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ORIGINAL ARTICLE

Profile of patients presenting hospital-acquired infection at intensive care units of public hospitals

Perfil dos pacientes com infecções relacionadas à assistência à saúde em unidade de terapia intensiva de um hospital público

Perfil de pacientes con infección relacionada con la asistencia sanitaria en la unidad de cuidados intensivos de un hospital público

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ABSTRACT

Backgroung and Objective: Currently, the Intensive Care Unit (ICU) plays a decisive role in the chance of survival of critically ill patients, whether they are trauma victims or experiencing any other serious clinical condition. However, it has become the main place of hospital infections occurrence, increasing morbidity, mortality and care costs, representing an important public health problem in the recent years. Thus, this study aims to identify the profile of patients with hospital-acquired infections in the Adult ICU of a public hospital in the Federal District, Brazil. **Method:** This is a retrospective and descriptive study, with quantitative approach. Data were collected directly from patients' electronic medical records. **Results:** We found 51 patients with cross infection, predominantly male and older adults; 24 from the hospital itself, 21 from other hospitals and 6 from Emergency Care Units. The main reason for hospitalization was clinical (76.4%). Regarding topography, 23 patients had pneumonia and 18 had urinary tract infections. The mean length of hospital stay was 31 days and the mortality rate was 37.2%. **Conclusion:** As important as the investment in state-of-the-art technology in intensive care is to know the profile of critically ill patients; as it can assist nurses in admission guidelines, nursing diagnosis and discharges.

Keywords: *Cross infection. Intensive Care Unit. Nursing.*

RESUMO

Justificativa e Objetivo: A Unidade de Terapia Intensiva (UTI) desempenha atualmente um papel decisivo na chance de sobrevida de pacientes gravemente enfermos, sejam eles vítimas de trauma ou de qualquer outra condição clínica extremamente grave. Em contrapartida, se tornou o principal local de ocorrência das infecções hospitalares

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que aumentam a morbimortalidade e os custos assistenciais, o que vem representando, nos últimos anos, um importante agravo de saúde pública. Deste modo, este estudo objetiva conhecer o perfil dos pacientes com infecções relacionadas à assistência à saúde na UTI Adulto de um hospital público do Distrito Federal, Brasil. **Método:** Estudo do tipo retrospectivo, de caráter descritivo, com abordagem quantitativa. Os dados foram coletados diretamente do prontuário eletrônico dos pacientes. **Resultados:** Foram encontrados 51 pacientes com infecção hospitalar, predominantemente do sexo masculino, idosos, entre os quais 24 eram oriundos do próprio hospital, 21 de outros hospitais e 6 das Unidades de Pronto Atendimento. O principal motivo da internação foi clínico, com percentual de 76,4%. Em relação à topografia, 23 pacientes apresentaram quadro de pneumonia e 18 tiveram infecções do trato urinário. O tempo médio de internação foi de 31 dias e o índice de mortalidade foi de 37,2%. **Conclusão:** Tão importante quanto o investimento em tecnologia de ponta em tratamento intensivo, o conhecimento do perfil dos doentes críticos é uma necessidade que se impõe, pois pode auxiliar o enfermeiro nas diretrizes das admissões, diagnóstico de enfermagem e altas dessa unidade.

Descritores: *Infecção Hospitalar. Unidade de Terapia Intensiva. Enfermagem.*

RESUMEN

Justificación y Objetivo: La unidad de cuidados intensivos (UCI) desempeña actualmente un papel decisivo en la posibilidad de supervivencia de pacientes gravemente enfermos, ya sea víctimas de trauma u otra condición clínica muy grave. En contrapartida, se ha convert en el principal lugar de ocurrencia de infecciones hospitalarias que resultan en el aumento de la morbimortalidad y de los costos asistenciales, lo que viene representando en los últimos años un importante agravio de salud pública. Este estudio busca conocer el perfil de los pacientes con infecciones related to la asistencia sanitaria en la UCI de un hospital público en el Distrito Federal (Brazil). **Method:** Studio of retrospective, descriptive character, with cuantitativo approach. Los datos fueron recogidos directly from los electronic medical records of patients. **Results:** Se encontraron a 51 pacientes con infección hospitalaria, con predominancia para el género masculino, personas mayores; de los cuales 24 pacientes eran del hospital, 21 de otros hospitales y 6 de las Unidades de Emergencya. La razón principal para la admisión fue clínica, con un porcentaje del 76.4%. En cuanto a la topografía, 23 pacientes tenían neumonía y 18 tuvieron infecciones del tracto urinario. La duración media de la estancia fue de 31 días, y la tasa de mortalidad fue del 37.2%. **Conclusion:** Tan importante como la inversión en tecnología de cuidados intensivos, el conocimiento del perfil de los pacientes críticamente enfermos es una necesidad, ya que puede ayudar al enfermero en las directrices de admisión, el diagnóstico de enfermería y la alta de esta unidad.

