



Occurrence of nosocomial infection in intensive care unit of a public hospital

Ocorrência de infecção hospitalar em unidade de terapia intensiva de um hospital público

Ocurrencia de infección nosocomial en una unidad de cuidados intensivos de un hospital público

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ABSTRACT

Introduction: Health care-associated infections stand out in scientific investigations for being related to increased length of stay as well as to morbidity and mortality rates, of hospitalized patients, especially in intensive care units. The study aims to profile the occurrence of invasive device-associated infections in an intensive care unit of a public hospital in Rio de Janeiro. **Outline:** Descriptive, documentary study with data collected in 2018 through form including patients hospitalized in 2016. For univariate analysis, Kaplan-Meier estimate and Logrank test with value $p < 0.05\%$ were used. **Results:** 181 predominantly male patients (53.59%) \geq 60 years (37.57%). Indwelling urinary catheter was the most used device although the highest percentage of infection was with invasive mechanical ventilation. The nosocomial infection rate was 28.73% predominantly in respiratory tract (56.91%). **Implications:** There was an association between nosocomial infection and the use of invasive devices investigated in the study, considering that the time of use was the most related factor.

DESCRIPTORS

Infection; Delivery of Health Care; Intensive Care Units.

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INTRODUCTION

Health care-Associated Infections - HAI deserve to be highlighted in scientific studies and discussions due to the impact that cause in hospitalized patient's recovery as well as in the strategies in patient safety.¹ The implementation of infection control measures is part of the epidemiological surveillance and is critical to ensure the safety of patients and health professionals who seek to reduce events that may cause often irreparable damage.²

In this context, in Intensive Care Unit - ICU, patients for being in serious situations are more exposed to the use of invasive devices; therefore, they are more prone to acquire nosocomial infections. In these units, the specialized and complex technology increases the survival of critical patients, but it increases the risk factors that cause the appearance of HAI, especially the ventilator-associated pneumonia.³

In order to understand how HAI establish in critical patients and in which context they can be reduced, the present study aimed to profile the occurrence of invasive device-associated infections in an ICU of a public hospital in the city of Rio de Janeiro - RJ.

METHOD

The study design was retrospective, descriptive, documentary, developed in an adult ICU of a public hospital in the city of Rio de Janeiro - RJ. It consists of 09 beds, meets clinical and surgical demands with occupancy rate of 100%. The data were collected in August and September 2018 through semi-structured form and had as data source records of National Nosocomial Infection Surveillance - NNIS and the laboratory results of positive or negative cultures.

All the patients hospitalized in 2016 were included, and those who were younger than 18 years and/or had ICU length of stay less than 72 hours were excluded. To delimit the dependent variable, the following was elected: the occurrence of nosocomial

infection previously established by Hospital Infection Control Committee - HICC recorded in the NNIS record.

The independent variables were: sex, age group, hospital source (emergency, surgical center or inpatient unit), days of hospitalization, use of invasive devices (mechanical ventilation -MV; central venous catheter - CVC and indwelling urinary catheter - IUC), invasive arterial puncture, drains, biological material cultures with respective results, colonization by multi-resistant bacteria and outcome of the case.

The data were entered using double data entry in Microsoft Excel® software version 2010 and subsequently transferred to Rstudio software for statistical analysis. Initially, a descriptive analysis of variables presented through tables with frequency distribution. In the univariate analysis, Kaplan-Meier estimate and Longrank test with $p < 0.05$ were used.

The study met the standards of resolution No. 466/2012 which regulates research involving human beings, approved by Ethics Committee of University of the State of Rio de Janeiro with favorable opinion No. 89164418.9.0000.5285.

RESULTS

Population consisted of 181 adult patients hospitalized in the period of January to December 2016. Most of it comes from surgical center, they already had invasive devices when admitted to ICU, the most common were indwelling urinary catheter and central venous catheter. Coming from the emergency, in addition to devices mentioned, patients were also with mechanical ventilation or chest drain, for example.

