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Bacteriological Profile and Antibiogram of isolates from cancer patients

KEYWORDS

Cancer patients, bacterial infections , antibiogram, risk factors .

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ABSTRACT Cancer patients are vulnerable to wide spectrum of infectious agents and their complications remain a significant cause of morbidity and mortality. The type of malignancy, the status of malignancy (i.e., active or in remission) and the intensity of the treatments directed against it are all important factors in determining infection risk1 . The aim of this study was to identify the bacteriological profile and their antibiogram in various clinical specimens in cancer patients and to study the possible risk factors associated with infection in these patients. Methodology : Two hundred clinical specimens from cancer patients were processed in department of microbiology , GMC Amritsar from Dec 2014- June 2016 by conventional methods and antibiotic susceptibility testing of all the isolates was done according to Clinical and Laboratory Standards Institute (CLSI) guidelines. Results : The most observed microorganism was Escherichia.coli 40 (43.47%) followed by Klebsiella pneumoniae 36 (39.13%) , Staphylococcus aureus 34 (58.60%) , Coagulase negative staphylococci 24(41.37%) , Pseudomonas aeruginosa 9(9.78%), Acinetobacter species 7(7.60%) . Overall gram negative organisms were 92 (61.33%) and gram positive 58(38.66%). Antibiogram showed that Imipenem andPiperacillin/Tazobactum were the most effective drugs in gram negative . Vancomycin and linezolid showed 100% sensitivity in gram positive bacteria . Conclusion : The changing pattern of infectious agents in cancer patients overtime postulates the necessity of other studies to give the most up-to-date insight of the organisms to physicians

Introduction :

Cancer patients remain at substantial risk for developing serious infectious complications which are an important cause of morbidity and mortality despite significant advances in cancer therapy and supportive care 2. To successfully identify, treat, and prevent infections, a comprehensive understanding of risk factors is necessary3. These patients are at risk of acquiring infections, since they often undergo invasive diagnostic and therapeutic procedures, intravenous line placement and hospitalization leading to the alteration of their skin and gut microbial flora4 . Institutions that provide care for cancer patients are expected to have higher rates of nosocomial infections than general care hospitals5 . The development of infections caused by multidrug-resistant (MDR) organisms has become a major health problem worldwide, and is of particular concern in cancer patients, who are at particular risk for severe sepsis and poor outcome6 . The epidemiology of infection in cancer patients undergo periodic changes and is often subject to geographic and institutional factors; however, certain trends are consistent7 . Although in the 1990s gram-positive bacteria were the leading causative agents in cancer patients , a trend is now emerging with a shift from gram-positive to gram-negative bacilli mostly caused by changes in the use of the antibiotic prophylaxis8. These days the awareness among people is increasing and they are becoming more concerned about the health related issues so there is a possibility for better recognition of infections in cancer patients.9

The goal of the present study was to identify the bacteriological profile , antibiogram and associated risk factors of infections in cancer patients .

Material and methods : The prospective study was conducted in department of microbiology, GMC Amritsar from Dec 2014 to June 2016. During this period, two hundred clinical specimens like blood, urine, pus ,sputum and body fluids were collected from cancer patients being treated in radiotherapy department in Guru Nanak Dev , Amritsar . All the specimens were inoculated onto blood agar , mac conkey's agar and brain heart infusion agar . The agar plates were incubated at 37°C and were examined for the presence of growth after 24 hours . The isolates were identified by colonial morphology, Gram's staining and routine biochemical tests . Antibiotic susceptibility pattern of the isolates was studied on Mueller Hinton agar (Difco) by using Kirby Bauer disc diffusion method according to CLSI guidelines . Staphylococcus aureus ATCC 25932, Escherichia coli ATCC 25922 and Pseudomonas aeruginosa ATCC 27853 were included as control strains.

Results : Out of 200 clinical specimens 150 (75.00 %) were culture positive showing bacterial growth and 50 (25.00 %) were culture negative. According to gram staining 92 (61.33%) were gram negative and 58 (38.66%) gram positive organisms.