Palabras clave: *Infección Hospitalaria. Unidades de Cuidados Intensivos. Enfermería.*

INTRODUCTION

With high-complexity technological advances, Intensive Care Units (ICU) are looking for the best way to provide treatment to their patients. It is a complex sector that ensures greater surveillance and mastery of critically ill patients[1], equipped with an uninterrupted monitoring system, which admits potentially complex patients, with intensive support and treatment that aim to serve the client in need safely and effectively, as to achieve their clinical improvement.[2,3]

These advances have provided survival to people affected by diseases that were previously considered incurable. However, along with this improvement, other complications arise, including the increase of hospital-acquired infections (HAI).[4]

HAI impacts on hospital lethality, length of hospital stay and costs. The increase in the number of infections varies according to the level of care of each hospital and its complexity: the hospitalization of more severe and immunocompromised individuals, added to the emergence of antimicrobial resistance, make HAI specially relevant for public health. In addition, developing countries may be up to twenty times more affected by HAI than developed countries.[5] Three factors are necessary to transmit infections in the hospital environment: the susceptible host; the means of transmission; and the sources of infection, which can be employees, patients, contaminated objects, surfaces, visitors and equipment.[6]

The transmission occurs, mainly, due to assistance failure of the multidisciplinary team, either by inadequate planning, incorrect execution of aseptic techniques or by non-compliance with standard precautionary guidelines, causing harm to the patient and economic and social burden, as well as suffering for the patients themselves and their families.[6]

It is worth mentioning that these events can be avoided, since they result from mistakes in the assistance itself. Ignoring standard patient safety precautions can increase infections, morbidity and mortality in health environments.[6-9] In addition to the damage caused to the patient's health, a study in a tertiary-level hospital in Brazil found that more than 25% of hospital-acquired infections happen in the ICU, especially bloodstream infections in surgical sites and catheter-related infections, which had higher expenses within the ICU, respectively

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R$ 666.47 and R$ 803.59 per day.[7]

Intensive care unit patients undergo procedures that use invasive devices that increase infection rate, such as Central Venous Catheter (CVC), Indwelling Urinary Catheter (IUC) and Mechanical Ventilation (MV).[8] Therefore, nursing is crucial within the Hospital Infection Control Service (HICS), as it plays a continuing education role for the entire care team, bringing knowledge and information aimed at improving infection control techniques.[10]

In view of these considerations, this study aims to understand the clinical profile of patients with HAI in the Adult Intensive Care Unit of a public hospital in the Federal District (DF), from January to December 2015.

METHODS

This is a documentary, retrospective and descriptive study. The study site was the ICU of the Asa Norte Regional Hospital (HRAN), considered a reference hospital in the Brazilian Midwest. The ICU of this hospital has ten beds for adults, eight of which are destined to general internal medicine and two to surgical clinic.

This is a public hospital, therefore, linked to the Unified Health System (SUS) and accredited by the Ministry of Education and the Brazilian Ministry of Health as a teaching hospital. Among the specialties, the hospital, which has approximately four hundred beds, is a reference in the care of burn injuries, cleft lip, CrisDown (care for patients with Down syndrome) and bariatric surgery.

The study population consisted of all patients who presented hospital-acquired infections (HAIs) in the Adult ICU from January to December 2015. Patients who were already hospitalized in the adult ICU before January 2015 were excluded from the study.

