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Prevalence of Bacterial and Fungal Isolates In Blood And Body Fluids Among Cancer Patients Admitted In A Superspecialty Hospitalin Delhi

JahnabiGogoi, Gurinder Singh*

Department Of Medical Laboratory Sciences, Lovely Professional University, Punjab (India)-144411

*Corresponding author E mail: gurinder.singh@lpu.co.in; Mobile: 7589170475

Abstract

Invasive bacterial and fungal infections are life threatening and associated with a high mortality among cancer patients. Hence the purpose of this work was to determine the prevalence of bacterial and fungal isolates in blood and body fluid samples.An institutional based study was conducted from January 2018 to April 2018. Total 659 samples were included in the study that comprised of blood and body fluid samples of cancer patients. All blood & body fluid samples were cultured on blood agar, MacConkey agar, chocolate agar and Sabourauds dextrose agar (SDA). Positive cultures were characterized by colony morphology, Gram stain, both conventional biochemical tests and VITEK 2 compact system.

The overall prevalence of isolated organisms (both bacterial and fungal) from blood and body fluid cultures were 22.58% (n=140/620) and 30.55% (n=11/39) respectively. Majority being Gram positive isolates 52.98 % (n=80/151). Coagulase negative Staphylococci 57.7% (n=46/80) was the commonest Gram positive isolate followed by *Staphylococcus aureus*18.75% (n=15/80). Out of 42.38% (n=64/151) Gram negative isolates, *Escherichia coli* 28.12% (n=18/64) was the commonest bacteria followed by *Klebsiellapneumoniae*23.43% (n=15/64). Prevalence of bacteria isolated from blood and body fluid culture was Coagulase negative *Staphylococci* and *Pseudomonas aeruginosa*respectively.

Many opportunities pathogens readily affect in cancer patients, because cancer patients are severely immunocompromised. Prevalence of isolates along with their speciation, age and sex distribution among these cancer patients with infections helps the clinicians to start the empiric treatment on admission.

Key words: Cancer, Bacteria, Fungi, Blood stream infections, immunocompromised.

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Introduction:

Cancer is one of the topmost international health problems after cardiovascular disease. It occurs in both genders and at any age group. Worldwide the rate of cancer is estimated 14.1 million in 2012; out of which 60% are from developing countries [1, 2]. Globally morbidity rate of cancer is about 13%. The spectrum of bacteria and fungi isolated from blood and body fluid samples may not be the same as that of non-cancer patients as because cancer patients are severely immunocompromised. Septicemia and Bacteraemia are the major causes of morbidity and mortality among cancer patients. [3, 13]

Thus cancer patients become susceptible to all types of infections[4].Bacterial Infection is one of the prominentlife-threatening complications for cancer patients and their treatment [1, 2]. Risk factors associated with infection include underlying immune deficiencies, associated co morbidities, and treatment-related adverse effects [5].Other factors likechanges in intestinal microflora, neutropenia; and damaged epithelial surfaces due to multiple antibiotic medications[6].
The organisms responsible for bacteraemia differ across geographical boundaries. In Europe and USA the familiar clinically significant causes of blood stream infections are *Escherichia coli* and *Staphylococcus aureus*. Other organisms like Coagulase negative *Staphylococci, Pseudomonas species, and Acinetobacter species* are probable pathogens of septicaemia[3].

Infection like candidiasis is the most common problems among cancer patient. Candida species are 4th highest common pathogens that are isolated from blood. Microbial infections such asBacteremia and fungemia are associated with cancer patient and mortality ranging from 20 to 50% every year [1].Mostly opportunistic bacteria are known or suspected to cause cancer.The *H. pylori* is the evidence to proof that the bacterium and its role in gastric cancer. Two mechanisms associated with bacterial cancer, one is prolonged bacterial infection and bacterial carcinogenic metabolites [20].

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Other bacteria such as*Chlamydia psitacii*, *Borreliaburgdorferi*and *Streptococcus bovis*have been responsible forskin, ocular, and colorectal cancers, respectively [15].Bloodstream Infections (BSI) are primary obstacles in cancer patient, due to more delay in right diagnosis and treatment which leads to longer stay in health care centre and increased healthcare costs [14]. This is the reason to increase the range of prevalence of BSI from 11% to 38% and overall mortality touches to 40% [19]

Now a day, the emergence of antimicrobial resistance has become a global problem. Multidrug-resistant (MDR) bacteria represents a clinical challenge due to excess use of drugs and lack of awareness, higher chances to reduce the immunity; and other adverse effects; and incomplete knowledge about the pharmacokinetics of the drug for right treatment of cancer patients with MDR microbial infections [17, 18]. Now it is the need of time to initiate the implementation of the programs to control the speedy development and spread of these MDR pathogens[16]. In a present study the prevalence of bacterial and fungal isolates from blood and body fluids and distribution of the isolates as per age and sex were taken among the cancer patients over thesemonths..

