



Review

# Systematic review and meta-analysis of the effectiveness of antiseptic agents for meatal cleaning in the prevention of catheter-associated urinary tract infections

O. Fasugba<sup>a,b,\*</sup>, J. Koerner<sup>a</sup>, B.G. Mitchell<sup>c,d</sup>, A. Gardner<sup>a</sup>

<sup>a</sup> Faculty of Health Sciences, Australian Catholic University, Canberra, Australian Capital Territory, Australia

<sup>b</sup> Lifestyle Research Centre, Avondale College of Higher Education, Cooranbong, New South Wales, Australia

<sup>c</sup> Faculty of Arts, Nursing and Theology, Avondale College, Wahroonga, New South Wales, Australia

<sup>d</sup> School of Nursing and Midwifery, Griffith University, Brisbane, Queensland, Australia

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## SUMMARY

**Background:** Catheter-associated urinary tract infections (CAUTIs) are among the most common healthcare-associated infections. Antiseptic cleaning of the meatal area before and during catheter use may reduce the risk of CAUTIs.

**Aim:** To undertake a systematic review of the literature and meta-analysis of studies investigating the effectiveness of antiseptic cleaning before urinary catheter insertion and during catheter use for prevention of CAUTIs.

**Methods:** Electronic databases were searched to identify randomized controlled trials. Pooled odds ratios (ORs) and 95% confidence intervals (CIs) were calculated and compared across intervention and control groups using DerSimonian–Laird random-effects model. Subgroup analyses were performed. Heterogeneity was estimated using the  $I^2$  statistic.

**Findings:** In total, 2665 potential papers were identified; of these, 14 studies were eligible for inclusion. There was no difference in the incidence of CAUTIs when comparing antiseptic and non-antiseptic agents (pooled OR 0.90, 95% CI 0.73–1.10;  $P=0.31$ ), or when comparing different agents: povidone-iodine vs routine care; povidone-iodine vs soap and water; chlorhexidine vs water; povidone-iodine vs saline; povidone-iodine vs water; and green soap and water vs routine care ( $P>0.05$  for all). Comparison of an antibacterial agent with routine care indicated near significance ( $P=0.06$ ). There was no evidence of heterogeneity ( $I^2=0\%$ ;  $P>0.05$ ). Subgroup analyses showed no difference in the incidence of CAUTIs in terms of country, setting, risk of bias, sex and frequency of administration.

**Conclusions:** There were no differences in CAUTI rates, although methodological issues hamper generalizability of this finding. Antibacterial agents may prove to be significant in a well-conducted study. The present results provide good evidence to inform infection control guidelines in catheter management.

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\* Corresponding author. Address: Faculty of Health Sciences, Australian Catholic University, Dickson, ACT 2602, Australia. Tel.: +61 2 6209 1325. E-mail address: [oyebola.fasugba@acu.edu.au](mailto:oyebola.fasugba@acu.edu.au) (O. Fasugba).

## Introduction

Indwelling urinary catheters (IDCs) are commonly used in hospital settings, and their use is implicated in hospital-associated infections (HAIs) which are costly and largely preventable. Recent estimates from 183 American hospitals found that 23.6% of patients had an IDC,<sup>1</sup> with a rate of 17.5% reported from 66 European hospitals,<sup>2</sup> and in 26% of Australian acute care patients.<sup>3</sup> Infections associated with IDCs are among the most common HAIs and are referred to as 'catheter-associated urinary tract infections' (CAUTIs).<sup>4</sup> A survey of adult patients in acute hospitals across England, Wales, Northern Ireland and the Republic of Ireland found that urinary tract infections (UTIs) were the second most common cause of HAIs.<sup>5</sup> CAUTI rates from 82 Australian hospitals were estimated to be 0.2%.<sup>6</sup> Catheter use and CAUTIs have been associated with increased length of stay, higher hospital costs, antibiotic use, morbidity and mortality,<sup>7,8</sup> providing a strong rationale for the implementation of effective interventions to reduce the risk of infection.

