

ARTÍCULO ORIGINAL/ARTIGO ORIGINAL

An outbreak of sepsis associated/related with the use of central venous catheter in a Neonatal Intensive Care Unit

Surto de sepse associada/relacionada ao uso de cateter vascular central em uma Unidade de Terapia Intensiva Neonatal

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Abstract

This paper aims at describing an outbreak of sepsis associated with the use of central venous catheter (CVC) in a Neonatal Intensive Care Unit (NICU) at Uberlândia University Medical School, as a result of vacations of the nurse in charge of inserting/caring CVC. The study period was split into subperiods: A (October-December/2006), B (January/2007-outbreak period) and C (February-March/2007). The rate of CVC-associated sepsis/1000 catheter/days was 8.1, 30.0 and 11.6, in subperiods A, B and C, respectively. About 20% of sepsis episodes occurring during the outbreak were associated with the use of CVCs and 16.7% were related to the use of that device. The outbreak had prominence of Gram-negative bacilli (44.5%). The status returned to its regular level after the return of the professional who is the responsible for inserting/caring CVCs.

Key words: Sepsis, outbreak, neonates.

Resumo

Este trabalho tem por objetivo descrever a ocorrência de um surto de sepse associada ao uso de cateter vascular central (CVC) ocorrido na Unidade de Terapia Intensiva Neonatal do Hospital de Clínicas da Universidade Federal de Uberlândia durante o período de férias da enfermeira responsável pela inserção/manuseio dos CVCs. O período do estudo foi estratificado em A (outubro-dezembro de 2006), B (janeiro/2007, período do surto) e C (fevereiro e março/2007). A taxa de sepse associada ao uso de CVC foi de 8,1/1.000 cateter/dia no período A, 30 /1.000 cateter/dia no período B e 11,6/1.000 cateter/dia no C. Cerca de 20% dos episódios de sepse ocorridos durante o surto foram associados ao uso de CVC, dos quais 16,7% foram relacionados ao uso deste dispositivo. O surto teve predomínio de bacilos Gram-negativos (44,5%). A situação foi regularizada após o retorno da enfermeira responsável pela inserção/cuidado com os CVCs.

Palavras-chave: Sepse, surto, neonatos.

Introduction

Neonates within Neonatal Intensive Care Unit (NICU) often require central venous access for parenteral nutrition, antibiotics administration, repeated blood sampling and transfusions, however, long-lasting

vascular access in high-risk neonates is associated with a higher risk of catheter-related sepsis.⁽¹⁾

There are some recommendations to be followed so as to reduce the infectious complications related to intravascular catheter use, according to guidelines, including maintaining aseptic technique for the insertion, care of intravascular catheters and disinfecting clean skin with an appropriate antiseptic before the catheter insertion and during dressing changes; these are considered **Category IA**; and replacing catheter-site dressing when it becomes damp, loosened, or visibly soiled is **Category IB**.⁽²⁾

A heavy nursing workload can be viewed as a risk factor for nosocomial infection (NI) and it contributes to recurrent NI outbreaks.⁽³⁾ On the other hand, having specifically trained staff for this function results in lower catheter-related sepsis.⁽⁴⁾

This study purports to describe the occurrence of central venous catheter related sepsis outbreak as a result of vacations of the nurse in charge of inserting/caring CVCs in a NICU at Uberlandia University Medical School.

Methods

The study was conducted in the NICU of Uberlandia University Medical School. The unit has 10 beds, rated level 3, and admits an average of 400 infants each year. Surveillance was performed over three different periods: A (October-December/2006), B (January/2007) and C (February-March/2007). A personal form containing demographic and clinical data, as well as risk factors for each neonate was filled out. Ethical approval was obtained from the Ethics Committee of Uberlandia Federal University. The statistical analysis of risk factors for bloodstream infections was performed

by applying the Fisher's exact test through the software Epi-Info 2000 (CDC- Atlanta). Statistical significance was defined as a *P* value ≤ 0.05.

Results

On the whole, 178 neonates were admitted in the unit from October/2006 to March/2007. In the subperiods A, B and C, 96, 28 and 54 neonates were hospitalized with 16.4, 16.0 and 18.8 hospitalization average time, respectively.

The occurrence of clinical sepsis was detected in 16.7%, 32% and 26% of neonates admitted during A, B and C sub-periods, respectively, with 69%, 100% and 35.7% under microbiological criterion (table 1).

The rate of laboratory-confirmed sepsis was 16.3, 45 and 11.6/1000 catheter/days, for the subperiods A, B and C respectively. Colonization frequencies of CVC tip were 7.3%, 7.1% and 14.8% in subperiods A, B and C, respectively, with *Staphylococcus* coagulase negative (SCoN) (82.5%), *S. aureus* (11.7%) and *Candida albicans* (5.8%) being the most frequent pathogens. The rate of associated sepsis/ 1000 catheter days was 8.1, 30.0 and 11.6, in subperiods A, B and C, respectively, and the one related to this device was 1.6 and 5.0/1000 catheter/days in subperiods A and B, respectively (table 2).

About 20% of sepsis episodes occurring during the outbreak were associated with the use of CVCs, but only 16.7% were related to the use of this device. The outbreak had a prominence of Gram-negative bacilli (44.5%), *Staphylococcus* coagulase negative (22.2%), *S. aureus* (11.1%), *E. faecalis* (11.1%) and *Candida albicans* (11.1%) (table 3). Approximately 56% of catheter-associated infections detected along the outbreak period were related to peripherally inserted central venous catheter (PICC).

