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ORIGINAL ARTICLE

Healthcare-associated infections in patients admitted to a cardiac intensive care unit

Prevalência de infecção relacionada à assistência à saúde em pacientes internados em unidade de terapia intensiva

Infecciones relacionadas con la atención sanitaria en pacientes ingresados en unidad de cuidados intensivos cardiológicos

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ABSTRACT

Justification and Objectives: Healthcare-associated infections (HAI) affect thousands of people worldwide and are a major cause of complications among hospitalized patients. This study aimed to identify HAI characteristics among patients hospitalized at a cardiac intensive care unit (CICU) in a reference hospital in Santa Catarina from January to December 2017. **Methods:** This is a descriptive cross-sectional study conducted in the hospital infection control committee (HICC) and intensive care unit (ICU) of the institution. Data were collected from 86 HAI notification forms. All patients admitted to the CICU notified with HAI by the HICC in 2017 were included in the study. Demographic and clinical data were collected from patients' medical records. Data were tabulated in Microsoft Excel and analyzed by the Statistical Package for the Social Sciences (SPSS) version 18.0. **Results:** In 2017, HAI incidence was 58.6% and mortality rate 44.8%. The infection was more prevalent among individuals aged between 71 and 80 years (39.6%), and mainly affected the respiratory tract (RTI) (58.1%), the urinary tract (43%), and the bloodstream (30.2%). *Pseudomonas aeruginosa* (27.9%), *Klebsiella pneumoniae* (26.7%) and *Acinetobacter baumannii* (19.8%) were the main etiological agents. Regarding the base pathology, congestive heart failure was the most frequent (19.8%). **Conclusion:** This study found similar results on the incidence of HAI in CICU to those reported in the literature. Studies have showed permanent education, prevention and control protocols (bundles), and appropriate hand hygiene to be effective actions in reducing infections.

Keywords: *Incidence. Cross Infection. Intensive Care Units.*

RESUMO

Justificativa e Objetivos: As Infecções Relacionadas à Assistência à Saúde (IRAS) acometem milhares de pessoas em todo o mundo e são uma das principais causas de complicações em indivíduos hospitalizados. O objetivo deste estudo foi conhecer as características das IRAS em pacientes internados em uma Unidade de Terapia Intensiva Cardiológica em um hospital de referência em Santa Catarina, no período de janeiro a dezembro de 2017. **Métodos:** Estudo descritivo, realizado de forma transversal na Comissão de Controle de Infecção Hospitalar (CCIH) e Unidade de Terapia Intensiva (UTI) da instituição. Os dados foram coletados em 86 fichas de notificação de IRAS. Fizeram parte deste estudo todos os pacientes internados na UTI Cardiológica que tiveram notificação de IRAS registrada pela CCIH em 2017, sendo coletadas nos prontuários as variáveis demográficas e clínicas. Os dados foram organizados no Excel e analisados por meio do Statistical Package for the Social Sciences (SPSS) versão 18.0. **Resultados:** O percentual de IRAS em 2017 foi de 58,6% e o índice de mortalidade foi de 44,8%. Verificou-se maior ocorrência de infecção em indivíduos com idade entre 71 e 80 anos (39,6%), principalmente infecção do trato respiratório (ITR) (58,1%), seguida de infecção do trato urinário (43%) e infecção da corrente sanguínea (30,2%). Os principais agentes etiológicos foram: *Pseudomonas aeruginosa* (27,9%), *Klebsiella pneumoniae* (26,7%) e *Acinetobacter baumannii* (19,8%). Quanto à patologia de base, a mais frequente foi a insuficiência cardíaca congestiva (19,8%). **Conclusão:** O levantamento dos dados acerca das IRAS em UTI Cardiológica evidenciou incidência semelhante aos achados com a literatura. Ações de educação permanente, elaboração de protocolos (*bundles*) de prevenção e controle, e técnicas de higienização correta das mãos têm se mostrado efetivos para reduzir as infecções.

