**WORKSHEET for Evidence-Based Review of Science for Emergency Cardiac Care**

**Worksheet author(s)**
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### Clinical question.
In adult cardiac arrest (prehospital [OHCA], in-hospital [IHCA]) (P), does the use of ACD-CPR (I) compared with standard CPR (C), improve any outcomes (eg. ROSC, survival) (O)?

**Is this question addressing an intervention/therapy, prognosis or diagnosis?** Intervention/therapy

**State if this is a proposed new topic or revision of existing worksheet:** Revision

### Conflict of interest specific to this question
Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? No COI

### Search strategy (including electronic databases searched).
- PubMed for ACD-CPR or Active compression decompression or Cardiopump®
- EMBASE using ACD-CPR or Active compression decompression or Cardiopump®
- AHA Endnote Master library
- Cochrane database for systematic review
- Review of references from articles and review articles, manual search
- 160 articles including 72 in the AHA master library from 1980 to May 2009

### State inclusion and exclusion criteria

#### Inclusion criteria:
Cardiac arrest studies using ACD-CPR and including any parameter related to prognosis (ROSC, survival, neurological outcome...)

#### Exclusion criteria:
- Experimental studies with only technical measurements
- Reviews
- Studies related to other worksheets using only LUCAS (WS ALSBLSCPRA 85) or ITD (WS ALSBLSCPRA 81) without manual ACD-CPR group

39 studies on ACD were identified and 19 were selected according these criteria

### Number of articles/sources meeting criteria for further review:
19 studies met the criteria for further review 5 LOE1, 9 LOE2, 1 LOE3, 1 LOE4, 3 LOE5
## Summary of evidence

### Evidence Supporting Clinical Question

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
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<td>Fair</td>
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**Level of evidence**

A = Return of spontaneous circulation  
B = Survival of event  
C = Survival to hospital discharge  
D = Intact neurological survival  
E = Other endpoint  
*Italics = Animal studies*
### Evidence Neutral to Clinical question

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<tr>
<td></td>
<td></td>
<td>Goralski 1998 ABCD</td>
<td>Schwab 1995 ABCD</td>
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<td>Skogvoll 1999 ACD</td>
<td>Luiz ABCD 1996</td>
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<td>Lafuente – Lafuente 2004 ACD</td>
<td>Panzer 1996 BC</td>
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<td>Arai 2001 A</td>
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<td>Kern 1996 AB Bertrand 2006ABC</td>
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#### Level of evidence

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### Evidence Opposing Clinical Question

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#### Level of evidence

- **A** = Return of spontaneous circulation
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- **D** = Intact neurological survival
- **E** = Other endpoint
- **Italics** = Animal studies
ACD is an alternative method of cardiac massage with a hand-held device to compress the chest and using suction to decompress it. Most of the articles have published ten years ago, including good-quality randomized studies. More recent studies on ACD have been oriented on the association of ACD with ITV, on mechanical CPR with LUCAS or constant flow insufflation of oxygen. Unfortunately, most of these recent studies have been excluded because extraction of data of sub-groups to analyze ACD effect on survival is difficult or impossible.

In the prehospital settings, the best study supporting the hypothesis that ACD improves survival of OHCA is coming from France (Plaisance 1997, 595, 1999, 569, 750 patients). This study is classified “level 2 good quality” according to the randomization based on alternate days. A small but significant benefit was observed in early survival. The positive effect on one-year survival is based on 17 survivors only, including 11 asystolic or with pulseless activity patients. The other supportive studies are less contributive: Lurie 1994, 1405 and He 2003, 292, are studies with a limited number of patients and a positive effect on early survival. Positive effect coming from subgroups extracted of studies oriented to another therapeutic intervention such as Gueugniaud 1998, 1595 must be, indeed, considered with caution. Oppositely, evidence in favor of a neutral effect are strong: 4 level 1 good quality (Stiell 1996, 1417, 1011 patients, Mauer, 125, 1996, 220 patients, Goralski 1998, 543, 150 patients, Skogvoll 1999, 163, 306 patients) and 3 level 2 good quality studies have been published. Four others studies of lower scientific quality are also neutral.

A recent meta-analysis of the Cochrane review group based only on good-quality RCT (Lafuente –Lafuente 2004-2009) using extraction of data confirms the neutral effect of ACD on survival. Interestingly, there is no negative study providing evidence of a deleterious effect of ACD on survival or on traumatic complications. A negative effect of ACD on neurological outcome has been discussed in several neutral studies; however, the data published on long-term survival are too rare to reach a definitive conclusion. The organization of the prehospital care system has been discussed and proposed to explain the positive results of Plaisance: good-quality ACD CPR by firefighters associated with ACLS by physicians. Cochrane review (Lafuente –Lafuente, 2004-2009) observed that the presence of a physician on scene does not modify the neutral effect on survival.