Average hospital stay was 16.91 days with median time of 10, predominantly male (53.59%) and elderly (37.57%) patients, followed by 50 to 59 years age group (21.55%). More than half (57.46%) belonged to the neurosurgery clinic in pre- and postoperative conditions, highlighting the brain tumor diagnosis (Table 1).

Table 1 – Profile of clinical variables of patients hospitalized in the adult intensive care unit. Rio de Janeiro – RJ, 2016.

Variables	n	%
Sex		
Female	84	46.41%
Male	97	53.59%
Age group		
18–30 years	28	15.47%
31–41 years	18	9.94%
41–50 years	28	15.47%
51–59 years	39	21.55%
60 years or more	68	37.57%
Source		
Surgical center	82	45.30%
Emergency	61	33.70%
Inpatient department	38	37.57%
Nosocomial infection		
Yes	52	28.73%
No	129	71.27%
Mechanical ventilation		
Yes	103	56.91%
No	78	43.09%
Central venous access		
Yes	153	84.53%
No	28	15.47%
Indwelling urinary catheter		
Yes	157	86.74%
No	24	13.26%

As for the usage profile of invasive devices, the indwelling urinary catheter was the most numerous, followed by central venous catheter, although the highest percentage of nosocomial infection has been receiving invasive mechanical ventilation. Of the patients with mechanical ventilation (56.91%), only 38.83% have record of tracheal aspirate for microbiological analysis. As to the presence of central venous catheter, 84.53% were using it; however, only 13.07% results of blood cultures were found. When using indwelling urinary catheter, of 86.74%, only 12.10% urine cultures were recorded (Table 2).

Regarding nosocomial infections, 28.73% of patients had infection during ICU stay. Length of stay was related to the emergence of HAI, especially those who were receiving mechanical ventilation, the longer the time of mechanical ventilation, the greater the probability of becoming infected. Females had greater

chance of becoming infected than males even though they are less numerous.

In relation to the age group using Logrank test, they do not differ regardless of age, the longer the length of stay (using the average time), the greater the chance for a nosocomial infection event. In the analysis of survival regression, the investigated devices are at risk for occurrence of nosocomial infection.

The use of central venous catheter and indwelling urinary catheter influenced in infection ($P < 0.0001$), the use of mechanical ventilation increased the chance of becoming infected regardless of age group and length of stay ($P < 0.0082$; Significance level 0.10).

Of the multi-resistant bacteria, the main cause of infections was *Acinetobacter baumannii*, it was present in 27 (56.25%) patients with closed diagnosis of sepsis with a pulmonary focus. The second infection that stood out the most in the study had urinary focus,

of 157 patients who were with indwelling urinary catheter, 3 (5.77%) acquired urinary infections, of the multi-resistant ones responsible for the infection, the Carbapenem-Resistant Enterobacteriaceae - CRE stood out the most in urine cultures.

The bloodstream infection was in third place, of 153 patients who were with central venous catheter,

there was a single record corresponding to 1.92%. Among these patients, 20 (13.07%) underwent blood cultures (Table 2). The other medical devices were not mentioned in the article for they were less numerous and had length of stay lower than 10 days, with no statistical significance.

Table 2 – Profile of clinical variables of patients hospitalized in the adult intensive care unit. Rio de Janeiro – RJ, 2016.

Variables	N	%
Culture material		
Tracheal aspirate	40	38.83%
Blood culture	20	13.07%
Urine culture	19	12.10%
Colonization by multi-resistant bacteria		
Yes	21	11.60%
No	160	88.40%
Prevailing multi-resistant bacteria		
<i>Acinetobacter baumannii</i>	30	16.56%
<i>Klebsiella pneumoniae carbapenemase</i> – KPC	5	2.25%
<i>Pseudomonas aeruginosa</i>	8	4.41%
Outcome of the case		
Death	46	25.41%
Survival	135	74.79%

DISCUSSION

The infections in ICU are frequent, and their mechanism of development deserves to be highlighted for providing actions and measures to be eradicated instead of treated.⁴ The educational strategies are critical to identify the adherence or not of professionals in relation to infection prevention and control practices.⁵⁻⁶

In the present study, women have more chance of becoming infected than men, affecting especially older people. The clinical outcome in the elderly is not always favorable, as they have more fragile characteristics,⁷ with the increase in life expectancy, they stand out in hospital environment for being more subject to disease and complications.

