Bloodstream infection surveillance in smaller hospitals

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Abstract

Infection Control (IC) nurses in 85 smaller (<100 acute care beds) public hospitals reported hospital acquired primary laboratory confirmed (LC) bloodstream infections (BSIs) over 26 months. The 'true' infection rate (as confirmed by two infectious diseases physicians) was 0.2 BSIs per 10,000 acute occupied bed days. Only 25% of the BSIs reported by the IC nurses were confirmed as 'true' infections. *Staphylococcus aureus* was the most commonly cultured causative micro-organism. The cause of the 12 confirmed BSIs may have been associated with the use of intravascular devices. The usefulness for smaller hospitals continuing this type of surveillance (particularly because hospital acquired primary LC BSIs are an infrequent, albeit serious event) is questionable.

Introduction

The primary aim of the Victorian Hospital Acquired Surveillance System (VICNISS) Coordinating Centre is, with participating hospitals, to reduce hospital acquired infections. In 2004, the centre established a surveillance program for the ninety smaller (<100 acute care beds) hospitals across Victoria. (The type and intensity of healthcare provided by these hospitals is described elsewhere [1].) This program included a module that involved collecting and reporting data on primary laboratory confirmed (LC) bloodstream infections (BSIs).

Hospital acquired BSIs are serious causes of mortality and morbidity [2], but there is little published literature about these infections in smaller hospitals [2-5]. In 1993 one smaller hospital was included in a comprehensive twelve-month survey of five Australian hospitals (range: 71 – 400 beds) [4]. Of the 489 significant episodes of bacteraemia across these hospitals, 178 (36%) were hospital-acquired. More recently, over three years, 1.59 episodes of *Staphylococcus aureus* bacteraemia per 1000 admissions were identified across seventeen Australian hospitals [3]. The two smaller hospitals (52 and 72 beds) included in this study identified 0.93 and 0.60 episodes of *S. aureus* bacteraemia per 1000 admissions respectively. During a seven-and-a-half year USA study, a total of 24,179 hospital-acquired BSIs were reported by forty-nine participating hospitals of various sizes and approximately 51% of these occurred in an intensive care unit [5].

As part of the VICNISS smaller hospital program, quarterly reports were forwarded to the participating hospital infection control (IC) nurses outlining their hospital and aggregate results. It was assumed that these comparative reports, as has been reported elsewhere [6], would act as an incentive to implement any appropriate intervention strategies. This article describes the BSI module data collected and analysed between 1 May 2004 and 30 June 2006.

Method

Trained IC nurses in the participating hospitals were asked to collect data on all adult (aged >16 years) patients who developed a hospital acquired primary LC BSI. This included data on the admission date, specimen date, presence of peripheral or central intravascular (IV) devices within 48 hours of the development of the BSI and causative micro-organism(s).

Hospital acquired BSIs were defined as those identified > 48 hours after patients admission. Post-discharge surveillance was not undertaken. Patients with a positive blood culture had to meet one of the following criteria, as published by the USA Center for Disease Control and Prevention (CDC) [7], Australian Infection Control Association (AICA) [8] and Australian Council on Healthcare Standards (ACHS) [9].

Criterion one:

For recognised pathogens (for example, *S. aureus* and *Escherichia coli*), isolation of a causative micro-organism from one or more blood cultures.

Criterion two:

For potential contaminants (for example, coagulase-negative staphylococci), patients that presented with fever, chills or hypotension. This was in addition to isolation of a causative micro-organism from at least two blood cultures drawn on separate occasions; or from a blood culture in a patient with an IV device and for whom appropriate antimicrobial therapy was commenced.

The BSI was classified as 'primary' if the causative micro-organism was not related to an infection at another site other than an infected IV device access site. BSIs meeting the criteria for the alternative CDC surveillance definition of (non-laboratory confirmed) 'clinical sepsis' were not included. Additional detailed data about the 'place of acquisition' and 'focus of infection' as defined by AICA [8] and ACHS [9] was not collected.

BSI rates were calculated as the number of LC BSIs per 10,000 acute occupied bed days (OBDs). OBDs was the sum of all acute bed days from the first day of the month to the last day of the month inclusive. Single and multi-day patients were included.

Strategies used to promote accurate data collection included:

- The distribution of a manual that explicitly outlined the definitions and reporting instructions for each data-field.
- A half-day training workshop (based on the manual) for all IC nurses in the participating hospitals.

To check the accuracy of the data collected during the surveillance period, two VICNISS Coordinating Centre infectious disease (ID) physicians retrospectively and independently assessed all reported BSIs. The hospital IC nurses assisting with this assessment, retrospectively collected additional data on the patient diagnoses and, if applicable, other microbiology reports. The physicians did not have access to patient medical records. The BSIs were categorised by the physicians as: 'confirmed' if the patient data met criterion one or two; 'excluded' if the patient data did not meet criterion one or two; 'unknown' if a conclusive assessment could not be made. The physicians later discussed any discrepant assessments in order to reach a consensus.