To collect the data, a script was elaborated containing the following variables: sex, date of birth, age, date of hospitalization, time prior to the ICU, origin and reason of hospitalization (general or surgical), days of hospitalization, invasive procedures, use of antibiotics, topography, date of discharge, type of discharge or death. Data were collected by the HRAN Hospital Infection Control Center in October 2016.

The results indicators and rate were calculated according to the definition of general standards, criteria and methods stipulated by the National Health Surveillance Agency (Anvisa) in the Diagnostic Criteria for Hospital-acquired Infections manual, 2nd edition, corrected on March 3rd, 2017.[4]

Data were collected through documents referring to the indicators of hospital infection of cultures carried out in 2015, with daily active search and registration in the Hospital Infection Control Commission (HICC) database.

For result analysis, a database was created in Microsoft Office Excel 2016; then, it was analyzed and presented through simple statistics. The Project was submitted to the Ethics Committee of the Health Sciences Education and Research Foundation (Fepecs) and approved under CAAE 61219410.3.0000.5553, with protocol number number 1.809.497. The study followed the recommendations of Resolution No. 466/2012 of the National Health Council.

RESULTS

Out of the 151 hospitalizations in the Adult ICU in 2015, 51 patients met the inclusion criteria for the study, as they presented diagnostic criteria for HAI (Table 1).

Among them, 22 (43.1%) were older adults – over 60 years old. Considering the unit of origin, most of the patients (n=10) came from the emergency room (41.6%), followed by 4 (16.7%), who came from the operating room and 1 (4.1%) from the burn injury unit (Table 1).

Table 1. Patients' Profile with HAI in the Adult ICU from January to December 2015.

Profile	N	%
Sex		
Male	27	53
Female	24	47
Total	51	100
Age		
20 to 35 years old	7	13.7
36 to 59 years old	22	43.1
60 to 97 years old	22	43.1
Reason for hospitalization		
General Medicine	39	76.4
Surgical	12	23.5
Length of hospital stay		
Minimum	1 day	–
Average	31 days	–
Median	8 dias	–
Maximum	173 days	–
Internal origin		
Emergency rooms	10	41.6
General surgery unit	6	25
Surgical Center	4	16.7
Obstetric Center	1	4.1
Emergency Unit	1	4.1
Thoracic surgical unit	1	4.1
Burn injury unit	1	4.1

Source: Occupational Health and Work Safety Service, 2019.

Table 2 describes the invasive procedures, topographies, antibiotic use and the type of discharge of patients with HAI in adult ICU.

Table 2. Patients' Profile with HAI in the Adult ICU from January to December 2015.

	N	%
Invasive procedures		
Indwelling Urinary Catheterization	51	100
Mechanical ventilation	48	94.1
Feeding Tube	41	80.3
Tracheostomy	38	74.5
Bloodstream		
Central venous catheter	16	31.3

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Topography		
Pneumonia	23	45.1
Urinary tract infection	18	35.2
Others	7	13.7
Use of antimicrobials		
Yes	50	98
No	1	2
Patients' Discharge		
Discharge from the ICU	30	58.9
Death	19	37.2
Hospitalized in general ward	2	3.9

DISCUSSION

In the studied hospital, we found 51 patients with HAI (34% of all ICU patients). Another study, conducted in Recife in 2015, found that between 20% and 50% of ICU patients present hospital-acquired infections.[11]

Regarding the sociodemographic profile of the surveyed patients, the male sex patients (27, 53%) predominated in relation to females – 24 cases (47%). Two national studies that characterize hospital-acquired infections in ICU patients corroborate the data we found; one of them, conducted in 2010 in a philanthropic hospital in the state of Paraná, found that the infection rate predominates in males, with a percentage of 58.9%;[12] the other, conducted in 2006 at the teaching hospital of the University of São Paulo, presented data from a retrospective study finding higher infection incidence in males, with a percentage of 56.6%.[13] This is expected because the male sex is mistakenly considered protected from possible organic and psychological problems, distancing themselves from health care, especially preventive aspects; besides, they have low treatment adherence, which increases the number of infections. The literature points out other risk factors, such as homicide and suicide attempt that occur frequently, increasing the incidence of deaths or hospitalizations.[14] These events, however, were not significant in this study.

