Impact of the pulmonary artery catheter in critically ill patients: meta-analysis of randomized clinical trials

CRD summary
This review assessed the pulmonary artery catheter (PAC) device in critically ill patients. The authors concluded that the use of the PAC does not increase mortality, improve survival or decrease length of hospital stay, therefore it should not be used routinely. The conclusions follow from the evidence presented, although they may not be generalisable to all patient groups.

Authors' objectives
To evaluate the safety and efficacy of the pulmonary artery catheter (PAC) device in critically ill patients.

Searching
The authors searched MEDLINE (1985 to 2005), the Cochrane Controlled Trials Register (1988 to 2005), ClinicalTrials.gov and the U.S. Food and Drug Administration website. The search terms used to search MEDLINE were reported. The reference lists of identified articles were checked for additional relevant studies. Only studies published between 1985 and 2005 and reported in the English language were eligible for the review.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) were eligible for the review.

Specific interventions included in the review
Studies that compared patients whose treatment was guided by conventional PAC with patients who did not have the PAC were eligible for the review. The treatment protocols varied between studies and were outlined in the paper.

Participants included in the review
There were no inclusion criteria relating to the study population. The studies included patients undergoing major general, abdominal, vascular or orthopaedic surgery, patients admitted to the intensive care unit with major sepsis or acute respiratory distress syndrome, or patients with advanced heart failure.

Outcomes assessed in the review
Studies that reported death and the number of days hospitalised, or the number of days in the intensive care unit, were eligible for the review.

How were decisions on the relevance of primary studies made?
Two authors independently assessed studies for inclusion in the review, in an unblinded standardised manner. Any disagreements were resolved by consensus.

Assessment of study quality
Validity was assessed on the basis of the following criteria: intention-to-treat analysis, allocation generation and allocation concealment. Two authors independently assessed the studies for validity, in an unblinded standardised manner. Any disagreements were resolved by consensus.

Data extraction
Two authors independently extracted the data from the primary studies, in an unblinded standardised manner. Any
disagreements were resolved by consensus. Mortality was summarised using odds ratios (ORs) with 95% confidence intervals (CIs), while days hospitalised were summarised as the difference in mean number of days.

**Methods of synthesis**

How were the studies combined?
The studies were combined using a random-effects meta-analysis. A meta-regression analysis was also used to estimate the pooled OR for mortality, as some of the studies had zero deaths in one of the groups.

How were differences between studies investigated?
Statistical heterogeneity was assessed, but the method used was unclear.

**Results of the review**

Thirteen RCTs, with a total of 5,051 participants, were included in the review.

There was no statistically significant difference in survival between patients randomised to the PAC and those who did not have the PAC (OR 1.04, 95% CI: 0.90, 1.20, P=0.59).

There was no statistically significant difference in the length of hospital stay between patients randomised to the PAC and those who did not have the PAC (difference between the mean for PAC and the mean for no PAC was 0.11 days, 95% CI: -0.51, 0.74, P=0.73).

Patients who were randomised to the PAC had a significantly higher rate of use of vasodilator agents (OR 2.35, 95% CI: 1.75, 3.15, P<0.001) and inotropes (OR 1.58, 95% CI: 1.19, 2.12, P=0.002) than patients who did not have the PAC.

None of the included trials showed a significantly positive effect of the PAC on outcomes.

**Authors' conclusions**
The use of the PAC across a variety of clinical circumstances in critically ill patients did not increase mortality, improve survival or decrease the length of hospital stay.

**CRD commentary**
The review question was clear in terms of the study design, intervention and outcomes of interest. The authors searched a number of electronic databases, but since only English language studies were included this increases the potential for language bias. The authors did not assess publication bias, although their search of trials registers reduces the potential for publication bias. Two authors independently assessed studies for inclusion in the review, assessed studies for validity and extracted data from the primary studies, thus reducing the potential for error or reviewer bias.

Adequate details of the included studies were tabulated. The authors highlighted the fact that the role of the PAC varies in different disease states. No subgroup analyses by disease state were performed. Although the authors assessed the validity of the included studies, they did not report the results of the validity assessment or discuss the potential impact of study quality on the conclusions. The authors' conclusion appears to follow from the evidence presented, although it is possible that relevant studies published in languages other than English might have been missed. The authors also noted that the trials only included patients in whom clinicians were uncertain about the use of the PAC before randomisation, as patients in whom clinicians thought a PAC was required for treatment were excluded from all of the trials. Therefore, it is possible that patients outside the boundaries of these trials may derive benefit from the PAC.

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

Practice: The authors stated that their results suggest that the PAC should not be used for the routine treatment of patients in the intensive care unit, patients with decompensated heart failure or patients undergoing surgery, until or
unless effective therapies can be found that improve outcomes when used with the diagnostic information obtained from the PAC.

Research: The authors stated that future trials should look at alternative end points, particularly symptom status. They also suggested that renewed emphasis should be placed on the development of novel therapies that may be effective when used with the diagnostic information obtained from the PAC.

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Other publications of related interest
This additional published commentary may also be of interest. Wiedemann HP. Review: A pulmonary artery catheter does not reduce mortality or hospital days in critically ill patients. ACP J Club 2006;144:70.

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