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Among gram negative Escherichia coli were 40 (43.47%) followed by Klebsiella pneumoniae 36 (39.13%) , Pseudomonas aeruginosa 9(9.78%) and Acinetobacter baumannii 7(7.60%) and in gram positive organisms , Staphylococcus aureus were 34 (58.60%) and Coagulase negative staphylococci 24(41.37%). (Table 1)

TABLE 1: PRINT HERE

Antibiogram showed Escherichia coli was sensitive to Imipenem 38 (95.00%) followed by Piperacillin- Tazobactum 34 (85.00%) , Sulbactum-Ceftazidime 32(80.00%) and Ceftriaxone 28(70.00%) . Klebsiella pneumonia showed maximum sensitivity to Imepenem 30(83.33%) followed by Piperacillin/ Tazobactum 27(75.00%), Sulbactum Ceftazidime 23(63.88%) and Ceftriaxone 21(58.33%). Ps. aeruginosa showed maximum sensitivity to Imipenem and Piperacillin/Tazobactum 8(88.88%) followed by Sulbactum/Ceftazidime and Ceftriaxone 7(77.77%) . Acinetobacter baumannii showed sensitivity to Imipenem 7(100.00%) followed by Piperacillin/Tazobactum 6(85.71%), Ceftriaxone 4(57.14%). Overall maximum resistance was seen in gentamicin and ceftazidime in most of the isolates.

In gram positive isolates , most effective drugs for both Staphylococcus aureus and coagulase negative staphylococci were Linezolid and vancomycin which showed 100% sensitivity. Methicillin resistance in staphylococcus aureus isolates was seen in 5(14.71%) and in CONS 5 (20.84%). Overall maximum resistance was seen in ciprofloxacin and gentamicin in most of the isolates . Antibiotic susceptibility pattern of both the gram negative and gram positive organisms is shown in table 2.

TABLE 2 PRINT HERE

Maximum risk for infection was seen in patients undergoing diagnostic and therapeutic procedures 65(32.50%) followed by neutropenia 50 (25.00%) , malnutrition 25(12.50%) , smoking 23(11.50%) , Diabetes mellitus 20(10.00%) and blood transfusion 17 (8.50%). (Figure 3)

FIGURE 3 : PRINT HERE

Discussion :

Infections are the leading cause of significant morbidity and mortality in cancer patients as a result of different cancer treatments or malignancy itself. Although certain cancers are intrinsically associated with immunocompromised status, the risk of infection is principally related to the intensity and duration of cytotoxic and immunosuppressive chemotherapy. Patients may have multiple predisposing factors that increase the risk of multidrug resistant pathogens10 . Thus prevention and treatment of infections are vital in the management of cancer patients which can be achieved by empirical antibiotic therapy covering the broadest spectrum of organisms[11].

The current prospective study involved 200 clinical specimens collected from cancer patients for studying bacteriological profile and their antibiogram . Our study demonstated that gram negative organisms are still the predominant pathogens causing infections involving Escherichia coli , Klebsiella pneumonia , Pseudomonas aeruginosa and Acinetobacter baumannii which is similar to what had been reported in both local and international studies. Predominance of gram negative bacteria in our study can be due to the fact that individual were unable to afford routine prophylactic oral antibiotics , such as quinolones , and lesser use of central lines . From infected sites , gram positive organisms were also isolated , these were Staphylococcus aureus and Coagulase negative staphylococci.

In cancer patients, defects of the immune response against infection arise from several factors acting either concomitantly or sequentially; certainly, major roles are played by the underlying disease and by the medical therapies developed to treat it. Indeed, many of the technologies and pharmacological tools used in modern medicine have the potential to facilitate the onset of infection caused by microorganisms that once were considered to be nonpathogenic or saprophytic. As new cancer treatments are introduced, evolution in the epidemiological and microbiological profiles of infections in patients with cancer brings new challenges for infectious diseases specialists 12. Bodey et al suggested that a patient's medical history, underlying illness, and treatment have long been recognized as playing a role in each patient's risk of acquiring serious infection and of dying from infection 13. The risk of severe infection and eventual death varies according to different patient characteristics.[14]

