Management of short term indwelling urethral catheters to prevent urinary tract infections:  
a systematic review

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Authors' objectives
To present the best available evidence related to the interventions aimed at preventing catheter associated urinary tract infections.

Searching
CINAHL, MEDLINE, Current Contents, the Cochrane Library, Expanded Academic Index, EMBASE and Dissertation Abstracts International were searched from inception to 1999. Search terms for each database are listed in the paper. The reference lists and bibliographies of retrieved studies were scanned for further relevant articles. Studies published prior to 1980, considered to be less relevant to practice than more recent studies, were excluded from analysis.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) that evaluated the effectiveness of interventions aimed at preventing UTI in people with indwelling urethral catheters. In the absence of RCTs, less rigorous study designs (i.e. non-randomised controlled trials and before-and-after studies) were considered for inclusion in a narrative summary.

Specific interventions included in the review
Interventions related to the prevention of catheter related urinary tract infection (UTI) including: catheterisation technique (clean, sterile); meatal care (povidone-iodine, neomycin-polymixin, polyantibiotic cream, soap/water); catheter composition (silicone, latex, silver coated latex foley, teflonised latex foley); bladder irrigation (povidone-iodine); drainage systems - physical adapters (pre-connected sealed junctions, pre-connected closed drainage, junction seal applied after catheter insertion, hydrophilic coated silicone catheter with sealed drainage system, catheter with exchangeable bags); drainage systems - solutions (chlorhexidine, trichloroisocyanuric acid, hydrogen peroxide); drainage systems - combined seals and solutions (closed drainage system and povidone-iodine releasing cartridge); indwelling vs intermittent catheterisation; care delivery and education. Studies evaluating supra-pubic catheters were excluded.

Participants included in the review
Adult patients with short-term urethral catheters. Evaluations of short-term indwelling urethral catheters were defined as studies that collected data from day 1 to day 14 of catheterisation.

Outcomes assessed in the review
The difference in UTI and bacteriuria between the experimental intervention and control. UTI was defined as (a) at least 10^5 colony forming units per ml or (b) at least 10^4 colony forming units per ml, with clinical indications of UTI such as pyrexia (at least 38 degrees) or supra-pubic tenderness. Bacteriuria was defined as at least 1000 colony forming units per ml.

How were decisions on the relevance of primary studies made?
The titles, abstracts and descriptor/MeSH terms of retrieved articles were assessed for relevance to the review. Reviewers were not blinded to author, and the authors do not state how many reviewers performed the selection.

Assessment of study quality
Methodological quality of RCTs was assessed using a checklist developed by the authors. Criteria included randomisation, interventions, outcomes, baseline comparability, blinding and follow-up. No validity checklist was used to assess the quality of the non-RCTs included in the narrative summary. The authors do not state how the papers were assessed for validity, or how many of the reviewers performed the quality assessment.
Data extraction
Data were extracted in a systematic manner according to predefined criteria. Data were extracted on: method, setting, number and sex of participants, type of interventions, definition of UTI or bacteriuria, other outcome measures, results and authors conclusions. Reviewers were not blind to study author or source. The authors do not state how many reviewers performed the data extraction.

Methods of synthesis
How were the studies combined?
Where possible, results from RCTs were statistically combined. Otherwise, they were summarised and included in a narrative synthesis of the appropriate intervention, along with the findings of non-RCTs.

How were differences between studies investigated?
The authors recognise that there was a great deal of variation between the interventions used in the included studies. The authors stated that where studies were combined, heterogeneity would be tested using standard a chi-square test. They also intended to undertake subgroup analyses for gender, age and period of time urethral catheters were insitu.

Results of the review
Eighteen RCTs (n=7167) were included in the analysis.

A number of the included RCTs had methodological problems including small sample sizes and high drop-out rates. Peto odds ratios and 95% CIs were calculated for each included RCT. All odds ratios (ORs) shown are based on the results of a single trial, unless otherwise stated.

1. Catheterisation technique. There was no significant difference in infection rate between groups receiving clean catheterisation and those receiving sterile catheterisation (1 trial: OR 0.85 (95% CI: 0.30, 2.38)).

2. Meatal care. There were no significant differences in bacteriuria between povidone-iodine (PVI) meatal care and standard care (OR 1.35 (95% CI: 0.76, 2.37)) or between green soap and water and standard care (OR 1.57 (95% CI: 0.86, 2.89)). There was no significant difference in bacteriuria between PVI meatal care and green soap and water (OR 1.37 (95% CI: 0.79, 2.36)). No overall significant differences were found between standard care and noemycin-polymixin beta-bactracin ointment (OR 0.87 (95% CI: 0.41, 1.82)) or polyantibiotic cream (1 trial: OR 0.65 (95% CI: 0.39, 1.08)).

