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CVC RELATED BACTEREMIA;

MICROBIOLOGICALLY CONFIRMED, CENTRAL VENOUS CATHETER RELATED BACTEREMIA IN INTENSIVE CARE UNIT PEDIATRIC PATIENTS.

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ABSTRACT… Objectives: To characterize clinically, epidemically and microbiologically the episodes of confirmed bacteremia associated with intravascular catheters of patients in the pediatric intensive care unit. **Study Design:** An analytical, prospective study. **Setting:** Intensive care unit of Pediatric Hospital José Luis Miranda". **Period:** January 2003 to December 2007. **Methods**: 453 patients. Rates, density of incidence, risk factors, static's and mortality were determined and analyzed. **Results:** 96 patients developed bacteremia episodes and 90 (74%) had microbiological criteria. The risk factors associate were: to have multiple catheters, permanency with the catheter more than 7 days, parenteral feeding, prolonged mechanical ventilation, previous transfusions and surgical interventions. The isolations of coagulase negative staphylococci prevailed in 33 patients (36, 7%). The previous demurrage to the insert of the catheter was of 4,0 ± 9,4 days for the healthy ones and 11, 6 ± 24,6 days in the sick persons (p = 0,000); the definitive demurrage was of 56,1 ± 62,4 days in the sick persons versus 24,6 ± 31,7 days in the healthy ones (p = 0,000). The mortality of the second group was superior (26%). **Conclusions:** Multiple dependent and independent factors exist on which actions should be focused to prevent and to diminish the mortality by bacteremias associated with catheters in children admitted in intensive care units.

Key words: Bacteremia, Central Venous Catheterization, Risk Factors, Intensive Care Units.

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INTRODUCTION

The clinical use of devices of central vein access was described for the first time by Aubaniac in 1952. In these days their use is indispensable in the everyday medical practice which has caused an increase in the incidence and severity of the complications related with the use of catheters, mainly the infectious complications. The infections related with intravenous catheters have been associated with attributable risk of mortality of 10-20% in United States, causing 35 000 deaths every year.

The microorganisms can approach the catheter by anyone of the following mechanisms:

(1) The microorganisms of the skin invade the percutaneous tract, probably facilitated by the capillary action in the moment of insertion or in later days.

(2) The microorganisms contaminate the connections of the catheter (and the lumen) when the catheter is inserted over a guide cable (seldinger) or when they are manipulated later on.

(3) The microorganisms are transported by hematogenic via to the intravascular catheter from distant infectious sources.

In all the cases the sanitary personnel's hands play an important role, acting as vehicle of contamination of patient's skin, modifying their habitual flora or polluting the connections.

The material by which the catheter is made and the intrinsic virulence of the microorganisms are very important pathogenic factors in the infections related with the catheter. Studies in vitro demonstrate that the polyvinylchloride catheters or polyethylene are probably less resistant to the adherence of the microorganisms than the teflon catheters, silicone elastomere or polyurethane.[12,13]

METHODOLOGY

A descriptive and analytical study of transverse type was done. 66 patients were included, admitted in the service of intensive cares, of the Educational Provincial Pediatric Hospital José Luis

Miranda of Santa Clara, from 1st January 2003 up to 31st of December 2007 which fulfilled following criteria of inclusion:

1. Hospital stay in the service minimum of 48 hours.
2. Subjected, during their stay, to endovascular catheters or in anyone of their modalities.
3. Development of clinical manifestations compatible with the criteria's of confirmed bacteremia according to the definitions of CDC, 1994.

Exclusion criteria

All those patients were excluded who:

1. Demonstrated some infection in another localization.
2. Admitted with oncohematological diseases under immunosuppressive treatment and with absolute neutrophil recount inferior to 1000 cells x mm3.
3. Admitted with extensive serious burns.

Two subgroups were made according to the microbiological results, the first subgroup comprised of 26 patients with an isolation of gram negative bacteria and the other one of 40 patients with gram positive bacteria isolation.

