

Original article

# *Staphylococcus aureus* healthcare associated bacteraemia: An indicator of catheter related infections

## *Les bactériémies associées aux soins à Staphylococcus aureus : un indicateur des infections associées aux cathéters*

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### Abstract

**Purpose.** – Surveillance of preventable healthcare associated infections and feedback of the results to clinicians is central in the efforts to improve performance. We assessed *Staphylococcus aureus* healthcare associated bloodstream infection (HA-BSI) as an indicator of healthcare quality.

**Patients and method.** – Between 2002 and 2012, we carried out a ten-year prospective bedside surveillance of *S. aureus* healthcare associated bacteraemia in a 940-bed university hospital using standard definitions.

**Results.** – Overall, 2784 HA-BSI were identified during the study period, among which 573 (18%) were due to *S. aureus*. Among these 573 *S. aureus* bacteraemias, 189 originated from intravascular catheters (32.8%) of which 84% (158/189) in patients outside intensive care units. The proportion of catheter related HA-BSI due to *S. aureus* was 56% (61/109) in PVC-related HA-BSI and 34% (103/301) in CVC-related HA-BSI. A sharp decrease of PVC-related HA-BSI from 20 to 7 per year was obtained during the same period.

**Conclusion.** – In our experience, *S. aureus* HA-BSI is a simple and useful indicator of catheter associated infections, and therefore of healthcare quality, especially in units not covered by other type of surveillance.

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**Keywords:** Bacteraemia; Catheter infections; Indicator of infections; *S. aureus*

### Résumé

**Objectifs.** – Les établissements de santé doivent disposer d'indicateurs pertinents permettant d'évaluer et de surveiller les infections associées aux soins dites évitables et en particulier celles liées aux cathéters. Le but de ce travail était de montrer que la surveillance des bactériémies nosocomiales à *Staphylococcus aureus* pouvait être un de ces indicateurs.

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<sup>2</sup> Dr C. Bonnal had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

<sup>3</sup> Dr B. Birgand participated to the acquisition of data and performed the critical revision of the manuscript for important intellectual content.

<sup>4</sup> I. Lolom participated to the acquisition of data and to the management of the data base.

<sup>5</sup> Dr S. Diamantis participated to the acquisition of data.

<sup>6</sup> Dr C. Dumortier participated to the acquisition of data.

<sup>7</sup> Dr F. L'Heriteau participated to the study concept and design and to the acquisition of data.

<sup>8</sup> Dr L. Armand Lefevre participated to the acquisition of data.

**Patients et méthode.** – Nous avons réalisé une surveillance prospective sur 10 ans des bactériémies associées aux soins à *S. aureus* dans notre hôpital de 940 lits en nous basant sur les définitions standard.

**Résultats.** – Entre 2002 et 2012, 2784 bactériémies associées aux soins ont été identifiées, dont 573 (18 %) étaient dues à *S. aureus*. Parmi ces 573 bactériémies, 189 (32,8 %) avaient pour origine un cathéter vasculaire et 84 % (158/189) survenaient en dehors des services de réanimation. *S. aureus* était associé à 56 % (61/109) des bactériémies liées à un cathéter veineux périphérique (CVP) et à 34 % (103/301) de celles dues à un cathéter veineux central (CVC). Les souches de *S. aureus* résistantes à la méticilline isolées des bactériémies ont diminué de 50,3 % à 18,4 % entre 2002 et 2012. Les bactériémies sur CVP ont baissé de 20 à 7 par an pendant l'étude.

**Conclusion.** – Dans notre expérience, la surveillance des bactériémies associées aux soins à *S. aureus* serait donc un indicateur simple et efficace des infections sur cathéter et donc de la qualité des soins, en particulier dans des secteurs non couverts habituellement par d'autres types de surveillance.

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**Mots clés :** Bactériémie ; Indicateur d'infections ; Infections liées aux cathéters ; *S. aureus*

## 1. Introduction

Bloodstream infection (BSI) is associated with major morbidity and mortality worldwide [1]. Identifying which BSI can be prevented is essential to the development of BSI-control strategy.

In one study, the BSI surveillance was restricted to *Staphylococcus aureus* BSI, and succeeded in decreasing central catheter related BSI in intensive care unit from 1.96 to 1.15/1000 catheter days [2]. In England, the Department of Health was faced with the need to reduce methicillin-resistant *S. aureus* (MRSA) bacteraemia, and mandatory case notification was implemented. The resulting decline in MRSA bacteraemia rates exceeded expectations [3].

In the National Prevalence Survey conducted in France in 2012 including 216,387 patients, hospital acquired bloodstream infections (HA-BSI) represented 1132 episodes: 847 (74.8%) were acquired in acute wards, 169 (14.9%) in intensive care units and 116 (10.2%) in rehabilitation wards [4]. *S. aureus* was the main species isolated (18.7%) followed by *Escherichia coli* (16.1%) and a catheter was responsible for the HA-BSI in 42% and 44.7% of intensive care unit and acute ward HA-BSI, respectively. The authors suggested that BSI surveillance restricted to *S. aureus* could be related to invasive procedures outside the intensive care units, thus providing a valuable indicator of preventable infections [4].

Our hospital participated to the national surveillance of HA-BSI, which was stopped in 2006. Since 2002, we have conducted systematic HA-BSI surveillance. This surveillance was carried out to identify HA-BSI adverse events, inappropriate practices and review all bloodstream infections in view to improve care. Several surveillance and preventive actions have already been performed from the results obtained by this survey, mainly on catheter related HA-BSI [5,6].

In the present study, we sought to evaluate HA-BSI as an indicator of healthcare quality. We therefore decided to analyse data from our 10-year active surveillance of HA-BSI, with a focus on the burden of *S. aureus* HA-BSI, the source of such BSIs and their potential use for prevention of healthcare associated infections.

## 2. Methods

This study was carried out in a 940-bed university hospital serving as both a primary and tertiary care centre for adults. It has 27 wards, including 7 intensive care units (ICUs; 83 beds), pulmonary and cardiac transplantation programs and wards for all medical and surgical specialties except haematology and neurosurgery. The yearly number of complete admissions is about 40,000.

Surveillance of HA-BSI began in 2002. HA-BSI was defined using standardized definitions, i.e. at least one positive blood culture unrelated to infection incubating at hospital admission except for common skin pathogens which were included after two positive blood cultures with the same strain [5,7]. HA-BSI having an identifiable source was defined as recovery of the same microorganism from one or more positive blood cultures and from the suspected source (tracheal secretion, urine, surgical site, soft tissue, intravascular catheter [IVC] or other) or with radiological and clinical signs suggestive of a source, according to standard definitions. Central IVC-related infections were documented by either a positive quantitative tip culture if the IVC was removed, or a significant differential time to positivity between peripheral and central blood cultures if the IVC was maintained. HA-BSI associated with a peripheral venous catheter (PVC) was defined as one or more positive blood cultures, the presence of at least two of the following signs at the catheter insertion site, i.e. pus, swelling, erythema, tenderness or warmth, cord induration and no other identifiable source. In the absence of an identifiable source of infection, HA-BSI was classified as primary.

All positive blood cultures were reviewed daily during weekdays by an infection control physician. When HA-BSI was suspected, the ward physician was interviewed within 4 days after receiving results of positive blood cultures for the following: demographic characteristics, date of admission to the hospital and unit in which the blood culture(s) were obtained, portal of entry (infection source), whether the positive blood culture indicated BSI or contamination, whether the BSI was healthcare associated and whether antimicrobials were initiated

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