ABSTRACT
Objective: to verify the association of nosocomial infection and the central venous catheter with non-compliance of the protocols in the intensive care unit. Method: it is longitudinal, quantitative and prospective study, with 31 patients undergoing insertion of central venous catheter in a university hospital in the city of Natal / RN / Brazil. The data collection was performed by means of structured observation and consultation to the medical charts. Data were categorized into Excel and processed in the software SPSS 15.0, after the project has been approved by the Ethics Research Committee of the Hospital Universitário Onofre Lopes (HUOL), under the n° 022/07. Results: during insertion and maintenance of central venous catheter, in the patients who showed infection, there was a variation from 2 to 9 errors (4.2 ± 1.7). The Spearman Correlation between the risk of infection in the wholeness process and the risk of infection at the insertion time showed up strong and significant (r = 0.845 p = 0.000). Conclusion: the errors committed by the professionals showed up as risk factors for the occurrence of nosocomial infections. Descriptors: Nosocomial Infection; Central Venous Catheterization; Intensive Care Unit; Teaching Hospitals.

RESUMO
Objetivo: verificar a associação da infecção hospitalar e cateter venoso central com o não cumprimento dos protocolos na unidade de terapia intensiva. Método: estudo longitudinal, quantitativo, prospectivo, com 31 pacientes submetidos à inserção do cateter venoso central em um hospital universitário em Natal/RN/Brazil. A coleta de dados ocorreu por observação estruturada e consulta aos prontuários. Os dados foram categorizados no Excel e processados no SPSS 15.0, depois de aprovado o projeto pelo Comitê de Ética do Hospital Universitário Onofre Lopes (HUOL), sob o n° 022/07. Resultados: durante a inserção e manutenção do cateter venoso central, nos que apresentaram infecção, houve variação de 2 a 9 erros (4,2 ± 1,7). A Correlação de Spearman entre o risco de infecção em todo o processo e o risco de infecção na inserção mostrou-se forte e significante (r=0,845 p=0,000). Conclusão: os erros cometidos pelos profissionais mostraram-se como fatores de risco para a ocorrência de infecções hospitalares. Descritores: Infecção Hospitalar; Cateterismo Venoso Central; Unidades de Terapia Intensiva; Hospitais de Ensino.
INTRODUCTION

The bloodstream infections are related to venous catheters are causes of nosocomial morbidity-mortality and when installed in an Intensive Care Unit (ICU) are responsible for more severe infections, where its incidence is higher, due to the increased length of stay, colonization with hospital flora and manipulation.¹

The Central Venous Catheters (CVC) has been increasingly used in admitted patients or outpatient patients, as guarantee of long-term venous access. The CVC breaks through the integrity of the skin, allowing infection by bacteria and / or fungi. The infection can be spread to the bloodstream, entailing hemodynamic changes and organic dysfunctions. Approximately 90% of bloodstream infections related to catheter occur in CVC.²

The diagnosis of catheter-related infections (CRI) is based on local and systemic clinical signs, associated with laboratory confirmation, by means of culture of catheter tips and blood cultures. The Center for Disease Control and Prevention (CDC) recommends carrying out these cultures as laboratory parameter for the diagnosis of CRI.³

North American data show the primary bloodstream infections - associated with the use of catheters - as responsible for 19% of infections acquired in clinical-surgical ICU of adults and 27.0% in pediatric ICU. According to European data, the catheter-related infections are responsible for 12.0% of infections acquired in ICU. According to the World Health Organization (WHO), the general global average of Nosocomial Infection (NI) is 5.0%, while in Brazil it is 15.5%, ranging from 9.0 to 20.0%.⁴

In intensive care, 48.0% of patients have CVC, totaling approximately 15 million catheters daily per year in ICU. Approximately 5.3 CRI occur per 1.000 days of catheters in ICU. The mortality attributable to such infections is about 18.0%. Thus, it is estimated that there were, in 2008, 14,000 deaths per year due to the infections related to CVC. Some estimates show higher indexes, on the order of 28,000 deaths per year.⁵

An important action to minimize the occurrence of infections associated to CVC is the use of barrier maximum precautions during preparation for insertion of the catheter. This means adherence, both from the responsible for the insertion and its assistant, to the standards of hand hygiene, use of caps, masks, aprons and sterile gloves.⁵

The risk of infection, related to the vascular access, is also associated with its location, infused solution, experience of the professional who performs the procedure, length of stay, the type and the manipulation of catheter, among others. Such factors are important strategic points for preventive actions against these types of infections.⁶

From the standpoint of the patient, the application of barrier maximum precaution means cover it from head to foot with sterile field, leaving only a small opening at the insertion site.⁵

One study on protocols for diagnosis and treatment of CRI showed that the greater the length of stay with the catheter, the greater the possibility of acquiring infection. The existence of a protocol on catheter has proven to be an effective measure to reduce the number of infections and it should involve aspects related to the training of the staff, aseptic technique at insertion and maintenance; caring for exit orifices and connections that include the disinfection; the use of gases and transparent dressings; periodic review of the closures of each connection and infusion catheters, among others.⁷

