Antimicrobial urinary catheters: a systematic review
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CRD summary
This review concluded that antimicrobial-coated catheters decreased the proportion of patients with catheter-associated bacteriuria/funguria, but as no trials were found that reported on urinary tract infection, the clinical relevance of this was unclear. Given lack of reporting of the review process, poor trial quality, and substantial clinical variation between trials, this conclusion may be overstated.

Authors' objectives
To summarise and evaluate existing evidence on catheter-associated urinary tract infections, updating a previous review (see Other Publications of Related Interest).

Searching
MEDLINE, BIOSIS Previews, PubMed, the Cochrane Library, the US National Institutes of Health, CINAHL, and CAB Abstracts were searched for studies published up to February 2008. Search terms were reported. The review used the results of a previous systematic review, published in 2006 (see Other Publications of Related Interest), to identify relevant studies published up to June 2005.

Study selection
To be eligible for inclusion, studies had to use a randomised or quasi-randomised design and use anti-microbial-coated catheters currently available and approved for use in the USA.

The primary outcome was symptomatic urinary tract infection. Secondary outcomes were catheter-associated bacteriuria/funguria, mortality, length of stay, bloodstream infection, and Gram-negative bacteriuria.

The publication date of included trials ranged from 1986 to 2007. Most trials were conducted in Sweden, Belgium, or the USA; other trials were performed in France, Saudi Arabia, Denmark, and South Korea. Most of the trials tested silver hydrogel-coated latex catheters, one tested silver-coated latex, and the remainder tested nitrofurazone-containing silicone catheters. Catheters used in the control groups included latex, silicone or silicone-coated latex, hydrogel-coated latex, and teflonised latex. The mean age of included patients ranged from 43 to 68 years; most were male (where reported). Trials varied in specimen collection methods used and definitions of a positive urine culture.

The number of reviewers involved in study selection was not reported.

Assessment of study quality
The reviewers assessed trials in terms of population size, study design (including blinding), and allocation method.

The number of reviewers involved in validity assessment was not reported.

Data extraction
Data required to calculate risk ratios (RRs) with 95% confidence intervals (CIs) were extracted.

The number of reviewers involved in data extraction was not reported.

Methods of synthesis
Risk ratios with 95% confidence intervals were not pooled due to the clinical heterogeneity between trials. Absolute risk reductions were calculated based on the data extracted.

A range of subgroup analyses were performed to estimate the effect according to trial characteristics of interest. Comparisons between two groups using continuous variables were tested using the Mann-Whitney U test.

Results of the review
Thirteen trials were included in the review (nine randomised; n=13,604 patients, range 27 to 11,032). None of the trials were assessed as having adequate allocation concealment. Five trials had poor allocation concealment. Only four trials were assessed as being double blinded. Five trials reported the number of participants initially enrolled. Seven trials did not report rates or reasons for drop-outs or exclusion post-enrolment.; amongst those trials that did report drop-out/exclusion rates, rates ranged from 21 to 27%.

**Primary outcome:** None of the trials provided information on symptomatic urinary tract infections.

**Secondary outcomes:** Thirteen trials reported the incidence of catheter-associated bacteriuria/funguria. The proportion of antimicrobial-coated catheter participants who developed catheter-associated bacteriuria/funguria ranged from 0% to 50% (trial RRs ranged from 0.08 to 0.94). Although this favoured the antimicrobial catheter, eight of the thirteen trials effect sizes had confidence intervals that indicated the effect was not statistically significant. Nine trials reported data required to calculate risk ratios for bacteriuria due to gram-negative bacteria (trial RRs ranged from 0.08 to 0.82). In all cases, the individual trial confidence intervals indicated that the effect was not statistically significant.

**Subgroup analyses:** The four pre-1995 trials testing silver catheters reported risk ratios for catheter-associated bacteriuria/funguria (RRs ranged from 0.24 to 0.44; median 0.32); these were significantly lower than the post-1995 silver catheter trials (RRs ranged from 0.53 to 0.94; median 0.84).

**Adverse events:** Six trials reported adverse events. These included bleeding due to misplaced catheter, difficulty removing catheter due to balloon ridging, false passage with subsequent catheter placement, intense pain and hematuria, burning sensation, pneumonia, sepsis, and death.

**Authors' conclusions**
Antimicrobial-coated catheters decreased the proportion of patients with catheter-associated bacteriuria/funguria, but the clinical relevance of this was unclear as no trials were found that reported on urinary tract infection.

**CRD commentary**
This review addressed a clear research question using broadly appropriate study selection criteria. The search was relatively comprehensive for studies published after 2005, and relied on a previous systematic review with a comprehensive search strategy for studies published up to 2005, reducing the risk of publication and language bias. The data extraction appeared adequate. The conduct of the review was not adequately reported, including how many reviewers were involved at each stage of the process, substantially reducing review transparency and increasing the risk of error and bias.

Trial quality assessment appeared appropriate and was clearly reported. Sufficient primary trial details were reported. The decision not to pool results by outcome appeared appropriate, given substantial clinical variability between trials.

Given lack of reporting of the review process, poor primary trial quality, and substantial clinical heterogeneity between trials, the authors’ conclusions may be overstated.

**Implications of the review for practice and research**
**Practice:** The authors stated that emphasis should be placed on educating clinicians on the indications for placing an indwelling catheter, implementing automatic reminder/stop orders, and promoting the use of alternative bladder management approaches whenever appropriate.

**Research:** The authors stated that, in addition to clinically relevant end points, future studies of antimicrobial catheters should also address some of the other shortcomings seen in the reviewed trials, such as the used of pre- and post-enrolment exclusionary criteria. Additionally, there is a need for new bladder drainage measures that address patient comfort, dignity, mobility and infection risk. Proven techniques to reduce the prevalence and duration of indwelling urinary catheter use should be implemented. Additionally, further research is needed in the form of high-quality clinical trials with appropriate end points, adequate power and multiple treatment arms to determine whether antimicrobial-coated catheters provide a clinically relevant benefit, and if so how large this benefit would be.

**Funding**
Not stated.
Bibliographic details

PubMedID
18573048

DOI
10.1586/17434440.5.4.495

Original Paper URL
http://www.expert-reviews.com/doi/abs/10.1586/17434440.5.4.495

Additional Data URL
http://www.annals.org/cgi/content/full/144/2/116

Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Anti-Infective Agents, Urinary /administration & dosage /adverse effects; Catheters, Indwelling; Coated Materials, Biocompatible; Equipment Design; Evidence-Based Medicine; Humans; Treatment Outcome; Urinary Catheterization /adverse effects /instrumentation; Urinary Tract Infections /etiology /prevention & control

AccessionNumber
12009102912

Date bibliographic record published
15/07/2009

Date abstract record published
16/02/2011

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.