of 65 wound swab samples were collected from patients visiting both the outpatient and inpatient departments. Along with the samples, socio-demographic information and laboratory data, such as bacterial isolates and their antibiotic susceptibility patterns, were recorded using a standardized form. Samples were cultured on Blood agar and MacConkey agar, and organisms were identified using standard microbiological techniques. Antibiotic susceptibility testing was performed by the disc diffusion method according to CLSI guidelines. **Results:** Out of 64 analyzed samples, bacterial growth was observed in 70.3% cases. The majority of participants were aged 21 to 40 years, with males slightly outnumbering females. Among 45 bacterial isolates, *Staphylococcus aureus* was predominant (58%), followed by *Pseudomonas aeruginosa* (17.7%), *Klebsiella* species (13.3%), and *Escherichia coli* (11.1%). Gram-positive isolates were most sensitive to vancomycin (65.0%), gentamicin (65.0%), and amikacin (58.0%). Among Gram-negative isolates, *Pseudomonas* species showed the highest susceptibility to colistin and piperacillin-tazobactam (87.5%). In contrast, Klebsiella species showed susceptibility to imipenem, amikacin, and colistin (83.3%), and Escherichia coli showed susceptibility to imipenem (100.0%). Cephalosporin generally demonstrated limited activity. **Conclusion:** In conclusion, *Staphylococcus aureus* and *Pseudomonas* species are the predominant pathogens in wound infections. [*Bangladesh Journal of Infectious Diseases, June 2025;12(1):52-56*]

Keywords: Wound infection; surgical wound infection; antimicrobial resistance; drug susceptibility testing; *Staphylococcus aureus*; *Pseudomonas aeruginosa*; *Klebsiella pneumoniae*; *Escherichia coli*

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Introduction

Wound infection is a common health issue that arises when microorganisms enter the body through a break in the skin.[1] Wounds can be classified as accidental, pathological, or postoperative[2], and provide a warm, humid environment that favors microbial colonization and proliferation[3]. Trauma is the most common underlying cause of wounds, with intentionally induced trauma including hospital-acquired wounds such as surgical wounds or those from intravenous medical devices, and non-intentionally induced wounds including pressure sores[4].

The wound microbiome refers to the specific community of microorganisms, including bacteria and fungi, present in and around a wound[5]. A wound can be considered infected if purulent material is observed, even without confirmation from culture[6]. Common bacterial pathogens associated with wound infection include *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Streptococcus pyogenes*, *Proteus* species, other *Streptococcus* species, and *Enterococcus* species[7].

The International Wound Infection Consensus Update 2022 reports that wound infection continues to be challenging for patients, their families, and healthcare professionals, often leading to delayed healing, repeated hospital visits, and increased healthcare costs[8]. Despite advances in infection control, the problem persists due to the emergence of antimicrobial resistance[9]. Recent studies have shown that a significant proportion of bacteria isolated from infected wounds exhibit resistance to critical antibiotics, including WHO priority pathogens[10]. Misuse of antibiotics, including over-the-counter access, further exacerbates resistance[11]. Therefore, identification of antimicrobial resistance patterns from isolates is crucial. This study aimed to determine the etiology and antimicrobial susceptibility pattern of pathogens associated with wound infections in patients attending a teaching hospital in Dhaka city.

Methodology

Study Settings and Population: This observational study was carried out in the Department of Microbiology at Zainul Haque Sikder Medical College Hospital, Dhaka, over six months from July to December 2024. A total of 65 wound swab samples were collected from patients visiting both the outpatient and inpatient departments. Along with the samples, socio-demographic information and laboratory data, such as bacterial isolates and their antibiotic susceptibility patterns, were recorded using a standardized form.

Study Procedure: All samples were carefully transported to the microbiology laboratory for analysis. They were cultured on Blood agar and MacConkey agar and incubated aerobically at 37°C for 24 hours. Bacterial identification was performed using standard microbiological methods, including colony morphology, Gram staining, and biochemical tests such as catalase, coagulase, oxidase, triple sugar iron (TSI) agar, MIU, and Simmon’s citrate agar tests. Antimicrobial susceptibility testing was carried out using the disc diffusion method following the Clinical and Laboratory Standards Institute (CLSI) guidelines[12].

