CENTRAL VASCULAR CATHETER INFECTION BY *Staphylococcus aureus*

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ABSTRACT

Central venous catheters are used when extended access to vascular system is needed. The catheter infections occur in 19% of patients, with 12% of blood infection. *Staphylococcus aureus* is a bacteria that is usually found in this kind of infection, mainly affecting immunocompromised patients with extended access catheter. It is found in normal microbiota, and it houses easily when natural barriers are compromised, taking to local or systemic infections. This infectious agent has become important in nosocomial environments due to its resistance and adaptability. The frequent occurrence comes from the indiscriminate use of antibiotics and the huge amount of implanted catheters. Meticilin resistant *S. aureus* (MRSA) are becoming more common, due to the high capacity of mutations and acquirement of resistant genes. Based on these facts, this study had as an objective to perform a literature review about catheters infections by *S. aureus.* These agents install in catheters increasing the length of stay and hospital costs, when it comes to a blood infection. To control this kind of infection it is necessary to educate both the health professionals and patients.

KEYWORDS: Catheter-related infection, cross infection, *Staphylococcus aureus*

1. INTRODUCTION

Central venous catheters (CVC) long-term are used in clinical conditions hemodialysis, blood therapy, chemotherapy and parenteral nutrition, or when requiring long-term access to the vascular system. The infection associated with catheters occurs in approximately 19 % of patients, 12 % of cases of bacteraemia, and 7 % in local infections. Some factors contribute to the risk of infection as location of access, infused solution, length of stay, manipulation, work experience, and type of catheter[1].

Staphylococcus aureus and coagulase negative *Staphylococcus* are bacteria that are commonly observed in the CVC infections. These infections occur primarily in immunocompromised patients with prolonged catheterization[2]. *S. aureus* are gram-positive cocci, which are present in normal microbiota, ie, the human is its main reservoir, may cause from mild infections to severe. In case natural barriers are easily compromised it is lodged, causing a local or systemic infection. Due to its enormous capacity for adaptation and resistance *S. aureus* has become one of the species most important in the setting of nosocomial infections, and its occurrence is related to the indiscriminate use of antibiotics, and increased use of CVC[3.]

A problem that has afflicted the health professionals is the high incidence of Methicillin resistant *S. aureus* (MRSA). The medical and scientific concern about this strain comes from the beginning of antibiotic therapy, and has been increasing as new resistance mechanisms have emerged. The identification of MRSA must be rapid to avoid spread throughout the hospital region and isolation of patients is considered in many countries. Research shows that bacteraemias caused by such bacteria tend to increase the stay of patients in nosocomial settings at 40 % and 32 % of the costs[4].

Thus, this study aimed to verify the occurrence and problems of venous catheter infections by Staphylococcus aureus through a bibliographic review in books and scientific articles in national and international databases.

2. MATERIAL AND METHODS

The present study consists in a literature review by scientific articles found on sites like PubMed, Scielo, NCBI and books and periodicals present in the Faculty Inga Library in order to verify the occurrence and problems of venous catheter infections by *Staphylococcus aureus*.

3. DISCUSSION

Vascular catheter central

The CVC is an equipment device between the human body and the external environment, and is usually used in Intensive Care Units (ICU) for administration of nutrients, drugs, drug infusion, monitoring vital signs, hemodynamics and parenteral nutrition[4]. The use of CVC entails high risks and increases the chances of morbidity and mortality of patients, because it is invasive and dangerous[5]. The CVC may also compromise the patient's immune system, as through the skin, and a direct open pathway to the entry of bacteria and yeasts [6]. Moreover,

some studies show that the activity of the phagocytosis, and bactericidal activity of the cells is compromised in the presence of poly-tetra-fluoroethylene devices and poly-methyl-methacrylate materials[1,6].

When it comes to nosocomial infection, the problem is greater in ICU where the patient has 5 to 10 times higher probability of contracting infection. The risks are directly related to the severity of the disease, the patient's nutritional conditions, and invasive procedures among other aspects[3].

The age of one year or more than sixty, use of immunosuppressive drugs, antibiotics, presence of infectious focus, female, hospital stay, skin moisture compared to curative, are risk factors for contracting infections associated with CVC, however little is known about the profile of patients who develop this type of infection[7]. The type of material of the catheter, the insertion site, proper aseptic hand handler and aseptic technique in device deployment, with antimicrobial and antiseptic, are essential for the control of infection in CVC. It is very important the continuing education of health professionals involved in this procedure[1,8].

Hospitals alone are of great risk of biological contamination, wards are home to several patients with various types of infectious agents that spread easily. Several people infected with infectious agents facilitate that they have gene flow, which is the exchange of biological material between bacteria of the same species or not, and the inappropriate use of antibiotics accelerates the spread and strength of these agents[9]. Immunocompromised patients, HIV patients, and other debilitated patients are the main targets of these bacteria, the main carriers of these employees themselves, where they live in the nasal mucosa and skin mainly.

Staphylococcus aureus

Staphylococcus are gram positive cocci belonging to *Micrococcaceae* family, catalase positive, without spores, without mobility, usually not encapsulated, may appear singly or grouped into short and irregular chains. In nosocomial environment strain of *S. aureus* is most important because it is related to a number of human infections. The spherical shape and the presence of the enzyme coagulase characterize the species[3,10,11].

