ISSN 2304-2354
Number 2, Volume 44, 2013

CATHETER RELATED BLOOD STREAM INFECTIONS IN SEVERE BURN PATIENTS. CLINICAL DATA FROM AN ORIENTATED SURVEILLANCE IN THE ICU OF THE SERVICE OF BURNS, ALBANIA

Monika BELBA

Hospital University Center "Mother Teresa", Service of Plastic Surgery

Abstract

Nosocomial infections (NI) are defined as infections acquired in the hospital by a patient who is hospitalized for another reason than infection Many types of NI can be present in the burned patient but more frequent are the burn wound infections and bloodstream infections (BSI).

The purpose of this study is to identify the incidence of Blood Stream Infections (BSI) and specifically CRBSI (Catheter Related Blood Stream Infections). Also to give data on the incidence of Catheter tip colonization (CTC) for Central Venous Catheter (CVC), and if there are statistical links between them.

The study is prospective, clinical and analytical. We have done appropriate calculations for BSI, CRBSI and CTC. CTC and CRBSI were analyzed for the possibility of linear correlation. The p values <0.05 (5%) were considered significant.

The incidence of BSI is 11.5% or 5,5 BSI for 1000 days hospitalization. The incidence of CRBSI was 11,7 BSI for 1000 catheter days. CTC was 15.6 for 1000 catheter days. By linear regression analysis between the CTC and CRBSI has resulted a strong linear correlation (r = 0.76, r = 0.56; incidence of CRBSI =0.62 +0.22 x incidence of CTC).

We think that positive identification of CTC serves as the endpoint for CRBSI. In this fact may also have an impact the femoral vein catheterization for placement of central venous catheter and also emerges as a necessity the implementation of asepsis rules during manipulations not only in the wound but especially during the central venous catheter placement.

Key words: nosocomial infections, bloodstream infections, burns

Introduction

Nosocomial infections (NI) are defined as infections acquired in the hospital by a patient who is hospitalized for another reason than infection. These infections occur worldwide and affect both developed and developing countries [1,2].

When defined as a nosocomial infection, its specific type needs to be determined according to Center for Disease Control (CDC) [3]. The American Burn Association (ABA), have developed and published standardized definitions for sepsis and infection-related diagnoses in the burn population [4].

Many types of NI can be present in the burned patient but more frequent are the burn wound infections and bloodstream infections (BSI). The implementation of ABA criteria helps to unify the terminology used to conduct the surveillance valid not only for the hospital service but also to make comparisons with advanced services that address the same problem.

The purpose of this study is to identify the incidence of BSI in the Intensive Care Unit (ICU) of the Service of Burns and Plastic Surgery in University Hospital Center (UHC) in Tirana, Albania.

The specific objectives of this study are:

- To give data on the BSI.
- To give data on Catheter Related Blood Stream Infections (CRBSI).
- To define the incidence of Catheter Tip Colonization (CTC) for Central Venous Catheter (CVC), and if there are statistical links between them.
- To identify risk factors for NI in general.

Materials and methods

Study type

The study is prospective, clinical and analytical. The study is continued / longitudinal because monitors all patients with severe burns during a specified time period 1 year (2010-2011). Patients are followed throughout the period of hospitalization in intensive care. This study is part of an orientated surveillance in the ICU of the service of burns that is considered as a unit with a

ISSN 2304-2354
Number 2, Volume 44, 2013

high risk for infections

Calculation of rates

- Incidence rate of NI Number of new infections in a period / The total number of patient days for the same period X 1000.
- The incidence of BSI Number of BSI / The total number of patient 'days X 1000.
- The incidence of CRBSI Number of BSI / The total number of days with CVC X 1000.
- The incidence of CTC Number of events with the colonization of the CVC/The total number of days with CVC X 1000.

Inclusion criteria

From all patients admitted with major burns were excluded those who presented no burns and those who did not survive the burn shock.

