SAS Journal of Surgery
Abbreviated Key Title: SAS J Surg
ISSN 2454-5104
Journal homepage: https://www.saspublishers.com

Surgery

Sensitivity Patterns of Different Types of Bacterial Organisms

Lt. Colonel Md. Kamruzzaman[1]*, Colonel Abdullah Al Mamun[2], Lt. Colonel Kazi Shafiqul Alam[3], Dr. Sadia Afrin[4]

[1]Classified Specialist in Surgery, Department of General Surgery, Combined Military Hospital, Dhaka Cantonment, Dhaka, Bangladesh
[2]Assistant Director Medical Services (Army), Medical Directorate, Army Headquarters, Dhaka, Bangladesh
[3]General Staff Officer-1 (Med) & Surgical Specialist, Department of Surgery, Combined Military Hospital, Mymensingh Cantonment, Mymensingh, Bangladesh
[4]Lecturer, Department of Anatomy, Homeopathic Medical College, Mirpur, Dhaka, Bangladesh

DOI: https://doi.org/10.36347/sasjs.2026.v12i09.008 | **Received:** 13.08.2026 | **Accepted:** 21.09.2026 | **Published:** 24.09.2026

***Corresponding author:** Lt. Colonel Md. Kamruzzaman
Classified Specialist in Surgery, Department of General Surgery, Combined Military Hospital, Dhaka Cantonment, Dhaka, Bangladesh

Abstract **Original Research Article**

Background: Infections of wounds have long been recognized as a leading source of illness, especially in trauma patients, but are becoming further complicated due to antimicrobial resistance. Knowing the microbial flora and its sensitivity to antibiotics is important to guide empirical treatment. ***Methods:*** This hospital-based cross-sectional study was done in the Trauma Management Centre, under the Surgery Department, Combined Military Hospital, Dhaka from August 2024 to January 2025. Total 100 patients who had wound infections were included in the study through a convenience sampling technique. Following asceptic precaution the pus samples were collected, used for culture and identification of the causative bacteria. Sensitivity testing of antibiotic was done through Kirby–Bauer disc diffusion technique. ***Results:*** All the subjects were males with an average age of 26.28 ± 8.58 years. Gram negative bacteria were prevalent (80%), among which Acinetobacter spp. and Klebsiella spp. were the most common (22% each), followed by Pseudomonas spp. (16%). S. aureus constituted 20%. Colistin showed maximum sensitivity (68%), followed by imipenem (36%), whereas, ciprofloxacin (26%), ceftriaxone (24%) and amikacin (24%) showed low sensitivity. Colistin was 100% sensitive to Pseudomonas spp. and Acinetobacter spp. Ceftriaxone (76%) and ciprofloxacin (74%). shown high resistance rates. ***Conclusion:*** Gram-negative bacteria, especially Acinetobacter and Klebsiella species, prevailed and showed high resistance to various antibiotics. The two most effective drugs, colistin and imipenem, underscored the need for judicious use of antibiotics and therapeutic cultures.

Keywords: Wound infection, antibiotic sensitivity, antimicrobial resistance, Gram-negative bacteria, colistin.

INTRODUCTION

Infections in wounds continue to be a major contributor to morbidity across the world especially in developing nations due to their underdeveloped health care systems and poor infection control measures [1]. Such infections are likely to prolong wound healing process, extend hospital stay and ultimately result in complications including sepsis, when not properly managed [2]. The development of antimicrobial resistance among many of these bacterial pathogens has posed additional problems also in the management of such infections [3].

Pus for culture and sensitivity test is very essential tools for the identification of the causative organism of those infections also determination of the antibiotic sensitivity patterns and thus guiding appropriate anti- microbial treatment for the problem [4]. Some organisms that cause wound infections are Staphylococcus aureus, Klebsiella spp, Pseudomonas spp, Proteus spp and Acinetobacter spp [5]. Most of these organisms show some degree of antibacterial resistance to various antibiotics used now a days, which causes problem in the management of that kind of infections [6].

