Original Research Article

Bacteriological profile of clinical isolates in cancer patients with febrile neutropenia in a tertiary care hospital in Kurnool, Andhra Pradesh

Y Hyma Prathyusha1, Aarthi Vara2*, G Suguneswari3

1Santhiram Medical College and General Hospital, Nandyala, Andhra Pradesh, India
2Dept. of Microbiology, Dr. VRK Women's Medical College, Aziznagar, Telangana, India
3GSL Medical College and General Hospital, Rajahmundry, Andhra Pradesh, India

A R T I C L E   I N F O

Article history:
Received 17-02-2021
Accepted 05-05-2021
Available online 30-07-2021

Keywords:
Febrile neutropenia
Cancer
Malignancies

A B S T R A C T

Introduction: In cancer patients, infection is the most significant and continuous problem. This study was done to show the spectrum of bacteria and sites of isolation in febrile neutropenic cancer patients.

Materials and Methods: A 1-year study of all isolates was conducted from various sites in our hospital. All the samples were processed, and isolates were identified as per CLSI guidelines.

Results: The commonest organism isolated was Escherichia coli among Gram negative organisms and Staphylococcus aureus among Gram positive organism. Out of 76 isolates 49 were Gram negative and 27 were Gram positive.

Conclusion: The pattern of infectious agents has changed in neutropenic patients over time and this postulates the need of other studies to give the most up to date insight of the causative organism to the physician.

© This is an open access article distributed under the terms of the Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/) which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

1. Introduction

In cancer patients, infection is the most significant and continuous problem.1 After chemotherapy approximately 10 to 50% of patients with solid tumors and more than 80% of these with hematologic malignancies will develop febrile neutropenia.2 Both direct and indirect effect on a patient’s immune system are caused by cancer. Many factors increase the susceptibility of immunosuppressed cancer patients to infection.1 As the therapy directly affects the production of neutrophils patients under chemotherapy are susceptible to infections.3 Neutropenia is defined as a neutrophil count of <500 cells/mm3, or a count of <1000 cells/mm3 with a predicted decrease to <500 cells/mm3.4 Reduction in neutrophils predisposes the body to bacterial invasion, proliferation and inhibits the appearance of any inflammatory response.3 Now a days the management of neutropenic cancer patients has become particularly challenging compared to previous decades, because of the adoption of intensive chemotheraphy protocols, widespread use of monoclonal antibodies or other biological agents, the increasing age of cancer patients and frequent presence of multiple co-morbidities. These neutropenic patients are vulnerable to a wide spectrum of infectious agents which are responsible for substantial mortality and morbidity among them.4 The principal complication in neutropenic cancer patients is infection. The commonest site of infections in neutropenic cancer patients is respiratory tract infection followed by blood stream infection, urinary tract infection, surgical site infection, oropharynx and gastrointestinal tract.5 Several studies assumed that the shift of infecting pathogens was more towards gram positive due to long term indwelling catheter, aggressive chemotherapy, continuous antibiotic use and changes in clinical and local antibiotic resistance. Recently the etiology of infecting pathogens changed again. The studies done from the United states and Europe reported the re-emergence of gram-negative bacteria in neutropenic cancer patients.5

*Corresponding author.
E-mail address: dr.aarthi22@gmail.com (A. Vara).
2. Materials and Methods

The specimens from all neutropenic patients were collected from hospital and sent to laboratory. A retrospective study was conducted on the bacterial spectrum and isolation sites in adult febrile neutropenic patients hospitalized between January 2016 and December 2016 in a tertiary care hospital in Kurnool.

2.1. Inclusion criteria

Male and female >18 years, presence of neutropenia, known malignancy. Fever was considered as single oral temperature of ≥ 38.3°C or a temperature of ≥38°C for ≥ 1 hour and absolute neutrophil count of < 500/mm³.¹

2.2. Exclusion criteria

Patients already on antimicrobials and those with fever due to noninfectious causes such as blood transfusion, drug infusion and others.

All microbiology reports were as per CLSI guidelines. The specimens were inoculated on blood agar and Mac Conkey agar plates at microbiology laboratory. The plates have been incubated at 37°C for 24 hrs. The control organisms used were Escherichia coli ATCC 35218, Klebsiella pneumoniae ATCC 700603, Pseudomonas aeruginosa ATCC 27853, Acinetobacter baumanii ATCC BAA – 747, Staphylococcus aureus ATCC 29213, Staphylococcus epidermidis ATCC 12228, Enterococcus faecalis ATCC 29212 for quality control.