The study was conducted near the ICU of the Service of Burns It has 10 beds and is the only center for the treatment of major burns in our country. There are refereed the major and moderate burns according to the criteria of the ABA in conformity with burn surface area (BSA) and depth of burn.. Patients from the city of Tirana may be presented directly without passing by primary care, while patients coming from districts are presented after receiving first aid in regional hospitals.

We have done microbiological analysis for cultures taken from blood (haemocultures) in patients with bacteremia after wound dressing or during the other period according to the clinical situation. These were taken by the relevant protocols [5, 6]. Also this study is completed with bacteriological analysis of the tip of catheter to identify the CTC.

Statistic

For data analysis was used SPSS 15.0 program and Microsoft Excel. Continuous data were presented at the average value and standard deviation. CTC and CRBSI were analyzed for the possibility of linear correlation. The p values < 0.05 (5%) were considered significant.

Results

Among 183 patients hospitalized in ICU during the period of the study, there were two deaths because burn shock. Of 181 burn patients, 113 cases (62.5%) were male and 68 cases (37.6%) were female. The average age was 19.8 ± 22.2 of which children represented the most affected group with 107 cases respectively (59, 1%). The most frequent cause of burn injury were scalds in 117 cases (65.3%), flame in 39 cases (21.5%), chemical burns in 14 cases (7.7%) and 10 electric cases (5.5%).

The mean Length of Hospital Stay (LOS) was 12.4 ± 15.6 days. According to the BSA, the majority of patients or 40.3% were with burns 11-20% BSA, while 27% were with burns 21-40%BSA. Full-thickness burns were present in 53 cases or 29.2% of them. Mean Abbreviated Burn Severity Index (ABSI) was 7,29±2,8. In 54% of patients are performed surgical interventions (escharotomy, surgical excision and skin graft), while the mortality was 2.2%. We have presented these data in the table nr.1.

From 181 patients under study, 22 or 12% developed nosocomial infections mainly in the burn wound. The infection prevalence rate was 12 infected patients per 100 patients. Incidence rate was 42.6 infections per 1000 hospitalization days.

We have calculated the incidence of BSI from the positivity of blood cultures. It is 5,5 BSI for 1000 days hospitalization. *Staphylococcus aureus* was present in 67% of cases with positive blood cultures (Figure nr.1). The incidence of CRBSI was 11,7 BSI for 1000 catheter days.

We have used central venous catheterization in 9 patients respectively 20% in the jugular vein, 7% in subclavia vein and 73% in femoral vein. In 4 cases there has been a colonization of central venous catheter tip (2 cases with *Pseudomonas*, 1 with *Staphylococcus aureus* and 1 with *Acinetobacter spp*).

CTC was 15.6 for 1000 catheter days. By linear regression analysis between the CTC and CRBSI has resulted a strong linear correlation (r=0.76, r=0.56; incidence of CRBSI = 0.62 +0.22 x incidence of CTC). This correlation was statistically significant (p <0.001) and presented graphically in the figure nr.2.

Using univarjate analysis for risk factors we see that age, BSA, full-thickness burns, flame, scalds, and LOS are risk factors for NI. From Table nr.2 we can see that these factors are statistically significant (p<0.005). NI patients were intervened in 16 cases or 72.6% of them. Hospitalization days have been long compared with patients without NI (42.5 ± 27.5 to 8.2 ± 5.7). Mortality was 2.2% (only 4 deaths from the cause of septic shock).

Discussion

Infection is the most frequent cause of death after the thermal injury. Burned patients are at risk for infection due to the nature of the damage, compromising the immunity from burning, extending the hospitalization days, and exposure to diagnostic and therapeutic procedures which are often invasive.

The burned patient by being unique in physiopathology of his illness has the relevant features in relation to nosocomial infections. From Center for Disease Control are reported data for patients with burns for the Incidence of CRBSI which is 7.0 for 1000 central venous catheter days [3].

In our study, as we said above, we will provide data on BSI and CRBSI since we use central venous catheters in a number of our patients. We will focus discussion mainly on the presentation of our data and explanations to answer to the objectives specified at the beginning and at the same time will make their comparison with literature data to better understand our situation

ISSN 2304-2354
Number 2, Volume 44, 2013

and to derive the tasks of our work in the future. The prevention of nosocomial infections is the duty of any staff that works with severely burned patients.