Now a days overuse as well as the misuse of antimicrobial drugs and absence of their antimicrobial stewardship program have been identified as an important factor which is responsible for the development of MDR bacterial pathogens [7]. Antibiotics resistance reduces not only treatment option of infections but is a matter of daunting challenge regarding public health [8]. Regular monitoring and surveillance for bacterial pathogen and their sensitivity patterns, thus an important factor for choosing empirical antibiotic therapy and formulation of an effective local antibiotic policy for an advanced health care centre [9].

Purpose of our study was to find out the antibiotic sensitivity pattern of bacterial isolates from wound swab or pus of infected wounds.

Methodology & Materials

The current hospital-based study was done at the Trauma Management Center in the General Surgery Department of CMH, Dhaka, for the duration of six months from August 2024 to January 2025. The study population were the patient suffering from infected wounds who are the victim of July 2024 antidiscrimination student movement who has traumatic wounds in different parts of the body due to bullets and shotguns injury and are managed initially in various hospital before admitted in trauma management center, CMH, Dhaka [10]. Total 100 patients were included in this study using appropriate sampling technique.

Inclusion criteria were all age and sex of patient who were admitted to trauma management center, CMH, Dhaka with infected wounds and whose pus samples as well as wound swab were feasible for culture and sensitivity tests. Our exclusion criteria included the patients who had treated with prolong antibiotics therapy before sample collection, also had unsatisfactory or contaminated samples, inadequate laboratory data and non-growth of bacteria. with all aseptic precaution wound swab or pus samples were collected and promptly send to the microbiology laboratory of armed forces institute of pathology for the determination of bacteria using conventional microbiological methods [11,12]. Then growth for antibiotic sensitivity test was done by the Kirby–Bauer disc diffusion method according to CLSI guidelines and the results were enrolled as Sensitive, Resistant, or Not done.

All demographic variables, type of bacterial isolates as well as antibiotic sensitivity results were documented in a structured data collection sheet. The key outcome variables included types of bacteria and their resistance patterns, and possible confounders included age, sex, previous usage of antibiotics, type and duration of wound as well as surgery. The data was entered into Microsoft Excel software and analyzed using SPSS version 26, where descriptive statistics like frequency, percentages, means and standard deviations were used. Quality was ensured by adherence to standard operating procedures, use of quality control strains, proper calibration of equipment and supervision by experienced microbiologists. Ethical approval was obtained and confidentiality of patient information was strictly maintained.

Results

Table I: Sex Distribution of Our Study Participants (n=100)

Sex	Frequency (n)	Percentage (%)
Male	100	100.0
Female	0	0.0

Table I shows the sex distribution of the 100 study participants. All patients were male (100%, n=100), with a male-to-female ratio of 100:0.

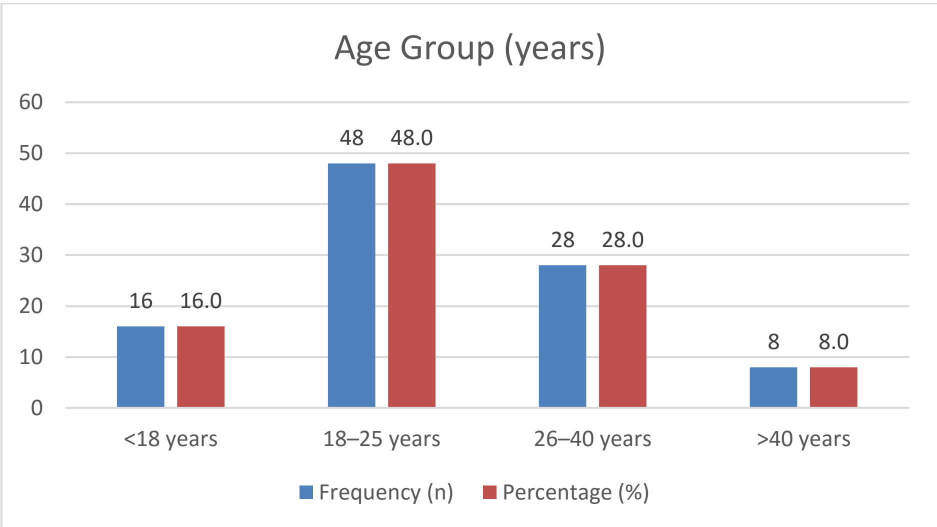

Figure 1: Age Group Distribution of Our Study Participants (n=100)

