RESEARCH COMMUNICATION

Screening of Bloodborne Pathogens and Antimicrobial Susceptibility Testing Among Cancer Patients

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Abstract

Aim: To screen bloodborne pathogens and test for antimicrobial susceptibility among patients with different types of cancer. Materials and Methods: Fifty volunteers undergoing chemotherapy in Madurai, Tamilnadu (14 males and 36 females) provided blood samples with consent for identification of pathogens by streaking on different selective and differential media. The antibiotic sensitivity for the entire isolates were tested by the Kirby-Bauer method. Results: *Pseudomonas aeruginosa* was found to be present in more samples than *Proteus mirabilis*, *Staphylococcus aureus*, and *E.coli*. Percentage sensitivities of blood pathogens to selected antibiotics were found to be: Amikacin 61%, Gentamicin 68%, Co-Trimoxole 31%, and Cefepime 42.8%.

Keywords: Cancer chemotherapy - bloodborne pathogens - antimicrobial susceptibility

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Introduction

Cancer is the uncontrolled growth of cells, coupled with malignant behavior and metastasis. Abnormal cells have accumulated enough DNA damage to be freed from the normal restraints of the cell cycle. Several pathogenic bacteria, particularly those that can establish a persistent, infection, can promote or initiate abnormal cell growth by evading the immune system or suppressing apoptosis. Intracellular pathogens survive by evading the ability of the host defense mechanism. Important mechanisms by which bacterial agents may induce carcinogenesis include chronic infection, immune evasion and immune suppression. It has been shown that several bacteria can cause chronic infections or produce toxins that disturb the cell cycle resulting in altered cell growth. The resulting damage to DNA, altered the control over normal cell division and apoptosis. Certain bacterial infections may evade the immune system or stimulate immune responses that contribute to carcinogenic changes through the stimulatory and mutagenic effects of cytokines released by inflammatory cells (Mager, 2006).

Many of the blood borne infections are acquired during the medical procedures, i.e. the usage of catheters; central venous catheters are the major source of the blood stream infection, particularly with solid tumors (Raad et al., 2007). Bacteremia is a serious complication in neutropenic cancer patients. While most cases are eradicated with a 2-week course of antibiotics, some recur, leading to significant morbidity and even death. The source of these relapsing infections remains unknown in more than a third of affected patients (Marisa et al., 2004).

Cytotoxic chemotherapy were used to treat the malignancies are important cause of deficient immunity (Giamarellou et al., 1991). Cancer patients receiving chemotherapy are prone to develop infections that might postpone treatment and lead to complications (Nordøy et al., 2002).

Patients with cancer are highly susceptible to bacterial infection, particularly during the period of chemotherapy. Generally chemotherapy is one of the choices for treating cancer. As chemotherapy suppresses the immune system it can facilitates the microbial entry so, to evade the pathogens, antibiotics are preferred.

Many chemotherapeutic agents used to treat malignant diseases damage lymphocytes and consequently suppress cell-mediated immunity. While individual agents clearly have immediate effects on lymphocyte counts and immune function, the widespread approach of treating both hematological and non-hematological malignancies with repeated cycles of chemotherapy given over many months has a prolonged and profound suppression of cell-m–ediated immunity (John and Katarina, 2009).

To fill the lacuna of knowledge in this area among Indian isolates of blood borne pathogen, the present study was conducted to estimate of the risk of bacteremia in cancer patients.

Materials and Methods

Period of study (June 2007-April 2008)

The study was carried out at the Department of Microbiology, The American college, Madurai in colloboration with Mohan nursing home, Madurai.

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Fifty volunteer cancer patients, who were undergoing chemotherapy in Mohan nursing home were subjected to the present study. The study population involves 14 males and 36 females with different types and stages of cancer. The samples were collected under the consent of the patients.

Collection of blood specimens

Blood was collected in a sterile syringe, which was immediately transferred into the 5 ml of BHI broth in screwcapped bottles. The bottles were labeled with name and serial number of the patient. The screwcapped bottles were kept in shaker overnight at 37° C.

Microbial analysis of blood

The blood borne pathogens were identified by streaking the blood samples on different selective and differential media such as Hichrome UTI agar, Eosin Methylene blue agar, Mannitol salt agar, MacConkey agar. The plates were incubated at 37°C for 24 hours.

Antibiogram

The antibiotic sensitivity for the entire isolates were tested by Kirby-Bauer method. The antibiotics were tested obtained from Hi- media laboratory. Pure cultures of the identified blob pathogens are swabbed over the Muller-Hinton agar. After complete swabbing the discs were placed on the agar using antibiotic places (Bauer et al, 1996). After incubation at 37° C for 24 hours the diameter of zone of incubation was measured. Antibiotics used were: Gentamicin (10 mcg); Amikacin (30mcg); Co-trimaxazole (10mcg); and Cefepime (30mcg).