The information was obtained through the revision of the clinical histories of the selected patients. The data collected was saved in a database created in the statistical software SPSS version 19 for Windows, where it was processed applying tests of descriptive statistic (ranges, absolute and relative frequencies, medium ,standard deviation, odds ratio) according to the type and distribution of the variables. To establish the degree of independence of the qualitative variables statistician Chi squared (adjustment kindness) and the exact statistician of Fisher, interpreting the levels of $p>0.05$ like statistical independence and at the values of $p<0.05$ as statistical dependence (significance level $\alpha= 95$) were used. Analysis of quantitative variables was done by the test of Kolmogorov-Smirnov the non-parametric test, used for two independent samples using the statistician Mann-Whitney, interpreting the levels of $p> 0.05$,without significant differences and the values of $p <0.05$, significant differences (significance level $\alpha =95$).

RESULTS

The congenital malformation represented with 24 patients (36.4%) was the main cause of admission (table-I). The most affected age group was form 1 month to 1 year represented by 30 patients (45.4%), (table-II), ($p>0,05$). Female sex was the most affected one with 34 patients (51.5%), (table-III), ($p>0.05$). Predominant group was of the gram positive bacteria with 40 cases (60.6%) and in this group the Staphylococcus coagulase negative was the most seen bacteria with 34 cases that represents 51.5% of the total cases. The gram negative bacteria represented 39.4% with 26 cases, in this group Acinetobacter spp and Klebsiella spp prevailed with 11 and 8 cases that constituted the 16.7 and 12.1% respectively (table-IV). There were more deaths in the group of patients which developed bacteremia from the gram negative bacteria with 6 patients (9.1%) while there were only 2 cases (3%) with bacteremia from gram positive. The value of p in this case was 0.036 showing that a dependence existed between the probability of dying and the type of developed bacteremia.

DISCUSSION

We coincide with some investigators[5] whose results showed that the base disease and the severity of the same did not have an independent association with the increment of bacteremia risk related with catheters in any of their microbiological variants, others do not coincide with our results, and they found that infectious pathologies represented the third factor of risk implied in the development of the bacteremia.[20]

The influence of the age for the acquisition of an infectious event shows inversely proportional relationship, although it depends on the progressive maturation of the immunologic system. Our results coincide with those obtained by other authors like Deep and collaborators[21] who found predominance of the infectious episodes in new borns (32.6%), followed by toddlers. According to

Basic causes			Type of bacteremia			
Gram -ve		Gram +ve		Total		
#	%	#	%	#	%	
Congenital malformations	12	18,2	12	18,2	24	36,4
Sepsis	6	9,1	10	15,1	16	24,2
Chronic diseases	2	3,0	8	12,1	10	15,1
Perinatal affection	2	3,0	2	3,0	4	6,1
Other pathologies	4	6,1	8	12,1	12	18,2
Total	26	39,4	40	60,6	66	100

Table-I. basic Causes of admission in ICUP
p>0.05
Source: Registration of hospital ingresses in ICUP

	Tipo de bacteriemia					
Gram negatives			Gram positives		Total	
	#	%	#	%	#	%
0 – 1 month	7	10,6	8	12,1	15	22,7
1 month – 1 year	12	18,2	18	27,2	30	45,4
2 – 5 years	1	1,5	5	7,6	6	9,1
6 – 12 years	2	3,0	4	6,1	6	9,1
13 – 18 years	4	6,1	5	7,6	9	13,6
Total	26	39,4	40	60,6	66	100

Table-II. Distribution of patient according to age and bacteremia type Group of ages
p>0.05

Sex			Type of bacteremia			
Gram negatives			Gram positives		Total	
	#	%	#	%	#	%
Male	13	19,7	19	28,8	32	48,5
Female	13	19,7	21	31,8	34	51,5
Total	26	39,4	40	60,6	66	100

Table-III. Distribution of patient according to sex and bacteriemia type.
p>0.05

Lakshmi[20] early age was a factor of significant risk in the analysis with a half age 4.4 ±3.9 (0.08-13).