Statistical Analysis: The collected data were organized according to patient characteristics and bacterial isolates. Data analysis was performed using Microsoft Excel, and the results were summarized using tables and percentages to provide a clear overview of the findings.

Ethical Consideration: The study was approved by the Institutional Review Board (IRB) of Zainul Haque Sikder Medical College Hospital. Patient privacy was strictly maintained by using coded data, ensuring that no personal identifiers were disclosed.

Results

Bacterial growth was detected in 70.3% of the 64 wound swab samples (Table 1).

Table 1: Frequency of Bacterial Isolates in Wound Swab (n=64)

Culture	Frequency	Percent
Growth	45	70.3
No growth	19	29.7
Total	**64**	**100**

Most participants were adults aged 21 to 40 years, with males slightly outnumbering females in this age group (Table 2).

Table 2: Age and Gender Distribution of Study Population

Age Group	Male	Female
Less Than 20 Years	10(25.0%)	4(16.7%)
21 to 40 Years	16(40.0%)	10(41.7%)

Age Group	Male	Female
41 to 60 Years	12(30.0%)	3(12.5%)
More Than 61 Years	2(5.0%)	7(29.1%)
Total	**40(100.0)**	**24(100.0)**

Among 45 wound isolates, *Staphylococcus aureus* was predominant (58%), followed by *Pseudomonas aeruginosa* (17.7%), *Klebsiella* species (13.3%), and *Escherichia coli* (11.1%). Gram-positive *S. aureus* dominated, while Gram-negative bacteria collectively accounted for 42.0% of isolates (Table 3).

Table 3: Pattern of Bacterial Growth among Total Samples

Isolates	Frequency	Percent
Staphylococcus aureus	26	58.0
Pseudomo. aeruginosa	8	17.7
Klebsiella species	6	13.3
Escherichia coli	5	11.1
Total	**45**	**100.0**

Pseudomo.=*Pseudomonas aeruginosa*

In the 26 *Staphylococcus aureus* isolates, vancomycin and gentamicin showed the highest effectiveness (65.0%), while amikacin, levofloxacin, and meropenem retained moderate activity (58.0%). Cefuroxime was effective in half of the cases, whereas ciprofloxacin and other cephalosporins showed limited activity, with ceftazidime being the least effective (4.0%) (Table 4).

Table 4: Antibiotic Sensitivity Pattern of Gram-Positive Bacteria

Antibiotics	Frequency	Percent
Amikacin	15	58.0
Amoxyclav	11	42.0
Azithromycin	3	12.0
Cefuroxime	13	50.0
Cefixime	3	12.0
Ceftriaxone	5	19.0
Ceftazidime	1	4.0
Cefepime	7	27.0
Cephradin	6	23.0
Gentamicin	17	65.0
Levofloxacin	15	58.0
Ciprofloxacin	10	39.0
Meropenem	15	58.0
Vancomycin	17	65.0

The antibiotic susceptibility of Gram-negative bacteria isolated from wound infections is summarized**.** *Pseudomonas* species showed the highest susceptibility to colistin and piperacillin–tazobactam (87.5%), with Imipenem and Amikacin also effective. *Klebsiella* species responded best to imipenem, amikacin, and colistin (83.3%), while *Escherichia coli* was uniformly sensitive to imipenem (100.0%) and highly susceptible to colistin and piperacillin–tazobactam (80.0%). Overall, cephalosporin generally demonstrated limited activity across all three species (Table 5).

Table 5: Antibiotic Sensitivity Pattern of Gram-Negative Bacteria

Antibiotics	*Pseudomo.*	*Klebsiella*	*E. coli*
Amikacin	75.0%	83.3%	60.0%
Amoxyclav	37.5%	16.7%	40.0%
Cefuroxime	0.0%	16.7%	0.0%
Cefixime	0.0%	16.7%	0.0%
Ceftriaxone	0.0%	50.0%	0.0%
Ceftazidime	37.5%	0.0%	40.0%
Cefepime	25.0%	33.3%	20.0%
Cephradin	0.0%	33.3%	20.0%
Gentamycin	50.0%	83.3%	20.0%
Ciprofloxacin	37.5%	66.7%	40.0%
Imipenem	75.0%	83.3%	100.0%
Colistin	87.5%	83.3%	80.0%
PP TZ	87.5%	66.7%	80.0%

Pseudomo.=*Pseudomonas aeruginosa; E.coli=Escherichia coli*

Discussion

One of the major concerns in health care is wound infection. In Bangladesh, prescribing antimicrobials unnecessarily is a scenario of day-to-day life. In spite of proper application of basic principles of wound care, several patients develop infections, needing proper identification of the organisms for appropriate management. In this study, among 64 samples 45(70.3%) were culture positive. This culture positivity rate in our study is in accordance with the other studies of Dessanlegn et al[13] and Seni[14] which are 71.0% and 68.8% respectively.