Materials and methods

This is an institutional study carried out in the Departments of Microbiology of DharamshilaNarayanaSuperspeciality Hospital, Delhi over four months (January 2018 to April 2018). The study included blood and body fluid samples that were processed in the Microbiology laboratory of the hospital collected from both outdoor and indoor patients.

Sample collection: Samples were collected under aseptic and antiseptic precautions. Sampling of the blood was taken by the health care workers. Samples were taken in BD blood culture bottles. For adult 5 to 8 ml and for pediatric blood 1 to 3 ml of blood was collected fortesting.

Culture and identification of isolates:

All inoculated blood culture bottles were processed in BACTEC 9050 (Becton Dickinson). The positive bottles were sub cultured and Gram smear were prepared, at the end of the testing period.

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Sub cultured on blood agar, 5% sheep blood agar, MacConkey agar, chocolate agar and Sabourauds dextrose agar (SDA). The plates were incubated at 37℃ for bacterial culture and 25℃ for fungal culturesfor 16-18 hours, which was extended for up to 48 hours in case of fungal isolates. If the subculture was negative, it was re- incubated for further 24 hours. Blood and chocolate agar plates were incubated in the candle jar. After that plates were examined for any growth if there was growth it was processed for further identification. Isolates were purified and identified using the conventional morphological and biochemical tests as well as by automated system (VITEK 2 Compact system).

After receiving the samples in microbiology laboratory all the body fluid samples were plated in MacConkey agar, blood agar and chocolate agar. Blood and chocolate agar plates were incubated in the candle jar. After 24 hours growth was examined, if there was no growth than the culture plates were re- incubated for the further 24 hours. All the plates with growth were further processed for identification.

In conventional identification method we used following biochemical tests: catalase, coagulase, oxidase, optochin, bacitracin, and CAMP test for gram positive isolates, and triple sugar iron, indole, citrate, motility, catalase, oxidase for Gram negatives. Final identification was done by automated method (VITEK 2 compact system)

Results:

It is a prospective analysis of the prevalence of bacterial and fungal isolates in blood and body fluids samples among cancer patients over a period of four months, from January 2018 to April 2018. Total blood culture samples that were included in the study were 620, Among the 39 body fluids that were included in our study were Cerebrospinal fluid (CSF) (12), Pleural fluids (16), Bile (6) and Ascetic fluid (5). Out of total 659 samples, 151 (22.91%) samples were positive in culture. Among blood samples, out of total 620, 140 (22.58%) were found to be positive and among 39 body fluids 11(30.55%) were positive in culture. Out of total 151 positive samples, 80 (52.98%) were Gram Positive cocci, 64 (42.38%) were Gram negative bacilli/coccobacilli and 7 (4.64%) were fungal isolates [Table: 1]

Table 1: Distribution of positive isolates in blood and body fluid samples

Totalisolates151	Blood (*n*=140)	Body fluid(*n*=11)

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Gram positivecocci 80 (52.98%)	76 (50.33%)	4 (2.64%)	
Gramnegativebacilli/coccobacilli 64 (42.38%)	57 (37.74%)	7 (4.63%)	
Fungal 7 (4.63%)	7 (4.63%)	0 (0%)	

Overall among the Gram-positive cocci 57.5% (n=46/80) were Coagulase negative Staphylococci, 31.25% (n=25/80) were *Staphylococcus aureus*and 8.75% (n=7/80) was *Enterococcus spp*. Among Gram-negative bacilli/coccobacilli, *E. coli* 43.57% (n=28/64) was the commonest isolate followed by *Klebsiellaspp*23.43% (n=15/64) and *Pseudomonas spp*14.06 % (n=9/64).

Table 2: Causative organisms of all episodes of bacteraemia.