3. Catheter composition. There were no significant differences between silicone and latex catheters for bacteriuria (1 trial: OR 1.07 (95% CI: 0.21, 5.54)). Incidence of infection with silver coated latex foley catheters was significantly lower than with teflonised latex foley catheters (1 trial: OR 0.23 (95% CI: 0.16, 0.63)).

4. Bladder irrigation. PVI bladder instillation significantly reduced bacteriuria compared to no instillation (1 trial: OR 0.17 (95% CI: 0.04, 0.70)).

5. Drainage systems - physical adapters. Overall (2 combined trials), sealed drainage systems did not significantly reduce infection rate compared with unsealed drainage systems (OR 0.90 (95% CI: 0.70, 1.16)). One of these trials did show a reduced incidence of infection among patients not taking antibiotics with sealed catheters versus unsealed catheters (OR 0.32 (95% CI: 0.16, 0.63)). Patients with a hydrophilic coated silicone catheter had a significantly lower rate of bacteriuria than those with a catheter with exchangeable bags (OR 0.12 (95% CI: 0.03, 0.51)).

6. Drainage systems - solutions. There was no significant reduction in bacteriuria in patients who had disinfectants added to their drainage bags. This was true for chlorhexidine (OR 1.31 (95% CI: 0.47, 3.64)) and hydrogen peroxide (OR 1.22 (95% CI: 0.74, 2.02)). A significant reduction in infection rates was seen for added trichloroisocyanuric acid when combined with a silver oxide coated catheter and adapter (OR 0.32 (95% CI: 0.12, 0.18)).

7. Drainage systems - combined seal and solution. A closed drainage system with PVI releasing cartridge, hydrophilic surface coated catheter, anti reflux mechanism and tamper discouraging seal significantly reduced UTI compared to a
closed drainage system with only one preventative measure (1 trial: OR 0.26 (95% CI: 0.09, 0.75)).

8. Indwelling vs. intermittent catheterisation. There appeared to be a slightly reduced level of bacteriuria with 'in-out' catheters (1 trial: OR 2.56 (95% CI: 1.00, 7.08)).

9. Care delivery. There was no significant difference in bacteriuria between one day and three days of post operative catheterisation following either vaginal plastic surgery (0.67 (95% CI: 0.30, 1.49)) or retropubic incontinence surgery (0.48 (95% CI: 0.19, 1.20)).

Authors' conclusions
Due to the lack of high quality studies for each type of intervention, the authors made recommendations primarily based on the findings of small individual RCTs. These recommendations were:

The use of a surgical sterile catheterisation technique has not been demonstrated to reduce the rate of catheter associated urinary tract infections. There is no evidence to suggest any benefit from using antimicrobial solutions. Tap water is sufficient for cleaning genitalia.

Catheter care should consist of good personal hygiene around the meatal area carried out on a regular basis.

Catheters which have been impregnated with silver may reduce the incidence of catheter associated bacteriuria, however, there is no clear evidence regarding which patient groups are likely to benefit from this strategy, nor the cost effectiveness of its implementation.

Sealed (e.g. taped, pre-sealed) draining systems are better at preventing bacteriuria, however cost issues should also be considered.

Adding anti bacterial solutions to drainage bags has no effect in reducing the incidence of catheter associated infection.

Catheters should be removed from post operative patients as soon as possible. Indwelling catheterisation is preferable to intermittent catheterisation for some groups of post operative patients in the reduction of complications, however a reduced level of bacteriuria has been shown to occur with 'in-out' catheters.

CRD commentary
This review provided a good summary of the current clinical evidence, but with some limitations. The review question was clearly stated and well supported by the study inclusion criteria. Although the authors state that efforts were made to identify unpublished studies, publication bias was not addressed during the analysis. Although appropriate terms were used to search a number of databases, this search appears to have been limited to English language papers, which may have led to publication bias. Results were based on validity assessed RCTs and discussed in the light of findings from broadly comparable non-RCTs. However, validity assessment and data extraction were not blind and it is unclear how many reviewers carried out these processes. The included studies were mostly summarised appropriately and the heterogeneity between studies was discussed. The recommendations for research were appropriate and seem to follow from the results presented. Most of the recommendations for practice seem to follow from the results, but should be treated with caution, considering that some are based on the results of individual small-scale studies.

Implications of the review for practice and research
Practice: The authors' recommendations are outlined in the 'Authors Conclusions' section.

Research: The authors state that there is an urgent need to replicate the included studies in other clinical settings, using a more appropriate outcome measure than 1000 colony-forming units per ml as an indicator of UTI. The authors also state that further research is needed to identify which patient groups would most benefit from the included interventions, and to address the cost implications of their implementation. They state that this is particularly important for the following interventions: clean versus sterile catheter insertion techniques; mental care regimens; indwelling versus intermittent catheterisation; different care delivery approaches; and the effect of education programmes for
minimising UTI.

**Bibliographic details**

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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.