Descritores: *Incidência. Infecção hospitalar. Unidades de Terapia Intensiva.*

RESUMEN

Justificación y Objetivos: Las infecciones relacionadas con la atención sanitaria (IRAS) afectan a miles de personas en todo el mundo y son una de las principales causas de complicaciones en individuos hospitalizados. El objetivo de este estudio fue conocer las características de las IRAS en pacientes ingresados en una Unidad de Cuidados Intensivos Cardiológicos, en un hospital de referencia de Santa Catarina, de enero a diciembre de 2017. **Métodos:** Estudio descriptivo realizado de forma transversal en la Comisión de Control de Infecciones Hospitalarias (CCIH) y la Unidad de Cuidados Intensivos (UCI) de la institución. Los datos se recopilaron en 86 formularios de notificación de IRAS. El estudio incluyó a todos los pacientes ingresados en la UCI de Cardiología que recibieron notificación de IRAS registrada por el CCIH en 2017, y se recogieron variables demográficas y clínicas de los registros médicos. Los datos se organizaron en Excel y se analizaron utilizando el Paquete Estadístico para las Ciencias Sociales (SPSS), versión 18.0. **Resultados:** El porcentaje de IRAS en 2017 fue del 58,6%, y la tasa de mortalidad resultó el 44,8%. Hubo una mayor ocurrencia de infección en individuos entre 71 y 80 años (39,6%), principalmente infección del tracto respiratorio (ITR) (58,1%), seguida de infección del tracto urinario (43%) e infección del torrente sanguíneo (30,2%). Los principales agentes etiológicos fueron: *Pseudomonas aeruginosa* (27,9%), *Klebsiella pneumoniae* (26,7%) y *Acinetobacter baumannii* (19,8%). En cuanto a la patología de base, la más frecuente fue la insuficiencia cardíaca congestiva (19,8%). **Conclusión:** La recogida de datos sobre las IRAS en UCI de Cardiología mostró una incidencia similar a los hallazgos de la literatura. Se ha demostrado que las acciones por la educación continua, la preparación de protocolos de prevención y control (*bundles*) y técnicas adecuadas de higiene de manos son eficaces para reducir las infecciones.

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

INTRODUCTION

Healthcare-associated infections (HAI) affect thousands of people worldwide and are a major cause of complications and deaths among hospitalized patients, posing an important patient safety issue.[1] HAI impact morbimortality, increase the length of stay in intensive care units (ICU) and rise healthcare-related costs[2]. For being caused by resistant microorganisms, HAI are considered serious difficult-to-treat complications.

According to the Ministry of Health, hospital infections are infections that arise after admission and manifest themselves during hospitalization or after discharge.[3]

Considering that these infections occur not only within hospitals, but also in other healthcare services, the Centers for Disease Control and Prevention (CDC) recommended in 2007 replacing the term hospital infection with HAI.[4]

The World Health Organization (WHO) estimates that one in every ten patients worldwide are affected by HAI, especially in developing countries.[2,3,5] According to the Patient Safety and Quality in Health Services Bulletin, 72% of the Brazilian hospitals reported HAI cases in adult ICU in 2017.[6]

In the same year, 233 hospitals in Santa Catarina reported cases of infection in adult ICU, including primary bloodstream infections (PCI), central venous catheter (CVC) complications, ventilator-associated pneumonia (VAP), and urinary tract infections (UTI) associated with delaying urinary catheter (DUC). Such infections are mainly caused by *Staphylococcus coagulase negativa*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, and *Acinetobacter baumannii*.[6]

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ICU patients are significantly more likely to acquire a hospital infection due the contact with health professionals, use of invasive equipment and devices, immunosuppressants, prolonged hospitalization, incoherent use of antibiotics, and greater risk of care environment contamination, which enables selective natural microorganisms to emerge.[7,8]

In these circumstances, and considering that cardiac surgery is a highly complex procedure, identifying HAI characteristics among patients admitted at the cardiac intensive care unit (CICU) is relevant.[8] In the national scope, this proposal is justified by the lack of studies approaching infections incidence, demographic and clinical characteristics, and main microorganisms and sites among patients admitted to CICU.

This research aims to advance a contextualized knowledge on the current incidence of HAI, enabling the development of control measures aimed at preventing and better managing infections.

For that, we sought to identify HAI characteristics among patients hospitalized at the CICU in 2017.

METHODS

This is a descriptive cross-sectional study with data on notifications of healthcare-associated infections (HAI) provided by the hospital infection control committee (HICC) and the CICU of a reference hospital in Santa Catarina affiliated to the Brazilian Unified Health System (SUS).