The incidence of BSI in our cases was 11.5% or 5,5 BSI for 1000 hospitalization days. By the U.S. literature it was 12.5%, 19.9% in Turkey while for venous catheter days CDC gives its 8, 8 for 1000 days while in U.S. was 5.3 for 1000 hospitalization days [7,8,9]. Looking at the literature on the incidence of CRBSI in Belgium it is reported 2.7 BSI for 1000 venous catheter days, in U.S., IOVA 5.8 BSI for 1000 venous catheter days and in our country is calculated 11.7 for 1000 venous catheter days [10,11].The CTC was 15.6 for 1000 catheter days compared with Belgium 13.5 for 1000 catheter days [11].

By linear regression analysis that resulted a strong correlation between CTC and CRBSI, we think that positive identification of CTC serves as the endpoint for CRBSI. In this fact may also have an impact the femoral vein catheterization for placement of central venous catheter. This data of ours is also supported by a study conducted at the UZ Leuven, Belgium in connection with clinical evidence for the problem of prevention of catheter related infections [11].

The risk of the colonization invasion to infection depends not only on the depth of the wound surface, but also on many factors related to the person affected and the virulence of the bacteriological flora that colonizes the wound. Among the factors that produce virulent microorganism, *Pseudomonas* and *Staphylococcus* are the most important because they produce virulent factors related to the cell (adhesins, alginate) and extracellular (elastase etc.).

During our univarjate analysis have resulted with a statistical significance these factors: age, adults, flame burns, burned surface area, hospitalization days and depth of burn ($p<0.005$). Different researchers support these data but the analysis also included the associated diseases on the duration antibiotics [8, 9, 11].

We think that to reduce the incidence of NI we should apply more stringent measures to check the infection, asepsie rules in the treatment of wounds and invasive manipulations and less antibiotics will be used and less resistance will thus be generated. Only this way we will have a reduction in the numbers of NI.

Conclusions

Nosocomial infections in all their complexity should be analyzed in every intensive care because they are a significant challenge to all health system. Infection control must be done correctly, according to relevant guidelines and periodic surveillance.

BSI remains an important issue very closed related with the complexity of the treatment of severe burn patient. The evidence in the medical literature about catheter-related infection seems to support use of CTC as a surrogate end point for catheter related BSI. In evaluating new techniques for the prevention of CRBSI, investigation of the prevention of CTC seems to be a logical step.

We think that positive identification of CTC serves as the endpoint for CRBSI. In this fact may also have an impact the femoral vein catheterization for placement of central venous catheter and also emerges as a necessity the implementation of asepsis rules during manipulations not only in the wound but especially during the central venous catheter placement.

Only by implementing infection control measures we will achieve the reduction the incidence of infection in the burn wound and in the bloodstream, limiting the use of antibacterials, reducing multidrug resistant microorganisms and at the end a better treatment and prognosis for severely burned patient.

Table nr.1-Demographic data and clinical

Data regarding patients in the study	
Age, mean(SD)	19,8(22,2)
Gender,% female (n)	37,6(68)
Group-age, % (n)	
Children(0-14 years)	59,1(107)
Adults(15-65years)	35,9(65)
Elderly(>66 years)	4,9(9)
Cause of burn,%(n)	
Scalds	65,3(117)
Flame	21,5(39)
Electrical	5,5(10)
Chemical	7,7(14)
Surface of burn BSA%, %,(n)	
0-10%BSA	25,9(47)
11-20%BSA	40,3(73)
21-40%BSA	27(45)
41-60%BSA	3,8(7)
61-80%BSA	1,6(3)
81-100%BSA	0,5(1)
Full-thickness, %(n)	29,2(53)
ABSI, mean (DS)	7,29(2,8)
Interventions ,%(n)	54 (98)
LOS,mean(SD)	12,4(15,6)
Mortality ,%(n)	2,2(4)