Figure 1 presents the age distribution of the 100 participants. The mean age was 26.28 ± 8.58 years (range: 13–48 years). The commonest age group found 18–25 years (48%, n=48), followed by 26–40 years (28%, n=28), <18 years (16%, n=16) and >40 years (8%, n=8).

Table II: Distribution of Bacterial Isolates (n=100)

Organism Category	Frequency (n)	Percentage (%)
Gram-negative	80	80.0
— Acinetobacter spp.	22	22.0
— Klebsiella spp.	22	22.0
— Pseudomonas spp.	16	16.0
— Escherichia coli	10	10.0
— Proteus spp.	8	8.0
— Burkholderia cepacia	2	2.0
Gram-positive (S. aureus)	20	20.0
Total	100	100.0

Table II shows the distribution of bacterial isolates obtained from clinical specimens. Gram-negative organisms predominated, accounting for 80% (n=80) of all isolates, while Gram-positive organisms (*Staphylococcus aureus*) constituted 20% (n=20). Among Gram-negatives, Acinetobacter spp. and Klebsiella spp. were the most frequent (22% each, n=22), followed by Pseudomonas spp. (16%, n=16), Escherichia coli (10%, n=10), Proteus spp. (8%, n=8) and Burkholderia cepacia complex (2%, n=2).

Table III: Overall Antibiotic Sensitivity Pattern (n=100)

Antibiotic	Sensitive %	Resistant %	Not Done %
Ciprofloxacin	26.0	74.0	0.0
Ceftriaxone	24.0	76.0	0.0
Amikacin	24.0	62.0	14.0
Imipenem	36.0	46.0	18.0
Colistin	68.0	12.0	20.0

Table III summarizes the antibiotic sensitivity pattern among 100 bacterial isolates. Colistin demonstrated the highest sensitivity rate (68.0%), followed by imipenem (36.0%). Ciprofloxacin (26.0%), ceftriaxone (24.0%) and amikacin (24.0%) showed poor overall sensitivity. Rate of resistance found highest in case of ceftriaxone (76.0%) and ciprofloxacin (74.0%). Notably, 14.0% of specimens were not tested for amikacin, 18.0% for imipenem and 20.0% for colistin.

Table IV: Sensitivity by Organism (%)

Antibiotic	Pseudomonas spp. (n=16)	Acinetobacter spp. (n=22)	Staphylococcus aureus (n=20)
Ciprofloxacin	25.0 (4/16)	0.0 (0/22)	50.0 (10/20)
Ceftriaxone	12.5 (2/16)	0.0 (0/22)	80.0 (16/20)
Amikacin	12.5 (2/16)	18.2 (4/22)	10.0* (2/20)
Imipenem	25.0 (4/16)	54.5 (12/22)	10.0** (2/20)
Colistin	100.0 (16/16)	100.0 (22/22)	— (not tested)

Table IV presents the antibiotic sensitivity patterns for the three most clinically relevant organisms. Colistin showed 100% sensitivity against both Pseudomonas spp. (16/16) and Acinetobacter spp. (22/22). Imipenem demonstrated moderate activity against Acinetobacter spp. (54.5%, 12/22) but lower activity against Pseudomonas spp. (25.0%, 4/16). Ceftriaxone was highly effective against S. aureus (80.0%, 16/20) but ineffective against Acinetobacter spp. (0%) and Pseudomonas spp. (12.5%). Ciprofloxacin showed 50% sensitivity in S. aureus (10/20) but only 25% in Pseudomonas spp. (4/16) and 0% in Acinetobacter spp. (0/22). Amikacin had low activity among all three organisms, with sensitivities ranging from 10% to 18.2%.

