

**Bacterial contamination of catheter tips and blood culture of a veterinary hospital****Contaminação bacteriana de pontas de cateter e hemocultura de um hospital veterinário**

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**ABSTRACT**

Hospital infections have a great importance in unique health, especially when one takes into account that the bacteria that cause these infections can be multidrug resistant, an entry path for these microorganisms can be the peripheral venous catheter used, primarily, to maintain the patients hydration. The objective of this work was to detect bacterial contamination and identify the microorganisms involved through blood culture and culture of peripheral venous catheters used by dogs in four different sectors of a Veterinary Hospital. 21 dogs were selected, without differentiation between age or race, and 21 of them had their blood samples collected and 21 samples of catheter tip used by them. The samples were differentiated and identified by biochemical tests and separated into Gram-Negative bacilli, coagulase-negative *Staphylococcus* spp. and *Streptococcus* spp. Among the 42 samples, there was no growth in 59.52% (25) of them, in 26.19% (11) of the samples, there was growth of Gram-Negative Bacilli, 11.90% (05) were coagulase-negative *Staphylococcus* spp., and 2.39% (01) were *Streptococcus* sp. This work shows that there should be concern about contamination that may be present in catheters or hospital probes that may cause serious infections in animals or humans.

**Keywords:** Bacterial contamination; Microbiology; Hospital Infection; Veterinary Medicine.

**RESUMO**

As infecções hospitalares têm uma grande importância em saúde única, principalmente quando se leva em conta que as bactérias causadoras destas infecções podem ser multirresistentes, uma via de entrada para estes micro-organismos pode ser o cateter venoso periférico utilizado, principalmente, para manter a hidratação dos pacientes. Este trabalho teve como objetivo detectar a contaminação bacteriana e identificar os micro-organismos envolvidos através de hemocultura e cultura de cateteres venosos periféricos utilizados por cães em quatro diferentes setores de um Hospital Veterinário. Foram selecionados 21 cães, sem diferenciação entre idade ou raça, e deles foram coletadas 21 amostras de sangue e 21 amostras de ponta de cateter por eles utilizados. As amostras foram diferenciadas e identificadas por provas bioquímicas, e separadas em Bacilos Gram-Negativos, *Staphylococcus coagulase negativa*, e *Streptococcus sp.* Dentre as 42 amostras, não houve crescimento em 59,52% (25) destas, em 26,19% (11) das amostras houve crescimento de Bacilos Gram-Negativos, em 11,90% (05) *Staphylococcus coagulase negativa*, e em 2,39% (01) *Streptococcus spp.* Este trabalho mostra que deve haver uma preocupação em relação a contaminação que pode estar presente em cateteres ou sondas hospitalares e que possam gerar infecções graves em animais ou humanos.

**Palavras-Chave:** Contaminação bacteriana; Microbiologia; Infecção Hospitalar; Medicina Veterinária.

**1. INTRODUCTION**

The selection of the intravenous route is a method used to employ the treatment, depending mainly on the established therapeutic plan, its duration, the time in which the drug needs to act, it depends on the patient diagnosis, its age, state of health, and its characteristics, and possible access. The most used venous accesses in hospital environments are the peripheral venous catheters (CVP) and central venous catheters (CVC) (Costa et al., 2010).

Studies show that the bloodstream infection caused by vascular devices has increased considerably, which reflects directly on the increase in the length of hospital stay and costs of the same. Several conditions have been suggested as risk factors for the development of infections related to catheters. The duration of catheterization, the skin colonization at the site of catheter insertion, the frequent manipulation of the venous line, the use of a catheter to measure central venous pressure, the type of dressings used, the underlying disease and the severity of the clinical status are considered the most important factors (Nascimento et al., 2015).

Infection is the most serious complication associated with the catheters. In a general way, it occurs in approximately 19% of patients in use of this device, being 7% local infections and 12% of the cases of bacteremia associated with catheter (Neves Junior et al., 2010).

Although the bloodstream infection is lower compared to other hospital infections (IH) such as pneumonia, infections of the urinary tract and those of the surgical site, the bloodstream infection has its importance for being the cause of substantial morbidity, mortality and increased hospital costs (Mesiano and Hamann, 2007).

