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Healthcare-Associated Infections at a Brazilian Cancer Hospital: five years of analysis

Infecciones asociadas a la atención de salud en un Hospital de Oncología Brasileño: análisis de cinco años

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Palabras clave: infección hospitalaria, Servicio de Oncología del Hospital, control de Infecciones; enfermería.

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ABSTRACT

Retrospective epidemiological study, carried out in 2009, to analyze healthcare-associated infection rates in cancer patients, according to infection site, lethality and data were collected from records filed at the institution's Hospital Infection Control Service (SCIH), between 2004 and 2008. The project was submitted and approved by the Research Ethics Committee. Regarding the healthcare infection rate, it was observed that 8.24% (5,821) of episodes occurred during the period. These rates ranged from 6.51% (1,017) in 2004 to 10.82% (1,790) in 2007, with a standard deviation of ± 1.91. Regarding the number of patients with infection, a rate of 5.75% (4.064) was found, ranging from 4.89% (765) in 2004 to 7.47% (1,237) in 2007.

The most affected sites were surgical site (26.11%), bloodstream (24.11%) and respiratory tract (18.50%). Infection associated lethality and mortality rates corresponded to 23.86% and 1.37% of deaths, respectively. The multiple factors involved in this process need to be assessed, so that the institution can develop infection prevention and control strategies and can intervene timely.

RESUMEN

Estudio epidemiológico retrospectivo realizado en 2009 a fin de analizar las tasas de infección asociada a los cuidados en la salud, en pacientes oncológicos, por topografía, letalidad y mortalidad de 2004 a 2008. Los datos se recogieron de registros archivados en el Servicio de Control de Infección Hospitalaria (SCIH) de la institución. Los aspectos éticos fueron observados. Referente a la tasa de infección asociada a los cuidados en salud se observó que ocurrió el 8,24% (5.821) de episodios en el período. Estas tasas presentaron variación

del 6,51% (1,017) en 2004 al 10,82% (1.790) en 2007 y desvío estándar = (± 1,91). Referente al número de pacientes con infección se encontró el 5,75% (4.064) variando del 4,89% (765) en 2004 al 7,47% (1237) en 2007. Las topografías más acometidas fueron las de sitio quirúrgico con el 26,11%, corriente sanguínea con el 24,11% y el tracto respiratorio con el 18,50%. La tasa de letalidad y mortalidad asociadas a la infección fueron el 23,86% y el 1,37% de óbitos respectivamente. Se considera necesaria la evaluación de los múltiples factores involucrados en ese proceso para que la institución desarrolle estrategias de prevención y control de las infecciones y pueda intervenir en tiempo hábil.

INTRODUCTION

In Brazil, health-associated infections (HAIs) represent one of the main causes of death in hospitalized patients. According to the Ministry of Health, the mean hospital infection (HI) rate is about 15%, against 10% in the USA and Europe. It should be reminded, however, that the HI rate significantly varies, as it is directly related with each hospital's care and complexity level. In general, the most frequently affected HI sites are urinary tract (40%), surgical wounds (25%), respiratory tract (10%) and bloodstream (10%) [(1)].

Hospital infection is considered as an infection the patient displays during and/or after hospitalization, which can be related with the hospitalization period and any procedures performed [(2)]. It is considered the main cause of morbidity and mortality and also increases the patient's hospitalization time, rising treatment costs [(3)]. Hospital infections affect the whole world and continue being one of the main public health problems [(1)], mainly in oncology, given its epidemiological proportions.

Technological evolution of invasive diagnostic and therapeutic procedures used for treatment of severely ill patients stands out among several HI-related determinants. Immunosuppressors, antibiotics, increased healthcare demands for immunodepressed patients and patients with chronic-degenerative conditions have increased risk for HI, including resistance to the microorganisms in the hospital microbiota [(1)]. Besides these determinants, hand washing is one of the main control measures but is still incipient [(4,5)], which enhances cross-contamination during care delivery.

This issue directly rises diagnosis and treatment costs in health care delivery to patients with HI and also included additional daily fees, new laboratory or radio-imaging support tests, payment of health professionals, among others. International evidence indicates that, on average, each patient with HI is hospitalized four days longer, direct costs increase by approximately US$ 2,100 and death risk due to this new pathology is 3.6% [(6)].