Group of isolate	**Name of the isolate**	**Positive cultures (140)**	**Male (72)**	**Female (68)**	**Age <40 yr (8)**	**Age 40-60 yr (60)**	**Age >60 yr (72)**
Gram positive bacteria isolate	Coagulase negative *Staphylococci*	44	26 (18.57 %)	18 (12.85 %)	0	14	30
	Enterococcus faecalis	6	4 (2.85%)	2 (1.42%)	0	5	1
	Staphylococcus aureus	24	9 (6.42%)	15 (10.71 %)	3	7	15
	Streptococcus pneumonia	2	1 (0.71%)	1 (0.71%)	0	2	0
Gram negative bacteria isolate	*Acinetobacterbaumannii*	3	1 (0.71%)	2 (1.42%)	0	2	1
	Aeromonashydrophila	1	1 (0.71%)	0 (0%)	0	0	1
	Burkholderiacepacia	1	1 (0.71%)	0 (0%)	0	0	1
	Escherichia coli	27	10 (7.14%)	17 (12.14 %)	3	15	9
	Chryseobacteriumindologenes	1	1 (0.71%)	0 (0%)	0	1	0

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	Citrobacter spp.	1	0 (0%)	1 (0.71%)	0	1	0
	Klebsiella pneumonia	14	8 (5.7%)	6 (4.28%)	1	7	6
	Proteus mirabilis	1	1 (0.71%)	0 (0%)	0	0	1
	Pseudomonas aeruginosa	7	4 (2.85%)	3 (2.14%)	1	4	2
	Sphingomonaspaucimobilis	1	1 (0.71%)	0 (0%)	0	1	0
Yeast/fungi isolate	*Candida albicans*	5	2 (1.42%)	3 (2.14%)	0	1	4
	Candida non-albicans	2	2 (1.42%)	0 (0%)	0	0	2

In Blood samples, out of 140, 73 (52.14%) were male and 67 (47.86%) were female. It was found that there was no significant variation in relation to sex of the patients.Among 140 blood culture positive samples, 72 (51.43%) belonged to >60 years age group followed by 40-60 years age group in which culture positivity rate found to be 60 years (42.86%) [Table: 2].

Among 39 body fluid culture positive samples 5(12.82%) belonged to 40-60 years age group followed >60 years age group in which culture positivity rate was 3 (7.69%). Out of 11 positive body fluid samples, 7(63.64%) were male and 4 (36.36%) were female. It was found that body fluid culture was more positive in case of male cancer patients [Table: 3].

Table: 3: The prevalence of isolates in body fluid culture.

Name of theSample	Total no ofsamples (39)	Positive isolate cultures (11)	Group of isolate	Name of the Organisms	Male (7)	Female (4)	Age <40 yr (3)	Age 40-60 yr (5)	Age >60 yr (3)
Ascitic fluids	5	2 (5.12%)	Gram negative bacteria	*Providenciaal califaciens*	1	0	1	0	0
			Gram positive	*Staphylococcus haemolyticus*	0	1		0	1

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			bacteria						
Bile	6	3 (7.69%)	Gram negative bacteria	*Escherichia coli*	0	1	0	1	0
				Aeromonass obria	0	1	0	1	0
			Gram positive bacteria	*Enterococcus faecalis*	1	0	0	0	1
CSF	12	2 (5.12%)	Gram positive bacteria	*Staphylococcus hominis*	1	0	1	0	0
			Gram negative bacteria	*Acinetobacterb aumannii*	1	0	0	1	0
Pleural fluids	16	4 (10.25%)	Gram negative bacteria	*Pseudomonas aeruginosa*	1	1	1	0	1
				Klebsiellapn eumoniae	1	0	0	1	0
			Gram positive bacteria	*Staphylococcus aureus*	1	0	0	1	0

The samples were collected from cancer patients, very less culture positivity was found in the age group <40 in both blood and body fluid. Out of total 151 positive (both blood and body fluid) samples, 80 (52.98%) were male, and 71 (47.02%) were female. The overall prevalence of bacterial and fungal isolates from blood was 92.71% (n=140/151) while from those body fluid was 7.28% (n=11/151). The most frequent isolated bacteria were CoNS 30.46% (n=46/151), *E.coli*18.54% (n=28/151), *S.aureus*16.55% (n=25/151), *Klebiesellapneumoniae*9.93% (n=15/151). In our study from blood culture Coagulase negative Staphylococci 31.42 % (n=44/140) was the most frequent isolated bacteria. In body fluid culture *P.aeruginosa*18.18% (n=2/11) and CoNS 18.18% (n=2/11) were the most frequent isolates. [Table: 1, 2]