In accordance with Agostinis et al., (2013) the genus *Staphylococcus* spp. is involved in infections that affect humans and animals and is directly associated with infections in the catheters. However, Cunha et al. (2004) emphasizes that the *S. epidermidis* is the most characterized and involved species etiologically, other species of coagulase-negative *Staphylococcus* pathogenic species have been isolated from a variety of clinical sources. Just as the *Streptococcus* sp. and Gram-negative bacilli, such as *Pseudomonas* sp. (Basile-filho et al., 1998; Arias et al., 2013).

According to Santos et al. (2012), the infections associated with catheters or other types of implants tend to be resistant to antimicrobials, causing increased morbidity and costs with assistance. The same occurs in veterinary medicine, mainly by the lack of Commissions of hospital infection control, becoming a problem common to animals, especially to those who are domestic.

Both in humans and animals, infections in the catheters are related to the lack of asepsis and the care of the manipulation of the same, being the intravenous catheters one of the most common causes of hospital infection, reinforcing the need for training of techniques for hand washing (Greene, 2006; Weese 2012). It was possible to realize that studies on infection related to support procedures such as insertion of central venous catheter in the hospital environment in veterinary medicine are scarce. Thus, the objective of this study is to detect bacterial contamination and to identify the microorganisms involved in blood and peripheral venous catheters used by dogs in four different sectors of a Veterinary Hospital of the northwestern region of Paraná State, Brazil.

## **2. MATERIALS AND METHODS**

### **2.1 ETHICS COMMITTEE**

This research was approved by the Committee for Ethics in Research Involving Animal Experimentation of UNIPAR under protocol 26680/2013.

### **2.2 STUDY LOCATION AND POPULATION**

Peripheral venous catheter tips were used, along with the blood collected from jugular or peripheral vein of 21 dogs of any age who underwent surgical procedures, radiographic and/or clinical treatments in a Veterinary Hospital in the northwest region of the state of Paraná, in the period from November to December 2014.

### **2.3 COLLECTION OF SAMPLES AND LABORATORY EXAMS**

For the completion of the procedures, the animals were contained manually with the aid of the owner for the realization of the trichotomy and asepsis. With the help of a syringe, the blood was

collected directly from the vein and sown into a plate containing agar base plus 5-8% defibrinated sheep blood, then, the samples were stored at a temperature of 37°C for 24 - 48 hours for subsequent identification technique.

After the permanence of animals in the sectors of hydration, insulation, postoperative, or radiography, the central venous catheter was removed, and then about 01 cm from the ends of these catheters were sectioned and placed in sterile tubes containing BHI broth (Brain Heart Infusion), and incubated for 24 - 48 hours at a temperature of 37°C. After this period, these samples were sown on agar base plus 5-8% defibrinated sheep blood for over 24 and 48 hours.

The bacterial differentiation was performed according to the macroscopic and microscopic characteristics of the colonies, such as morphology, color and arrangement, viewed through an optical microscope with 100x magnification, the results of biochemical tests were also used, such as catalase, coagulase, reduction of nitrate, indole, motility and fermentation of carbohydrates as a form of identification (Quinn et al., 1994).

#### 2.4 RESEARCH INSTRUMENT

Each sample of venous catheter was accompanied by a clinical form that contained information related to the rectal temperature, procedure performed or pathology of the animal, time of permanence of the catheter, and the place of accommodation of the animals.

#### 2.5 STATISTICAL ANALYSIS

The data were tabulated and, then, submitted to statistical analysis using ANOVA test, to check the variance analysis, presenting the absolute and relative frequencies.

### 3. RESULTS

In total, the animals submitted to different procedures showed no bacterial growth in 52.4% of the samples of catheter tip and in 66.7% of blood samples. There was a growth of Gram negative bacilli (BGN) in 33.3% of the catheter tip samples and in 19% of the blood samples. In relation to *Staphylococcus coagulase negative* (STACN), 9.5% were present in the samples of catheter tip, and 14.3% in blood samples (Table 1). Animals in the postoperative period obtained the following result; there was no bacterial growth in 66.7% of samples of catheter and in 55.6% of blood samples, while there was a growth of 33.3% in BGN catheter and 22.2% of blood, since the results of STACN catheter were: 0% and blood 22.2% (Table 2).

