



Predictive value of superficial cultures to anticipate tunneled hemodialysis catheter-related bloodstream infection ☆☆☆

Emilio Bouza^{a,b,c,d,*}, Loreto Rojas^a, María Guembe^{a,*}, Mercedes Marín^a, Fernando Anaya^b, José Luño^b, Juan M. López^b, Patricia Muñoz^{a,b,c,d} and on behalf of the COCADI Study Group

^a Department of Clinical Microbiology and Infectious Diseases, Hospital General Universitario Gregorio Marañón, Madrid, Spain

^b Department of Nephrology, Hospital General Universitario Gregorio Marañón, Madrid, Spain

^c Universidad Complutense de Madrid, Madrid, Spain

^d Red Española de Investigación en Patología Infecciosa (REIPI), Sevilla, Spain

ARTICLE INFO

Article history:

Received 5 March 2012

Received in revised form 18 April 2013

Accepted 9 December 2013

Available online 17 December 2013

Keywords:

Bacteremia

Catheter-related bloodstream infection

Hemodialysis

Superficial cultures

Tunneled catheters

ABSTRACT

We performed a prospective study in patients with tunneled catheters to assess the validity of Gram stain and superficial culture for anticipating catheter exit-site infection and hemodialysis catheter-related bloodstream infection. The sensitivity and negative predictive value were high, and we succeeded in identifying a subpopulation at low risk of infection.

© 2014 Elsevier Inc. All rights reserved.

Hemodialysis catheter-related bloodstream infection (HC-RBSI) is 1 of the most frequent causes of sepsis in patients under hemodialysis, and the incidence rates range from 0.5 to 7.6 episodes per 1000 catheter-days (Farinas et al., 2008; Grothe et al., 2010; Klevens et al., 2008; Lemaire et al., 2009; Powe et al., 1999; Saeed Abdulrahman et al., 2002).

Microorganisms colonizing skin, hubs, or both are considered the first step to catheter tip colonization and, consequently, to catheter-related bloodstream infection (C-RBSI) (Cercenado et al., 1990; Linares et al., 1985; Sherertz et al., 1997; Templeton et al., 2008).

Semiquantitative cultures from skin and hubs can anticipate catheter tip colonization and identify subpopulations at risk of C-RBSI. However, these findings are only from a general population and in patients admitted to intensive care units with short-term central venous catheters (Bouza et al., 2005; Cercenado et al., 1990).

In order to reduce HC-RBSI and its associated complications, we hypothesized that colonization of skin, hubs, or both in patients

undergoing hemodialysis with tunneled catheters could anticipate the risk of exit-site infection (ESI) and HC-RBSI.

We performed a prospective observational cohort study over an 8-month period in a large teaching institution. We selected adult patients with renal impairment who were undergoing hemodialysis and plasmapheresis. All patients who agreed to participate and signed a consent form were included in the study.

All catheters were non-antibiotic-coated (HemoStar® Long-term Haemodialysis Catheter and Bard® Hickman® Catheter; C.R. Bard, Inc Nordic, Helsingborg, Sweden) and were inserted by trained vascular interventional radiologists using ultrasound and a standardized aseptic technique (O'Grady et al., 2002).

Cultures from the skin insertion site and all hubs (superficial cultures) were collected every 15 days immediately before the hemodialysis session over a period of 6 months (March 1, 2010, to August 30, 2010). All samples were processed immediately at the microbiology laboratory.

Superficial cultures were considered positive when there were ≥ 15 CFU/plate (Cercenado et al., 1990).

Peripheral blood cultures (BCs) were obtained when infection was suspected. In general, 2 or 3 BCs (from 2 or 3 different sites) were obtained.

Catheter tip culture was performed using the semiquantitative roll-plate technique (Maki) (Bouza et al., 2007; Maki et al., 1977).

In patients suspected of having HC-RBSI, the correlation between the microorganisms isolated in superficial cultures and those isolated

☆ Funding sources: This study was partially financed by the Infectious Diseases Program of Fundación BBVA-Fundación Carolina through the research fellowship granted to Loreto Rojas.

☆☆ Conflicts of interest: The authors declare no conflicts of interest.

* Corresponding authors. Tel.: +34-91-586-84-53; fax: +34-91-504-49-06.

E-mail addresses: ebouza@microb.net (E. Bouza), mariaguembe@hotmail.com (M. Guembe).

in BCs was determined using phenotypic identification to genus and species level and susceptibility testing. Susceptibility testing of the isolated microorganisms in both superficial cultures and BCs was performed following the recommendations of the Clinical Laboratory Standards Institute (Wayne, 2010). Molecular typing was performed by pulsed-field gel electrophoresis (PFGE) for *Staphylococcus* species isolates or Rep-PCR for Gram-negative isolates, as previously described (Cercenado et al., 2008; Sanz-Garcia et al., 2009). Results were considered concordant if the same organism (genus and species) was isolated from superficial cultures and BCs or if both cultures yielded negative results. If the same organism was present in both cultures, it was considered concordant, even if 1 of them was polymicrobial. Any other results were defined as discrepant.

Diagnosis of ESI and HC-RBSI was based on the intravascular catheter infection guidelines of the Infectious Diseases Society of America (Mermel et al., 2009).

Continuous variables for the comparison of the patients' characteristics in the univariate analysis were assessed using the Mann-Whitney test, and qualitative variables were assessed using the Fisher exact test or χ^2 test. A *P* value <0.05 was considered significant. All statistical tests were 2-tailed.

The statistical analysis was performed using SPSS version 15.0 (SPSS Inc., Chicago, IL, USA).

Patients were monitored during the study period and followed for 2 months.

