The efficacy of silver alloy-coated urinary catheters in preventing urinary tract infection: a meta-analysis

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Authors' objectives
To answer the question: 'compared with standard non-coated indwelling catheters, are silver-coated urinary catheters less likely to lead to urinary tract infection?'

Searching
MEDLINE was searched from January 1, 1966, to January 31, 1997, using the exploded keywords 'silver' and 'catheter'. Publications in any language were considered. The references of identified articles were also examined. Additional published and unpublished studies were identified by contacting the original authors of the included trials, catheter manufacturers, and experts in the field.

Study selection
Study designs of evaluations included in the review
Any study design comparing coated and uncoated catheters was included.

Specific interventions included in the review
Silver-coated urinary catheters were compared with uncoated urinary catheters. Studies had to report the incidence of bacteriuria, evaluation by urine culture, and sufficient data. Trials that included patients who were bacteriuric at baseline, or used an open urinary drainage system, were excluded. Silver alloy and silver oxide-coated catheters were used in the studies identified.

Participants included in the review
There was no restriction on the medical speciality from which the patients were chosen. The patients in the included trials were from urology, medicine, surgery, neurology or intensive care. It was assumed that all of the patients were being treated in an acute in-patient facility, although this was not specifically stated.

Outcomes assessed in the review
The outcome used in this review was the presence of bacteriuria.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the authors performed the selection.

Assessment of study quality
The validity of the studies was assessed, based on the criteria of Jadad et al. (see Other Publications of Related Interest). Specifically, the studies were assessed for the following: the provision of details on randomisation; the extent of blinding; a description of the eligible patients; and a description of those patients not completing the trial. Two authors independently assessed validity and any disagreements were resolved by discussion.

Data extraction
Two authors independently extracted the data and any disagreements were resolved by discussion. Four (all using silver alloy catheters) of the eight studies did not provide information on eligible patients or on those not completing the study.
Methods of synthesis
How were the studies combined?
The studies were combined by calculating the odds ratios (ORs) along with 95% confidence intervals (CIs) for each
individual study, and a summary OR; Mantel-Haenszel methods with a fixed-effect model were used. Subset analyses
were performed according to gender, catheter type (alloy or oxide) and study design.

How were differences between studies investigated?
Differences between the studies were tested, based on the rates of bacteriuria across the subsets of the studies (i.e. alloy
versus oxide). These differences were analysed using a least-squares regression, with weights inversely proportional to
the estimated variance of the study-specific treatment effects.

Results of the review
Eight studies involving 2,355 patients were included in the review.

The summary OR for bacteriuria was 0.59 (95% CI: 0.42, 0.84). The tests for heterogeneity showed that the ORs varied
significantly between trials (P=0.002).

The pooled OR of the studies using silver alloy was 0.24 (95% CI: 0.11, 0.52), with a heterogeneity (P) of 0.48. The
pooled OR of the studies using silver oxide was 0.79 (95% CI: 0.56, 1.10), with a heterogeneity (P) of 0.24.

The pooled OR of 6 trials that used a random allocation process was 0.27 (95% CI: 0.13, 0.58), with a heterogeneity (P)
of 0.56. The pooled OR for the 2 studies that did not use a random allocation process was 0.87 (95% CI: 0.64, 1.18),
with a heterogeneity (P) of 0.94.

The four studies of silver oxide-coated catheters provided gender data. The pooled OR was 0.57 (95% CI: 0.38, 0.86)
for women and 1.18 (95% CI: 0.65, 2.14) for men.

The exclusion of one study in which an antibiotic was used in the drainage bag, or one study in which catheters were
left in place longer than in the other studies (duration not stated), did not change the results of the analysis.

Cost information
The cost of a silver alloy catheter was approximately $13, whilst a standard catheter was approximately $7.

Authors' conclusions
This meta-analysis clarified discrepant results among trials of silver-coated urinary catheters, by revealing that silver
alloy catheters are significantly more effective than silver oxide catheters in preventing urinary tract infections. Though
silver alloy urinary catheters cost about $6 more than standard urinary catheters, they may be worth the extra cost since
catheter-related infection is a common cause of nosocomial infection and bacteraemia.

CRD commentary
This was a well-conducted review, addressing a clear study question. The literature search attempted to locate both
published and unpublished studies, although only the MEDLINE database was searched. Searching other databases,
such as EMBASE, may have located other studies. The inclusion criteria were broad. The validity of the studies was
assessed; however, the study quality was not used to include or exclude studies from the meta-analysis. The data from
the primary studies were tabulated. More information, such as the patients' ages and risk factors for bacteriuria (i.e.
chronic diseases) would have been helpful. The data were synthesised correctly. Specific weaknesses of the review were
discussed by the authors. These included the following: the variation in the use of antibiotics across the studies; all four
silver alloy studies were performed at one institution; bacteriuria is a surrogate end point for symptomatic urinary tract
infection; and publication bias. The subset analyses were based on very few studies (e.g. the gender-based analysis),
therefore the results may reflect the small numbers of patients rather than a true difference in the outcome.

This review was relevant to the subject area, although the caveats described should be taken into account when
interpreting the conclusions.

**Implications of the review for practice and research**
The authors state that a formal analysis is needed to determine whether routine use of urinary catheters coated with silver alloy in hospitalised patients, especially those at high risk for urinary tract infections, would be cost-effective.

**Bibliographic details**

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**Other publications of related interest**

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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.