Evaluation of the evidence on benefits and harms of pulmonary artery catheter use in critical care settings


CRD summary
This review evaluated therapeutic management of cardiac output and volume status based on pulmonary artery catheter (PAC) monitoring. The authors concluded that in patients for whom PAC is not deemed absolutely necessary, routine use of PAC does not improve long term clinical outcomes and yet has uncommon but identifiable risks of adverse events. Given the heterogeneity of included studies and limitations within these studies, the authors’ conclusions should be interpreted with caution.

Authors' objectives
The review addressed a number of issues around pulmonary artery catheter use (PAC) in critical care settings. The key question from the review covered in this abstract is: "Does therapeutic management of cardiac output and volume status based on PAC monitoring lead to improved patient outcomes compared to noninvasive and less invasive techniques in critical care settings?"

Searching
MEDLINE and Cochrane Database of Systematic Reviews were searched from inception to September 2006. Reference lists of relevant reviews and primary studies were examined for further relevant studies. Abstracts were not included. There did not appear to be a search for unpublished data. Inclusion was limited to studies published in English. Search terms were reported.

Study selection
Random Controlled Trials (RCTs) in adults with conditions requiring inpatient haemodynamic monitoring that evaluated PAC for treatment management (either intermittent or continual measurement devices) and reporting clinical outcomes (as reported in the review) were eligible for inclusion in the review.

Overall, the average age of participants was approximately 62 years. Pregnancy-related populations and pre-heart transplant patients were excluded.

The authors did not state how many reviewers selected studies for the review.

Assessment of study quality
Quality of included studies was graded using a three-category grading system. Studies were graded as A (good), B (fair/moderate) or C (poor) in terms of their susceptibility to bias. For RCTs, judgements about susceptibility to bias were based on randomisation method, concealment of allocation, blinding, use of intention-to-treat analysis, reporting of dropouts and description of valid outcomes. For studies of adverse events, susceptibility to bias was based on whether studies were prospective or retrospective in design (grades A and B were given to prospective studies, grade C to retrospective studies).

The applicability of included studies to the review’s objectives were graded as high, moderate or low.

The authors did not state how many reviewers assessed the validity and applicability of the included studies.

Data extraction
For dichotomous data, odds ratios (ORs) and their related standard errors (SEs) were calculated. For continuous outcomes, the effect size (ES; for example, mean between-group difference in length of hospital and intensive care unit stay), and their SEs were calculated. Where only exact p values were reported, SEs were back-calculated from the p value.
The authors did not state how many reviewers performed the extraction.

**Methods of synthesis**
Studies were combined using DerSimonian and Laird's random-effects model. Effect estimates were presented with 95% confidence intervals (CIs). Heterogeneity was assessed using the Cochran's Q and I² statistics. Where meta-analysis was inappropriate, studies were combined in a narrative synthesis.

Subgroup analyses were performed for type of comparison: PAC versus no PAC; and PAC versus central venous pressure catheter (CVP).

**Results of the review**
A total of 16 trials (n=6,151; 3,162 PAC, 2,989 controls) were included in the review. Sample sizes ranged from 33 to 1,994 patients. The trials were clinically heterogeneous.

Six studies were of good quality and two of wide applicability.

Mortality (15 studies, no statistically significant heterogeneity): there was no statistically significant difference between groups, 15 studies, OR 1.03 (95% CI: 0.9, 1.2).

Hospital length of stay (10 studies, no statistically significant heterogeneity): there was no statistically significant difference between groups, 10 studies, ES 0.3 (95% CI: -0.4, 1.0).

ICU length of stay (eight studies, no statistically significant heterogeneity): there was no statistically significant difference between groups, eight studies, ES 0.00 (95% CI: -0.5, 0.5). The figures in text and forest plots were discrepant. Forest plot figures are presented here.

Subgroup analyses did not significantly alter the overall results.

Complications and other outcomes (such as quality of life) related to PAC were based on an included systematic review.

**Authors' conclusions**
The available evidence suggested that, in patients for whom PAC was not deemed absolutely necessary, the routine use of PAC did not improve long term clinical outcomes. At the same time, PAC use imposed uncommon but identifiable risks of adverse events.

**CRD commentary**
The review question was well defined in terms of the participants, interventions, comparators, outcomes and study designs of interest. Electronic databases and other sources were searched to identify studies, although the decision to limit the search to English language publications may have meant that relevant non-English language studies could have been missed. Since no attempt was made to identify unpublished studies, the potential for publication bias cannot be ruled out. The validity of individual studies was assessed and presented alongside other relevant information. However, it was not clear if the authors took steps to minimise the potential for errors and bias in the selection, extraction or validity assessment processes.

The included studies were synthesised using broadly appropriate meta-analytic methods where possible. Narrative synthesis was used where statistical pooling was impossible or inappropriate. Though no statistical heterogeneity was reported, there appeared to be clinical and methodological differences between the included studies, there were high numbers of crossovers between PAC and comparators, and confidence intervals were wide for many of the individual studies. Given these limitations, the authors' conclusions should be interpreted with caution.

**Implications of the review for practice and research**

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Practice: the authors did not state any implications for practice:

Research: the authors stated that future RCTs should focus on specific patient populations that might benefit from PAC, as opposed to those for whom PAC is only reasonable or of possible value. They add that observational studies may be the only ethical way to address this question, in which case any such studies should be rigorously conducted and adjust for confounding.

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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.