We included 115 catheters from 98 patients (95, hemodialysis; 3, plasmapheresis). The main population characteristics are described in Table 1. A total of 1845 superficial cultures were performed. The total number of positive superficial cultures was 267 (43.4%), and the colonization rate was 15.6 episodes per 1000 catheter-days.

ESI was present in 17 patients, with an incidence rate of 1 episode per 1000 catheter-days. The median (interquartile range [IQR]) number of positive samples per patient with ESI was higher than in the other patients: 7 (3.5–7.0) versus 1 (0–4) (*P* < 0.01).

The validity values of surveillance samples for Gram stain/culture to predict ESI were as follows: sensitivity, 94.1%/100%; specificity, 33.3%/43.2%; positive predictive value, 22.9%/27%; negative predictive value, 96.4%/100%; positive likelihood ratio, 1.4/1.8; and negative likelihood ratio, 0.2/0.0 (Table 2).

HC-RBSI was present in 6 (6.1%) patients with an incidence rate of 0.35 episodes per 1000 catheter-days. Of the 6 patients, 2 (33.3%) had tunnel infection by *Serratia marcescens* and methicillin-sensitive *Staphylococcus aureus* (MSSA), whereas 2 patients (33.3%) had left-side endocarditis by *Staphylococcus lugdunensis* and MSSA affecting the aortic valve. The mortality rate of patients with C-RBSI was 16.7%, which was higher than in the other patients (6.5%). The median (IQR) number of positive samples per patient with HC-RBSI was higher than in the other patients, 5.5 (1.0–7.5) versus 1.5 (0–4.8) (*P* < 0.01).

The accuracy of Gram stain/superficial cultures for predicting HC-RBSI was as follows: sensitivity, 66.7%/100%; specificity, 28.3%/38.0%; positive predictive value, 5.7%/9.5%; negative predictive value, 92.9%/100%; positive likelihood ratio, 0.9/1.6; and negative likelihood ratio, 1.2/0 (Table 2).

Our study shows that superficial Gram stain and cultures had excellent sensitivity and negative predictive values, which could be useful when identifying patients who will not develop infection. The most important issue is to know which patients will benefit from preventive measures in order to avoid infectious complications.

Other studies of colonization of skin and hubs in patients undergoing major heart surgery or in the general population showed that all episodes of C-RBSI occurred in the colonized population (Bouza et al., 2005; Cercenado et al., 1990); (Rodriguez-Oranda et al., 2010).

In conclusion, superficial cultures are very useful for identifying patients with chronic kidney failure receiving hemodialysis or apheresis via a tunneled catheter who are at high risk of

Table 1
Characteristics of the 98 patients included.

Characteristics	No. of patients (%)
Median age (IQR)	75 (65–81)
Male sex	49 (50)
McCabe and Jackson index	
Non-fatal	58 (59.2)
Ultimately fatal	40 (40.8)
Rapidly fatal	-
Median Charlson index (IQR)	8 (7–10.3)
Type of CKD or indication for apheresis	
Diabetic nephropathy	29 (29.6)
Glomerulonephritis	12 (12.2)
Obstructive uropathy	10 (10.2)
Vasculitis	7 (7.1)
Nephrosclerosis	6 (6.1)
Ischemic nephropathy	4 (4.1)
Polycystic renal diseases	2 (2)
Chronic pyelonephritis	2 (2)
Interstitial nephritis	1 (1)
Unknown	18 (18.4)
Other	6 (6.1)
Underlying conditions	
Chronic heart failure	86 (87.8)
Acute myocardial infarction	22 (22.4)
Peripheral vascular disease	49 (50)
Diabetes mellitus	41 (41.8)
Solid tumor	23 (23.5)
COPD	19 (19.4)
Stroke	19 (19.4)
Liver disease	16 (16.3)
Peptic ulcer disease	14 (14.3)
Collagenosis	14 (14.3)
Hematologic malignancy	4 (4.1)
Dementia	1 (1)
HIV	1 (1)
Immunosuppressive therapy	11 (11.2)
Laboratory parameters	
Kt/V	1.56 (1.3–1.8)
Albumin	3.8 (3.4–4.1)
Hemoglobin	11.9 (10.9–12.8)
Creatinine	6.5 (4.9–8)
Calcium	8.8 (8.3–9.2)
Phosphorus	4.2 (3.4–5.5)
CRP	4 (1–16.3)
Ferritin	233 (116–395)
iPTH	248 (149–437)
Median no. of sessions per week (IQR)	3 (3–3)
History of previous C-RBSI	11 (11.2)
Catheter replacement	10 (10.2)
Median no. of catheter replacements (IQR)	1 (1–1)
Catheter characteristics (days)	
Median days of catheter use (IQR)	214 (121–230)
Nasal colonization culture	
Positive with MRSA	6 (6.1)
Positive with MSSA	8 (8.2)
Negative	84 (85.7)
Superficial samples	
Positive superficial Gram stain	70 (71.4)
Positive skin Gram stain	50 (51)
Positive hub Gram stain	39 (39.8)
Positive superficial cultures	63 (64.3)
Positive skin cultures	61 (62.2)
Positive hub cultures	9 (9.2)
Positive cultures/cultures performed	0.35 (0.0–0.8)
Insertion site findings	
Erythema	12 (12.2)
Purulent secretion	7 (7.1)
No abnormalities	79 (80.6)
Global mortality	7 (7.1)

CKD = chronic kidney disease; COPD = chronic obstructive pulmonary disease; Kt/V = number for measuring the dose of dialysis; CRP = C-reactive protein; iPTH = intact parathyroid hormone; MRSA = methicillin-resistant *Staphylococcus aureus*.

Download English Version:

<https://daneshyari.com/en/article/3347024>

Download Persian Version:

<https://daneshyari.com/article/3347024>

[Daneshyari.com](https://daneshyari.com)