

Prevalence of Nosocomial Infections Associated with Cancer Patients

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ABSTRACT

Background: Cancer patients are immunosuppressed and neutropenic due to chemotherapy, radiation therapy, surgery, stem cell or bone marrow transplant, steroids or the cancer itself. They may carry or acquire infections within the healthcare settings. This study was designed to assess the frequency of acquiring nosocomial infections in cancer patients during immunosuppression and neutropenic conditions (neutrophil count <1000/mm³). Design: This study was carried out at Cancer Hospital and Research Institute, Gwalior, India. A total of 90 patients admitted for >150 days squaring 45 males, 35 females and 10 pediatric patients were analyzed for overall and site specific infections during March 2003 to July 2003. Considering random distribution, 27 urine samples, 22 vaginal, 17 throat, 14 pus and 10 sputum swabs were collected. Method: Direct microscopic examination, cultural characteristics and biochemical analysis were performed to identify the bacterial cultures. Results: Of the 90 patients screened for nosocomial infections, 39.75% gram-positive and 60.25% gram-negative, 12 bacterial species belonging to 9 genera were identified contributing 86.66% to overall nosocomial infections. Conclusion: Patients were either carrying the infections prior to admission or have acquired the same later, identified and recommended for the further treatment. The cost of the treatment is an over increasing number in current situation suggesting an intense screening shall be performed prior admitting the patients to the facility.

Keywords: Cancer Patients, Immunosuppression, Neutropenia and Nosocomial Infections.

INTRODUCTION

Modern medical care encircling increased use of broad-spectrum antibiotics and chemotherapeutic drugs, radiation therapy, surgery, stem cell or bone marrow transplant and use of steroids have elevated the prognosis and life expectancy of cancer patients, nevertheless, they suffer from long-term immunosuppression and hospital stays. Consequently, patients are at high risk of acquiring nosocomial infections^{1,3,4}. Opportunistic microorganisms often invade the patients with neutropenia (neutrophil count <1000/mm³) causing nosocomial infections at various sites e.g. respiratory, urinary or digestive tract⁴. One of the prime responsibilities and challenges for infectious diseases and infection control practitioners are to consider and treat oncology patients as a discrete population². As per the definitions by the Centers for Disease Control and Prevention (CDC), Nosocomial Infections are prevalence of infections within the healthcare units and/or settings with obsolete or spontaneous infection at the time of entry⁶. A report in 1980, Study on the Efficacy of Nosocomial Infections Control (SENIC) depicts that trained professionals could prevent nosocomial infection up to an extent via surveillance and infection control practices⁵. Eventually, hospital epidemiologists and infection control practitioners are responsible and advised to keep a check on prevalence of nosocomial infections in settings⁷. Considering the same, this study was designed to acquire

the frequency of incidence of nosocomial infections in cancer patients with 2 to >150 days of hospitalization and immunosuppression or low neutrophil count. Day to day nurse records and pathological reports were used to monitor and analyze occurrence of infections. The rate of overall and site-specific infections was taken into account for patients under prolonged antibiotic prophylaxis. The definition criteria for Nosocomial Infections were adapted from guidelines as in US Centers for Disease Control and Prevention (US CDC NI 1988), as infections occurring post 48 hours of admissions to the hospital. Although this cut off time point doesn't discrete the carriers who can spread the infection at later stage via mechanical ventilation, catheter insertion and invasive procedures. This clearly suggests that intense screening shall be performed prior admitting the patients to the facility.

MATERIAL AND METHODS

The study was executed at Cancer Hospital and Research Centre-CHRC, Gwalior, India, (formerly Cancer Hospital and Research Institute-CHRI), a Regional Centre for Cancer Research and Treatment funded by the WHO and Government of India, having 150 bed facility associated with Department of Surgical Oncology, Radiation Oncology, Medical Oncology, Gynecology, Anesthesiology & Pain & Palliative Care, Pathology, Biochemistry and Microbiology. The study includes patients receiving chemotherapeutic, radiation and