DISCUSSION

In our study, the bacteriology and the sensitivity profile of patients that has wounds which was infected, undergone investigated, and the study found a preponderance of Gram-negative bacterial organism (80%), and Staphylococcus aureus comprised of 20%. This is similar to previous research studies where the major clinical pathogens isolated were Gram negative bacteria. For example, Islam *et al.,* and Hossain *et al.,* had previously reported a high prevalence of Gram-negative bacteria in clinical infections [13,14]. The high percentage of Acinetobacter spp. and Klebsiella spp. (22% each) is also found the report of Khan et al., who isolated these organisms as major contributors to wound infections and soft tissue infections [15].

The preponderance of Gram-negative bacteria in this study can be attributed to the type of wounds and exposure to hospitals, which makes the patients vulnerable to opportunistic and nosocomial infections. As mentioned in Mende et al.'s article, trauma patients are prone to infections from multi-drug resistant (MDR) organisms like Acinetobacter and Pseudomonas [16].

In terms of antibiotic susceptibility, the results of our study revealed that colistin was the most susceptible (68%), followed by imipenem (36%), whereas commonly used antibiotics like ciprofloxacin (26%), ceftriaxone (24%) and amikacin (24%) were less susceptible. These results are similar with other studies carried out under same conditions. In our study, we have found resistance to ciprofloxacin were 74% and to ceftriaxone were 76% which was very high, where in other reported studies, high rate of resistance towards fluoroquinolones and third-generation cephalosporins were also seen [17,18]. This pattern is associated with irrational usage of these antibiotics, as discussed by Rashid et al., who stated that misuse of "Watch group" antibiotics is related with increasing resistance [19].

Colistin being highly sensitive in this study is also seen in the results of other studies by Alhazmi *et al.,*and Atlaw et al., which indicated that colistin is amongst the most efficacious agents against MDR Gram negative organisms [20,21]. In our study, 100% susceptibility towards colistin against Pseudomonas and Acinetobacter species was recorded. However, reliance on such reserve drugs raises concerns about the future emergence of resistance, as noted by Assefa, who discussed the growing threat of MDR Gram-negative infections [22].

Imipenem showed moderate effectiveness overall (36%), with better activity against Acinetobacter spp. (54.5%) compared to Pseudomonas spp. (25.0%). This result is also supported by Abdulfatai *et al.,* who also observed variable sensitivity of carbapenems among Gram-negative isolates [23]. The declining effectiveness of carbapenems is alarming and indicates the possible emergence of carbapenem-resistant organisms.

In contrast, ceftriaxone and ciprofloxacin showed poor effectiveness against Gram-negative organisms in our study, although ceftriaxone demonstrated relatively high sensitivity (80%) against S. aureus. Same variability also been reported by Mahmud et al., where Gram-positive organisms retained better sensitivity to certain antibiotics compared to Gram-negative bacteria [24]. Also, sensitivity to ciprofloxacin was 50% in S. aureus, but far lower (25%) in Pseudomonas spp. and absent in Acinetobacter spp. The results match those of Fakron, who found increasing resistance of both Gram positive and negative bacteria to fluoroquinolones [25].

Sensitivity to amikacin ranged between low and moderate (10–18.2%) among the major pathogens of the study, matching results of Khan *et al.,*on declining efficacy of aminoglycosides due to increased resistance [15]. The problem is indicative of the limited range of treatments available for MDR infections.

In summary, the results of our study indicate the importance of the antimicrobial resistance issue, especially of Gram-negative bacteria in trauma-associated infections. The high resistance to common antibiotics and the dependence on limited resort antibiotics namely colistin demonstrate the pressing need for rational use of antibiotics. Continuous monitoring of the bacterial profile and its sensitivity as recommended by Salam *et al.,* is necessary [26].

Limitations

There are few limitations may be associated with this study, which should be accounted for when interpreting the results obtained. In particular, being a single-center study performed in a dedicated trauma care environment, the results cannot be generalized to other health care facilities or community settings. The selected sample of the population was also characterized by certain injury patterns that might influence the pattern of distribution and antibiotic resistance among the bacteria.

