Management with a pulmonary artery catheter did not reduce all-cause mortality in critically ill patients


**Clinical impact ratings:** Hospitalists ★★★★★☆ Critical Care ★★★★★☆

**Question**
In critically ill patients, does management with a pulmonary artery catheter (PAC) reduce hospital all-cause mortality?

**Methods**

**Design:** Randomized controlled trial (Pulmonary Artery Catheters in Management of patients in intensive care [PAC-Man] trial).

**Allocation:** Concealed.*

**Blinding:** Unblinded.*

**Follow-up period:** Until discharge from the acute hospital or up to 3 months after the recruitment phase ended.

**Setting:** 65 intensive care units (ICUs) in the United Kingdom.

**Patients:** 1041 patients admitted to an adult ICU who were identified by the treating clinicians as patients who should be managed with a PAC. Exclusion criteria included elective admission for preoperative optimization and presence of a PAC on admission.

**Intervention:** Management with (n = 519) or without (n = 522) a PAC. The timing of insertion and subsequent clinical management were at the discretion of the treating clinician.

**Outcomes:** All-cause mortality before final discharge from an acute hospital ward.

Secondary outcomes included ICU and 28-day all-cause mortality, length of stay in the original ICU, total length of stay in an acute hospital ward, and organ days of support in the original ICU after randomization.

**Patient follow-up:** 97% (mean age 65 ± 58% men) (intention-to-treat analysis).

**Main results**
The groups did not differ for any outcome (Tables 1 and 2).

**Conclusions**
In critically ill patients, management with a pulmonary artery catheter did not reduce hospital all-cause mortality.

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**For correspondence:** Professor M. Singer, University College London, London, England, UK. E-mail m.singer@ucl.ac.uk.

*See Glossary.

### Table 1. Management with vs without a pulmonary PAC in critically ill patients at 3 months†

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>PAC</th>
<th>No PAC</th>
<th>RRI (95% CI)</th>
<th>NNH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital all-cause mortality</td>
<td>68%</td>
<td>66%</td>
<td>4% (–5 to 14)</td>
<td>Not significant</td>
</tr>
<tr>
<td>ICU all-cause mortality</td>
<td>60%</td>
<td>57%</td>
<td>5% (–5 to 14)</td>
<td>Not significant</td>
</tr>
<tr>
<td>28-d all-cause mortality</td>
<td>62%</td>
<td>60%</td>
<td>3% (–6 to 14)</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

†ICU = intensive care unit; PAC = pulmonary artery catheter. Other abbreviations defined in Glossary; RRI, NNH, and CI calculated from data in article.

### Table 2. Management with vs without a pulmonary PAC in survivors compared with nonsurvivors

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Population</th>
<th>PAC</th>
<th>No PAC</th>
<th>Difference</th>
<th>P value‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median length of stay in the ICU (d)</td>
<td>Survivors</td>
<td>12.1</td>
<td>11.0</td>
<td>1.1</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Nonsurvivors</td>
<td>2.6</td>
<td>2.5</td>
<td>0.1</td>
<td>0.71</td>
</tr>
<tr>
<td>Median length of stay in the hospital (d)</td>
<td>Survivors</td>
<td>34</td>
<td>40</td>
<td>–6</td>
<td>0.43</td>
</tr>
<tr>
<td></td>
<td>Nonsurvivors</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0.90</td>
</tr>
<tr>
<td>Median organ days of support in the ICU</td>
<td>Survivors</td>
<td>19</td>
<td>19</td>
<td>0</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>Nonsurvivors</td>
<td>9</td>
<td>8</td>
<td>1</td>
<td>0.74</td>
</tr>
</tbody>
</table>

‡All differences were not significant (Mann-Whitney rank-sum test for difference in distribution).

**Commentary**

Device-delivered hemodynamic variables have been considered necessary to guide therapy in critically ill patients (1). However, the PAC-Man trial by Harvey and colleagues did not show any benefit from PAC use. The mortality rate of 69% in the PAC-Man trial was higher than anticipated, indicating that only seriously ill patients had been randomized and that the results may apply primarily to these patients.

This trial stands out because of its large sample size and high participation rate. However, the delay from ICU admission to randomization (> 16 h) raises concerns about whether earlier placement of the PAC could be beneficial (2). The lack of a specific management protocol could also have influenced the findings. PAC monitoring in high-risk surgical patients using specific management protocols may improve outcomes (3).

The complication rate of 10% in the PAC group raises important concerns that the complication-related time and resources could be better spent in other ways. However, the detrimental outcomes may not emanate from the use of a PAC per se but from our lack of knowledge about appropriate use of information received from the PAC. In the PAC group, 73% of patients were already receiving inotropic or vasoactive drug treatment before PAC use and the most frequently reported changes in therapy after PAC insertion were infusion of fluids (42%) and introduction of vasoactive drugs (32%). Both of these interventions may be ineffective or even harmful and could explain the lack of benefit in PAC patients.

While effective therapies and interventions are much needed for critically ill patients, introducing potentially harmful interventions is an even greater concern. This trial suggests that PACs (or the treatments they lead to) are not beneficial; however, it leaves room for many explanations for the findings.

**References**