The mean age of the population of this study was 56 years old. The largest share of hospitalizations, 29 (56.8%), was composed of adults. Twenty-two (43.1%) older adults were identified, who, in relation to younger patients, presented numerous risk situations that predisposed them to HAI, a condition that increases morbidity and mortality.[15]

The results regarding the reason for hospitalization indicated that 76.4% of the patients came from general internal medicine and 23.5% from surgical procedure – surgical (2) and clinical (8) beds. Another study pointed out similar results, with 39 general internal medicine patients.[16]

The HAI risk is closely related to the performed procedures, the nutritional conditions of the patients and the length of hospitalization, among other aspects.[17] Thus, according to Table 2, the 51 (100%) patients underwent invasive procedures: 48 (94.1%) mechanical ventilation; 38 tracheostomy (74.5%); 51 indwelling urinary catheterization (100%); and 41 feeding tube (80.3%). These rates vary between 9% and 40% of infections acquired within the ICU. The high incidence is due to the invasive procedures to which patients are submitted.[18]

The most frequent infection in this study was pneumonia, associated with mechanical ventilation – 23 patients (45.1%). Colonization and aspiration of microorganisms from endogenous or exogenous microbiota are one of the main ways of acquiring ventilator-associated pneumonia (VAP).[19] A study found that VAP – among hospital-acquired infections – has the highest incidence in ICU. It develops between 48 and 72 hours after tracheal intubation and may also appear 48 hours after extubation.[18]

In this study, urinary tract infection (UTI) associated with the indwelling urinary catheter was identified in 18 patients (35.2%). The interval registered by the National Health Surveillance Agency (Anvisa) has rates from 3.1 to 7.4/1,000 catheters/day.[20] The risk of UTI-CR is directly related to how long the catheter is used: 2.5% in one day, 10% in two or three days and 12.2% in four or five days. The risk can reach 26.9% when the catheter permanence time is equal to or greater than six days.[21]

The UTI bundle – preventive measures packages – may vary between institutions. The main measures include avoiding using urinary catheters in situations where they are not properly indicated, implementing institutional protocols for early catheter insertion and removal (checklist or daily plan and interventions, such as electronic or manual reminders) and appropriate techniques for catheter insertion and maintenance (sterile insertion and closed drainage system).[21]

The implementation of prevention bundles has been proven to decrease patient exposure and the development of invasive device-related infection in up to 88%.[23]

Therefore, when analyzing the factors associated with the occurrence of UTI – as well as the variables influenced by the performance of the professionals involved in this procedure – it is necessary to pay close attention to the nurse's role, who should be active in the multidisciplinary team when evaluating ICU patients and discussing the use of the indwelling urinary catheter (IUC), as well as its insertion and maintenance.[24]

The third most frequent infection found in this study was primary bloodstream infection, associated with the use of CVC – 16 patients (31.3%). The central venous catheter is frequently used in the care of patients requiring complex therapeutic interventions, usually with several venous punctures throughout treatment, which, added to the irritating and/or vesicant characteristics of each drug, can lead to vascular fragility and stiffening, making it difficult to visualize and puncture, which favors extravasation.[25] We would like to point out that, in ICU treatment, obtaining safe and reliable vascular access is extremely important so the patient is not exposed to risks.[25]

Infections are the most well-known causes of death in patients with serious illnesses. More severe conditions (severe sepsis, septic shock and multiple organ dysfunction syndrome) are the main cause of ICU mortality.[26]

Considered potentially severe, sepsis is characte-

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rized as a systemic reaction in the body. For the most part, epidemiological reports on sepsis come from developed countries.

