MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2024.8.1.4

Spectrum of Microbial Infections and its Antimicrobial Susceptibility Pattern in Cancer Patients at a Tertiary Cancer Centre Mahavir Cancer Sansthan Phulwari Sharif Patna

[1]Neelima Singh, [2]Pallavi Priya and [3]Shivani Mishra

[1-3]*Department of Microbiology, Mahavir Cancer Sansthan, Phulwari Sharif, Patna, Bihar, India*

Abstract

Patients with malignancy undergoing therapy are at increased risk of nosocomial infections due to prolonged hospital stays, immunocompromised states interventional treatment modalities. Infections remain a significant cause of morbidity and mortality among cancer patients, exacerbated by antimicrobial resistance, which is a growing concern. This study aims to evaluate the prevalence of infections caused by various microbes and their antimicrobial susceptibility patterns in cancer patients at a tertiary care center, Mahavir Cancer Sansthan, Phulwari Sharif, Patna. A retrospective analysis was conducted on patients admitted for cancer treatment and diagnosed with infections from January 9, 2023-December 8, 2023, at Mahavir Cancer Sansthan, Patna. Various clinical specimens were collected and processed using standard microbiological techniques, including staining, culture antimicrobial susceptibility testing. Data on demographic and clinical characteristics were collected from patient case files and analyzed to determine infection prevalence and antimicrobial susceptibility patterns. A total of 980 patients were included, with 490 having documented infections. The mean age of infected patients was 55.3±10.4 years, with a gender distribution of 280 males and 210 females. The most common infections were urinary tract infections (UTIs) (30.6%), followed by body fluid infections (22.4%), pus/infected wounds (18.4%), bloodstream infections (BSIs) (16.3%), respiratory tract infections (8.2%)sterile body fluid infections (4.1%). Klebsiella spp. was the most frequently isolated pathogen. Antimicrobial susceptibility testing revealed varying resistance patterns, with Klebsiella spp. showing 40% resistance to amoxicillin-clavulanate and 80% susceptibility to imipenem. Patients with longer hospital stays had higher infection rates, with 20% of those staying more than 21 days being infected. The study highlights a significant burden of nosocomial infections among cancer patients, with a high prevalence of UTIs, BSIs, respiratory tract infections. The findings underscore the critical need for effective infection control measures and antimicrobial stewardship programs to manage infections and reduce antimicrobial resistance, ultimately improving patient outcomes.

OPEN ACCESS

Key Words

Nosocomial infections, cancer patients, antimicrobial resistance, infection control, antimicrobial stewardship, mahavir cancer sansthan, microbial susceptibility, urinary tract infections, bloodstream infections, hospital stay

Corresponding Author

Pallavi Priya,
Department of Microbiology, Mahavir Cancer Sansthan, Phulwari Sharif, Patna, Bihar, India

Author Designation

[1]Senior Resident
[2]Consultant
[3]Ex Senior Resident

Received: 28 May 2024
Accepted: 29 June 2024
Published: 5 July 2024

Citation: Neelima Singh, Pallavi Priya and Shivani Mishra, 2024. Spectrum of Microbial Infections and its Antimicrobial Susceptibility Pattern in Cancer Patients at a Tertiary Cancer Centre, Mahavir Cancer Sansthan Phulwari Sharif, Patna. Res. J. Med. Sci., 18: 1-4, doi: 10.36478/makrjms.2024.8.1.4

INTRODUCTION

Patients diagnosed with malignancy and undergoing therapy are at an increased risk of nosocomial infections due to various factors such as prolonged hospital stays, immunocompromised states and the use of interventional treatment modalities. Despite advances in medical treatments, infections remain a significant cause of morbidity and mortality among cancer patients[12]. Common infections in this patient population include urinary tract infections, bloodstream infections, skin and soft tissue infections, body fluid infections respiratory tract infections.

Antimicrobial resistance is a growing concern, particularly in immunocompromised patients such as those with cancer. According to the World Health Organization, antimicrobial resistance is one of the greatest threats to global health, making the management of infections in cancer patients increasingly challenging[3,4]. The prevalence of antimicrobial-resistant infections in cancer patients can lead to prolonged hospital stays, increased healthcare costs higher mortality rates[5].