Conclusion

The current paper demonstrates a prevalence of Gram-negative organisms among the species which were isolated from the infected wounds with a high degree of resistance to frequently used antibiotics such as ceftriaxone and ciprofloxacin. At the same time, colistin and imipenem are the most effective antibiotics, which indicates an alarming trend toward the development of dependence on last-line drugs. Hence, this study result proves the necessity of routine culture and sensitivity tests, proper antibiotic therapy, and antimicrobial stewardship.

Financial Support and Sponsorship: No funding sources.

Conflicts of Interest: No conflicts of interest are associated with this study.

References

1. Maharjan N, Mahawal BS. Bacteriological profile of wound infection and antibiotic susceptibility pattern of various isolates in a tertiary care center. Journal of Lumbini Medical College. 2020 Oct 29;8(2):218-24.
2. Rajput K, Johri S, Goyal A. Identification of bacterial isolates and their antimicrobial susceptibility pattern from wound/pus sample in a tertiary care hospital, Gwalior, India. Annals of the National Academy of Medical Sciences (India). 2023 Apr;59(02):097-103.
3. Tameez-ud-Din A, Sadiq A, Chaudhary NA, Bhatti AA, Lehrasab RS, Khan MT. Bacteriological profile and antibiotic sensitivity pattern of pus samples in a tertiary care hospital. Journal of Rawalpindi Medical College. 2020 Dec 12;24(1):18-22.
4. Jobayer M, Rahman M, Akter N, Shareef N, Rana RA, Shamsuzzaman SM. Organisms isolated from wound swab and pus with their antibiotic susceptibility pattern in a tertiary care hospital of Bangladesh. Bangladesh Med Res Counc Bull. 2021 May 17; 47:181-7.