In relation with the sex most of the studies coincide in highlighting a slight prevalence of the males, the relationship vary from 3;2 up to 2;1[20], other authors[5] end up establishing a true protective roll of the female sex during infectious diseases. This behavior was not found in our work although the differences were very slight in the favor of the female sex.

Multiple studies show a prevalence; although with variations in the figures, of the isolations of gram positive bacterias in the ethiology of the bacteremia related with the catheter. According to Elward[5], 7,7% of the reported episodes were polibacterial. Armenian and collaborators (22), determined that the Gram-positive and Gram-negative bacterias represented 72.7% and 22.7% of the total of isolations obtained, respectively.

According to Deep and collaborators[21], in the

Microorganism	Types of bacteremia				Total			
Defined	Probable				Possible			
#		%*	#	%*	#	%*	#	%*
Gram positive Bacterias								
Staphylococcus coagulase negative Staphylococcus auerus Enterococcus spp.	7 1 1	10,6 1,5 1,5	17 1	25,8 1,5	10 3	15,2 4,5	34 5 1	51,5 7,6 1,5
Subtotal	9	13,6	18	27,3	13	19,7	40	60,6
Gram negative Bacterias								
Acinetobacter spp. Klebsiella spp. Stenotrophomonas maltophilia Enterobacter spp. Escherichia coli Pseudomonas aeruginosa	4 1 1 1	6,1 1,5 1,5 1,5	7 3 2	10,6 4,5 3,0	4 1 1 1	6,1 1,5 1,5 1,5	11 8 2 2 1 2	16,7 12,1 3,0 3,0 1,5 3,0
Subtotal	7	10,6	12	18,2	7	10,6	26	39,4
Total	16	24,2	30	45,5	20	30,3	66	100

Table-IV. Microbiological Isolation according to types of confirmed bacteremia.
Source: Hospital's laboratory archives

Evolution	Types of bacteremia	p	RR	IC
Gram negatives		Gram positives		Total
#	%	#	%	#	%
Dead	6	9,1	2	3,0	8	12,1	0,036	2,2	1,3-3,7
Not dead	20	30,3	38	57,6	58	87,9			
Total	26	39,4	40	60,6	66	100			

Table-V. Evolution according to bacteriemia type.

infections related with catheters the isolations of Staphylococcus aureus prevailed with 12, followed by klebsiella spp. 11, ECN and Pseudomonas spp with 10 respectively, and coli 4, Acinetobacter 3 .

The differences found in the final evolution of the patients with increased risk of dying by bacteremias by gram negative bacterias are due to multiple factors.[26] The administration of an empiric antimicrobial treatment that didn't cover these agents appropriately. Also the appearance of multiresistent Acinetobacter or Klebsiella producer of betalactamasas of extended spectrum (blees) could be the cause of the initial therapy failure.

The differences found in the final evolution of the patients with increased risk of dying by confirmed bacteremias by gram negative bacterias are due to multiple factors.[26] The administration of a empiric antimicrobial treatment that didn't cover these agents appropriately. Also the appearance of multiresistent Acinetobacter or Klebsiella producer of betalactamasas of extended spectrum (blees) could be the cause of the initial therapy failure.

CONCLUSIONS

1. Patients with ages between one month and one year, admitted for congenital malformations or sepsis were larger in number. In relation to the sex we did not find any significant prevalence for any group.
2. Marked prevalence exists of the probably related bacteremias with the use of central intravenous catheters in the group of gram positive microorganisms, especially due to Staphylococcus negative coagulase. In the

group of bacteriemias by gram negative microorganisms, the species of Acinetobacter and Klebsiella were the main agents implied in the development of probably related bacteremias and with defined criteria respectively.

3. The evolution of patients who developed microbiologically confirmed bacteremias related with the use of intravenous catheters was satisfactory for the grand majority of the patients, however the risk and the probability of dying was significantly superior for the group of patient with bacteremia by gram negative bacterias.

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