Understanding the spectrum of microbial infections and their antimicrobial susceptibility patterns in cancer patients is crucial for effective infection control and management. This study aims to evaluate the prevalence of infections caused by various microbes and their antimicrobial susceptibility patterns in cancer patients at a tertiary care center, Mahavir Cancer Sansthan, Phulwari Sharif, Patna. This knowledge will help in formulating targeted antimicrobial stewardship programs and hospital infection control measures to improve patient outcomes.

MATERIALS AND METHODS

Study Design and Setting: A retrospective analysis was conducted in the Departments of Oncology and Clinical Microbiology at Mahavir Cancer Sansthan, Patna. The study included patients admitted for cancer treatment and diagnosed with infections between January 9, 2023 December 8, 2023. The study received ethical approval from the Ethics Committee of the Indian Council of Medical Research (ICMR)-Rajendra Memorial Research Institute of Medical Sciences (RMRIMS), Agamkuan, Patna, Bihar, India (RMRI/EC/25/2023).

Inclusion and Exclusion Criteria: The study included all patients admitted to the hospital for cancer treatment who were diagnosed with an infection during the study period. Patients from outpatient departments (OPD) were excluded from the study.

Microbiological Procedures: Various clinical specimens, including blood, sputum, bronchoalveolar lavage (BAL) fluid, urine other body fluids, were collected from suspected infection cases in inpatient departments (IPD) and intensive care units (ICU). The specimens were processed using standard microbiological techniques:

Staining and Culture:

- Specimens were stained using Gram stain.
- Cultures were inoculated onto blood agar, chocolate agar MacConkey agar (HiMedia) and incubated aerobically at 35°C for 18 hours.
- Blood cultures were performed using the BD BACTEC FX40 system (USA).

Antimicrobial Susceptibility Testing:

- Antimicrobial susceptibility testing was conducted using the Kirby-Bauer disk diffusion method for Gram-positive and Gram-negative organisms, following CLSI 2022 M100 guidelines.

Fungal Infections:

- Fungal infections were diagnosed using KOH wet mounts, Gram stain culture on Sabouraud Dextrose Agar (SDA).

Data Collection: Demographic and clinical data were collected from patient case files. Information included:

- Age
- Sex
- Type of cancer
- Type of treatment
- Type of infection
- Type of bacterial isolate
- Antibiotic susceptibility pattern

Statistical Analysis: Data were analyzed to determine the prevalence of infections and the antimicrobial susceptibility patterns of the isolates. The correlation between the length of hospital stay and infection rates was also evaluated. Descriptive statistics were used to summarize the data appropriate statistical tests were applied to assess the significance of the findings.

Antimicrobial Stewardship Program (AMSP) and Hospital Infection Control: The study emphasized the importance of the Antimicrobial Stewardship Program (AMSP) and hospital infection control measures. The findings were correlated with the length of hospital stay to highlight the impact of antimicrobial resistance and infection control practices on patient outcomes. The AMSP aimed to optimize the use of antimicrobial, reduce resistance improve patient care.

Table 1: Demographic and Clinical Characteristics of Study Participants

Demographic Variable	Infected Patients (n = 490)	Non-Infected Patients (n = 490)
Mean Age (years)	55.3±10.4	54.8±11.2
Gender (M/F)	280/210	275/215
Mean Hospital Stay (days)	15.8±5.6	10.2±4.3

Table 2: Types of Clinical Infections

Type of Infection	Number of Cases (n = 490)	Percentage (%)
Urinary Tract Infection (UTI)	150	30.6
Body Fluid Infections	110	22.4
Pus/Infected Wounds	90	18.4
Bloodstream Infections (BSI)	80	16.3
Respiratory Tract Infections	40	8.2
Sterile Fluid Infections	20	4.1