For IHCA in 3 published studies, 1 large-scale neutral (Stiell 1996, 1417, 773 patients) and found no difference in ROSC, one-hour survival, or survival to hospital discharge; two small fair study (Cohen 1993, 1918, Tucker 1994, 201) have positive on ROSC and one of these studies (Cohen, 1993, 1918) has included many end-of-life patients with major coexisting diseases.

Consequently, ACD CPR is not associated with a clear benefit on survival. However, ACD is not proven to be detrimental, and may be used by trained personnel or for research protocols in association with other intervention such as ITV.

**Citation List**


Retrospective analysis of multiple institution cases

LOE 4, Fair, neutral


Study on CFIO in France, a group of patients is treated with ACD. Sub group comparison of the control group MMV STD CPR and the control group MMV ACD CPR showed no difference in outcome.

LOE 5, Fair, Neutral


Very small study but positive. In the in hospital study patients in end of life were included

LOE 2 Fair Supportive
Goralski M., Villégé J.L., Cami G., Linassier P et Al
Evaluation of active compression-decompression cardiopulmonary resuscitation in out-of-hospital cardiac arrest
Reanimation Urgences 1998 7:5 (S43-550)

Study published in French only, SAMU system with physician, good quality randomization
LOE 1 Fair Neutral


About 30% of the patient included I the study received ACD CPR, in the SDT dose of epinephrine an increase of the survival (ROSC, admission to the hospital) was observed as compared to STD CPR STD EPI
LOE 5, Good, Supportive


Study in china, abstract only
LOE 2, Fair, Supportive


Experimental study on a pig model with analysis of survival better result with ACD in one group
LOE 5, Fair, Neutral


LOE 1 Fair Neutral


Randomization discussed, very small study neutral, physician on scene.
LOE 2 Fair, Supportive


Study stopped prematurely by FDA, statistically significant benefit in witnessed arrests subgroup, randomization not adequate
LOE 2 Fair, Supportive


Good quality randomization, prehospital system with physician
LOE 1, Fair, Neutral


The original study was a 3 site study, 1 site withdrew, randomization discussed, paramedics system only
LOE 2, Fair, Neutral


Retrospective study with non significant positive result for ROSC and negative for other parameter
LOE 3 Fair Neutral


LOE 2, Good, Supportive

**LOE 2 Good Supportive**


Study in 2 different cities with different EMS system, good quality randomization non adequate

**LOE 2 Fair Neutral**


**LOE1, Fair , neutral. Randomized study , but only monocentric**


Study in and out of the hospital , good quality randomization , paramedics in prehospital settings

**LOE1, Good, Neutral**


**LOE 2 Fair supportive**
Studies related to ACD – CPR and not included in the review:


  Study not included: experimental mechanical protocol on ACD forces on cadavers


  Study not included: Study on VF incidence after ACD CPR by the first tier. Study stopped for safety reasons related to mechanical trauma. Autopsy analysis of patients after receiving STD CPR and ACD CPR. More CPR related injuries in the ACD CPR group.


  Study not included: Doppler study in end of life patients


  Study not included: experimental study on dogs only, hemodynamic data only no survival analysis


  Study not included: experimental hemodynamic study comparison ITC ACD CPR


  Study not included: experimental study no analysis of outcome


  Study not included: experimental hemodynamic study comparison ITC ACD CPR


  Study not included: Analysis of ETCO2 and CPP in 21 patients with sequential performance of ACD CPR and STD CPR


  Study excluded because it is a partial meta analysis performed in 1999. A more recent meta analysis performed by the Cochrane group using the same data extracted from the same randomized studies with a better methodology is included in the review.


  Study excluded: Alternative CPR methods, ETCO2 analysis, improvement during ACD CPR period as compared STD CPR period in the same patients no outcome analysis


  Study not included: Study on the mechanism of blood flow during ACD CPR

Study not included: experimental study on pigs, comparison of ACD and ACD + IPPV no analysis of outcome


Study not included: autopsy analysis of patients after receiving STD CPR and ACD CPR (+ STD CPR) No direct relationship with outcome


Study not included: Comparison of ACD-CPR associated with ITV and STD CPR and hypothermia. No data on outcome of ACD CPR alone


Study not included: VF induced in cath lab no survival analysis


Study not included: no analysis of outcome, work of the rescuers


Study not included: hemodynamic data only no analysis of outcome


Study not included: Study on the mechanism of blood flow during ACD CPR


Study not included: Analysis of the ventilation effect of ACD CPR no outcome data


Study not included: lab test of a mechanical device for CPR