According to the International Agency for Research on Cancer (IARC) /World Health Organization (WHO), the global impact of cancer has doubled in the last 30 years. In 2008, it is estimated that there were more than 12 million of new diagnosed cancer cases, 7 million deaths by cancer and 25 million people living with cancer [(7)]. The incidence of new cancer cases in Brazil between 2010 and 2011 is estimated at 489,270 cases [(8)]. Cancer patients are submitted to several hospitalizations, and to different diagnostic and therapeutic procedures that extend their hospital stay. Hence, they are exposed to colonization by virulent microorganisms, many of which are multidrug-resistant. And, although cancer care has improved in recent decades, demonstrated by patients surviving longer, immunosuppression due to malignant disease or treatment, they are more vulnerable to infection. In addition, new treatments increase the group of patients at risk of infection of all kinds [(9)].

Immunity deficit is characterized according to baseline pathology and age; dose and duration of immunosuppression therapy; epithelial integrity; humoral and cell immunological status; metabolic factors like bad nutrition; hyperglycemia and liver failure; abnormality of the mononuclear phagocyte system and presence of infections that modulate immunity, such as the Human Immunodeficiency Virus or cytomegalovirus [6,10]. Among the factors influencing infection development, the most common are: immunological status, age (newborns and elderly are more vulnerable), abuse of antibiotics, invasive procedures, immunosuppression and errors in infection control procedures [1,6,10].

During our study group's experience in practice and research at the Hospital Infection Control Service (SCIH) of a cancer hospital, it was verified that hospital infections in these patients present themselves differently. It was also perceived that the multiprofessional team has delivered care distanced from the standards recommended by health policies, which aroused our interest in conducting this study, with the purpose to identify the indicators of this problem in the study population, analyze HI rates according to site, and its lethality and mortality, during a period of five years.

METHOD

Retrospective epidemiological study, covering the period from 2004 to 2008, carried out at the Hospital Infection Control Service (SCIH) of a nationally renowned teaching and research institution specialized in cancer treatment, located in the West Central Region of Brazil. The institution has 172 beds, and, on average, attends 26,000 patients per month, including consultations, hospitalizations, surgeries, chemotherapy and radiotherapy sessions.

Case definition

According to a Brazilian Ministry of Health decree, published in 1998[2], hospital infection was stipulated as an infection acquired after the patient's admission, which can manifest itself during hospitalization and/or after discharge and is associated with the hospitalization or procedures performed at the institution. Hospital infection was also considered as any clinical manifestation of infection presented as from 72 hours of admission[1]. The patient's hospitalization date and date antimicrobials were prescribed were observed on the form used to request and justify the use of antimicrobials (ATB). Cases were those which attended the description above and the NNISS (National Nosocomial Infection Surveillance System) method to diagnose surgical site, bloodstream, urinary tract and respiratory tract hospital infections [11].

Data collection procedures

Data collection was undertaken in 2009. Included data from dressing records, forms to request and justify the use of ATB and infectious disease expert opinions filed at the SCIH. Therefore, a structured script was used, according to the National Information System for Health Service Infection Control – SINAIS version 2007 [9]. The variables were: number of exits (discharge/death/transfer) during the study period, hospitalization date, date of discharge, date the antimicrobials was prescribed, infection type (hospital, community and inter-hospital), infection site, service type (distributed according to medical specialty) and date of death.

Ethical-legal aspects

Approval for the project was obtained from the Research Ethics Committee of the institution where the study was accomplished (protocol 006/2009).

Data treatment

The database was structured and processed in Microsoft Office Excel, version 2003. For data analysis, descriptive statistics were used and results were presented in tables.

RESULTS

Between 2004 and 2008, 70,662 registrations for cancer patients were identified, and each patient was submitted to different therapeutic procedures.

Regarding the healthcare-association infection rate (HAIs), it was observed that 5,821 episodes occurred, with a global rate of 8.24%. These rates ranged from 6.02% (508), in 2005, to 10.82% (1,790), in 2007, with a mean HAIs rate of 7.99% (SD± 1.91) during the period (1,164), as shown in **Table I**. The upper control limit (UCL) was 10.99%; the lower control limit (LCL) was 4.99%.

