Clinical-epidemiological characteristics and outcome of patients with catheter-related bloodstream infections in Europe (ESGNI-006 Study)

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ABSTRACT

This study analysed 89 episodes of catheter-related bloodstream infection (CR-BSI) occurring during one week in 107 hospitals from 21 European countries (1.02 episodes/1000 admissions). Patients from European Union (EU) countries had a higher incidence of CR-BSI than patients from non-EU countries (1.55 vs. 0.33/1000 admissions). Most (67%) catheters were non-tunneled central venous catheters, were in the jugular vein (44%), had been implanted for >7 days (70%), were made of polyurethane (61%) and were multilumen (67%). In 36% of cases, catheters were implanted by physicians other than anaesthetists or surgeons, and 50% were inserted by junior staff.

Keywords Bacteraemia, catheter-related bloodstream infections, central catheters, epidemiology, Europe, nosocomial infections

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The objectives of this study (ESGNI-006) were to define the clinical and epidemiological characteristics of patients with catheter-related bloodstream infections (CR-BSIs) in Europe. The study assessed the situation in countries belonging to the European Union (EU) in comparison with that in countries not belonging to the EU, and the characteristics of the catheters involved were investigated.

ESGNI-006 was a cross-sectional survey of CR-BSI performed over a 1-week period (22–26 October 2001). Patients with microbiologically proven CR-BSI were recorded in each institution during the study period. For each episode of CR-BSI, a bedside evaluation and follow-up for a maximum of 1 month were carried out. Data collected from each patient with CR-BSI concerned mostly the characteristics of the intravenous catheter (IVC). Catheter colonisation, CR-BSI and local signs of catheter infection were defined according to published guidelines [1]. Continuous variables were expressed as the mean and standard deviation (SD) and 95% confidence interval (CI 95%). Student's unpaired *t*-test was used to compare continuous variables, and the chi-square test was used to compare proportions.

Information was obtained from 107 hospitals of different sizes from 21 countries (82 hospitals from 12 EU countries, and 25 from nine non-EU countries), serving an estimated population of 92 343 614 (Table 1). Overall, the total number of admissions in these institutions during 2000 was 4 549 757. In total, 89 patients presented with CR-BSI (16 from non-EU countries, 73 from EU countries) during the study period, with an estimated yearly incidence of 1.02 episodes/1000 admissions (1.55 in EU countries, 0.39 in non-EU countries; $p < 0.0001$).

Of 105 different microorganisms isolated from CR-BSI episodes, the seven most frequent were, in decreasing order: coagulase-negative staphylococci (34%), *Staphylococcus aureus* (17%), *Enterobacter* spp. (9%), *Candida* spp. (9%), *Klebsiella* spp. (6%), *Pseudomonas* spp. (6%) and *Enterococcus* spp. (6%). Although coagulase-negative staphylococci were the pathogens isolated most commonly in EU countries, *S. aureus* was predominant in non-EU countries (39% vs. 13%; p 0.01).

Only 31 patients with CR-BSI displayed local signs of catheter infection. The characteristics of the IVC in patients with CR-BSI are described in Table 2. Most (67%) were non-tunneled central venous catheters, the jugular vein was the most frequent (44%) site of catheter insertion, and the catheter material was mostly polyurethane (73%) and was multi-lumen in 67% of cases. Povidone

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Table 1. Characteristics of the hospitals supplying data for the study

	Total	EU countries	Non-EU countries
Population served	92 343 614	47 442 812	44 900 802
Number of beds			
< 500 beds	34.6%	35.4%	32%
500–1000 beds	42.3%	45.6%	32%
> 1000 beds	23.1%	19%	36%
Admissions in the year 2000	4 549 757	2 444 076	2 105 681
CR-BSI episodes in the study period[a]	89	73	16
CR-BSI/1000 admissions[b]	1.02	1.55	0.39

[a]22–26 October 2001.
[b]$p < 0.0001$.

iodine was the type of skin disinfectant used most commonly (71%). Total parenteral nutrition had been given to 53.5% of patients with CR-BSI, and was administered to 39% of patients through a multi-lumen catheter.

Catheters were inserted by anaesthetists (56%), surgeons (8%), radiologists (2%) and other specialists (34%). Junior doctors inserted 50% of the catheters. The mean time from insertion to withdrawal of catheters was 21 days (CI 95%: 11.3–30.3 days), with a median of 10 days. Of patients with CR-BSI, 71% retained the IVC for >7 days. No differences were found between EU and non-EU countries in this respect.