According to the Brazilian setting on the problem of hospital infections and regarding the responsibilities of the manager of the hospital infection control program - Programa de Controle de Infeccão Hospitalar (PCIH) and other leaders; it is known that there is a lack of communication motivated by mutual ignorance about the advisory actions, about the meaning linked to hospital quality, the area of coverage and depth of the PCIH, information usage, as well as the lack of systematic and official information on this area in Brazil.⁸ ⁹

Based on these considerations and the observation that the health professionals are not involved and do not meet most protocols for the prevention and control of NI or, even, its use is carried out in an incipient manner. Thus, it is necessary to know the problem for seeking solutions that contribute for an appropriate, safe and quality assistance. Thus, the study aims:

- Verify the association of nosocomial infection and the central venous catheter with non-compliance of the protocols in the intensive care unit.

METHOD

It is a descriptive and prospective study, with longitudinal design and quantitative approach, performed at the Hospital...
Infection of Central Venous Catheter and the...
According to the Figure 2, among patients who were exposed to the risk of developing infection, those ones who passed away showed a higher average of errors ($4.2 \pm 2.0$), ranging from 1 to 9. As for the patients who had another destination, they showed an average of $2.9 \pm 1.2$, ranging from 0 to 5. This difference presented itself like statistically significant ($p = 0.044$).

When considering the overall risk for development of infection, of 31 surveyed (100.0%), 48.4% were exposed to a high risk. Of these, 35.5% developed clinical and laboratory signs of infection, and this value was significant ($p = 0.045$), and 32.3% have passed away ($p = 0.049$).

In observation of the patients who showed infection, the clinical sign that more was present was the fever (35.5%), followed by hypotension (19.4%) and chills (3.2%). The microorganisms that more appeared in blood cultures were *Staphylococcus aureus* (9.7%), *Enterococcus gran* (-) and *Candida spp*, the latest two with 6.5%.

The Figure 3 addresses the main committed errors, highlighting the hand hygiene at all steps and, in the entire procedure, as well as the non-use of the expanded and sterile field and the non-use or contamination of sterile gloves during maintenance of the catheter.
Using epidemiological data in the area of infection, the risk of infection at the insertion time and the risk of infection throughout the process proved to be strong and significant ($r = 0.845$ and $p = 0.000$). As for the risk of infection in maintenance, the correlation was moderate and significant in relation to the entirety of the process ($r = 0.551$ and $p = 0.001$).

![Figure 3](image)

Analyzing the Figure 4, regarding the procedures with each other and the correlation between the risk of infection at the insertion time and the risk of infection throughout the process proved to be strong and significant ($r = 0.845$ and $p = 0.000$). As for the risk of infection in maintenance, the correlation was moderate and significant in relation to the entirety of the process ($r = 0.551$ and $p = 0.001$).

![Figure 4](image)

During the study, we noted the lack of standardization of the antiseptic used at the puncture location, both at the time of installation of the catheter and in the dressing changes. In most cases, Povidone-iodine (PVPI) and chlorhexidine were used. In the absence of these products, the staff performed a cleaning with physiological saline.

The dressing was carried out by nursing technicians every 24 hours, covering it with sterile gauze and micropore, at the beginning of the research. During the last days, the sector acquired transparent film and the exchange started to be performed every 7 days. This lack of standardization has hindered us to assess the use of antiseptic, as well as the coverage as a risk factor for bloodstream infections.

**DISCUSSION**

The ICU is a sector studied by other surveys, because of a high incidence of infections, as a result of the highly aggressive frequent medical and therapeutic interventions, the increased number of invasive medical devices, the exposure of the patient to multiple therapeutic treatments, the use of antimicrobial at a large-scale and, therefore, the patient's age.

The epidemiological data in the area of infectology present the elderly population as the more susceptible to the development of nosocomial infections. However, this study has demonstrated that the group of patients that more showed clinical and laboratory signs related to infection by CVC was in the age group of up to 59 years old.

The Institute for Healthcare Improvement (IHI), in its campaign "5 Million Lives" that has as one of the objectives preventing bloodstream infections associated with catheter, through the implementation of the 5 components of care called "Bundle of Central Venous Catheter," argues that adoption of barrier maximum precautions significantly reduces the chances of developing bloodstream infections. It also has demonstrated that the probability for development of infection can be from 2.2 to 6.3 times higher when the barrier maximum precautions were not adopted.

