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Prevalence of infection in patients with temporary catheter for hemodialysis in a teaching hospital

Palmiane de Rezende Ramim Borges[1*] and João Bedendo[2]

*[1]Faculdade Pitágoras, Rua Edwy Taques de Araújo, 1100, 86047-500, Londrina, Paraná, Brazil. [2]Universidade Estadual de Maringá, Maringá, Paraná, Brazil. *Author for correspondence. E-mail: palmirezende@hotmail.com*

ABSTRACT. This study aimed to determine the prevalence of infection related to the provisional catheter for hemodialysis in a teaching hospital and evaluate the risk factors associated with these infections. A cross-sectional study analyzed by descriptive statistics and parametric tests. It was found that out of 129 patients, 48.8 % had catheter-related infection in hemodialysis, 65 % were male, 33.3 % were 60 years old and over, and 88 % of patients were admitted to intensive care unit. The prevalence of infection in this group was high, and the vast majority of diagnoses of infection were empirical. Given this, it is suggested to establish the routine culture of the catheter tip in all cases of suspected catheter infection to improve the quality of patient care, and the relentless pursuit of the causes that trigger the infection process in line with good practice from across the healthcare team.

Keywords: kidney failure, renal dialysis, central venous catheterization.

Título Prevalência de infecção em pacientes com cateter provisório para hemodiálise em um hospital ensino

RESUMO. Este estudo objetivou determinar a prevalência de infecção relacionada ao cateter provisório para hemodiálise em um hospital ensino e avaliar os fatores de risco inerentes a estas infecções. Realizou-se um estudo epidemiológico transversal, analisados por estatística descritiva e testes paramétricos. Constatou-se que dos 129 pacientes avaliados, 48,8% apresentaram infecção relacionada ao cateter de hemodiálise, 65% eram do sexo masculino, 33,3% possuíam idade igual ou superior a 60 anos e 88% dos pacientes estavam internados em unidade de terapia intensiva. A prevalência de infecção neste grupo mostrou-se elevada, e a grande maioria dos diagnósticos de infecção foram feitos de forma empírica. Frente a isso, sugere-se estabelecer como rotina a cultura da ponta de cateter para todos os casos de suspeita de infecção de cateter para melhoria da qualidade do cuidado prestado ao paciente, além da incessante busca das causas que desencadeiam o processo infeccioso em consonância com as boas práticas de toda a equipe de saúde.

Palavras-chave: insuficiência renal, diálise renal, cateterismo venoso central.

Introduction

In recent decades the incidence of end-stage renal disease has increased dramatically in Brazil wherein in 2000 the number were estimated at 42,695 patients and 2011 were 91,314 (Al Mohajer & Darouiche, 2012).

Technological development and biomaterials in the recent decades have provided a breakthrough in the quality and life expectancy of patients with chronic renal failure (CRF) making use of the renal replacement therapy (RRT) (Bernardina, Diccini, Belasco, Bittencourt, & Barbosa, 2008) The use of temporary catheter for hemodialysis reflected positively in the prognosis of those patients with acute renal failure (ARF) that need immediate hemodialysis or those patients with chronic kidney disease CKD who do not have permanent vascular access. The technique is quick and the insertion of the catheter is done painlessly before hemodialysis session. (Bevilacqua, Gomes, Santos, & Canziani, 2011) (Bonfante, Gomes, Andrade, Lima, Acurcio, & Cherchiglia, 2011).

Patients on hemodialysis are highly susceptible to infections, due to the severe clinical condition, low immunity, insertion of catheters, prostheses and frequent punctures. These are relevant factors and can cause disseminated bacteremia and bloodstream infection that lead to higher mortality, hospitalizations and high costs (Bresolin, Bandeira, & Toporovski, 2008).