Results

The occurrence of blood borne pathogens among cancer patients, *Pseudomonas aeruginosa* was found to be present in more samples, when compared to Proteus *mirabilis*, *Staphylococcus aureus, and E.coli*.

Table 1, shows the total number of isolates among cancer patients. Breast cancer patients have 16% *Pseudomonas aeruginosa*, 17% *Staphylococcus aureus*, 7% *E.coli* and 4% Proteus than the other types of cancer patients. The occurrence of isolates as one isolate 28%, two isolates 32%, three isolates 30% and four isolates 10%.

Table 2 shows the percentage of bacterial isolates from cancer patients, percentage of individual isolates accounts for *Pseudomonas aeruginosa* (36%), *Staphylococcus, Escherichia coli* (18%), *Proteus mirabilis* (11%), *Pseudomonas fluorescense* (9%).

Sensitivity pattern of blood pathogens to selected antibiotics is represented in Table 3. Gentamicin proved to be the most effective antibiotic with *S.aureus, P. aeruginosa and P.mirabilis* isolates.

Table 1. Occurrence of Blood Pathogens

Cancer	Pathogens	Isolates
Breast	P.aeruginosa, E.coli	2
Paratoid	P. fluorescence	1
Ovarian	E.coli ,S.aureus	2
Tongue	E.coli, P. fluorescence	2
Prostate	E.coli, S.aureus, P. fluorescence	3
Stomach	E.coli, S.aureus, P. fluorescence	3
Ovarian	E.coli, S.aureus, P. fluorescence	3
Breast	P.aeruginosa, S.aureus	2
Breast	P.aeruginosa, E.coli, S.aureus	3
Breast	P.aeruginosa, S.aureus	2
Hodgkin's	P.aeruginosa/mirabilis, E.coli, S.aureus	3
Cervical	P.aeruginosa/mirabilis, E.coli, S.aureus	4
Ovarian	P.aeruginosa, E.coli, S.aureus	3
Breast	P.aeruginosa	1
Stomach	E.coli, S.aureus, P. fluorescence	3
Rectum	P.aeruginosa	1
Breast	P.aeruginosa, S.aureus	2
Breast	S.aureus, P. fluorescence	2
Breast	P.aeruginosa, E.coli, S.aureus	3
Stomach	P.aeruginosa	1
Peritoneum	P.aeruginosa/mirabilis	2
Breast	P.aeruginosa, E.coli, S.aureus	3
Stomach	P.mirabilis	1
Breast	S.aureus	1
Breast	S.aureus	1
Thyroid	P.aeruginosa	1
Breast	P.aeruginosa, E.coli, S.aureus	3
Breast	P.aeruginosa, P.mirabilis	2
Prostate	-	0
Stomach	P.aeruginosa, E.coli	2
Ovarian	P.aeruginosa, S.aureus	2
Breast	P.aeruginosa	1
Breast	P.aeruginosa, S.aureus	2
Ovarian	P.aeruginosa	1
Ovarian	P.aeruginosa, S.aureus	2
Cheeks	P.aeruginosa/mirabilis, E.coli, S.aureus	4
Breast	P.aeruginosa/mirabilis, E.coli, S.aureus	4
Iliac bone	P.aeruginosa, S.aureus	2
Rectum	P.aeruginosa, P.mirabilis	2
Breast	P.aeruginosa/mirabilis, S.aureus	3
Soft tissue	P.aeruginosa/mirabilis, S.aureus	3
Breast	P.aeruginosa/mirabilis, E.coli, S.aureus	4
Breast	S.aureus	1
Maxilla	P.aeruginosa	1
Thyroid	P.aeruginosa, S.aureus, P. fluorescence	3
Cheeks	P.aeruginosa, S.aureus, P. fluorescence	3
Right limb	P.aeruginosa, S.aureus, P. fluorescence	3
Breast	P.aeruginosa, S.aureus	3
Leukemia	P.aeruginosa, E.coli	2
Breast	S.aureus	1

Discussion

Infection is one of the most common life-threatening complications of cancer. It is important to weigh the risk of infection and other side effects against the benefits of cancer treatment. Cancer patients are known to be immunocompromised and susceptible to various infections. Bacterial infections have emerged in the last decade as particularly devastating complications of cancer treatment because to increased resistance to drugs, including the emergence of bacterial strains that are resistant to all available antibacterial agents, has created a public health problem of potentially crisis proportions (Kalantar et al., 2006). Gram-positive bacteria (GPB) were responsible for the majority of bloodstream infection, but when compared to gram-positive bacteria, Gram negative bacteria were associated with a high bacterial load (HBL)