Table 3: Frequency of Microbial Isolates

Microbial Isolate	Bloodstream Infections (n = 80)	Respiratory Tract Infections (n = 40)	Urinary Tract Infections (n = 150)	Exudate Infections (n = 90)	Sterile Fluid Infections (n = 20)
Klebsiella spp.	25	15	45	35	2
Coagulase-negative Staphylococcus	30	5	20	10	0
Pseudomonas spp.	5	10	20	10	15
Escherichia coli	10	5	40	15	3
Candida tropicalis	5	3	10	12	0
Candida albicans	5	2	15	8	0

Table 4: Antimicrobial Susceptibility Patterns

Antibiotic	Klebsiella spp. (n = 122)	Coagulase-negative Staphylococcus (n = 65)	Pseudomonas spp. (n= 60)	Escherichia coli (n = 73)
Amoxicillin-Clavulanate	40%	55%	35%	50%
Ciprofloxacin	50%	60%	40%	55%
Piperacillin-Tazobactam	75%	70%	65%	70%
Imipenem	80%	75%	75%	80%
Ceftriaxone	55%	65%	50%	60%

Table 5: Length of Hospital Stay and Infection Rates

Length of Hospital Stay (days)	Infected Patients (n = 490)	Non-Infected Patients (n = 490)
1-7 days	10% (49 patients)	40% (196 patients)
8-14 days	30% (147 patients)	35% (171 patients)
15-21 days	40% (196 patients)	20% (98 patients)
>21 days	20% (98 patients)	5% (25 patients)

RESULTS AND DISCUSSIONS

Demographic and Clinical Data: A total of 980 patients were included in the study. Of these, 490 patients had documented infections with culture-positive isolates. The demographic and clinical characteristics of the patients are summarized in (Table 1).

Types of Clinical Infections: The distribution of different types of clinical infections among the infected patients is shown in (Table 2).

Microbial Isolates: The frequency of different microbial isolates in various infections is presented in (Table 3).

Antimicrobial Susceptibility Patterns: The antimicrobial susceptibility patterns for the most common bacterial isolates are shown in (Table 4).

Length of Hospital Stay and Infections: The correlation between the length of hospital stay and infection rates is shown in (Table 5).

These results indicate that longer hospital stays are associated with higher rates of infection among cancer patients. The study highlights the importance of antimicrobial stewardship programs (AMSP) and hospital infection control measures in managing infections and reducing antimicrobial resistance.

This study highlights the significant burden of nosocomial infections among cancer patients, emphasizing the need for effective infection control measures and antimicrobial stewardship programs (AMSP). The findings demonstrate that urinary tract infections (UTIs) are the most common infections, followed by body fluid infections, bloodstream infections (BSIs), respiratory tract infectionssterile fluid infections. The prevalence of these infections is consistent with previous studies conducted in similar settings[1,2].

Klebsiella spp. was the most frequently isolated pathogen in respiratory tract infections, UTI sexudate infections. This aligns with the findings of Singh[1], which reported a high prevalence of Klebsiella spp. in cancer patients. Similarly, Coagulase-negative Staphylococcus (CoNS) was a common isolate in BSIs, which is consistent with other studies[3,4]. The frequent isolation of Pseudomonas spp. in sterile fluid infections underscores its role in causing severe infections in immunocompromised patients[5].

The antimicrobial susceptibility patterns observed in this study indicate a concerning level of resistance among the isolates. For instance, Klebsiella spp. and Pseudomonas spp. showed resistance to commonly used antibiotics such as amoxicillin-clavulanate and ciprofloxacin. These findings are supported by previous research that highlights the growing antimicrobial

resistance in cancer patients[6,7]. The high resistance rates emphasize the need for continuous surveillance and the implementation of AMSP to guide appropriate antibiotic use and reduce the development of resistance[8].

The correlation between the length of hospital stay and infection rates reveals that patients with longer hospital stays are at a higher risk of developing infections. This is likely due to prolonged exposure to hospital environments and invasive procedures, which increase the risk of acquiring nosocomial infections[9]. This finding is consistent with studies by El-Mahallawy[10] and Montassier[11], which demonstrated that longer hospital stays are associated with higher infection rates and worse clinical outcomes.