Discussion:

This study is conducted in DharamshilaNarayanaSuperspeciality Hospital, Delhi. Study

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was done by the episode of bacteraemia among cancer patients. In our study, it was found that blood stream infection was (n=140/620) 22.58% among cancer patients, which was similar to the findings of Nejad*et al.* (positivity of blood culture was (24.6%). [5] However our findings were dissimilar to the findings of Zahraa*et al.* (65.6%) [6], Batra*et al*. (12%) [7], and Legese*et al*. (55%).[3]. In our study bile culture was found to be positive in (n=3/6) 50% of patients with gall bladder carcinoma, which is almost similar to the study of Sharma *et al.* 65% [8]. In the present study CSF culture positivity rate was (n=2/12) 16.66% which was almost similar to the finding of JE *et al.* (n=79/312) 25.32% [9]. In our study most fungal infections are caused by the commonly recognized opportunistic fungi Candida spp. which is similar to the study done by G *et al. [10]*

It was found that out of 151 positive culture 140 (92.71%) showed bacterial growth in blood samples, out of which Gram positive isolates were (76/140) 54.28% and Gram negative isolates were (57/140) 40.71% that was similar with the study done by Rani *et al.* 91.4% bacterial growth, 46.1% Gram positive isolates and 46.1% Gram negative isolates [11]. However our finding were dissimilar to the finding of Sirkhazia et al. (23/138) 16.17% Gram positive and (23/138) 16.17% in Gram negative isolates[12].In our study the most frequent Gram negative isolates of blood culture was *E.coli*(27/140) 19.28%, *K.pneumoniae*(14/140) 10% and *P.aeruginosa*(7/140) 5% which was almost similar to the finding of Sirkhazia*et al. E.coli*(42/138) 30.43% , *K.pneumoniae*(20/138) 14.49%, and *P.aeruginosa*(10/138) 7.25%. [12]

Positivity of bacterial isolates in body fluid culture was 11 isolates (28.20%) which was dissimilar to the study done by Sirkhazia*et al*. 13 isolate (9.41%) [12].In our study Gram-positive bacteria were more prevalent as a cause of infection in adult cancer patients in blood samples which is dissimilar to the study done by Sirkhazi*et al*. (Gram negative bacteria) [12].In present study Coagulase-negative staphylococci (CoNS) (n=44/140) 31.42% is the most frequent isolates of blood cultures which showed similarity with other studies Nejad*et al*. 21.5% [5] and dissimilar to the finding of Abdollahi*et al. E. coli* was the most common bacteria isolated from the blood cultures (34%). [1]

Concluision

In this study, 659 samples taken from patients with cancer, 22.91% (n=151/659) were culture positive. Out of which 22.58% (n=140/620) and 30.55% (n=11/39) showed positivity of blood and body fluid culture respectively. Infections are the most

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prevailing lethal complications among cancer patients. Certain organisms are seen more often, while some organisms give inclination for immunocompromised patients. However, among those infected patients clinical correction is equally important. In the present study prevalence of Gram positive isolates are more familiar than that of Gram negative isolates. Blood stream infection is predominantly caused by Coagulase negative Staphylococci and *Escherichia coli* respectively. In blood culture positive samples the most common isolate was CoNS (both paired and unpaired samples). However rate of isolation of CoNS was found high in clinical samples. Among those culture positive patients clinical correction is important. The results show that treatment of cancer is more assert in older adults. It is due to by virtue of their enduring health condition, like diabetes. Adult one suffers from greater virulent form of infection than that of younger one. It was found that in blood samples there was no significant variation in relation to sex of the patients. Body fluid culture was more positive in case of male cancerpatients.Cancer patients are efficiently infected by many opportunistic pathogens. Blood and body fluids culture is essential for the treatment of Bacteremia and Septicemia for preserving patients' lives.

A strategic plan must be implemented to ensure the prolonged and quality life of cancer patients. Accurate diagnosis leads to right pathway for treatment of cancer patient in order to ensure cancer control plan. The patient should be diagnosed in early stage so that the treatment will be effective and greater chances of cure. It will reduce the stay of patient in the hospital to avoid the hospital acquired infections which enhance the chances of microbial infections and generate life threating complications. The programme must never be developed in isolation, there should be the involvement of each division of hospital to aware, educate the patient and community members about the risk factors and to take protective measures to avoid the developing cancer.

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