Data was collected with respect to gender, underlying diseases, chemotherapy, neutropenia, presence of infection, microorganisms in culture (blood, urine, catheter tip), antimicrobials used and clinical outcome (discharge or death) from requisition form and from respective units and wards. Data was obtained through an active daily evaluation of all neutropenic patients identified by blood count screening. Cultures were obtained from blood, urine, sputum, wound abscess or any other focus of infection. All isolates were identified at the microbiology laboratory by routine methods.

3. Results

72 patients (49 males, 23 females) were evaluated over a period of 12 months and 76 bacterial isolates were cultured from them while they were febrile and neutropenic. Total number of Gram-negative bacteria isolated were 49/76 isolates. Among them Escherichia coli was the commonest organism isolated followed by Pseudomonas aeruginosa and Klebsiella pneumoniae. Total number of Gram-positive bacteria isolated were 27/76 isolates. Amongst them Staphylococcus epidermidis was the commonest comprising of 11/27 followed by Staphylococcus aureus 6/27, sputum and body fluids 11.1% (3/27).

Table 1: Frequency of organisms at different isolation sites

| Site          | Gram positive organisms | Gram negative organisms |
|---------------|-------------------------|-------------------------|
| Blood         | 8                       | 20                      |
| Urine         | 7                       | 11                      |
| Wound         | 6                       | 7                       |
| Sputum        | 3                       | 5                       |
| Body fluids   | 3                       | 6                       |
| Total         | 27                      | 49                      |

Table 2: Distribution of microorganisms isolated

| Gram negative organisms | Number | Gram positive organisms | Number |
|-------------------------|--------|-------------------------|--------|
| Escherichia coli        | 21     | Staphylococcus aureus   | 11     |
| Pseudomonas aeruginosa  | 10     | Staphylococcus epidermidis | 6     |
| Klebsiella pneumoniae   | 8      | Enterococcus           | 8      |
| Acinetobacter baumanii  | 5      | Streptococcus          | 2      |
| Stenotrophomonas        | 1      |                         | 1      |
| Proteus                 | 2      |                         | 2      |
| Enterobacter            | 2      |                         | 2      |

Table 3: Sources of isolation of Gram-negative organisms

| Organism               | Blood | Urine | Body fluids | Wound | Sputum |
|------------------------|-------|-------|-------------|-------|--------|
| Escherichia coli       | 6     | 4     | 2           | 7     | 2      |
| Pseudomonas aeruginosa | 3     | 2     | 3           | 2     | 3      |
| Klebsiella pneumoniae  | -     | 2     | 1           | 2     | 3      |
| Acinetobacter baumanii | -     | 2     | -           | 2     | 1      |
| Stenotrophomonas       | -     | -     | -           | -     | 1      |
| Proteus                | -     | 1     | -           | 1     | -      |
| Enterobacter           | -     | 1     | -           | -     | -      |

Table 4: Sources of isolation of Gram-positive isolates

| Organism               | Blood | Urine | Body fluids | Wound | Sputum |
|------------------------|-------|-------|-------------|-------|--------|
| Staphylococcus epidermidis | 5     | 1     | -           | 4     | 1      |
| Staphylococcus aureus  | 3     | 1     | -           | 2     | -      |
| Enterococcus           | 4     | 3     | -           | 1     | -      |
| Streptococcus          | 1     | -     | -           | 1     | -      |
4. Discussion

The study was done to evaluate the developing bacterial trends to understand the prevalence and to determine the effectiveness of the antibiotics to treat the infections. The studies done from different parts of the world showed a changing of trend in organisms from Gram positive to Gram negative similar to our study where Gram negative organisms accounted for 64.4% and Gram positive to 35.5%. \(^6\)\(^7\) The potential for antibiotic resistance is an important concern for clinicians treating patients with confirmed or suspected bacterial infections as they are often resistant to a broad range of antimicrobial agents. Febrile neutropenia is of specific concern in immunocompromised patients as this state makes them more prone to bacterial infections. The commonest complication of chemotherapy is infection as it causes morbidity and mortality in neutropenic cancer patients. In order for clinician to treat effectively, the knowledge of likely pathogens and local bacterial spectrum is very important. Regarding the duration of neutropenia, infections caused by gram negative organisms accounted for greater proportion and are associated with the longest duration that is > 29 days. In our study Escherichia coli was most prevalent followed by Pseudomonas aeruginosa. \(^4\) Of the Gram-positive cocci, the commonest isolate was coagulase negative staphylococcus particularly from patients who had indwelling venous access devices.\(^3\)\(^8\) Our study showed that Gram negative isolates accounted for a higher percentage of bloodstream infections compared to Gram positives which is similar to many other studies. \(^9\)\(^–\)\(^12\) In our study, Gram negative bacteria were seen more than other organisms in febrile neutropenic patients and Escherichia coli was the most common pathogen. Because of obtaining the samples from patients with nosocomial fever and neutropenia in our study the high rates of Gram-negative organisms may be reasonable. Continuous surveillance to identify changes in microbiologic patterns is recommended for the purpose of guiding proper antimicrobial use and to give the most up to date insight of the organisms to physicians.