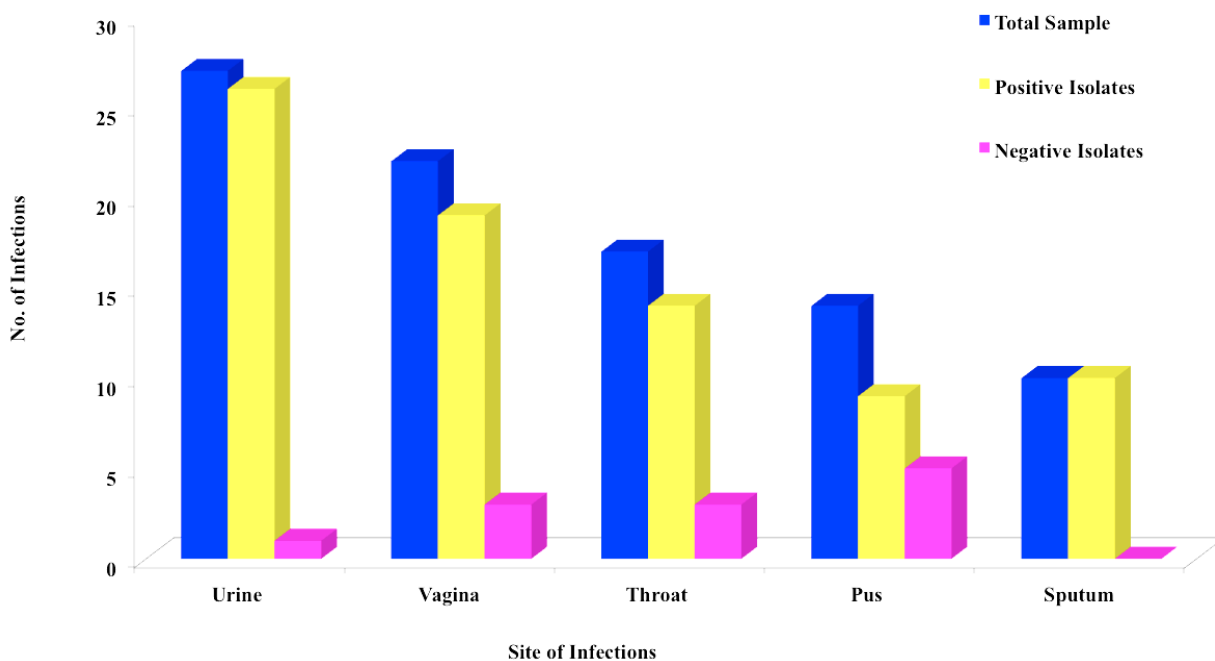


Figure 1: Overall and site specific nosocomial infections in patients with cancer.

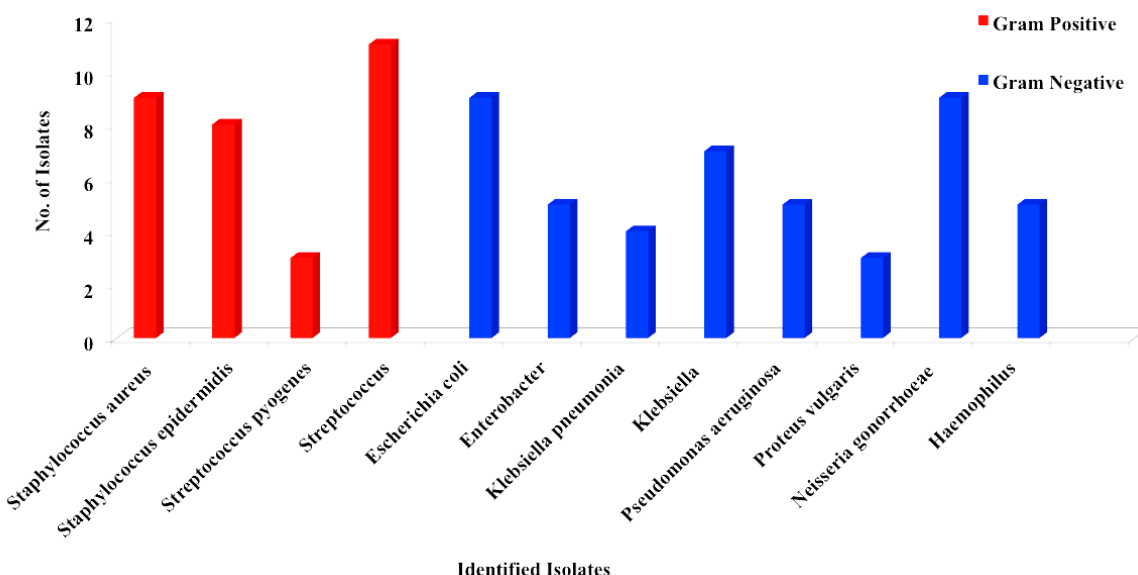


Figure 2: Occurrence of Gram-negative and Gram-positive pathogens belonging to twelve species and nine genera.

surgical modes of treatment for lymphomas, hematological malignancies, solid tumors and leukemia as recommended by Indian Council of Medical Research (ICMR). Samples were collected during March 2003 to July 2003, from patients with neutropenia (neutrophil count $<1000/\text{mm}^3$) developed for 2 or more days. Samples/swabs were obtained, cultured and examined as described elsewhere².

