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Research

Administrative data has poor accuracy for surveillance of *Staphylococcus aureus* bacteraemia

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Abstract *Background:* To determine the accuracy of the International Classification of Diseases (ICD-10) coding for *Staphylococcus aureus* bacteremia (SAB) compared with laboratory results during a ten-year period (January 2002–December 2011).
Methods: A retrospective comparison of ICD-10 code A41.0 for *S. aureus* sepsis with SAB identified from the laboratory information system (LIS). Patients with LIS identified SAB (LIS+) and/or the ICD-10 A41.0 code (ICD-10) were identified and classified as concordant (LIS+/ICD+) or discordant (LIS+/ICD− or LIS-/ICD+). From July 2010 an additional code for healthcare associated SAB (HA-SAB), U90.0, was introduced and evaluated against prospectively designated episodes of HA-SAB.
Results and Conclusions: There were 740 laboratory confirmed episodes of SAB however, only 408 of these were recorded by ICD-10 A41.0whilst 106 patients with negative blood cultures were miscoded as ICD-10 A41.0. The sensitivity and PPV for ICD-10 A41.0 were 55% [95% CI: 51–59%] and 72% [95% CI: 68–76%]. For the subset of HA-SAB, the sensitivity and PPV for ICD-10 U90.0 were only 12% [95% CI: 5–24%] and 32% [95% CI: 15–54%] respectively.

Surveillance based solely on ICD-10 A41.0, code underestimates the true incidence of SAB even while including non-bacteremic episodes. ICD-10 U90.0 for HA-SAB has even poorer sensitivity and PPV. Laboratory culture results should become the major criterion for ICD-10 coding for SAB to improve the accuracy of surveillance data.

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Highlights

- Established factors: SAB is common and associated with mortality rates of 20—30%.
- Healthcare associated SAB (HA-SAB) is reportable and a marker of quality in healthcare in Australia.
- New factors: ICD-10 coding has limited sensitivity and positive predictive value in identifying laboratory confirmed SAB and is even less accurate for HA-SAB.
- Implications: Surveillance and reporting data for SAB should be based on laboratory data.

Introduction

The International Classification of Diseases (ICD) has become a standard recording tool for epidemiology, health management and clinical purposes. Data, using this coding based on entries in the patients' medical records, is used to monitor the incidence and prevalence of diseases, to provide mortality and morbidity statistics, and for reimbursement and resource allocation decision-making [1]. It is endorsed by the World Health Organization and used by all Members States. Accuracy of the coding system is therefore paramount for the production of reliable data. A major limitation of ICD coding is that a healthcare practitioner must record in the notes the medical condition before it can be coded. Laboratory results by themselves are not able to be used for coding. Previous studies have reported variable accuracy of ICD in the coding for infectious disease [2—10], although few have specifically examined bloodstream infections [4,5,8—10].

Staphylococcus aureus is one of the commonest causes of bacteraemia, both in community and healthcare settings, carrying mortality rates of 20—40% [11—13]. In addition, healthcare associated *S. aureus* bacteraemia (HA-SAB) is used as an indicator of quality in healthcare and reported publically in Australia (www.myhospitals.gov.au) [14], and the UK [15,16]. The diagnosis of SAB is relatively uncomplicated, as isolation of *S. aureus* from blood cultures is almost always clinically significant, with very few *S. aureus* isolates in blood being considered contaminants. Using laboratory data for SAB episodes will therefore give one of the most accurate measures of SAB incidence within an institution. The aim of this study was to determine the accuracy of the ICD-10 coding system for the identification of SAB patient episodes at Canberra Hospital (CH).

Methods

A retrospective comparison of SAB cases identified between 1 January 2002 and 31 December 2011 in patients attending Canberra Hospital; a tertiary referral hospital within the Australian Capital Territory, providing services to a population of approximately 600,000 people. Medical record coders at Canberra Hospital are trained in clinical coding using ICD-10 (Australian Version) [17], and undertake regular competency evaluations and audits. Allocation of codes is based on identification by the coders of the specific diagnoses within the medical record, with multiple codes often applied to each hospital admission. Patients attending the Emergency Department, who are not admitted, do not receive ICD-10 coding for that episode of care.

Patients admitted during the study period with the ICD-10 code A41.0 "*S. aureus* sepsis" were identified from medical records. From 1 July 2010 a new supplementary code, U90.0 *Healthcare associated S. aureus* bacteraemia (HA-SAB), was introduced. For laboratory diagnosed episodes, the Canberra Hospital laboratory information system (LIS) was used to identify episodes of SAB based on the isolation of *S. aureus* from blood cultures performed on patients either via the Emergency Department or whilst admitted during the same time period. For patients with multiple positive blood cultures with *S. aureus* during the same hospitalisation, only the first episode was included. The results from the two datasets were compared. As coding is applied at the end of an episode of care, bacteraemia episodes coded during the study period but occurring prior to the commencement of the study period were excluded, whilst bacteraemia episodes coded after the study period but occurring during the study period ended were included in the analysis. Laboratory diagnosed cases of SAB which were coded in the patients' medical records with an A41.0 code, were classified as concordant (LIS+/ICD-10+). Discordant cases were those with a SAB laboratory diagnosis but without the A41.0 code (LIS+/ICD-10−) or an A41.0 code without a laboratory diagnosed SAB episode (LIS-/ICD-10+). The medical records of discordant cases were investigated further to identify factors responsible for missing or incorrect codes.

The subset of HA-SAB episodes were identified by cross-referencing the episodes with a pre-existing prospectively collected infection control bacteraemia database. These episodes were compared to the admissions receiving the ICD-10 U90.0 code. HA-SAB (inpatient and non-inpatient) was defined according to Australian guidelines and were consistent with the U90.0 definitions [17,18].

The sensitivity of ICD-10 A41.0 code for SAB was determined by dividing the number of concordant episodes (LIS+/ICD-10+) by the total number of SAB identified by the LIS. The positive predictive value (PPV) was calculated by dividing the concordant episodes by the total number of admissions with the ICD-10 A41.0 code. Similarly, the sensitivity and PPV of U90.0 for HA-SAB was calculated with reference to bacteraemia database.

The ACT Health Directorate Human Research Ethics Committee approved the study in August 2012.