ISSN 2304-2354
Number 2, Volume 44, 2013

Table nr.2 Results of Univariate analysis for risk factors

Regarding nosocomial infections in burn patients			
	Patients with NI (n=22)	**Patients without NI** (n=159)	**p**
Age,mean(SD)	35,8±23,4	17,5±21,2	0,04
Gender,% Female (n)	36,3(8)	37,7(60)	0,06
Group-age, % (n)			
Children(0-14 years)	27,2(6)	63,5(101)	0,12
Adults(15-65years)	59,0(13)	32,7(52)	0,06
ELderly (>66 years)	13,6(3)	3,7(6)	0,12
Cause of burn,%(n)			
Scalds	18,1(4)	71(113)	0,04
Flame	61,8(15)	15(24)	0,04
Electrical	4,5(1)	5,6(9)	0,06
Chemical	9(2)	7,5(12)	0,06
Burn Surface BSA%	45,6±21,2	17,6±20,1	0,001
Full-thickness, %(n)	86,3(19)	21,3(34)	0,001
ABSI, mean (SD)	8,0±2,8	7,2±2,0	0,02
LOS,mean(SD)	42,5±27,5	8,2±5,7	0,001

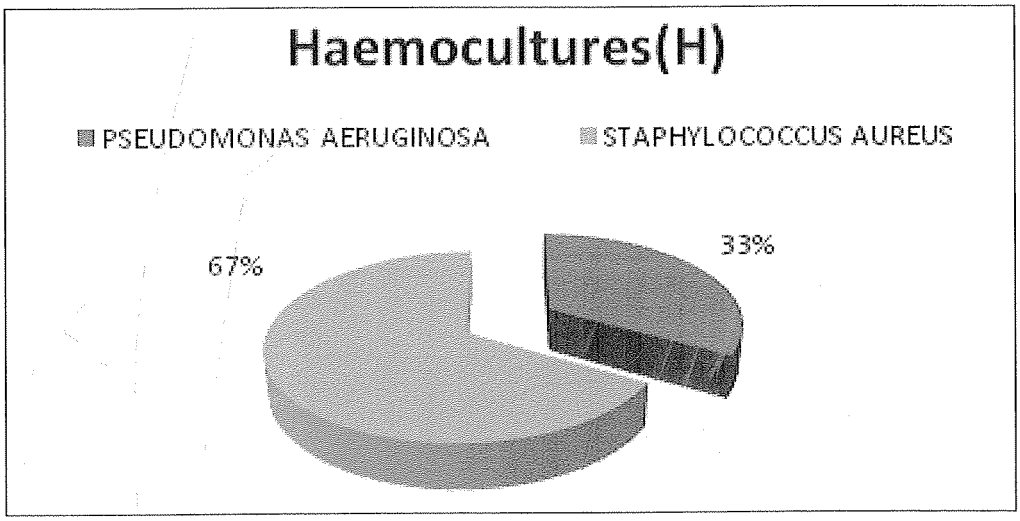

Figure nr.1-Microbiology in positive blood cultures

ISSN 2304-2354
Number 2, Volume 44, 2013

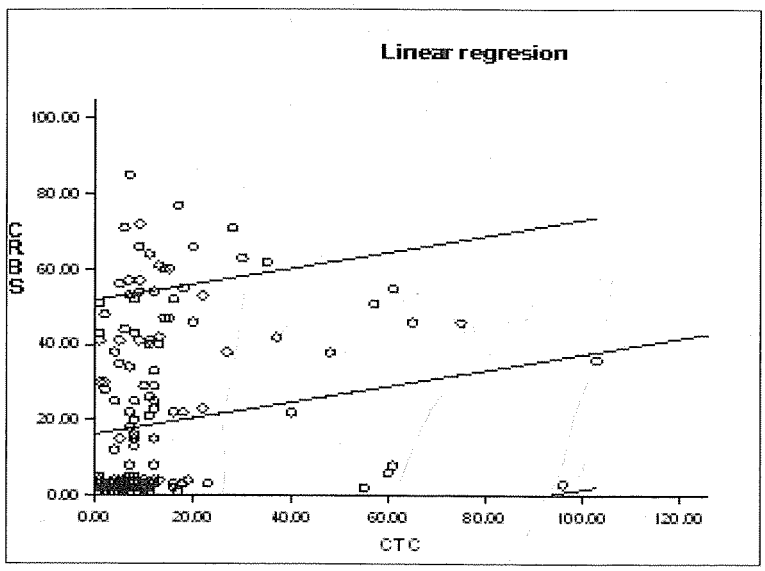

Figure nr.2 Linear regression of catheter tip colonization (CTC) and catheter-related Bloodstream infection (CRBSI), with mean 95% prediction intervals. Incidence of CRBSI=0.62+0.22 x incidence of CTC.

References

1. **G. Ducel J. Fabry L. Nicolle:** Prévention des infections nosocomiales. Guide pratique. 2e edition. Available from: http://whqlibdoc.who.int/hq/2008/WHO_CDS_CSR_EPH_2002.12_fre.pdf Accessed May, 11,2012.
2. **Benenson, A.S. (ed.)** "*Control of Communicable Diseases Manual, 16th edition*" TheAmerican Public Health Association, Washington (USA) 1995.
3. **Teresa C. Horan, MPH, Mary Andrus, RN, BA, CIC, and Margaret A. Dudeck, MPH Atlanta, Georgia.:** CDC/NHSN surveillance definition of health care–associated infection and criteria for specific types of infections in the acute care setting .Available from: www.cdc.gov/ncidod/dhqp/pdf/nnis/NosInfDefinitions.pdf Accessed May,11,2012