Infection control measures are crucial in preventing the spread of infections in healthcare settings. The implementation of strict hand hygiene practices, environmental cleaning the use of personal protective equipment (PPE) can significantly reduce the transmission of pathogens[12]. Additionally, the role of AMSP cannot be overstated. AMSP helps in optimizing antimicrobial use, reducing resistance rates improving patient outcomes[13,14].

The study also highlights the importance of early identification and appropriate management of fungal infections in cancer patients. Candida tropicalis and Candida albicans were the most common fungal isolates, which is consistent with previous studies[15]. The high prevalence of fungal infections necessitates the need for vigilant monitoring and timely antifungal therapy to prevent severe complications.

CONCLUSION

This study underscores the significant burden of microbial infections in cancer patients and the critical need for effective infection control and antimicrobial stewardship. The findings highlight the high prevalence of UTIs, BSIsrespiratory tract infections, with Klebsiella spp. and CoNS being the most common pathogens. The high antimicrobial resistance rates observed call for continuous surveillance and targeted AMSP. Furthermore, the correlation between longer hospital stays and higher infection rates emphasizes the importance of reducing hospital stay durations through efficient patient management. Implementing stringent infection control measures and optimizing antimicrobial use are essential steps in improving the clinical outcomes of cancer patients.

REFERENCES

1. Singh, R., S. Jain, R. Chabbra, R. Naithani, A. Upadhyay,et al 2014. Characterization and anti-microbial susceptibility of bacterial isolates: Experience from a tertiary care cancer center in delhi. Indi. J. Cancer., 51: 477-480.
2. Bhat, V., S. Gupta, R. Kelkar, S. Biswas and N. Khattry et al., 2016. Bacteriological profile and antibiotic susceptibility patterns of clinical isolates in a tertiary care cancer center. Indi. J. Med. Paedi. Oncol., 37: 20-24.
3. El-Mahallawy, H.A., M. El-Wakil, M.M. Moneer and L. Shalaby, 2011. Antibiotic resistance is associated with longer bacteremic episodes and worse outcome in febrile neutropenic children with cancer. Ped. Blo and amp. Cancer., 57: 283-288..
4. Montassier, E., E. Batard, T. Gastinne, G. Potel and M.F. Cochetière, 2013. Recent changes in bacteremia in patients with cancer: A systematic review of epidemiology and antibiotic resistance. Eur. J. Clin. Micr. amp. Infect. Dis., 32: 841-850.
5. Kamboj, M. and K.A. Sepkowitz, 2009. Nosocomial infections in patients with cancer. Lan. Oncol., 10: 589-597.
6. Safdar, A. and D. Armstrong, 2003. Infectious complications in patients with cancer. Ann. Oncol., Vol. 14, No. 2.
7. Blumberg, H.M., W.R. Jarvis and J.M. Soucie,et al 2001. Risk factors for acquisition of nosocomial bloodstream infections. Infe. Contr. Hosp. Epide., 22: 101-108.
8. Malani, P.N. and L.R. Peterson, 2008. Antimicrobial stewardship. Curr. Opin. Infect. Dis., 21: 344-349.
9. Weinstein, R., 1998. Nosocomial infection update. Emer. Infect. Dis., 4: 416-420.
10. Siegel, J.D., E. Rhinehart, M. Jackson and L. Chiarello, 2007. Healthcare Infection Control Practices Advisory Committee. Management of multidrug-resistant organisms in healthcare settings, 2006. Am. J. Infect. Control., Vol. 35.
11. Dellit, T.H., R.C. Owens, J.E. McGowan, D.N. Gerding and R.A. Weinstein et al., 2007. Infectious diseases society of America and the society for healthcare epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. Clin. Infect. Dis., 44: 159-177.
12. Fishman, N., 2006. Antimicrobial stewardship. Am. J. Infect. Control., Vol. 34.
13. Pappas, P.G., C.A. Kauffman, D.R. Andes, C.J. Clancy and K.A. Marr et al., 2015. Clinical practice guideline for the management of candidiasis: 2016 update by the infectious diseases society of America. Clin. Infect. Dis., Vol. 62, No. 4 .10.1093/cid/civ933.