The incidence of wound infection in males (62.5%) is higher than in females (37.5%)[15]. In another study, it was reported higher infection rate was reported in males (65.6%) than (34.4%) female which is similar to this study. This could be due to males being more prone to being involved in physical activities in outdoor places. So, they are exposed to the contaminated environments, which is an aggravating factor of wound infection.

In this study, most wound infections occurred in the 21 to 40 years age group, which is consistent with earlier reports showing higher susceptibility in individuals from their twenties to forties[15]. This age range is considered particularly vulnerable, as people are actively engaged in diverse occupations and daily activities that increase their risk of sustaining wounds.

Our findings showed *Staphylococcus aureus* as the leading pathogen in wound infections, which is in line with earlier studies by Sultana et al[16], Shriyan et al[17], Noroozi and colleagues[18]. This dominance is understandable, as *Staphylococcus aureus* naturally forms part of the skin and nail flora. *Pseudomonas aeruginosa* was the next most frequent isolate (17.7%), followed by *Klebsiella* species and *Escherichia coli*, similar to the results reported by Obi[19] and Nobel et al[20] also observed *Pseudomonas* species as the predominant gram-negative organism in wound infection.

In our study, *Staphylococcus aureus* isolates were 85.0% sensitive to vancomycin, amikacin (75.0%) and gentamycin (85.0%), and less sensitive to ciprofloxacin (50.0%), cefepime (35.0%), cephradin 30.0%, ceftriaxone (25.0%), and ceftazidime (5.0%). This study was in agreement with the work of Sultana et al[16]. Another study showed complete sensitivity to vancomycin and amikacin[21]. Our study closely resembles the studies mentioned above. Poor performance of commonly used antibiotics such as ceftriaxone, cephradine, ceftazidime, and ciprofloxacin may be due to the development of resistance resulting from mutation of drug target site. So, these drugs fail to exert expected antimicrobial activities. Pronounced susceptibility of *Staphylococcus aureus* to vancomycin, amikacin, and gentamycin may be due to less availability, cost, and toxic effect[21].

Pseudomonas aeruginosa isolates were susceptible to Imipenem 75.0%, amikacin 75.0%, and colistin 87.5%. Sultana et al[16] also reported a variable susceptibility pattern with imipenem 70.58%, amikacin 73.52%, and colistin (70.58%) for *Pseudomonas aeruginosa*. These results are in accordance with our study.

Conclusion

This study revealed that a diverse range of bacteria was identified in wound infection. Among them Staphylococcus aureus was found to be predominant, showing the highest level of sensitivity to vancomycin, gentamycin, followed by amikacin, levofloxacin, and meropenem. Among Gram-negative pseudomonas was the most common isolates were the highest sensitivity to piperacillin-tazobactam, Colistin, followed by Imipenem. Knowing the prevalent type of microorganism and its susceptibility pattern in infected wounds is helpful in the rational use of antibiotics. Thus, the wound infection was managed effectively.

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None

Conflict of Interest
The authors have no relevant conflicts of interest to declare.

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None

Authors' contributions
Samia Afreen Khan: Conceptualization, Supervision, Investigation, Data curation, Resources; Samia Afreen Khan : Writing - original draft, Formal analysis, Validation, Methodology, Funding acquisition, Visualization, Project administration; Nesar Ahmed Khan Ashekin, Mst. Junnatul Ferdus: Writing - review & editing, Validation; Sharmin Shanjana, Dr Mst. Junnatul Ferdus: Investigation, Data curation, Software. All authors read and approved the final manuscript.

Data Availability
Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate
Ethical approval for this study was obtained from the Ethical Committee of State University of Bangladesh. Written informed consent was obtained from all participants prior to their inclusion in the study.

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