4. **Greenhalgh DG, Saffle JR, Holmes JH 4th, Gamelli RL, Palmieri TL, Horton JW, Tompkins RG, Traber DL, Mozingo DW, Deitch EA, Goodwin CW, Herndon DN, Gallagher JJ, Sanford AP, Jeng JC, Ahrenholz DH, Neely AN, O'Mara MS, Wolf SE, Purdue GF, Garner WL, Yowler CJ, Latenser BA.:** American Burn Association consensus conference to define sepsis and infection in burns,28(6):776-90, 2007.
5. Wound Swab Guideline. Available from: http://www.nscchealth.nsw.gov.au/services/wound.care/WoundSwabGuidelines.pdf Accessed May,11,2012
6. **Martin Llewelyn, Jonatan Cohen:** Diagnosis of infection in sepsis. Intensive Care Medicine, 27:S10-S32, 2001.
7. Anonymous. National Nosocomial Infections Surveillance (NNIS) System Report, Data Summary from January 1992-June 2001, issued August 2001. Am J Infect Control, 29:404–21, 2001.
8. Weber JM, Sheridan RL, Pasternack MS, Tompkins RG: Nosocomial infections in pediatric patients with burns. Am J Infect Control.,25(3):195-201, 1997.
9. **O. Oncul, E. Ulkur A. Acar, V. Turhan, E. Yeniz, Z. Karacaer, F. Yildiz:** Prospective analysis of nosocomial infections in a Burn Care Unit,Turkey. Indian J Med ,130: 758-764, 2009.
10. **Lucy Wibbenmeyer, MD,Roy Danks, MD, Lee Faucher, MD,Marge Amelon, NP, Barbara Latenser, MD, G. Patrick Kealey, MD,Loreen A. Herwaldt, MD:** Prospective Analysis of Nosocomial InfectionRates, Antibiotic Use, and Patterns of Resistance in a Burn Population Journal of Burn Care & Research ,27(2):152-160, 2006.
11. **Bart J. A. Rijnders, Eric Van Wijngaerden, and Willy E. Peetermans:** Catheter-Tip Colonization as a Surrogate End Point in Clinical Studies on Catheter-Related Bloodstream Infection: How Strong Is the Evidence? Clinical Infectious Diseases, 35:1053–8, 2002.