The *S.aureus* spread of efficiency occurs due to easy adaptation to different environments, pH, moisture and nutrient deficiency, making it viable for a long period of time, in a dust particle, or in human circulation environments. Man is the main reservoir, where about 40 % of the population has colonized nasal passages, throat and other sites such as skin, also have been described[3,12,13]. Most people is asymptomatic but infectious processes can result when natural barriers are compromised by a trauma or surgical procedure, or when, for example, opens a pathway to this microorganism[14,15,16]. The pathogenicity and colonization ability of *S. aureus* is directly related to its virulence factors are adherence host cells or the extracellular matrix; Evasion of the immune system of the patient enterotoxins, toxic shock syndrome toxin, protein A. beta-lactamases, coagulases, hyaluronidases and catalases are also some of the enzymes produced by *S. aureus* conferring great pathogenic potential[17,18].

S.aureus carries risks for diabetic patients, people undergoing hemodialysis, HIV positive, among others, causing infectious processes ranging from simple skin infections like folliculitis, impetigo, boils and carbuncles until systemic infections which can be fatal[12,13,19]. Patients who make use of CVC are susceptible to contamination by S. aureus, as a bacteria present in the normal flora of humans, where it evades the catheter insertion site. This bacteria is able to migrate into the bloodstream and can lead to severe bacteraemia, especially when the patient is home MRSA strains[20]. The catheter infection occurs in approximately 19 % of patients using CVC, 7 % local infections and 12 % of cases are bacteraemia[21]. The semi implantable catheters have higher infection rate 43 % of cases compared with 8 % of the fully implantable[8].

The bacteraemia associated with catheter has features for patients with fever or chills, and signs of inflammation. As proven by blood culture peripheral, or the own catheter, using literature to confirm the diagnosis described it: maki technique (more than 15 colony-forming units); Growth 5 to 10 times CFU/ mL in samples of blood; Growth 1,000 CFU/ mL of blood was collected from the catheter.[22,23]. This type of device has increased cases of primary bloodstream infections related to catheter and mortality was increased by approximately 20 %[24].

Antimicrobial resistance

At the end of the 1930s with the introduction of antibiotic therapy, the first two *S. aureus* strains resistant to sulfanilamide. The methicillin was the first semi-synthetic penicillin developed resistant to beta lactamase in 1960, but the resistance to this drug came less than a year after its release and then immediately resistance cephalosporins[25,26,27].

MRSA spread rapidly up the nosocomial ambietes, thereby limiting the antibiotics vancomycin and teicoplanin. In England the number of deaths due to resistant *S. aureus* increased between 2001 and 2005 by 122%, although no other country has had such a large index, MRSA is a global concern in the medical and scientific community[28,29]. Vancomycin has been known since 1956 but little used because of the success of penicillin. Currently in many cases of MRSA is one of the few effective drugs against this strain. In 1997 isolated the first strain resistant to vancomycin in Japan

and in 2000 in Brazil[30].

Antibiotic resistance is due to mutations in bacterial genes, which alters the antibiotic action site or by acquiring genes of other bacteria of the same species or not, that destroy or inactivate the drug, trasmitidas by plasmids and transposons[27,31]. In a hospital in Goiânia, the average number of cases of sepsis caused by MRSA in patients over one year, was 5 for 1000 inpatients from 2000 to 2001 and the death rate of 35.1 %[32].

The access of bacteria to catheters occurs in several ways: at the time of insertion, the colonization of the skin, contamination of connections, contaminated infusion solutions, hematogenic transmission of other infectious focus, or the hands of professionals or others. The infection associated with catheter bloodstream is one of the most serious complications, and second Belated prolongs patient hospitalization within 7 days increasing the additional costs to US $ 6,000 per patient. Therefore prevent this type of infection is the best way to avoid them[33,34].

The addition of anti-infective substances such as minocycline, rifampin, chlorhexidine and silver sulfadiazine, the catheters can prevent adhesion of microorganisms and formation of biolfimes. These catheters in short stay reduced cases of infections[33].

At high levels of *S. aureus* infections in nosocomial environments and high methicillin resistance level the World Health Organization (WHO) confirms the urgent need for the discovery of new antibiotics for the treatment of *S. aureus* resistentes[26,27]. In addition, understanding the danger of pathogenicity of S. aureus, can guide health professionals in the rationalization of antibiotics, thus reducing the chance of antimicrobial-resistant strains[2].

The Protocols of care to vascular access should be reviewed frequently, be standardized and available to everyone. So the key to control of infections related to catheters is effective and continuing education of health professionals[35].

4. CONCLUSION

Given the findings of the literature, we emphasize the importance of characterizing the type of catheter infection, to tailor the best treatment for each patient. The most critical point is the bacteraemia related to CVC, where knowledge about the pathogenicity of *S. aureus* can guide health professionals to the rationalization of antibiotic therapy, minimizing the chances of resistant strains. It is essential instruction on the correct use of antibiotics for patients because the neglect of the dosage and the correct treatment time has become more difficult will cure bacterial infections. Moreover, it is extremely important to invest in research and synthesis of new drugs effective against this infectious agent, especially resistant.

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