Review: active compression-decompression CPR has no benefit over standard resuscitation for cardiac arrest


What is the effectiveness and safety of active compression-decompression cardiopulmonary resuscitation (ACDR CPR) compared with standard manual cardiopulmonary resuscitation (STR) for cardiac arrest?

METHODS

Data sources: Cochrane Central Register of Controlled Trials (issue 4, 2003), Medline (to January 2004), and EMBASE/Excerpta Medica (to January 2004); reference lists of retrieved articles; experts in the field; and a manufacturer of ACDR CPR devices.

Study selection and assessment: published and unpublished randomised controlled trials (RCTs) and quasi-randomised controlled trials in any language that compared ACDR CPR with STR performed by a trained medical or paramedical team in adults (>16 y of age) in cardiac arrest. 2 reviewers independently assessed the quality of individual studies (ie, adequacy of allocation concealment).

Outcomes: immediate mortality (spontaneous circulation not recovered); mortality to hospital discharge; neurological impairment in patients surviving to discharge classified as moderate (impaired functionality but self sufficient for basic needs [Glasgow-Pittsburgh Cerebral Performance [GPCP] category 2]), severe (dependency for >1 basic needs [GPCP categories 3 and 4]), or any neurological impairment; and complications (sternal and rib fractures, haemothorax or pneumothorax, and internal organ damage).

MAIN RESULTS

10 studies (n = 4988) met the selection criteria. 8 studies included only out of hospital cardiac arrests (n = 4162). 6 studies had inadequate or unclear allocation concealment. Of the 2 RCTs of in hospital arrests, 1 study (n = 773) found no difference between ACDR CPR and STR for immediate mortality (relative risk [RR] 1.01, 95% CI 0.91 to 1.12), mortality before hospital discharge (RR 1.01, CI 0.96 to 1.06), neurological impairment (RR 1.14, CI 0.46 to 2.87), or complications (RR 0.97, CI 0.49 to 1.93); the second study (n = 53) found no differences for any of the outcomes. Meta-analysis of 8 studies of out of hospital cardiac arrests (n = 4162) showed no difference between groups for any of the outcomes (table). None of the studies reported on long term mortality.

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CONCLUSION

Active compression-decompression cardiopulmonary resuscitation does not reduce mortality, neurological impairment, or complications compared with standard resuscitation for cardiac arrest.

### Active compression-decompression cardiopulmonary resuscitation (ACDR CPR) v standard manual cardiopulmonary resuscitation (STR) for out of hospital cardiac arrest*

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Number of studies (n)</th>
<th>ACDR CPR</th>
<th>STR</th>
<th>RRR (95% CI)</th>
<th>RRI (CI)</th>
<th>NNH (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate mortality</td>
<td>10 (4162)</td>
<td>73%</td>
<td>75%</td>
<td>2% (1 to 6)</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Mortality before hospital discharge</td>
<td>9 (3412)</td>
<td>93%</td>
<td>94%</td>
<td>1% (1 to 2)</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Any neurological impairment</td>
<td>5 (144)</td>
<td>27%</td>
<td>16%</td>
<td>71% (10 to 225)</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
<tr>
<td>Complications</td>
<td>7 (3032)</td>
<td>8%</td>
<td>7%</td>
<td>9% (14 to 38)</td>
<td>Not significant</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

*Abbreviations defined in glossary; RRR, RRI, NNT, NNH, and CI calculated from data in article using a fixed effects model.

Commentary

STR technique has been shown to vary among nurses, and therefore a device that reduces such variability might be beneficial in cardiac arrest situations. ACDR CPR involves the use of a device that is attached by vacuum to the sternum and allows active physical compression and decompression of the chest. This maximises cardiac stroke volume by active, quicker refilling of the heart. Whether ACDR CPR improves haemodynamics or not, the review by Lafuente-Lafuente and Melero-Bascones found that use of ACDR CPR did not result in improvements in survival or neurological performance. Most complications were similar for ACDR CPR and STR, although sternal fractures, iatrogenic cardiac injuries, skin trauma, and ecchymosis were more common in the ACDR CPR group.

ACDR CPR is not without other problems: it requires physical exertion for both compression and decompression and is therefore more tiring than STR. In 1 study, compression rate, depth, and decompression force were reduced because of fatigue within 2 minutes when performing ACDR CPR. In another study, rapid rotation of operators was needed to combat exhaustion. 7 studies also reported non-adherence of the ACDR CPR device to the chest, which resulted in the substitution of STR. In addition, ACDR CPR also required additional training, which has cost implications.

In considering the findings of this review, it should be noted that ACDR CPR and STR were performed by trained paramedics or physicians, and most trials were conducted in out of hospital settings. Only 1 study occurred in a hospital setting, and 1 occurred in both in hospital and out of hospital settings. Nevertheless, the review will be of interest to nurses, who are often the first responders to cardiac arrest in hospital settings. Nurses who find themselves initiating CPR in less than ideal environments, such as bathrooms, can be reassured that STR is not less effective than ACDR CPR. Further research is needed to determine if specific subgroups of patients might particularly benefit from ACDR CPR.

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