Rates of infection for single-lumen versus multilumen central venous catheters: a meta-analysis

CRD summary
This review assessed whether multi-lumen venous catheters (i.e. those with two or three bores) placed patients at a higher risk of infection than single-lumen catheters. The authors' conclusion that multi-lumen catheters may have been associated with a slightly higher risk seems appropriate, but the quality of the included studies was not good enough to provide a firm conclusion.

Authors' objectives
To determine the risk of central venous catheter-related bloodstream infection (CRBSI) and catheter colonisation in multi-lumen catheters compared with single-lumen catheters.

Searching
MEDLINE, CINAHL, Current Contents, EMBASE and PREMEDLINE were searched; the search terms were reported. The reference lists of retrieved studies were checked and relevant authors were contacted for further studies or data.

Study selection
Study designs of evaluations included in the review
The authors did not state any inclusion criteria relating specifically to the study designs. The studies included were randomised controlled trials (RCTs), prospective studies with similar groups, and retrospective or prospective studies with significant differences between the comparator groups.

Specific interventions included in the review
The authors included studies of single-lumen, double-lumen or triple-lumen catheters. Studies that focused on haemodialysis catheters, peripherally inserted central venous catheters (CVCs), pulmonary artery catheters or their introducer sheaths, and tunnelled, cuffed, or antiseptic- or antibiotic-coated CVCs were excluded.

Participants included in the review
The authors did not state any inclusion criteria relating specifically to the participants, neither did they provide any details of the participants in the included studies.

Outcomes assessed in the review
Studies were included if they measured the prevalence of CRBSI and/or catheter colonisation. The authors gave detailed definitions of these outcomes.

How were decisions on the relevance of primary studies made?
Two authors independently screened the titles and abstracts of all studies.

Assessment of study quality
The studies were assigned quality scores of A, B or C. 'A' referred to RCTs; 'B' was assigned to non-randomised studies that showed the comparison groups to be similar on important variables at baseline; category 'C' appears to have been assigned to any other included studies. The authors did not state how the papers were assessed for quality, or how many reviewers performed the quality assessment.
Data extraction
Two authors independently extracted the data. From each study, data were extracted on the number of infected catheters, the total number of catheters and the number of cases of CRBSI in each group.

Methods of synthesis
How were the studies combined?
For each outcome, individual study odds ratios (ORs) were calculated and combined in a meta-analysis using the random-effects model of DerSimonian and Laird (see Other Publications of Related Interest). The meta-analysis was repeated using only studies with quality scores of A or B.

How were differences between studies investigated?
The authors reported statistical heterogeneity between the studies included in the meta-analyses. Studies were removed and replaced individually to determine how they influenced this heterogeneity.

Results of the review
Fifteen studies (n approximately 6,199) were included in the review: 6 RCTs, 3 prospective studies with similar groups, and 6 prospective or retrospective studies with dissimilar groups.

Since double-lumen catheters made up only 2% of the total catheters, they were grouped together with triple-lumen catheters as multi-lumen catheters in the analyses.

When all studies that provided ORs (n=13) were combined, the summary ORs for both CRBSI (2.15, 95% confidence interval, CI: 1.00, 4.66) and colonisation (1.78, 95% CI: 0.92, 3.47) indicated a higher risk of infection with multi-lumen catheters, but the differences were not statistically significant. Heterogeneity was statistically significant in both analyses (P=0.001 and P=0.004, respectively).

The meta-analysis limited to RCTs and prospective studies with similar groups (n=7) showed no significant difference in CRBSI (OR 1.30, 95% CI: 0.50, 3.41) or colonisation (OR 1.30, 95% CI: 0.82, 2.07). Heterogeneity was not statistically significant (P=0.11 and P=0.67, respectively).

The authors reported the results of the sensitivity analyses in the paper.

Authors' conclusions
Multi-lumen CVCs may be associated with a slightly higher risk of infection in comparison with single-lumen catheters; this relationship diminished when only high-quality studies that controlled for patient differences were considered. The slight increase in infectious risk when using multi-lumen catheters is likely to be offset by their improved convenience, thereby justifying the use of multi-lumen vascular catheters.

CRD commentary
This meta-analysis was based on a broadly defined question, only supported by inclusion criteria relating to the interventions and outcomes. The search seemed reasonable: several major electronic databases were searched, reference lists were checked and authors were contacted. Two authors selected studies and extracted the data, thus minimising errors and potential biases. The types of data extracted from the included studies seemed appropriate. The authors divided the studies into three grades based on study design, but this did not equate to a formal validity assessment. In addition, it did not differentiate studies of the same design (e.g. RCTs) from one another in terms of quality. The subgroup analyses of ‘higher quality’ studies included both RCTs and a vaguely defined group of prospective studies where the groups did not have significant differences at baseline. Nevertheless, given the results of the meta-analyses presented here, the authors' broad conclusions about infection risk seem appropriate, although their statements regarding the trade-off between infection rates and ease of use referred to issues beyond the scope of the evidence presented here.
Implications of the review for practice and research
The authors did not state any implications for practice or further research.

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