The empiric use of broad spectrum antibiotics in cancer patients is very critical. On one hand, it is crucial to decrease mortality during the febrile episode; on the other hand, it is a risk factor for emergence of bacteremia with resistant organisms[15] . Increasing rates of drug resistance among gram-positive and gram-negative pathogens are being documented in many hospitals, including cancer treatment centers [16] . Microbiologically documented gram-negative as well as gram-positive infections including bacteremias were significantly reduced in patients receiving antibacterial prophylaxis15. A relationship between infection with resistant bacteria and poor outcome has been reported in several settings .The decision for or against the administration of a prophylactic antibiotic regime is guided by the risk of an individual patient to acquire a severe, life-threatening infection, carefully balanced against the potential risks of long-term administration of a broad-spectrum antibacterial agent with systemic activity. The administration of systemic antibacterial prophylaxis may aim at a reduction of severe infections, a delay of the onset of such infections to a later phase of neutropenia, avoidance of infection-related anti cancer treatment delays, reduction of hospitalization, reduction of treatment costs or a combination of these goals [15].

Individual patient risk factors must be identified and modified whenever possible . Driven by healthcare costs and increased demand for existing inpatient resources, outpatient care of patient with malignancies has become increasingly common at present 17. Designing a practical and reliable surveillance system will be beneficial to predict infectious complications in cancer patients at time of onset and guide the proper antimicrobial therapy[15].

Conclusion : Despite the various diagnostic and therapeutic advancement in cancer treatment , infectious complications continues to decrease, but new epidemiological risk factors and microbiological patterns continue to challenge physicians and health care providers18. Therefore , studies that assess the risk of major complications, epidemiological and microbiological patterns carry significant weight as every patient is different and deserves focused attention for the identification of causative agents and their antimicrobial susceptibility patterns to determine the best course of treatment19 . Still, further research need to be done for early detection of infections , so that better treatment can be provided that will improve the patients quality of life significant. [9]

Sound hospital infection control practices , decreased reliance on hospital-based care and restricted antibiotic use would go a long way in improving an all too familiar dismal situation in developing countries[20].

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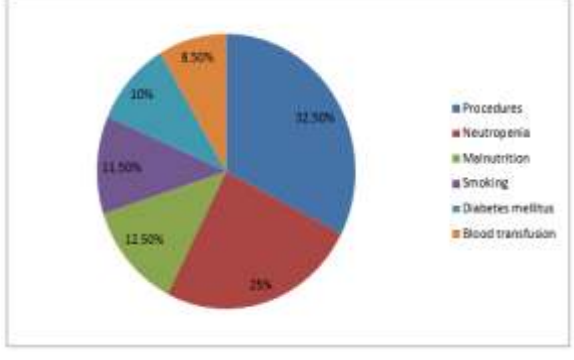
Table 1 : Bacterial organisms isolated from cancer patients

Organisms	Number of organisms (n=150)	Percentage
Escherichia coli	40	43.47
Klebsiella pneumoniae	36	39.13
Staphylococcus aureus	34	58.60
Coagulase negative staphylococcus	24	41.37
Pseudomonas aeruginosa	9	9.78
Acinetobacter species	7	7.60
Total	150	100.00

Table 2: ANTIMICROBIAL SUSCEPTIBILITY PATTERNS (Percent sensitive) OF ISOLATES

Antibiotic	Escherichia coli	Klebsiella pneumoniae	Staphylococcus aureus %	oagulase negative staphylococci %	Pseudomonas aeruginosa	Acinetobacter baumannii
Ampicillin	-	-	41.17	41.66	-	-
Amikacin	60	44.44	52.94	41.66	66.66	28.57
Gentamycin	30	52.77	38.23	54.16	44.44	42.85
Ciprofloxacin	55	55.55	38.23	50	66.66	42.85
Ceftriaxone	70	58.33	-	-	77.77	57.14
Ceftazidime	35	47.22	-	-	22.22	28.57
Sulbactum-ceftazidime	80	63.88	-	-	77.77	71.42
Piperacillin–tazobactum	85	75	-	-	88.88	85.71
Imipenem	95	83.33	-	-	88.88	100
Erythromyc	-	-	50	58.33	-	-
Cephalexin	-	-	47.05	75	-	-
Methicillin	-	-	85.29	79.16	-	-
Linezolid	-	-	100	100	-	-
Vancomycin	-	-	100	100	-	-



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