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Risk factors for urinary catheter associated bloodstream infection



Evan C. Bursle^{a,b,*}, Jane Dyer^{a,b}, David F.M. Looke^{a,b},
David A.J. McDougall^a, David L. Paterson^c, E.G. Playford^{a,b,**}

^a Infection Management Services, Princess Alexandra Hospital, Woolloongabba, Brisbane 4102, Australia

^b University of Queensland, School of Medicine, Brisbane, Queensland, Australia

^c University of Queensland Centre for Clinical Research, Royal Brisbane and Women's Hospital, Queensland 4006, Australia

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Summary Objectives: Urinary catheter associated bloodstream infection (UCABSI) causes significant morbidity, mortality and healthcare costs. We aimed to define the risk factors for UCABSI.

Methods: A case-control study was conducted at two Australian tertiary hospitals. Patients with urinary source bloodstream infection associated with an indwelling urinary catheter (IDC) were compared to controls with an IDC who did not develop urinary source bloodstream infection.

Results: There were 491 controls and 67 cases included in the analysis. Independent statistically significant risk factors for the development of UCABSI included insertion of the catheter in operating theatre, chronic kidney disease, age-adjusted Charlson comorbidity index, accurate urinary measurements as reason for IDC insertion and dementia. IDCs were inserted for valid reasons in nearly all patients, however an appropriate indication at 48 h post-insertion was found in only 44% of patients. Initial empiric antibiotics were deemed inappropriate in 23 patients (34%).

Conclusion: To our knowledge, this is the first study to look specifically at the risk factors for bloodstream infection in urinary catheterised patients. Several risk factors were identified.

* Corresponding author. Pathology Queensland Microbiology Department, Building 7, Royal Brisbane and Women's Hospital, Butterfield Street, Herston, 4006 Brisbane, Australia. Tel.: +61 432631984.

** Corresponding author. Infection Management Services, Building 17, Level 1, Princess Alexandra Hospital, Ipswich Road, Woolloongabba, 4102 Brisbane, Australia.

E-mail addresses: evanbursle@gmail.com, evan.bursle@health.qld.gov.au (E.C. Bursle), jane.dyer@health.qld.gov.au (J. Dyer), david.looke@health.qld.gov.au (D.F.M. Looke), david.mcdougall@health.qld.gov.au (D.A.J. McDougall), david.paterson@health.qld.gov.au (D.L. Paterson), geoffrey.playford@health.qld.gov.au (E.G. Playford).

IDC management and empiric management of UCABSI could be improved and is likely to result in a decreased incidence of infection and its complications.

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Introduction

Catheter-associated urinary tract infection (UTI) is a significant problem, with catheter-associated bacteriuria (CAB) the most common hospital acquired infection worldwide.¹ CAB is estimated to account for up to 40% of all healthcare related infections and the majority of hospital-acquired UTIs.² Furthermore, CAB is one of the most common infections in long-term care facilities and in the home care environment.³ These figures are perhaps unsurprising given catheterisation rates: 5–10% of nursing home patients^{4,5} are catheterised and up to 25% of hospitalised patients² receive an indwelling urinary catheter (IDC), with these rates rising in recent years.⁶ A large portion of these patients will develop bacteriuria, primarily dependent on the length of catheterisation. Overall around one quarter of patients with short term (<30days) catheters will be bacteriuric,² with a daily incidence of 3–8%.^{7–9} Of these patients, an estimated 16–32% will develop symptoms related to their bacteriuria.¹⁰

The most common cause of gram negative bloodstream infection (BSI) is bacteriuria, with the urinary tract responsible for greater than 17% of healthcare associated BSIs, a rate surpassed only by intravenous catheters.¹¹ BSI is a significant complication of CAB and will develop in 1–4% of patients.^{12–15} Furthermore, urinary catheters are responsible for 45–55% of BSIs in patients from long-term health care facilities,^{16,17} with an indwelling catheter conferring a relative risk of BSI of 39 in one study.¹⁸ The outcome of these infections is often poor, with an attributable mortality rate of 13%.¹⁰ Unsurprisingly, the health care costs of urinary tract related BSIs are high, with each episode estimated to cost approximately \$USD3000 and an additional 17–19 hospital days.^{2,19} However, this estimate is now more than a decade old and likely to be a significant underestimate, with other studies of healthcare associated BSIs indicating attributable excess costs of \$USD10,000 to greater than \$USD40,000.^{20,21}

Despite the prevalence and considerable costs attached to this problem, there have been few studies examining the risk factors for developing hospital associated urinary tract BSI and none into indwelling catheter-related BSIs. In contrast, several studies have evaluated the risk factors for developing bacteriuria. Duration of catheterisation is the single most important risk factor,²² with other associations including lack of systemic antibiotic therapy, older age, female sex, elevated serum creatinine at time of insertion of catheter, rapidly fatal underlying illness, non-surgical disease, insertion outside the operating room and diabetes.^{23–28} The risk factors for urinary tract BSI have been less clearly defined, with the relatively low incidence impairing the statistical power of the few studies that have been performed. A small retrospective case-control study in bacteremic UTI patients (mostly community acquired), showed that older age, non-infectious urinary tract disease

and indwelling catheters were associated with BSI.²⁹ A more recent study has also shown IDCs to be a risk factor for BSI,³⁰ while a larger study from the 1980s demonstrated risk factors for BSI in healthcare associated UTI to be male sex and infection with *Serratia marcescens*.¹⁵ A newer retrospective case-control study also found that males were more likely to develop urinary tract BSI, however few female patients were enrolled.³¹ This study also found that cigarette smoking, immunosuppressive therapy, malignancy, diabetes and corticosteroid use in those aged <70 years were significant risk factors for BSI. Most recently, Greene et al. also showed that male sex, immunosuppressive therapy, neutropenia, insulin, renal disease, liver disease and urological procedures were associated with nosocomial urinary tract BSIs.³² Recent antibacterial therapy had a protective effect in this study. However, none of these studies have specifically examined the risk factors in the catheterised population. This study sought to define those risk factors as well as appropriateness of IDC presence and therapy of the BSI.

Materials and methods

Setting

The Princess Alexandra Hospital (PAH) is an 800-bed tertiary referral centre located in Brisbane, Australia. It provides care in all major adult specialities, excluding obstetrics. The study was approved by the human research ethics committee of the Princess Alexandra Hospital (HREC/12/QPAH/115).

The Greenslopes Private Hospital (GPH) is a 676-bed hospital located in Brisbane, Australia, providing care in all major adult specialities. This study was approved by the Greenslopes Private Hospital Ethics Committee.

Case definition

All adults (18 years of age or older) with the presence of an indwelling or supra-pubic urinary catheter for greater than 48 h, were eligible for the study. Case patients (urinary source BSI) were identified retrospectively through the respective hospital infection control BSI databases from the years 2011–2012 for PAH, and 2010–2011 for GPH. Cases had developed symptoms related to urinary source BSI in the presence of catheterisation, or with a history of catheterisation in the previous 14 days. The microbiological criteria used for inclusion were the same organism isolated from the blood and urine within 48 h, or a urinary pathogen isolated in blood, with mixed urinary culture and pyuria (leukocytes $\geq 10/L$) within 48 h and no other source of BSI deemed likely by the physician reviewer. Subsequent episodes of BSI in the same patient during the study period were excluded from the risk factor analysis.

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