In the ICU, bacteriuria associated with bladder catheter, urinary infections and ventilator-related pneumonias are found, all with high morbidity and mortality.[15]

Another study conducted in a teaching hospital in Recife found that 60% of HAI occur through four types of infections: UTI, pneumonia (RTI PAV) – usually associated with mechanical ventilation –, catheter-related bloodstream infection (CRBSI) and surgical site infection (SSI), which, within the ICU, represents between 14% and 17% of the infections.[11]

The use of antimicrobials and the unit environment – which makes natural selection favorable to the development of microorganisms and, consequently, colonization and/or infection – are considered inadequate in approximately 50% of the cases.[27]

These heavy, broad-spectrum antimicrobials, associated with routine invasive procedures, contribute to the increasing rates of HAI.[28] As for the use of antimicrobials, only 2% of patients did not use them; even though antibiotics mean a major advance for medicine in the treatment of infections, when used indiscriminately they may cause microorganisms to develop mechanisms of resistance.[29]

According to a study conducted in the ICU of a university hospital in the city of São Paulo, 50 patients acquired HAI and 19 of them died.[16] In our study, in 2015, 51 patients were admitted to the ICU and diagnosed with hospital-acquired infection, 30 of them had a favorable outcome, with hospital discharge; 2 remained hospitalized and 19 died, all related to HAI. Therefore, there was no significant difference in the quantitative comparison of deaths between the two studies, even with the 10-year difference between them.

It should be emphasized that, regardless of all technology used, health professionals should join the campaign "Protecting million lives," coordinated by the Healthcare Improvement Institute (HII), which promotes the prevention of infection in invasive procedures and recommends packages of preventive measures (bundles) that, individually, result in even more substantial improvements.[30]

These bundles are evidence-based actions. When performed in an integrated, structured, uniform and reliable way, they improve the processes and results related to patient care.[31]

Thus, professional awareness is of paramount importance to increase patient safety in relation to bacterial transmission, effectively contributing to reduce HAI.

Methicillin-resistant *Staphylococcus aureus* (MRSA) is one of the main causes of hospital infections. It increases morbidity and mortality rates, prolongs hospitalization and swells costs.[33]

In a study conducted in China[33] with 1,347 patients, 102 had nosocomial (hospital) infection. Prevalence was 7.57%, with rates ranging from 7.19% to 7.73% over the three years of the study. Lower respiratory tract (43.1%), urinary tract (26.5%) and bloodstream infections (20.6%) were the most common. The most frequently isolated pathogens were *Staphylococcus aureus* (20.9%), *Klebsiella pneumoniae* (16.4%) and *Pseudomonas aeruginosa* (10.7%). Multivariate analysis showed that categories D or E of mean severity of the disease and the use of mechanical ventilator are the independent risk factors for infection.[3]

In a retrospective study with 65 patients hospitalized with liver cirrhosis, who had developed hospital-acquired infections, the epidemiology of these infections was examined regarding resistance to the most commonly used antimicrobials and the patient-specific risk factors associated with the development of pathogen infection.[34] The most frequently isolated organisms were *Enterococcus* spp. (*n* = 34, 52.3%), *Klebsiella* spp. (*n* = 10, 15.4%) and e. coli (*n* = 6, 9.2%). Of these, 35 isolated organisms (53.8%) were identified as multidrug resistant bacteria (MDR) and 30 (46.2%) did not present MDR. The overall resistance to ceftriaxone was 92%. Thus, we emphasize the need for institutions to individualize protocols for the treatment of hospital-acquired infections, particularly in immunocompromised populations.[35]

The emergence of multidrug-resistant bacteria is a challenge for physicians, who have limited therapeutic options. Contaminated environment surfaces are a potential reservoir for the transmission of many pathogens associated with health care. Pathogens can survive or persist in the environment for months and are a possible source of infection, when proper hygiene and disinfection procedures are inefficient.[37]

Limitations in this study were the fact that this research was carried out in a single center, as well as the lack of evaluation of the patients' basis diagnosis and, also, the way of access to data: medical records in which, supposedly, information is lost due to lack of details and quality of data. Data collection occurred retrospectively and, therefore, problems were noted in data records in the electronic registers. We were not allowed to collect the involved strains. Moreover, the reality analyzed was that of the ICU of the studied hospital.

This study allowed the identification of the sociodemographic profile and clinical characteristics of patients admitted to an ICU of a public hospital.

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AUTHORS' CONTRIBUTIONS

Suzi Stéfanne Siqueira and Fabio Rodrigo Galvão Cardoso - Data collection, data interpretation and final writing of the article.

Aline Zulte de Oliveira - Critical reading and final writing of the article.

Maria Liz Cunha de Oliveira – Study design, monitoring of data collection and analysis and final writing of the article.

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