RESULTS

The samples were collected from 90 patients encircling 45 males, 35 females and 10 children with various kinds of cancer under recommended treatment in respective facilities. Figure 1 depicts the overall and site-specific prevalence of bacterial infections as a ratio of total and positive isolates. Overall rate of 86.66% positive isolates

including 12 species belonging to 9 genera dominated by gram-negative species (Table 1) is an outcome of day-to-day infection control surveillance nurse records carried out under supervision of trained professionals followed by direct microscopic culture examination and biochemical analysis. The rate of occurrence of gram-positive bacteria is 39.75% whereas gram-negative bacteria contributed to 60.25% of nosocomial infections (Figure 2). Interestingly, 10% patients were found infected with *Neisseria gonorrhoeae*, which commonly is not a hospital borne infection but a cause of the sexually transmitted infection gonorrhoea.

DISCUSSION

In the concurrent study, an excessively high rate of Nosocomial Infections (86.66%) in patients with cancer

Table 1: Occurrence and percentage of pathogens in different samples from cancer patients.

S. No.	Sample Site and Symptoms	Urine Fever, >100,000 colonies/ml urine (cloudy or foul), dysuria and bacteremia	Vagina Fever, >100,000 colonies/ml urine (cloudy or foul), dysuria and bacteremia	Throat Fever, Ear, Throat and Sinus Pain	Pus Localized pain/tenderness and redness with fever, purulent drainage, positive culture from aspiration	Sputum Fever, Sputum Production, Cough, Dyspnea
1	<i>Staphylococcus aureus</i>	02 (07.69)	02 (10.52)	02 (14.28)	02 (22.22)	01 (10)
2	<i>Staphylococcus epidermidis</i>	04 (15.38)	-	04 (28.57)	-	-
3	<i>Streptococcus pyogenes</i>	-	-	02 (14.28)	-	01 (10)
4	<i>Streptococcus</i>	-	05 (26.31)	04 (28.57)	-	02 (20)
5	<i>Escherichia coli</i>	07 (26.92)	01 (05.26)	-	01 (11.11)	-
6	<i>Enterobacter</i>	02 (07.69)	03 (15.78)	-	-	-
7	<i>Klebsiella pneumoniae</i>	01 (03.84)	-	-	-	03 (30)
8	<i>Klebsiella</i>	02 (07.69)	-	-	03 (33.33)	02 (20)
9	<i>Pseudomonas aeruginosa</i>	03 (11.53)	-	-	02 (22.22)	-
10	<i>Proteus vulgaris</i>	02 (07.69)	-	-	01 (11.11)	-
11	<i>Neisseria gonorrhoeae</i>	03 (11.53)	06 (31.57)	-	-	-
12	<i>Haemophilus</i>	-	02 (10.52)	02 (14.28)	-	01 (10)
Total	--	26	19	14	9	10