Recent interventions to prevent HAIs include the implementation of bundle interventions. CAUTI prevention bundles include staff training on CAUTI prevention measures, audits on catheter insertion, and implementation of more detailed catheter-related record-keeping.<sup>9–11</sup> Evaluation of CAUTI bundles has found significant reductions in catheter utilization and CAUTI rates.<sup>11</sup> Recent data from 603 hospitals in the USA showed that following implementation of the national Comprehensive Unit-based Safety Program to reduce CAUTIs, CAUTI rates decreased by 22.3% from 2.82 to 2.19 infections per 1000 catheter-days.<sup>11</sup> Given that bundle interventions have been shown to be effective in reducing CAUTIs, there is a need to explore other strategies that may further contribute to decreasing CAUTIs.

Peri-urethral colonization is strongly associated with bacteriuria and CAUTIs.<sup>12</sup> As such, reducing bacterial colonization around the meatal area may have the potential to reduce the risk of CAUTIs. Reviews conducted to date have been inconclusive about the benefits of antiseptic cleaning of the peri-urethral area before and during IDC use to prevent CAUTIs.<sup>13,14</sup> Although the guidelines of the Infectious Diseases Society of America do not recommend the use of antiseptic agents, they state that data are insufficient to make recommendations on the effectiveness of meatal cleaning prior to catheter insertion in the prevention of CAUTIs.<sup>15</sup> Similarly, UK guidelines do not recommend using antiseptic agents, advising cleaning of the urethral meatus with sterile normal saline prior to catheter insertion.<sup>16</sup> These recommendations are based on single studies with a limited number of participants.<sup>14</sup> Australian guidelines also acknowledge that the benefits of using antiseptic agents vs sterile saline for meatal cleaning before IDC insertion are unresolved.<sup>17</sup> The most recent systematic review with meta-analysis reported that there was evidence to suggest that cleaning with water or saline as opposed to disinfection may reduce CAUTI rates.<sup>18</sup> These findings need to be treated with caution as, although the authors claim that the meta-analysed studies were comparable due to the lack of statistical heterogeneity, there was considerable clinical heterogeneity in the included studies.

There was a strong rationale to undertake the present study given inconclusive evidence. The literature was reviewed

systematically, and a meta-analysis of studies investigating the effectiveness of antiseptic cleaning before IDC insertion and during catheter use for prevention of CAUTIs was conducted. The findings will inform clinical practice, contribute to future guideline development, and inform the development of well-designed intervention studies in the future.

## Methods

A protocol was developed to guide the conduct of the systematic review and meta-analysis, and the protocol was registered on the PROSPERO International Prospective Register of Systematic reviews (Registration No: CRD42015023741). The format for reporting this review followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement.<sup>19</sup>

### *Data sources and search strategy*

The following electronic databases were searched from inception to December 2015: Cochrane Library, PubMed, Embase, CINAHL, Medline, Joanna Briggs Institute EBP database, Ovid, Science Direct, EBSCO, Scopus, Academic Search Complete and Health Source. Search parameters were adapted to database requirements. Text words and MeSH terms used included: urinary catheter, urinary tract infection, meatal cleaning, peri-urethral cleaning, antiseptic, antimicrobial, antibacterial, antibiotic, topical, and bundle intervention. Details of the search strategy are provided in [Appendix A](#) (see online supplementary material). Furthermore, reference lists of relevant articles were searched manually for relevant papers.

### *Study inclusion and exclusion criteria*

Randomized controlled trials (RCTs) and quasi-experimental studies (pre- and post-test design, non-RCTs) that evaluated the use of antiseptic, antibacterial or non-medicated agents for cleaning the meatal, periurethral or perineal areas before IDC insertion or intermittent catheterization, and during routine meatal care were included. Studies involving patients requiring short- or long-term IDCs or intermittent catheterization in hospitals, community settings and long-term care facilities were included. Studies from all countries published in the English language were considered. Studies that focused solely on children were excluded. In addition, studies that investigated patients with pre-existing UTIs; grey literature such as conference abstracts, letters to editors, reports and guidelines; studies with data unavailable for analysis; studies that did not evaluate the intervention or control agents; and studies for which the full-text article was not held in an Australian library were excluded.

The primary outcome measure under investigation was the difference in the rates of CAUTIs in the intervention and control groups. This systematic review accepted the definition of CAUTI provided in included studies.

### *Study selection*

Preliminary selection involved two reviewers (JK and AG) who independently examined the titles and abstracts of all articles retrieved from electronic databases and hand searches

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