5. Ghimire G, Chaudhary RP, Lekhak B. Bacteriological profile and antibiotic susceptibility pattern of isolates of wound infection in children visiting Kanti Children Hospital. Tribhuvan University Journal of Microbiology. 2020 Dec 27;7:123-32.
6. Maharjan B, Karki ST, Maharjan R. Antibiotic susceptibility pattern of Staphylococcus aureus isolated from pus/wound swab from children attending International Friendship Children's Hospital. Nepal Journal of Biotechnology. 2021 Jul 31;9(1):8-17.
7. Huda N, Yusuf MA, Sultana H, Hossain M andalib S. Antimicrobial sensitivity pattern of bacteria isolated from pus sample collected from a private diagnostic laboratory in Rangpur district of Bangladesh. Bangladesh Journal of Infectious Diseases. 2021;8(2):64-70.
8. Shimekaw M, Tigabu A, Tessema B. Bacterial profile, antimicrobial susceptibility pattern and associated risk factors among patients with wound infections at Debre Markos Referral Hospital, Northwest, Ethiopia. The International Journal of Lower Extremity Wounds. 2022 Jun;21(2):182-92.
9. Gebissa T, Bude B, Yasir M, Mekit S, Noorulla KM. Bacterial isolates and their antibiotic sensitivity pattern of surgical site infections among the surgical ward patients of Asella Referral and Teaching Hospital. Future Journal of Pharmaceutical Sciences. 2021 May 8;7(1):100.
10. World Health Organization. Global guidelines for the prevention of surgical site infection. Geneva: World Health Organization; 2016.
11. Clinical and Laboratory Standards Institute (CLSI). Performance standards for antimicrobial susceptibility testing. 33rd ed. Wayne (PA): CLSI; 2023.
12. Magiorakos AP, Srinivasan A, Carey RB, Carmeli Y, Falagas ME, Giske CG, *et al.,*Multidrug-resistant, extensively drug-resistant and pandrug-resistant bacteria: an international expert proposal for interim standard definitions for acquired resistance. Clin Microbiol Infect. 2012;18(3):268–81.
13. Islam MA, Islam MR, Khan R, Amin MB, Rahman M, Hossain MI, Ahmed D, Asaduzzaman M, Riley LW. Prevalence, etiology and antibiotic resistance patterns of community-acquired urinary tract infections in Dhaka, Bangladesh. Plos one. 2022 Sep 15;17(9):e0274423.
14. Hossain MJ, Azad AK, Shahid MS, Shahjahan M, Ferdous J. Prevalence, antibiotic resistance pattern for bacteriuria from patients with urinary tract infections. Health Science Reports. 2024 Apr;7(4):e2039.
15. Khan RM, Dodani SK, Nadeem A, Jamil S, Zafar MN. Bacterial isolates and their antimicrobial susceptibility profile of superficial and deep-seated skin and soft tissue infections. Asian Biomedicine. 2023 Sep 17;17(2):55-63.
16. Mende K, Akers KS, Tyner SD, Bennett JW, Simons MP, Blyth DM, Li P, Stewart L, Tribble DR. Multidrug-resistant and virulent organisms trauma infections: trauma infectious disease outcomes study initiative. Military medicine. 2022 May 1;187(Supplement_2):42-51.
17. Majumder MM, Mahadi AR, Ahmed T, Ahmed M, Uddin MN, Alam MZ. Antibiotic resistance pattern of microorganisms causing urinary tract infection: a 10-year comparative analysis in a tertiary care hospital of Bangladesh. Antimicrobial Resistance & Infection Control. 2022 Dec 10;11(1):156.
18. Faruk O, Hasan SE, Jubayer A, Akter K, Al Shiam SA, Rahman K, Ali MY. Microbial isolates from urinary tract infection and their antibiotic resistance pattern in Dhaka city of Bangladesh. Journal of Knowledge Learning and Science Technology ISSN: 2959-6386 (online). 2023 Dec 20;2(3):76-87.
19. Rashid MM, Akhtar Z, Chowdhury S, Islam MA, Parveen S, Ghosh PK, Rahman A, Khan ZH, Islam K, Debnath N, Rahman M. Pattern of antibiotic use among hospitalized patients according to WHO access, watch, reserve (AWaRe) classification: findings from a point prevalence survey in Bangladesh. Antibiotics. 2022 Jun 16;11(6):810.
20. Alhazmi AH, Alameer KM, Abuageelah BM, Alharbi RH, Mobarki M, Musawi S, Haddad M, Matabi A, Dhayhi N. Epidemiology and antimicrobial resistance patterns of urinary tract infections: a cross-sectional study from Southwestern Saudi Arabia. Medicina. 2023 Aug 2;59(8):1411.
21. Atlaw A, Kebede HB, Abdela AA, Woldeamanuel Y. Bacterial isolates from diabetic foot ulcers and their antimicrobial resistance profile from selected hospitals in Addis Ababa, Ethiopia. Frontiers in Endocrinology. 2022 Aug 31;13:987487.
22. Assefa M. Multi-drug resistant gram-negative bacterial pneumonia: etiology, risk factors and drug resistance patterns. Pneumonia. 2022 May 5;14(1):4.
23. Abdulfatai K, Sanusi SB, Usman A, Lawal SM, Idris H. Prevalence and antimicrobial susceptibility pattern of Klebsiella pneumoniae and Pseudomonas aeruginosa among women with urinary tract infections attending antenatal care in Kaduna, Nigeria. Science World Journal. 2023 Apr 13;18(1):114-9.
24. Mahmud F, Shila S, Islam MM, Ali MR. Investigation of the prevalence of different bacterial infections, causative bacterial species and reveal their antimicrobial susceptibility pattern: A hospital-based study at Tangail district, Bangladesh. The Microbe. 2025 Jul 16:100451.
25. Fakron A. Risk factors for ciprofloxacin and gentamycin resistance among gram positive and gram negative bacteria isolated from community-acquired urinary tract infections in Benghazi City. Scientific Journal for Faculty of Science-Sirte University. 2022 Apr 17;2(1):76-87.
26. Salam MA, Al-Amin MY, Pawar JS, Akhter N, Lucy IB. Conventional methods and future trends in antimicrobial susceptibility testing. Saudi journal of biological sciences. 2023 Mar 1;30(3):103582.