Table 2. Available data regarding intravenous catheters in patients with catheter-related bloodstream infections

	Total (89)	EU (73)	Non EU (16)
Time from insertion to removal of IVC			
1–7 days	25/88 (28%)	17/72 (24%)	8/16 (50%)
8–30 days	54/88 (61%)	47/72 (65%)	7/16 (44%)
> 30 days	9/88 (10%)	8/72 (11%)	1/16 (6%)
Type of catheter			
Non-tunneled CVC	60/89 (67%)	52/73 (71%)	8/16 (50%)
Tunneled CVC	10/89 (11%)	8/73 (11%)	2/16 (12.5%)
Peripheral intravenous line	6/89 (7%)	3/73 (4%)	3/16 (18%)
Central arterial catheter	3/89 (3%)	1/73 (1%)	2/16 (12.5%)
Peripheral arterial catheter	3/89 (3%)	3/73 (4%)	0/16 (0%)
Peripherally inserted CVC	2/89 (2%)	2/73 (3%)	0/16 (0%)
Antibiotic- or antiseptic-impregnated CVC	2/89 (2%)	1/73 (1%)	1/16 (6.5%)
Other	3/89 (3%)	3/73 (4%)	0/16 (0%)
Multi-lumen catheter	60/84 (71%)	50/70 (71%)	10/14 (71%)
Parenteral nutrition given	46/86 (53.5%)	40/70 (57%)	6/16 (37.5%)
Type of skin antiseptic applied			
Povidone iodine	54/89 (61%)	44/73 (60%)	10/16 (62.5%)
Chlorhexidine + alcohol	21/89 (24%)	17/73 (23%)	4/16 (25%)
Alcohol	8/89 (9%)	6/73 (8%)	2/16 (12.5%)
Chlorhexidine aqueous	4/89 (4.5%)	4/73 (5.5%)	0/16 (0%)
Other	2/89 (2%)	2/73 (3%)	0/89 (0%)
Catheter material			
Polyurethane	54/74 (73%)	45/59 (76%)	9/15 (60%)
Silicone	7/74 (9%)	6/59 (10%)	1/15 (7%)
Teflon	5/74 (6.5%)	3/59 (5%)	2/15 (13%)
Polyvinyl chloride	5/74 (6.5%)	3/59 (5%)	2/15 (13%)
Antimicrobial-coated	3/74 (4%)	2/59 (3%)	1/15 (7%)
Catheter dressing			
Sterile gauze	46/84 (55%)	36/69 (52%)	10/15 (67%)
Transparent dressing	36/84 (43%)	31/69 (45%)	5/15 (33%)
Others	2/84 (2.5%)	2/69 (3%)	0/15 (0%)
Practitioner inserting the catheter			
Anaesthesist	50/89 (56%)	41/73 (56%)	9/16 (56%)
Surgeon	7/89 (8%)	5/73 (7%)	2/16 (12.5%)
Radiologist	2/89 (2%)	2/73 (3%)	0/16 (0%)
Other	30/89 (34%)	25/73 (34%)	5/16 (31%)
Grade of doctor			
Junior	44/88 (50%)	35/73 (48%)	9/15 (60%)
Consultant	44/88 (50%)	38/73 (52%)	6/15 (40%)

IVC, intravenous catheter; CVC, central venous catheter.

An assessment of the incidence of CR-BSI in >300 hospitals in the USA revealed an overall incidence of 4.3–7.7 episodes/1000 catheter days in intensive care unit patients with short-term IVCs [2]. Patients with other types of central venous catheter, and with long-term tunneled catheters, have an incidence of CR-BSI of 0.6–6/1000 catheter days, as found in more limited studies [3,4]. In the present study, an overall incidence of CR-BSI in Europe was estimated according to the number of admission days; such information is available more easily than catheter days for broad-based studies, and therefore can be useful as a baseline for comparison in future studies assessing the impact of possible interventions. The figure obtained was close to one episode/1000 hospital admissions, and was significantly higher in EU countries. This could reflect the admission of patients with more complicated conditions who undergo more invasive procedures for their management.

It was interesting to note that local signs of infection were evident in <50% of patients with CR-BSI, as has been reported previously [1]. The site of insertion is a recognised risk factor for CR-BSI, and jugular vein catheters are more prone to infection [5,6]. Accordingly, it is not surprising that 44% of patients with CR-BSI included in the present study had jugular vein catheters.

One potential point of intervention is the choice of skin antiseptic. Despite the proven superiority of aqueous chlorhexidine, povidone iodine was the antiseptic used most widely (61%) for skin preparation, as found in previous studies [7,8].

The expertise of the physician who inserts a catheter has been shown to correlate with the rate of complications and cost [9]. In the present study, 34% of catheters were not inserted by anaesthetists or surgeons, and 50% were not inserted by senior staff. Specially trained catheter teams for inserting and maintaining catheters could reduce the incidence of infection and costs [10].

In the present study, >70% of patients with CR-BSI had a catheter implanted for >7 days. Duration of catheterisation is considered to be the major risk factor for CR-BSI [11,12], and, although some studies and meta-analyses have failed to demonstrate the efficacy of periodic changes of central venous catheter [13–16], early withdrawal

of unnecessary catheters could prevent most episodes of CR-BSI. Total parenteral nutrition was given to 40% of the patients in the present study through multi-lumen catheters. This practice is not recommended by the UK Department of Health [17], but the most recent USA guidelines for the prevention of IVC infection did not consider that specific situation [10].

In conclusion, this study shows clear room for improvement in decisions concerning the choice, indications, duration and care of IVCs, and offers baseline data for the current situation in Europe.

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RESEARCH NOTE

Outbreak in France of *Neisseria meningitidis* B:15:P1.12 belonging to sequence type 1403

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