Table I. Distribution of healthcare-associated infection rates per year at a cancer hospital in Brazil

Period	Discharge/transfer/death	Infection episodes	%
2004	15,618	1,017	6.51
2005	8,433	508	6.02
2006	14,022	1,103	7.86
2007	16,541	1,790	10.82
2008	16,048	1,403	8.74
Total	70,662	5,821	8.24

The HAIs rate in patients was calculated taking into account the number of patients with infections and the number of exists, including deaths/discharge/transfers occurred each year. Rates of patients with HAIs ranged from 4.89% (765), in 2004, to 7.47% (1,237), in 2007. The mean rate of patients with HAIs was 5.56% (812), as shown in **Table II**.

Table II. Distribution of patients with healthcare-associated infections per year at a cancer hospital in Brazil

Period	Discharge/transfer/death	Patients with infection	%
2004	15,618	765	4.89
2005	8,433	341	4.04
2006	14,022	753	5.37
2007	16,541	1,237	7.47
2008	16,048	968	6.03
Total	70,662	4,064	5.75

Regarding HAIs rates per site, the most affected sites were the surgical site (26.11%), bloodstream (24.11%) and respiratory tract (18.5%), as shown in **Table III**.

Table III. Distribution of healthcare-associated infection rates per site, at a cancer hospital in Brazil

Sites	Infection episodes	%
Surgical site	1,520	26.11
Bloodstream	1,404	24.11
Respiratory tract	1,077	18.50
Skin and soft parts	529	9.09
Oral cavity	564	9.69
Urinary tract	420	7.21
Gastro-intestinal tract	290	5.00
Outros	17	0.29
Total	5,821	100

To calculate the lethality rate associated with healthcare related infection, the number of deaths by HI and patients with HI was used. Lethality rates ranged from 21.17% (162), in

2004, to 27.62% (208) in 2006, with a mean rate of 23.80% (194) SD± 2.41, as shown in **Table IV**.

Table IV. Distribution of lethality rate associated with healthcare-related infection per year at a cancer hospital in Brazil

Period	Patients with infection	Deaths associated with infection	%
2004	765	162	21.17
2005	341	79	23.16
2006	753	208	27.62
2007	1,237	301	24.33
2008	968	220	22.72
Total	4,064	970	23.86

To calculate the mortality rate associated with HAIs, the number of deaths by HI and the number of exits (discharge and death during the period) were used. The mortality rate associated with HI between 2004 and 2008 corresponded to 1.37%.

DISCUSSION

The evolution of healthcare-associated infection rates allows an observation of the trend in these infections over the years and can indicate whether actions performed during the period effectively reduced infection rates at health institutions.

The mean HAIs rate that the SCIH identified at the institution under investigation, between 2001 and 2003, was 6.60%, against 7.99% between 2004 and 2008. It is highlighted that the rate in 2007 amounted to 10.82% (Table I). This result can indicate that outbreaks occurred during this period, even if the rate remained within expected limits for the institution. In Brazil, the yearly prevalence of hospital infections identified in 99 tertiary care hospitals corresponded to 15.5% [(6)].

A study performed at a hospital specialized in tumor treatment in China that analyzed HI occurrence, spectrum of pathogenic bacteria and its resistance to antimicrobials revealed that, during a two-year period, 952 (1.9%) out of 50,011 admitted patients developed hospital infection. The same study reveals that the main causes of these infections were associated with cancer patients receiving chemotherapy or radiotherapy and patients submitted to surgeries [(12)].

Evidence in literature reveals that institution size, type of care and service delivered, teaching institution, patients' hospitalization period, among others, makes the discussion about hospital infection in cancer patients increasingly complex [(12,13)]. These studies support the need for more specific studies to better understand the risk factors and mechanisms involved in treatment and care related to hospital infection in cancer patients.

As for HAIs patient rates, in 2007, this corresponded to 7.47% (1,237), according to Table II. In a Brazilian study, the rate of patients with hospital infections in health institutions affiliated with the Unified Health System amounted to 13.0% [6].