In subperiod C, a decrease of laboratory-confirmed sepsis was seen (*P* = 0.01) (9.3%) and *S. aureus* was the pathogen responsible for 60% of all these infections. The total mortality rate reached 10.4%, 10.7% and 9.3% in sub-periods A, B and C, respectively, while the one associated with sepsis was 1%, in subperiod A and 3.6% in sub-period B.

Discussion

Bloodstream infections are the most frequent nosocomial infections in neonatal intensive care unit patients. Brito et al re-

Table 1. Rates of CVC-related/associated sepsis with and without microbiological diagnosis in the NICU of Uberlandia University Medical School in the period between October/2006 and March/2007

	A N (%)	B N (%)	C N (%)	AxB	AxC	BxC
Tip colonization	7 (7.3)	2 (7.1)	8 (14.8)	<i>P</i> = 1.00 RR = 1.0	<i>P</i> = 0.20 RR = 0.71	<i>P</i> = 0.50 RR = 0.55
CVC-associated sepsis	5 (5.2)	6 (21.4)	5 (9.3)	<i>P</i> = 0.02 RR = 0.56	<i>P</i> = 0.50 RR = 0.77	<i>P</i> = 0.10 RR = 1.76
CVC-related sepsis	1 (1.0)	1 (3.6)	0	<i>P</i> = 0.40 RR = 0.64	<i>P</i> = 1.00 RR = 1.57	<i>P</i> = 0.30 RR = 3.0
Laboratory-confirmed sepsis	11 (11.5)	9 (32.1)	5 (9.3)	<i>P</i> = 0.02 RR = 0.67	<i>P</i> = 0.90 RR = 1.08	<i>P</i> = 0.01 RR = 2.30
Clinical sepsis	16 (16.7)	9 (32.1)	14 (25.9)	<i>P</i> = 0.13 RR = 0.79	<i>P</i> = 0.30 RR = 0.80	<i>P</i> = 0.73 RR = 1.22
Mortality-associated to sepsis	1 (1.0)	1 (3.6)	0	<i>P</i> = 0.40 RR = 0.64	<i>P</i> = 1.00 RR = 1.57	<i>P</i> = 0.30 RR = 3.0
Total mortality rate	10 (10.4)	3 (10.7)	5 (9.3)	<i>P</i> = 1.00 RR = 1.0	<i>P</i> = 0.90 RR = 1.0	<i>P</i> = 0.10 RR = 0.57

A: October, November, December; **B:** January; **C:** February, March.

Table 2. Average time of hospitalization in the unit, tip colonization and sepsis rates/1000 CVC/days, from October/2006 to March/2007

	A	B	C
Number of patients	96	28	54
HAT* (days)	16.4	16.0	18.8
Tip colonization/1000 CVC/days	11.4	10.0	23.1
Sepsis-associated/1000 CVC/days	8.1	30.0	11.6
Sepsis-related/1000 CVC/days	1.6	5.0	0
Laboratory-confirmed sepsis/1000 CVC/days	16.3	45.0	11.6

* HAT: hospitalization average time.

lated one rate reaches 68% of the bloodstream infection in the studied unit.⁽⁵⁾ The rate of catheter-associated sepsis in our NICU was 8.1, 30.0 and 11.6 per 1000 CVC/days, in subperiods A, B and C, respectively, and laboratory-confirmed sepsis was 45 per 1000 CVC/days during subperiod B. However, the rate of sepsis related to CVC was lower (5.0/1000 CVC/days) than that associated with CVC (30.0/1000 CVC/days).

It is possible to preview the link between colonization and bacteremia. Polderman and Girbers suggested that approximately 20% of colonized catheters had as a consequence catheter-related sepsis.⁽⁶⁾ In the outbreak period, 50.0% of catheter-tip colonization was linked to catheter related sepsis, and *Staphylococcus coagulase negative* were found as the most predominant microorganisms isolated.

As previously stated, "good nursing practices" include: aseptic technique for insertion, CVC care, CVC insertion skill programs, and prevention of infections associated with this device, result in lower nosocomial infection rates.^(2,7) Research carried out found an increase in the risk for CVC-associated sepsis for certain periods during the time when a patient with CVC was looked after by a float nurse.⁽⁸⁾ Thus, it is important for NICU managers to make sure that there is adequate training, experience and enough nurses to attend to patients with CVCs.

Usually, outbreaks within NICUs are caused by *Staphylococcus epidermidis*, *S. aureus* and Gram-negative bacilli.⁽⁹⁾ This is in accordance with the outbreak described here where the infection episodes were caused by different microorganisms with prevalence of Gram-negative bacilli, probably associated with "break of barriers" when inserting and/or handling CVCs.⁽¹⁰⁾

Conclusion

The outbreak had a prominence of Gram-negative bacilli and was probably associated with "break of barriers" when inserting and/or handling CVCs. The status was back to its regular level after the return of the professional responsible for inserting/caring CVCs.

Table 3. Etiological agents of CVC-related/associated sepsis in endemic (A, C) and epidemic (B) subperiods

Microorganism	Subperiods		
	A	B	C
<i>S. aureus</i>	3 (27.3)	1 (11.1)	3 (60.0)
SCoN	5 (45.4)	2 (22.2)	0
Others*	3 (27.3)	6 (66.7)	2 (40.0)
Total	11 (100.0)	9 (100.0)	5 (100.0)

*A: *P. aeruginosa* (1); *Enterococcus faecium* (1); *Streptococcus agalactiae* (1).
 B: *Candida albicans* (1); *Serratia marcescens* (1); *Serratia liquefaciens* (1);
E. coli (1); *E. faecalis* (1); *Enterobacter agglomerans* (1).
 C: *Enterococcus faecalis* (1); *E. coli* (1).

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