The length of use of catheter and the number of hemodialysis sessions (HD) have been described as the main factors associated with high risk of sepsis development or colonization of the catheter (Cais, Turrini, & Strabelli, 2009). Others risk factors for infection are related to the catheter insertion site, the

duration of the implantation procedure, the need to repeat the procedure, the type of material, the number of lumens, the frequency of the handling device, the type of dressing used, the microorganisms involved in colonization, the hospital stay, the severity of the clinical and immunological status of the patient (Cravo, Miranzi, Iwamoto, & Júnior, 2011). Thus, the patient will benefit from the use of temporary catheter only if there is a rigorous epidemiological surveillance program of infections control.

Patient will not benefit from the use of that temporary catheter for hemodialysis unless good practices and best care were developed (Bonfante et al, 2011).

Considering the importance and complexity of the topic catheter infection in patients on dialysis, this study aimed to determine the prevalence of infection related to temporary catheter for hemodialysis in a teaching hospital and evaluate the risk factors associated with such infections.

Material and methods

This epidemiological study carried out between November 2012 and May 2013, included patients adults, over 18 years of age, of both gender, with chronic kidney failure in a dialyses treatment who underwent implantation of a provisional double or triple lumen catheter of polyurethane. Study dismissed those patients who switched to dialysis during the research, dropped out of treatment or were discharged soon after implantation of the catheter, once it was not possible to follow them up.

For data collection, the nursing records and medical development in patient files as well as results of laboratory tests were used. The collected data included age, presence of diabetes, site access used, catheter dwell time, the reason for changing catheter, reason for catheter removal, laboratory test results that indicate infectious process of etiologic agent found in the infection and the inpatient unit. After filling out the data collection files, the infection was defined as the outcome variable. Other variables such as gender, age, catheter dwell time, place of catheter insertion and inpatient unit were defined as dependent variables. Data were tabulated and treated in the Statistical Package for Social Sciences (SPSS) version 15.0. To characterize the sample a descriptive statistics frequency data, percentage, mean and standard deviation was carried out. After checking the normality of data through the Kolmogorov-Smirnov test, Student's t test was applied to assess infection regarding age and the catheter dwell time. To assess the association between the outcome variable and the other variables logistic regression followed by the chance ratio test (odds ratio) was performed. For all analyzes we considered the statistical significance at $p < 0.05$, with a 95% confidence interval.

Research ethics

This study was approved by the Research Ethics Committee at n.160.441 / 12, in view of Resolution 196/96 of the National Health Council, which establishes guidelines for research involving human subjects.

Results

Throughout the study 129 patients were evaluated. It was found that 63 (48.84%) patients had infection related to hemodialysis catheter, 65% were male, 79.85% were diabetic, 88% of them were admitted to intensive care units (ICU) and 12% in other sectors. Fifty two of the patients (54.17%) died during the study period.

Using the mean and standard deviation test, it was observed that the average age of the group was 61 years, but only 33.3% of the infected samples were from individuals 60 years of age or over. Thus there was no statistically significant relationship between the average age and infection.

Through the results of the Student t test, an association was found between the catheter time and frequency of infection with $p = 0.001$. The 63 patients with catheter infection (48.84%) remained with the device an average of 12 days, while the 66 patients without catheter-related infection (51.16%) remained with the catheter an average of 6 days.

Among the patients with infection, 75% were diagnosed through blood count, blood culture 11.11%. The general culture test that recognize the infectious process of unspecified origin was of 6.35%, and 7.94% were through catheter tip culture that precisely identifies the microorganism.

Regarding the maintenance of the catheter, 19 (14.7%) patients required exchange the device and in 7 (36.8%) the change was due to infection.

Death was the most prevalent reason for catheter removal (54.17%) and the other reasons were by reverted acute renal failure 21.87%, infection 12.5%, due to the loss of the catheter 5.2%, by fistula maturation 4.17 and 2.08% by early PD.

Catheters were inserted into the femoral region, 63.3% of punctures. It was noticed that the infection occurred in 15.87% in the subclavian region, 15.87% in the jugular area and 68.25% in the femoral region.