**Table 1.** Sample, sector of permanence, procedure and/or the animal pathology, rectal temperature, time spent with the catheter and results of bacterial culture of 21 dogs who underwent clinical, surgical and/or radiographic treatments in a Veterinary Hospital of the northwestern region of Paraná State, Brazil, 2018.

Sample	Place	Pathology or procedure	Rectal Temperature	Time of permanence of the catheter	Catheter	Blood
Hydration		Anorexia	39.2	24h	STACN	No bacterial growth
Hydration		Hemoparasitosis - renal insufficiency - Pyodermitis	38.2	48h	BGN	BGN
Hydration		Hyperadrenocorticism	39.8	72h	BGN	BGN
Hydration		Bone marrow hypoplasia	38.0	48h	No bacterial growth	No bacterial growth
Hydration		Chemotherapy	38.6	5h	No bacterial growth	No bacterial growth
Isolation		Canine distemper	38.9	48h	BGN	No bacterial growth
Isolation		Canine distemper	Death	48h	No bacterial growth	No bacterial growth
Post-operative		Tail Amputation	37.7	24h	BGN	STACN
Post-operative		Enucleation	37.8	24h	No bacterial growth	No bacterial growth
Post-operative		Splenectomy	36.4	24h	No bacterial growth	No bacterial growth
Post-operative		Mastectomy	37.7	12h	No bacterial growth	No bacterial growth
Post-operative		Mastectomy	37.7	24h	No bacterial growth	No bacterial growth
Post-operative		Cutaneous neoplasia	36.7	24h	No bacterial growth	No bacterial growth
Post-operative		Osteomyelitis - Orchiectomy	39.7	48h	No bacterial growth	STACN
Post-operative		Ovariectomy	38.2	24h	BGN	BGN
Post-operative		Urethrostomy	38.2	48h	BGN	BGN
X-rays		Abdomen	38.0	30 minutes	STACN	No bacterial growth
X-rays		Dysplasia	38.0	15 minutes	No bacterial growth	No bacterial growth
X-rays		Dysplasia	37.1	15 minutes	BGN	No bacterial growth
X-rays		Jaw Fracture	39.0	30 minutes	No bacterial growth	No bacterial growth
X-rays		Thorax	37.3	20 minutes	<i>Streptococcus</i> sp.	STACN

Legend: BGN: Gram-negative bacillus; STACN: *Coagulase-negative Staphylococcus* spp.; STREPTO: *Streptococcus* spp.

**Table 02.** Frequency of bacterial growth of samples of catheter tip and blood of 21 dogs who underwent clinical, surgical and/or radiographic treatments, in a Veterinary Hospital of the northwestern region of Paraná State, Brazil, 2018.

Sectors	Material	SC		BGN		STACN		STREPTO		TOTAL
		N	%	N	%	N	%	N	%	
Hydration	Catheter	02	40	02	40	01	20	0	0	05
	Blood	03	60	02	40	0	0	0	0	05
Isolation	Catheter	01	50	01	50	0	0	0	0	02
	Blood	02	100	0	0	0	0	0	0	02
Post-operative	Catheter	06	66.7	03	33.3	0	0	0	0	09
	Blood	05	55.6	02	22.2	02	22.2	0	0	09
Diagnostic	Catheter	02	40	01	20	01	20	01	20	05
Imaging	Blood	04	80	0	0	01	20	0	0	05
TOTAL	Catheter	11	52.4	07	33.3	02	9.5	01	4.8	21
	Blood	14	66.7	04	19	03	14.3	0	0	21

Legend: SC: without growth; BGN: Gram Negative Bacillus

STACN: *Coagulase-negative Staphylococcus* spp.; STREPTO: *Streptococcus* spp.

The animals were subjected to radiographic procedures exhibited: no bacterial growth catheter 40% and blood 80%, BGN 20% catheter and blood 0%, STACN 20% catheter and blood 20%, *Streptococcus* sp. catheter and 20% blood 0%.