5. Source of Funding

None.

6. Conflict of Interest

The authors declare that there is no conflict of interest.

References

1. Saghir S, Faiz M, Saleem M, Younus A, Aziz H. Characterization and anti-microbial susceptibility of Gram-negative bacteria isolated from bloodstream infections of cancer patients on chemotherapy in Pakistan. Indian J Med Microbiol. 2009;27(4):341–7.

2. Zuckermann J, Stoll P, Rosas Lieberknecht Meneghel, Ricardo Souza Kuchenbecker, Rodrigo Pires dos Santos, Leila Beltrami Moreira. Microbiological findings in febrile neutropenic patients in a tertiary hospital of Southern Brazil. Rev HCPA. 2012;32(3):261–7.

3. Lima SSS, França MS, Godoi CCG, Martinho GH, Jesus LA, Romanelli RMC, et al. Neutropenic patients and their infectious complications at a University Hospital. Rev Bras Hematol Hemoter. 2013;35(1):18–22.

4. Davood Y, Alireza F, Masih M, Reihaneh KM, Mohammad AA. Current spectrum of bacterial infections in patients with nosocomial fever and neutropenia. Caspian J Intern Med. 2013;4(3):698–701.

5. Sirkhazi M, Sariff A, Aziz NA, Almana F, Arafat O, Shorman M. Bacterial Spectrum, Isolation Sites and Susceptibility Patterns of Pathogens in Adult Febrile Neutropenic Cancer Patients at a Specialist Hospital in Saudi Arabia. World J Oncol. 2014;5(5-6):196–203.

6. Walwyn M, Nicholson A, Lee MG, Wharfe G, Frankson MA. Febrile neutropenia in cancer patients. West Indian Med J. 2010;59(2):209–14.

7. Hassan BAR, Yusoff ZBM, Othman SB. Fever/clinical signs and association with neutropenia in solid cancer patients–bacterial infection as the main cause. Asian Pac J Cancer Prev. 2010;11(5):1273–7.

8. Syrjälä H, Ohtonen P, Kinnunen U, Räty R, Elonen E, Nousiainen T, et al. Blood stream infections during chemotherapy-induced neutropenia in adult patients with acute myeloid leukemia: treatment cycle matters. Eur J Clin Microbiol Infect Dis. 2010;29(10):1211–8.

9. Gupta A, Sharma S, Gupta A, Arora A. Changing trends of in vitro antimicrobial resistance patterns in blood isolates in a tertiary care hospital over a period of 4 years. Indian J Med Sci. 2010;64(11):485–92.

10. Murra AR, Camargo LFA, Pignatari ACC, Sukienik T, Behar PRP, Medeiros EAS, et al. Nosocomial Bloodstream Infections in Brazilian Hospitals: Analysis of 2,563 Cases from a Prospective Nationwide Surveillance Study. J Clin Microbiol. 2011;49(5):1866–71.

11. Qureshi M, Aziz F. Prevalence of microbial isolates in blood cultures and their antimicrobial susceptibility profiles. Biomedica. 2011;27:136–9.

12. Prabhush K, Medhekar A, Ghaedalyatil N, Noronha V, Bivwasa S, Kurkure P, et al. Blood stream infections in cancer patients: A single center experience of isolates and sensitivity pattern. Indian J Cancer. 2010;47(2):184–8.

Author biography

Y Hyma Prathyusha, Associate Professor
Aarthi Vara, Assistant Professor
G Suguneswari, Professor

Cite this article: Prathyusha YH, Vara A, Suguneswari G. Bacteriologic profile of clinical isolates in cancer patients with febrile neutropenia in a tertiary care hospital in Kurnool, Andhra Pradesh. Indian J Microbiol Res 2021;8(2):139-141.