Table 1 describes the etiologic agents of infections related to temporary catheter in patients undergoing hemodialysis. It was observed prevalence of the *Pseudomonas aeruginosa*, followed by *Acinetobacter baumannii, Klebsiella ozaenae, Enterobacter aerogenes, Klebsiella pneumoniae and Escherichia coli*. It was also observed that more than one etiological agent was isolated from the catheter of the same patient (data not shown).

Table 1. Distribution of the seven etiological agents of infection in patients with temporary catheter for hemodialysis.

Infectious agentes	F	%
Pseudomonas aeruginosa	4	28.57
Acinetobacter baumanni	2	14.28
Klebsiella ozaenae	2	14.28
Enterobacter aerogenes	2	14.28
Klebsiella pneumoniae	2	14.28
Escherichia coli	1	7.14
Staphylococcus saprophyticcus	1	7.15

Discussion

The infection rate due to the insertion of central venous catheters is high and implies in elevate morbidity and mortality among hospitalized patients. In this study this infection rate was 48.84%. Several factors contribute to the high catheter infection rate in patients on dialysis, the main ones being: the colonization of the catheter, the length of stay of the provisional catheter and number of hemodialysis sessions, insertion region and length of stay. (Fram, Taminato, Ferreira, Neves, Belasco, & Barbosa, 2009).

In the ICU infection rate is generally higher when compared to other hospital units, by adding more severe clinical conditions, as many invasive procedures and depression of the immune system, making patients more susceptible to developing infections. (Leiser, Tognim, & Bedendo, 2007) The predominance of infected patients admitted to the intensive care unit (ICU), the prevalence of very old male individuals was similar to previous studies (Grothe, Belasco, Bitencourt, Vianna, Sesso, & Barbosa, 2010; Moreira, Borges, Costa, Quinino, Serra, & Oliveira, 2008)

The diabetic patients undergo constant changes and complications of disease, including risk of developing nephropathy (Oliveira, Alves, & Bezerra, 2009). Our study, however, found no relationship between kidney disease and this disease.

The highest infection rate related to temporary catheter for hemodialysis occurred among those patients who remained longer with the device, corroborating the literature, which recommends the temporary use for a maximum of three weeks (Grothe et al, 2010; Ribeiro, 2008). The manifestation of the infectious process can only be associated with the use of catheter when using the gold standard diagnosis test. This test is a catheter tip culture by a quantitative or semi-quantitative method, which reveals accurate results and allows the adoption of safer therapeutic action (Riella, 2010). Among the patients with catheter-related infection, only 7.94% had this diagnosis identified by the survey considered the gold standard. The majority of patients who develop infections related to the use of temporary catheters for hemodialysis were diagnosed through blood count and blood culture results. In most cases the treatment of the infection was conducted empirically and was not possible to identify the etiologic agent before starting therapy. Infection is an important variable but was not the most common reason for catheter removal. Other elements (63.2%) were also responsible for the removal.

Veins commonly used for catheter implantation are the internal jugular, subclavian and femoral. The use of the femoral vein implies in the risk of venous thrombosis, increased rates of morbidity and mortality in relation to the upper limbs and also a higher incidence of infection (Ross et al., 2006). Our results, however, showed no statistically significant association related to catheter infection and deployment pathways.

Most of diagnoses on the catheter infection were done empirically. Due to that few microorganisms were isolated. Among them prevailed gram negative bacteria confirming previous studies (Souza et al., 2012; Sesso et al., 2011). Non-fermentative bacteria such as Gram-negative bacteria cause concern as they may cause outbreaks of hospital infection linked to increased mortality rates (Storti, Pizzolitto, & Stein, 2007; Trelha et al., 2013).

Conclusion

In this study a high prevalence of infection in patients using temporary catheter for hemodialysis has been shown. The infection was associated with the longer permanence of the catheter.

It was found that the vast majority of infection diagnoses were made by no gold standard test laboratory that is the culture of the catheter tip by quantitative method. Considering the importance of the use of gold standard test we suggest the establishment this test in the routine even if the results are late. More reliable results, even if late will assist in improving the quality of care provided.

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