Table 2. Occurrence of Individual Isolates

Cancer	Number of Individual Isolates %			
	Pseudomons	S.aureus	E.coli	P.mirabilis
Breast	36	39	60	9
Ovarian	39	38	23	-
Stomach	40	20	30	10
Prostate	0	0	0	-
Rectum	50	25	-	25
Thyroid	50	-	50	-
Cheeks	33	33	70	17
Parotid	100	-	-	-
Tongue	50	-	50	-
Cervical	25	25	25	25
Peritoneum	50	-	-	50
Soft tissue	33	33	-	33
Leukemia	50	-	50	-
Upper limb	33	33	33	-
Iliac bone	50	50	-	-
Hodgkin's	33	-	33	33
Maxilla	100	-	-	-

Table 3. Sensitive Pattern of Bacterial Isolates (%)

Organism	Sensitivity Pattern (%)			
	Amikacin	Gentamicin	Co-Trimoxasole	Cefepime
P. aeruginosa	61	72	8.3	72
P.fluorescence	22	17	33.3	33
E.coli	5.5	38	16	33
S.aureus	80	90	64	32
P.mirabilis	54	63	36	54

(Safdar et al., 2006).

The outcome of the study has a major impact on gram-negative bacteria than gram-positive bacteria. Mostly bacteria reach the blood by means of bacterial translocation, which is defined as the passage of viable indigenous bacteria from the intestinal tract through the epithelial mucosa to the mesenteric lymph node and then to systemic circulation (Hryniewicz et al., 2001).

In the present study, the organism prevalence frequency among blood isolates, which reveals that the two isolates occurrence was found to be dominant over the range of frequency of isolates, among the two isolates frequency, the association between *Pseudomonas aeruginosa* and *Staphylococcus aureus* are found to occur maximum in the establishment of bloodstream infection. While comparing the overall frequency, *P.aeruginosa* had its close association with other organisms in the establishment of infection. The synergistic effect of organism, increase the impact of infection. Chemotherapy inversely proportional to the bacterial load in blood, thus the antimicrobial peptide interrupts the therapeutic agents.

Thereby, the knowledge of modifiable risk factors is useful in the development of strategies that may contribute to the prevention of bloodstream infections. The results of this study suggest that decisions on using infection control interventions might be more cost-effectively driven by using both the impact of infections on specific patient populations and the overall risk of infection in that patient population.

In conclusion, preventing infection are based on fundamental steps like identifying patients at risk; educating patients, family members, and health-care personnel on how to avoid practices that may increase colonization; and decreasing the use of invasive procedures. Many of the blood borne infections are acquired during the medical procedures, i.e. the usage of catheters; central venous catheters are the major source of the blood stream infection, particularly with solid tumors. Antibiotic prophylaxis for cancer patients undergoing chemotherapy may reduce mortality and also cancer progression.

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References

Barrett J, Le Blanc K (2009). Cancer chemotherapy and immune regulation. *Am J Immun*, **5**, 8-16.

Giamarellou H, Souli M, Papapetropoulou M (1991). Program and abstracts of the 31st interscience conference on antimicrobial agents and chemotherapy. Washington, D.C: American society for microbiology; . Diffusion of various antibiotics through slime produced by clinical isolates of coagulase-negative staphylococci (CNS), abstr. 1310; 317.

Hryniewicz K, Szczypa K, Sulikowaska A, et al (2001). Antibiotic susceptibility of bacterial strains isolated from blood stream infection. *J Antimicrob Chemother*, **47**, 773-80.

Kalantar E, Mosaei E, Ekrami A, et al (2006). Isolation and antimicrobial susceptibility of bacteria from external ear canal of cancer patients at Shafa cancer hospital -Ahwaz. *J Cancer Res Ther*, **2**, 17-9

Mager DL (2006). Bacteria and cancer, coincidence or cure? A review. *J Translational Med*, **4**, 1186-476.

Miceli M, Atoui R, Thertulien R, et al (2004). Deep septic thrombophlebitis: An unrecognized cause of relapsing bacteremia in patients with cancer. *J Clin Oncol*, **22**, 1529-31.

Nordøy T, Aaberge I, Husebekk A, et al (2002). Cancer patients undergoing chemotherapy show adequate serological response to vaccinations against influenza virus and streptococcus pneumonia. *Med Oncol*, **19**, 71-8.

Raad I, Hachem, Hardy, et al (2007). Sources of outcome of bloodstream infection in cancer patients: The ole of central venous catheters. *Eur J Clin Microbiol Infect Dis*, **26**, 549-56.

Safdar A, Rodriguez GH, Balakrishnan M, et al (2006). Changing trends in etiology of bacteremia in patients with cancer. *Eur J Clin Microbiol Infect Dis*, **25**, 522-6.