Concerning the occurrence of infection, there was positive association between the use of invasive devices and the occurrence of nosocomial infection. The ventilator-associated pneumonia was in the highest percentage of cases (92.31%), corresponding to

other studies on the occurrence of HAI in greater number in patients receiving mechanical ventilation.⁷⁻⁸

The use of indwelling urinary catheter is still pointed out as a risk factor for infection. The nursing staff is primarily responsible for raising awareness of care that reduces these infections, simple measures such as hand hygiene, aseptic techniques, closed system maintenance and placement of the collection bag are pointed out as essential in prevention care plan.⁸

The bloodstream infections caused by the use of central venous catheter produce challenges for increasing days of hospitalization and chance of death. Simple actions and proper instructions for the use collaborate to reduce infections.⁹ In the present study, 84.53% of the patients were using the device, but the infection rate did not present significant data, only 1.92%.

The positive impact in reducing bloodstream infections is observed when preventive measures through bundles are adopted in central venous catheter insertion and maintenance practices.¹⁰ In the year that patients were hospitalized, the present ICU analyzed did not have well-established bundles in its daily practice.

As regards the bacterial profile, the microorganism *Acinetobacter baumannii* (27.58%) prevailed, present in mechanical ventilation corroborating the literature, followed by *Pseudomonas aeruginosa* (1.65%). Profiling the microbiota in the department, especially in ICU allows the understanding about care and therapeutic approaches. Hartmann et al.¹¹ indicate that antimicrobials should be used rationally, conducted by cultures to reduce the appearance of multi-resistant bacteria.

Sousa et al.¹² discuss about the need for new studies on invasive procedures and infection through a review of international publications that revealed a scarcity of studies within this theme. In the present study, it is noted that further investigations are needed on the association of HAI with the use of invasive devices in order to choose preventive measures that can impact in reducing costs to treat the infections as well as deaths.

Study shows that the adherence of health professionals to hand hygiene is low, only 43.7% adhere to this practice that today is considered as international goal. The nursing technicians were the ones that adhere the least, giving cause for concern because they are professionals who are in direct contact with patients, providing care that involve cross-infection risks.¹³

More investment on infection prevention is needed since the relation of invasive devices to the appearance of the infectious condition is already known,¹⁴ the safety culture in hospitals and adoption of strategic measures and guidelines with good practices¹⁵⁻¹⁶ are essential in promoting patient health.

Although initiatives have occurred to improve patient safety and the incidence of infections has

reduced, much remains to be done. The infections generate high costs for hospital departments and cause negative impacts in patient health. Study shows the high costs in treatment of bloodstream infections followed by ventilator-associated respiratory tract infections.¹⁷

In the present study, the laboratory investigations are early, most of patients were not submitted to examinations for investigation, if performed, they were not recorded, weakening even more the assessment and analysis of this study. The study has limits in its analysis, and it is not possible to prove if all the patients with these invasive devices were investigated on the infectious process through the biological material collection (tracheal aspirate/blood/urine) because no results of laboratory examinations were found. The data found were not enough to fulfill the investigations of the study on the presence of multi-resistant bacteria. There was no access to imaging examinations and patient records, only Hospital Infection Control Committee records.

It is essential to continue studies that seek resolute measures in daily practice of health care-associated infections. The present study contributes to health staff practice for presenting data that represent the fragility of our practice and how important the adoption of protocols and routines is in an attempt to provide a quality care.

CONCLUSION

The occurrence of invasive device infections in patients monitored in ICU showed association, considering that the time of use was the factor with the greatest relation, leading us to discuss about what criteria need to be established to reduce this event that can cause increase in morbidity and/or mortality.