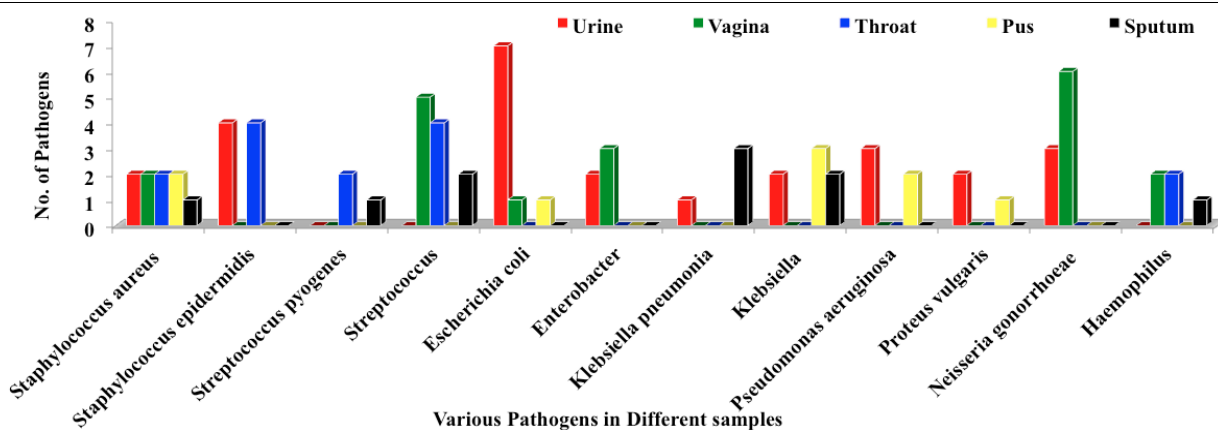


Figure 3: Occurrence of various pathogens in different samples.

while immunosuppression or neutropenia was observed (Table 2). Cancer patients, either carrying the infections prior to admission or the victim due to neutropenic condition and cross infections pose major challenges to practitioners to be considered as separate community. Sputum and urine samples were found highly infected

(100% and 96.30%) followed by vagina and throat (86.36% and 82.35%) suggesting that most of the infections caused were either endogenous or opportunistic gram-negative (60.25%) or gram-positive (39.75%) aerobic bacterial pathogens which require an instant induction of broad-spectrum antibiotic prophylaxis. We

Table 2: Prevalence of Bacterial Infection at Different Sites.

Sample Site	No. of Specimen/ (%)	Positive Isolates/ (%)	Negative Isolates/ (%)
Urine	27 (30.00)	26 (96.30)	01 (03.70)
Vagina	22 (24.44)	19 (86.36)	03 (13.64)
Throat	17 (18.88)	14 (82.35)	03 (17.65)
Pus	14 (15.55)	09 (64.28)	05 (35.72)
Sputum	10 (11.11)	10(100.00)	-
Total	90	78 (86.66)	12 (13.34)

deprived of anaerobic bacterial culture facility hampering respective experiments. As an opportunistic pathogen, *Staphylococcal* infection was the most prominent in all sites clearly indicating a hostile situation within the setting and lower immune system of the subject. *Streptococcus* typically affects people with compromised immune system e.g. patients with cancer and was clearly visible in our studies with a very high occurrence rate in vagina, throat and sputum. *E. coli* and *Neisseria gonorrhoeae* showed a similar pattern in urine, vagina and pus respectively (Figure 3). Since *Neisseria gonorrhoeae* is responsible for the sexually transmitted infection gonorrhea, we suspect that carrier(s) have introduced this infection in the hospital and there are chances of the spread of the same via catheter insertion etc. In order to identify, manage and prevent nosocomial infections in cancer patients, a multidisciplinary approach is required squaring infection control trained professionals, infectious diseases physicians, microbiologists and oncologist. Nosocomial infections alleviate total cost of the treatment affecting the economy and overall health. Prior admission to the hospital patients with cancer should pass through intense screening for existing infections preventing cross infection within the setting.

REFERENCES

1. Bodey G, Buckley M, Sathe Y, Freireich E. Quantitative relationships between circulating leukocytes and infection in patients with acute leukemia. *Annals of Internal Medicine* 1966; 64: 328–340.
2. Carlisle PS, Gucalp R, Wiernik PH. Nosocomial infections in neutropenic cancer patients. *Infection Control and Hospital Epidemiology* 1993; 14: 320-324.
3. Chen YY, Chou YC, Chou P. Impact of nosocomial infection on cost of illness and length of stay in intensive care units. *Infection Control and Hospital Epidemiology* 2005; 26: 281-287.
4. De Pauw BE, Verweij PE. Infections in patients with hematologic malignancies. In: Mandell GL, Bennett, Dolin R, (Ed). *Principles and Practice of Infectious Diseases*, 6th edn. Churchill Livingstone, Pennsylvania, PA 2005: 3432–3441.
5. Haley RW, Quade D, Freeman HE, Bennett JV. The SENIC Project. Study on the efficacy of nosocomial infection control (SENIC Project). Summary of study design. *American Journal of Epidemiology* 1980; 111(5): 472-85.
6. Horan TC, Andrus M, Dudeck MA. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. *American Journal of Infection Control* 2008; 36: 309-432.
7. Shojania KG, Duncan BW, McDonald KM, Wachter RM, Markowitz AJ. Making health care safer: a critical analysis of patient safety practices. *Evidence report/technology assessment* 2001; (43):i-x, 1-668.

CONFLICTS OF INTEREST

Authors declared no conflicts of interest.

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