A research the World Health Organization (WHO) conducted in 55 hospitals from 14 countries in four regions (Europe, Eastern Mediterranean, Southeast Asia and Western Pacific) showed that, on average, 8.7% of hospitalized patients acquired hospital infections[14]. Studies discuss cancer patients' vulnerability to these infections, especially those associated with invasive procedures, involving different types of microorganisms [15,16,17].

Regarding infection sites, it was identified that the most frequent types were surgical site, bloodstream and respiratory tract infection. Although other sites showed rates below 10%, care is needed with patients' immunological status, as they can evolve to death in a short period.

Surgical site infections amounted to 26.11 % (Table III). This result suggests that other factors are involved in the acquisition and evolution of these infections, besides low immunity and chemotherapy and radiotherapy effects, such as the large number of surgeries performed at the hospital for example. Surgical procedures are an influential indicator for this problem. It should be reminded that the research institution performs about 650 surgeries per month.

A prospective study at *Instituto Nacional de Cancerologia* of Mexico found a surgical site infection rate of 18.7% in patients submitted to breast cancer surgery between January 2001 and December 2005. Risk factors associated with infection were preoperative radiation, hematoma, obesity and prolonged duration of surgery [18].

As for bloodstream infection (BSI), the rate identified was 24.11% (Table III), considered the second highest rate among other infections. Patients undergoing cancer treatment generally need recurring infusions and receive temporary and indwelling catheters. This result may be related with the large number of invasive procedures and/or infusions they are submitted to during treatment, as well as professionals' lack of hand washing during care delivery, lack of hub disinfection during medication administration, among others.

A study carried out at a hematology-oncology department of a child medical center in Israel that aimed at defining central venous catheter-associated complications in pediatric cancer patients revealed that 207 episodes of catheter-related bloodstream infection occurred between November 2000 and December 2003 [19].

Respiratory tract infection, then, was the third highest infection rate, corresponding to 18.50%, Table III. In view of the relevance of the lower respiratory tract, infections are very important due to their frequency and associated morbidity. These infections are classified as tracheobronchitis and pneumonia. Among pneumonias, those associated with mechanical ventilation through orotracheal intubation or tracheotomy are the most frequent[1]. A large range of agents cause pneumonia, including bacteria, fungi, viruses, with bacteria as the most common causes [1].

A research aimed at analyzing hospital infections in cancer patients' files found that the main sites involved in infectious processes were surgical site (28.2%), respiratory tract (19.2%) and urinary tract (18.7%)[20]. Healthcare-associated infections according to the infection sites identified in that study are in line with literature.

The lethality rate indicates the disease's power to determine death and indicates the quality of care delivery to patients in health institutions. It was verified that the mean lethality rate was 23.80% (SD± 2.41). In 2006, this rate exceeded the expected limit for the institution. In view of the lack of studies appointing an expected limit for lethality in cancer patients, more studies are needed to determine these limits.

The mortality rate associated with healthcare-related infection the SCIH identified at the research institution between 2001 and 2002 corresponded to 1.02%. The mortality rate associated with HI during this study period was 1.37%. This result indicates that patients' mortality rate due to infection did not vary over the last eight years.

Few studies discuss mortality and lethality associated with hospital infection in cancer patients, which makes it complex to classify the rates, due to the lack of parameters related to the study population and the work processes.

Among the study limitations, the lack of gender records, birth date and laboratory test results on the ATB forms in order to confirm the diagnosis is highlighted. Besides, it is known that the passive surveillance method, carried out through hospital infection detection forms, may not be as effective as the active surveillance method.

CONCLUSION

Although healthcare-associated infection rates have mostly remained within institutional control limits, the multiple factors involved in cancer patients catching these infections need to be assessed, as the risk of acquiring them is greater for this population, due to these people's immunological status and the treatments they are submitted.

Considering that patients undergoing cancer treatment need safe and high-quality care, ranging from adequate nutritional intake to reduce the occurrence of problems to healthcare-associated infection control and prevention actions, these study results indicate the need for further investments in healthcare-associated infection prevention and control actions at the institution, especially regarding the use of antimicrobial Policy, standard precautions and environmental flora monitoring.

This study also indicates that further research is fundamental, addressing the development of hospital infections in cancer patients, with a view to the adaptation of hospital infection prevention and control standards and routine monitoring, implementation and supervision programs, specifically for this population and for hospitals specialized in cancer treatments.

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