Samples of the animals that were in the hydration that showed no bacterial growth were: 40% catheter and blood 60%, BGN catheter 40% and blood 40%, STACN catheter 20% and blood 0%.

In relation to animals in isolation, there was no growth in 100% of the blood samples collected and in 50% of samples of catheter; the other 50% are in relation to the BGN growth.

The results showed that hospitalized patients in the postoperative period and in the hydration obtained higher (28.57%) frequency of bacterial contamination.

#### **4. DISCUSSION**

Such research takes into account the proximity between dogs and their owners, besides their role in unique health in the dissemination of microorganisms that can cause serious diseases and/or be resistant to antibiotic therapy (Van Duijkeren et al., 2004).

Infection is one of the main causes of morbidity and mortality in patients submitted to hospital procedures and the time of permanence of central venous catheter is the main determining factor for the development of bloodstream infection, in addition to the duration of use of the catheter (Passamani and Souza, 2011).

Of the studies sectors, the one which presented the highest index of microorganisms was the postoperative sector, adding seven (16.66%) isolates, which may be a result of the surgical procedure by which the animal was tested, and the time of permanence of the catheter (24h - 48h). In human and veterinary area scarcity of studies was detected related to this sector, where the research is mostly focused on intensive care unit (ICU) and central venous catheters (CVC) (Costa et al., 2014; Mesiano and Hamann, 2007; Passamani and Souza, 2011).

The scarcity of published articles in the area of veterinary medicine is also present in research related to blood culture, because they are usually related to sepsis, and cultures of catheter tip, having, then, this study being based on human literature.

In the work of O' Grady, et al., (2002) it was reported that in 37% of blood cultures carried out in a hospital for eight years *Staphylococcus* coagulase negative were identified, 13% of the cases of infection were *Staphylococcus aureus* and 36% were for the Gram-negative bacilli in cases in humans, this statistic does not corroborate with the present study, taking into account that the BGN were found in 33.3% of samples of catheter tip, while the coagulase-negative *Staphylococcus* were present in only 9.5% of the samples. The genus *Staphylococcus* was also found in the majority (60.9%) of the samples of Ross et al., (2006), in 48% of cases in the work of Machado, et al., (2009).

The work of Basile-Filho et al., (1998), identified as primary cause (45%) of sepsis in patients with CVC the *Staphylococcus* sp., and gave emphasis on coagulase negative, which have been the cause of 31% of sepsis, showing its relevance in relation to its pathogenicity.

Passamani and Souza (2011) and Oliveira et al. (2017) reported that in relation to microorganisms present at the ends of catheter for hemodialysis and also in the blood of patients, both in the sector of emergencies was obtained prevalence of 34% and 55% respectively for *Acinetobacter* sp. that is a gram-negative bacillus. These results corroborate with the present study, where the largest

percentage of micro-organisms found were the BGN. These results may have occurred because of that some BGN are opportunistic pathogens, and have their medical importance by the fact that can be widely used for multidrug-resistant to antibiotics, such as penicillin (OLIVEIRA et al., 2017).

## 5. CONCLUSION

The results of this study demonstrate that greater care is required in relation to the use of peripheral venous catheters in animals, given its importance in the patient's health, thus avoiding sepsis or other complications involving infections. In this sense, also avoiding possible transmission of pathogenic microorganisms and/or probably multidrug-resistant to antibiotics in their owners or people having contact.

New studies in veterinary hospital environment should be conducted to assist in understanding the real prevalence of microorganisms, their multiresistance and later to evaluate the care that the nursing professional may exert on the growth of microorganisms.

## 6. CONFLICT OF INTEREST

The authors have no competing interests.

## 7. ETHICS STATEMENT

The present study is in agreement with the Ethical Principles of Animal Experimentation, according to law 11.794/2008, and all procedures were carried out in agreement with the guidelines Committee of Ethics on Animal Use and approved by Committee for Ethics in Research Involving Animal Experimentation of UNIPAR (Protocol number: 26680/2013).

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