The intensive care unit (ICU) in question contains fourteen beds, receives critically ill adult patients with heart diseases, and predominantly performs surgical care. Considering the definitions proposed by the centers for disease control and prevention (CDC), all patients hospitalized at the ICU for over 24 hours diagnosed with HAI were included in the study.

Data was initially collected by a retrospective survey of HAI cases registered at the HICC and later from the medical records of HAI patients hospitalized at the ICU. The following variables were investigated: demographic (gender and age) and clinical (infection site, invasive devices, type of etiological agent, base pathology, comorbidities, and clinical outcome).

The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 18.0. This study complies with the ethical principles for research involving human beings (established by the Resolution 466/12 CNS) and was approved by the Research Ethics Committee of the Universidade do Sul de Santa Catarina, under opinion no. 3.102.120 and CAAE 03564918.1.0000.5369.

RESULTS

Among the 146 patients hospitalized at the CICU, 86 (58.9%) were diagnosed with healthcare-associated infections (HAI) by the HICC. These were predominantly male patients, aged between 71 and 80 (39.6%) and 61 and 70 years old (24.4%) (Table 1).

Table 1. Demographic characteristics of HAI patients in the CICU of a reference hospital in the state of Santa Catarina in 2017.

Variables	n	%
Sex		
Female	32	37.2
Male	54	62.8
Age		
30 to 40 years	2	2.3
41 to 50 years	10	11.6
51 to 60 years	7	8.2
61 to 70 years	21	24.4
71 to 80 years	34	39.6
81 to 90 years	12	13.9

The most common infection site was the respiratory tract (58.1%), associated with mechanical ventilation (83.7%), delaying urinary catheter (69.8%) and central venous catheter (58.2%). *Pseudomonas aeruginosa* (27.9%), *Klebsiella pneumoniae* (26.7%) and *Acinetobacter Baumannii* (19.8%) were the main etiological agents. The average length of stay was 35.4 days, with a minimum of 3 days and a maximum of 142 days (Table 2).

The most frequent base pathology was congestive heart failure (CHF) (19.8%), followed by cardiac arrest (CRP) (17.6%). All study participants presented comorbidities, including systemic arterial hypertension (SAH) (64.7%), diabetes mellitus (DM) (34.9%), coronary artery disease (CAD) (24.7%), and smoking (18.6%).

Clinical discharge was the most common clinical outcome (55.8%), but 44.1% of the cases resulted in death (Table 2).

Table 2. Clinical characteristics of HAI patients in the CICU of a reference hospital in the state of Santa Catarina in 2017. Florianópolis/SC, 2020.

Variables	n	%
Infection site		
Respiratory tract	50	58.1
Urinary tract	37	43.0
Bloodstream	26	30.2
Invasive devices		
Mechanical ventilation	72	83.7
Delaying urinary catheter	60	69.8
Central venous catheter	50	58.2
Microorganisms		
Pseudomonas aeruginosa	24	27.9
Klebsiella pneumoniae	23	26.7
Acinetobacter baumannii	17	19.8
Others	13	15.1
Base pathology		
Congestive heart failure	17	19.8
Cardiorespiratory arrest	15	17.6
Acute myocardial infarction	13	15.1
Others	06	7.0
Comorbidities		
Systemic arterial hypertension	55	64.7
Diabetes mellitus	30	34.9
Coronary artery disease	21	24.7
Smoking	16	18.6
Clinical outcome		
Discharge	48	55.8
Death	38	44.1

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DISCUSSION

We found the incidence rate of healthcare-associated infections (HAI) to be equal to 58.9% – similar to those reported by other studies approaching HAI in intensive care unit (ICU), which ranged from 35.5% to 61.6%.[9-14] In our study, HAI were more common in men (62.8%), corroborating other studies.[15-18] This finding may be explained by the self-care deficit among this population,[19] pointing to a need for strengthening strategies targeting health education, autonomy promotion, and the recognition of the disease.