The prevalence of ICU infections is still high due to the use of invasive devices. Although the presence of such devices is a risk factor for the occurrence of health care-associated infections, they are still needed to treat critical patients.

The infection due to invasive mechanical ventilation had the greatest association with the hospital infection, followed by urinary tract and bloodstream infection. Even though there are studies that approach infections and invasive devices, it is worth noting that new evidence is presented so that we can reduce infection rates, considering the high

hospitalization, treatment costs and irreparable damages such as death.

We hope that the results of this study can contribute to the reflection of care practices, allowing the implementation of routines based on scientific evidence for the development of strategies that aim to adopt safer practices for patients.

RESUMO

Introdução: As infecções relacionadas à assistência à saúde se destacam nas investigações científicas por estar relacionada ao aumento do tempo de internação bem como aos índices de morbidade e mortalidade, dos pacientes internados, especialmente nas unidades de terapia intensivas. O estudo tem como objetivo traçar o perfil da ocorrência das infecções relacionadas ao uso dos dispositivos invasivos em uma unidade de terapia intensiva de um hospital público do Rio de Janeiro. **Delineamento:** Pesquisa descritiva, documental com dados coletados em 2018 através de formulário sendo incluídos os pacientes internados em 2016. Para análise univariada utilizaram-se estimativa de Kaplan-Meier e teste de Longrank com valor $p < 0,05\%$. **Resultados:** 181 pacientes com predomínio do sexo masculino (53,59%) ≥ 60 anos (37,57%). O cateter vesical de demora foi o dispositivo em maior uso embora o maior percentual de infecção seja pelo uso de ventilação mecânica invasiva. A taxa de infecção hospitalar foi de 28,73% com predomínio no trato respiratório (56,91%). **Implicações:** Houve associação entre infecção hospitalar e o uso dos dispositivos invasivos investigados no estudo, considerando que o tempo de uso foi o fator de maior relação.

DESCRITORES

Infecção; Assistência à Saúde; Unidades de Terapia Intensiva.

RESUMEN

Introducción: Las infecciones relacionadas con la atención médica se destacan en las investigaciones científicas porque están relacionadas con una mayor duración de la estancia hospitalaria, así como con las tasas de morbilidad y mortalidad de los pacientes hospitalizados, especialmente en las unidades de cuidados intensivos. El estudio tiene como objetivo perfilar la aparición de infecciones relacionadas con el uso de dispositivos invasivos en una unidad de cuidados intensivos de un hospital público en Río de Janeiro. **Delineación:** Investigación documental descriptiva con datos recopilados en 2018 a través de un formulario que incluye pacientes hospitalizados en 2016. Para el análisis univariado, se utilizó una estimación de Kaplan-Meier y una prueba de Longrank con un valor de $p < 0,05\%$. **Resultados:** 181 pacientes con predominio del sexo masculino (53,59%) ≥ 60 años (37,57%). La sonda vesical permanente fue el dispositivo de mayor uso, aunque el mayor porcentaje de infección se debe al uso de ventilación mecánica invasiva. La tasa de infección nosocomial fue del 28,73% con predominio en el tracto respiratorio con 56,91%. **Implicaciones:** Hubo una asociación entre la infección nosocomial y el uso de dispositivos invasivos investigados en el estudio, considerando que el tiempo de uso fue el factor con la mayor relación.

DESCRIPTORES

Infeción; Prestación de Atención de Salud; Unidades de Cuidados Intensivos.

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COLLABORATIONS

DLA: substantial contributions to work conception; data collecting, analysis and interpretation; writing the article and final version to be published. ASC: substantial contributions to data collecting, analysis and interpretation; writing the article and final version to be published. RFAS: substantial contributions to work design; critical review of the article and final version to be published. All the authors agree and take responsibility for the content of this manuscript version to be published.

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AVAILABILITY OF DATA

Does not apply.

FUDING SOURCE

Does not apply.

CONFLICTS OF INTEREST

There are no conflicts of interest to declare.