Results

Eighty-five smaller hospitals continuously participated in the VICNISS BSI module during the 26-month surveillance period. One hospital that solely treated oncology patients was excluded from the data analysis, because its patient population was considered significantly different. None of the participating hospitals had intensive care units.

Nineteen hospitals reported 49 primary LC BSIs in 49 patients. Of these reported BSIs, 46 were caused by recognised pathogens. The two ID physicians independently agreed on 36 (74%) assessments: 7 'confirmed'; 20 'excluded'; 9 'unknown'. Of the unknown assessments, 4 were because the IC nurses had not provided the additional requested information. After discussion about the discrepant BSIs the physicians amended the assessment categories to: 12 'confirmed'; 26 'excluded'; 11 'unknown'. The 26 excluded BSIs were because the causative organism was related to an infection at another site.

Aggregate rates are outlined in Table I. The total number of acute OBDs was 790,329. For the 12 BSIs confirmed by the ID physicians the cultured microorganisms were *S. aureus* (5), *Enterococcus faecalis* (3), *C. albicans, E. coli, Streptococcus equisimilis (Group C),* and *Salmonella spp*. Of the patients, 2 and 10 respectively had a central and peripheral IV device in situ.

Discussion

Over 26 months, the majority (94%) of the Victorian smaller public acute care hospitals continuously participated in the VICNISS BSI module. Crude comparisons made with other studies that included at least one smaller hospital, suggested the confirmed VICNISS BSI rate (0.2 to 0.3 per 10,000 OBDs) was relatively low. Comparisons were not made with other BSI results publicly reported by other

Table I. BSI Aggregate rates (May 1st 2004 to June 30th, 2006).

Category	Number of BSIs	Rate*	95% Confidence interval
'Confirmed' BSIs	12	0.2	0.0-0.3
'Confirmed' & 'unknown' BSIs	23	0.3	0.2-0.4
ALL reported BSIs ('Confirmed', 'excluded' & 'unknown' BSIs)	49	0.6	0.5-0.8

* Rate per 10,000 occupied bed days.

Australian state health departments – the South Australian Infection Control Service [10] and New South Wales Health [11] have reported on BSIs that were identified predominately in larger hospitals or specialised units. As with other studies [4,5], the most common causative micro-organism was *S. aureus*.

We believe the 12 'confirmed' BSIs were associated with the use of IV devices. However, this could not be definitely established because, as is required by some published definitions [3,5], IV device 'tips' were not cultured. The VICNISS BSI rate may have been low because IV devices (especially central IV devices) are infrequently used in smaller hospitals. The incidence of BSIs associated with the use of peripheral IV devices is lower than for central IV devices [12].

Comparisons of infection rates will be misleading if data is inaccurately collected. Of the VICNISS reported BSIs, 25% were confirmed by the two ID physicians as 'true' infections. This was in marked contrast to a CDC study [13] that examines the accuracy of reported hospital acquired infections in intensive care unit (ICU) patients. In this study, the predictive value positive for reported BSIs is 87%. As with the Victorian smaller hospitals, over-reporting was mostly due to incorrectly reporting secondary BSIs as primary BSIs.

The methodology described in this article had several limitations. First, accurate data collection was partly dependent on medical staff ordering blood cultures, drawing blood from a peripheral vein (not an existing IV device) and microbiology laboratories detecting BSI isolates and disseminating reports. In the Victorian smaller hospitals, the efficiency of these influential factors has not been evaluated. Second, an incidence rate using instead the 'number of days of device exposure' would have more accurately reflected the population at risk. Third, although retrospective medical record review is believed to be a valid surveillance technique [14], the ID physicians using a limited form of this technique as part of the data checking process were not always able to apply the surveillance criteria in a uniform manner.

Despite these limitations, participation by Victorian smaller hospitals in the BSI module during the specified surveillance period was worthwhile – a baseline rate for hospital-acquired primary LC BSIs was established. However, the usefulness for these hospitals (particularly because hospital-acquired LC BSIs in the smaller hospitals are such an infrequent, albeit serious event) to continue participating in the module as it currently exists is now questionable. Other approaches [15,16], such as 'signal event and root cause analysis' surveillance and the strategies to used to promote accurate data collection are to be re-examined.

Acknowledgments

We especially wish to acknowledge the IC personnel in the participating hospitals and VICNISS Coordinating Centre staff for their assistance. The VICNISS Coordinating Centre is fully funded by the Victorian Department of Human Services. Gratitude is expressed to the Quality and Safety Branch, Department of Human Services, and Melbourne Health.

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