Considering age group, infections were more prevalent among individuals aged 71–80 years. Previous studies suggest that factors such as age and comorbidities (including systemic arterial hypertension, diabetes mellitus, and chronic heart disease) implicate organic dysfunctions, influencing patients' immunosuppression and contributing to the emergence of HAI.[15.17.20]

The respiratory tract was the main infection site, comprehending 58.1% of the cases – data that corroborates previous studies.[10,12-13] Mechanical ventilation time, chronic lung disease, smoking, sepsis, neurological disease, trauma, and previous use of antibiotics are among the risk factors for HAI.[18] From an epidemiological point of view, HAI comprises approximately 25% of all ICU-acquired infections, especially in patients undergoing mechanical ventilation.[10.14.18]

In line with our study, the Ministry of Health states that HAI emergence is closely related to impaired immunity, presence of multidrug-resistant microorganisms, and environmental contamination.[21]

We found the urinary tract to be the second main infection site, accounting for 43% of the cases. Previous studies have associated the use of invasive devices with HAI development. A research conducted in Arabia found UTI and the use of DUC to be significantly correlated, as well as BSI and the use of CVC.[22] Likewise, factors such as inserting urinary catheters in patients without medical indication or using them for longer than necessary were significantly associated with UTI development.[22]

BSI occurred in 30.2% of the cases, possibly attributable to catheter contamination due to inadequate manipulation. In the ICU, contaminated professionals, objects, and clothing may function as vectors for pathogens and, added to poor hand hygiene, favor HAI development.[20.23-25]

Patients who underwent mechanical ventilation (83.7%), DUC (69.8%), and CVC (58.2%) during hospitalization in the cardiac ICU have higher risks of developing infections. A study conducted in a teaching hospital in Minas Gerais found intubation time and CVC and DUC permanence to be the independent predictors of infection outcomes after cardiac surgeries.[23]

In line with a study conducted in an ICU in the Federal District (21.4%),[10,24,25] *Pseudomonas aeruginosa* was the most common etiological agent in our study, with an average incidence of 27.9% in 2017. Previous studies found *Pseudomonas aeruginosa* to be one of the main pathogens in respiratory tract samples of hospitalized patients, resulting in prolonged hospital stay, increased hospital costs, and higher morbidity and mortality rates.

We also verified that CHF was the most frequent base pathology (19.8%), which may be explained by the factors increasing its occurrence probability: the cardiovascular diseases, such as hypertension, diabetes mellitus, smoking, dyslipidemia, sedentary lifestyle, and obesity. Cardiovascular diseases tend to cause hemodynamic and functional changes in the individual, besides destabilizing the body's defense mechanisms. Considering that, base pathologies are deemed a serious risk factor for HAI development when associated with cardiovascular diseases.[12]

Although hospital discharge was the most frequent outcome, the number of deaths was still relevant (44.1%). The mortality rate of HAI patients may be associated with ICU admission, given that this sector receives patients requiring critical care. HAI were more common among patients hospitalized for cardiac causes and who underwent surgery, which is justified by their subsequent hemodynamic instability, comorbidities, the invasive procedures performed, and long-term use of vasoactive drugs.[10,12,15,16]

For being associated with multidrug-resistant pathogens, HAI and their relative mortality rate pose a major challenge in the care of critically ill patients, whose mortality rate is five times higher.[12] Studies have showed permanent education, prevention and control protocols (bundles), and appropriate hand hygiene to be effective actions in reducing infections.[10.17]

In this study, male patients were the most affected by HAI, among which the more common infections occurred in the respiratory tract, urinary tract, and bloodstream. Regarding the microbial profile, the gram-negative bacteria *Pseudomonas aeruginosa*, *Klebsiella pneumoniae,* and *Acinetobacter baumannii* were the most incident. Several factors favor the appearance of these microorganisms in the ICU, such as: the flow of patients undergoing surgery, underlying diseases, use of invasive devices, long hospital stay, immune status, age, and use of immunosuppressant drugs. Antibiotics may likewise contribute to antimicrobial resistance, impairing treatment and increasing hospital costs.

This study found similar results on the incidence of HAI in CICU to those reported in the literature, advancing the knowledge on the characteristics of infections within this sector.

Some of the difficulties found in the study include the lack of information in the notification forms provided by HICC, which did not present all variables. These institutions must reinforce the need to completely fill out the forms to improve HAI notification and control.

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AUTHORS' CONTRIBUTION

Carolina Huller Farias and Fabiana Oenning da Gama contributed to the conception, design, analysis, and writing of the article;

Fabiana Oenning da Gama contributed to the planning, design, review, and final approval of the article;

All authors approved the final version of the manuscript and declare themselves responsible for all aspects of the study, guaranteeing its accuracy and integrity.

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