A study conducted in a tertiary hospital in Brazil points out that the infection at the surgical site is multifactorial, and that the surgical team is an important pathogens source for its etiology. In view of the above, the use of the surgical scrub is a coherent way of preventing transmission of infection and infection, both for the professional and for
the patient, and its proper use is related, too, to the warranty of the maintenance of asepsis.11

The errors made by professionals in the procedures of insertion and maintenance of CVC in this research, associated with other conditions, showed up as risk factors for the development of NI, corroborating with a study performed in Spain on protocols related to catheter infection.7 The long period of hospitalization, also observed by this research, constitutes itself in a relevant variable for the emergence of NI, in agreement with other surveys.12,13

One of the most overlooked steps by professionals, throughout the process, reaching 87.1% of failures in maintenance, was the hand hygiene that, despite being a relatively simple procedure, it is an important means to reduce the chance of occurrence of infection. According to the IHI, the hand hygiene or use of alcohol gels 70.0% help in the preventing of contamination of the insertion sites of CCV, as well as in the bloodstream infections resulting therefrom.3

A study conducted in a post-anesthetic recovery room at a teaching hospital in the city of Goiânia / GO (Brazil) shows that the frequency of hand hygiene was low by nursing staff. The adherences to this practice between the nursing staff before and after the procedures were, respectively, 2.95% and 6.34%; whereas among nurses, the adherence was 15.93, before, and 17.70%, after, the procedures. Although the category of nurses have obtained better results, it is still worrying the low rate of adherence to the hand hygiene practice.14

Other flaws highlighted by the survey are related to contamination of gloves and aprons, as well as the non-use of sterile expanded fields and mask. The most common cause for the problems found is related to aseptic techniques, showing a frequent contact of sterile areas of surgical scrub components with skin, equipment and non-sterile surfaces, especially, in the placement and removal of gloves and aprons.15

The dressing on the puncture site should be permeable to water vapor, comfortable for the patient and easy handling by the healthcare professional and / or patient. It may be transparent or with gauze attached with adhesive tape. The advantage attributed to the transparent form is related to the allowance of a clear visualization of the insertion orifice, besides to foster barrier against dirtiness and might provide less frequent exchanges, by favoring an ongoing assessment by health professionals. There is no consensus on the risk of infection and association with the dressings of intravascular catheters. The important issue is that the change of gauze dressing should be performed whenever it is damp, dirty or loose.6 In the cases monitored by this study, the change of dressings of the insertion site was performed every 24 hours, in case of coverage with sterile gauze, or when necessary, as directed above and using the available antiseptic.

Regarding the pathogens found in this study, Staphylococcus aureus, Enterococcus gran (-) and Candida spp have appeared most frequently, similarly to the study group of the Spanish Society of Parenteral and Enteral Nutrition - Sociedad Española de Nutrición Parenteral y Enteral (SENPE), which showed that the gran-positive pathogens, such as Staphylococcus coagulase-negative, Staphylococcus aureus, Streptococcus spp and Enterococcus spp, are responsible for over 75% of infections associated with CVC.7

The microorganisms that commonly colonize the external surface of the catheter are Staphylococcus coagulase-negative and Staphylococcus aureus, while nosocomial pathogens such as Pseudomonas spp, Stenotrophomonas spp, Acinetobacter spp, Enterococcus spp, Staphylococcus spp and Candida spp frequently colonize the lumen of the catheter.16-17

Among the prophylactic measures, the protective barrier is a low cost practice and should be considered as standard in the insertion of all types of catheters, since it favors the control of infections and, consequently, positively affects the organizational results, by decreasing morbidity-mortality from NI.18-19 The insertion of central venous catheter should be performed by specific teams or properly trained staff, observing the reduction of infections, as it decreases tissue trauma and reduces the use and retention of the central venous catheter, with a clear advantage in the cost / benefit evaluation.19

**CONCLUSION**

Of the totality of patients undergoing insertion of CVC in the intensive care unit in question, 71.0% were female and 29.0% male; the age ranged from 18 to 85 years (52.6 ± 22.5). During the insertion, we noted a ranging from 0 to 5 errors (1.2 ± 1.4); as for the maintenance, the average was 2.3 ± 0.9 errors, varying from 0 to 4. During the process of insertion and maintenance of CVC, in those patients who showed infection, there was a variation from 2 to 9 errors (4.2 ± 1.7); as for those who had no infection, the variation was
from 0 to 5 errors (2.8 ± 1.5). The Spearman Correlation between the risk of infection throughout the process and the risk of infection at the insertion time showed up strong and significant (r = 0.845 p = 0.000) and, in relation to the risk of infection in maintenance, it was moderate and significant (r = 0.551 p = 0.001).

The institutions and their professionals need to review these issues in a way that justifies the use of the surgical scrub as an essential practice in controlling contaminations and infections in surgery and not a mere ritual, because the results of this study have demonstrated that the breaking of aseptic technique have exposed, significantly, the patients to a high risk for the development of infection, and the number of deaths was striking.

This current study allowed us to conclude that many prescriptive measures for prevention of nosocomial infection found in the literature are not being observed in the actions of the researched professionals. A proper approach in healthcare, focused on quality of care and prevention of errors, is essential to the decrease of the risk factors associated with infections. For this purpose, it is necessary having the motivation and training of professionals, in order to look at the prevention and fulfillment of care protocols.

As difficulty in performing this survey, we found the lack of scientific material that addresses the break of protocols by the health professionals in relation to CVC. It is hoped that this study can enrich the literature and encourage other studies, as well as contribute to the restructuring of services, in order to deploy a core of in-service ongoing education.

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