Active compression–decompression CPR for cardiac arrest did not improve survival or neurologic outcomes


Objective
To compare the effectiveness of active compression–decompression (ACD) cardiopulmonary resuscitation (CPR) with standard CPR on the survival and neurologic outcomes for in-hospital and prehospital patients with cardiac arrest.

Design
Randomized controlled trial with follow-up to hospital discharge.

Setting
5 tertiary-care hospitals and any location where cardiac arrest occurred outside the hospitals in 2 mid-sized cities in Ontario, Canada.

Patients
1784 patients (mean age 68 y, 60% men) who had cardiac arrest and required chest compression during resuscitation. Patients were excluded if they were age < 16 years; were terminally ill; went without basic CPR for > 15 minutes; had acute trauma or exsanguination; had recent sternotomy; had a cardiac arrest in the operating, recovery, or delivery room; or had received inappropriate CPR.

Intervention
ACD involves a suction device that allows the rescuer to decompress the patient's chest between compressions. In the hospital, 368 patients were allocated to standard CPR and 405 patients to ACD CPR. Outside the hospital (prehospital), 510 patients were allocated to standard CPR and 501 patients to ACD CPR.

Main outcome measures
Survival for 1 hour from the time CPR was discontinued and survival to hospital discharge, at which time neurologic status was assessed using a modified Mini-Mental State Examination (MMSE).

Main results
For in-hospital patients, no differences existed between the ACD CPR and standard CPR groups for 1-hour survival (34.6% vs 35.1%, P = 0.89; absolute difference 0.5%, 95% CI -6.4% to 7.4%), survival to hospital discharge (10.4% vs 11.4%, P = 0.64; absolute difference 1.0%, CI -3.5% to 5.6%) or in the median MMSE score of survivors (37 in both groups). For prehospital patients, no differences existed between the ACD CPR and standard CPR groups for 1-hour survival (18.2% vs 16.5%, P = 0.48; absolute difference 1.7, CI -3.1 to 6.5), survival to hospital discharge (4.6% vs 3.7%, P = 0.49; absolute difference 0.9, CI -1.7 to 3.4), or in the median MMSE score of survivors (35 in both groups). For the in-hospital and prehospital strata, the study had 80% power to detect a 10% difference in 1-hour survival.

Conclusion
Active compression–decompression cardiopulmonary resuscitation did not improve survival or neurologic outcomes for in-hospital or prehospital patients with cardiac arrest.

Sources of funding: Ontario Ministry of Health and Ambu International, Denmark.

For article reprint: Dr. I.G. Stiell, Clinical Epidemiology Unit, Loeb Medical Research Institute, Ottawa Civic Hospital, 1053 Carling Avenue, Ottawa, Ontario K1Y 4E9, Canada. FAX 613-761-5351.


Commentary
Experimental research in animal models and hemodynamic studies in humans have suggested that ACD may be of benefit in CPR. ACD allows the rescuer to actively decompress the chest during the upstroke of CPR, theoretically increasing venous return to the heart and improving ventricular filling, stroke volume, and myocardial and cerebral blood flow. Small trials in humans have shown improved short-term outcomes and modest improvements in long-term survival, but none reached statistical significance (1, 2).

The large, well-designed randomized trial by Stiell and colleagues found no significant difference between ACD CPR and standard CPR in survival to hospital discharge or in neurologic outcomes in in-hospital or prehospital settings. The authors also did several subgroup analyses but could not identify any group of patients in which ACD CPR was superior to standard CPR.

This investigation is much larger than previous studies, which makes it unlikely that insufficient power explains the findings. As the authors point out, animal models of ACD may not accurately represent the physiology of elderly and chronically ill humans. Also, short-term hemodynamic improvements noted at the bedside may not necessarily translate into prolonged survival. Although ACD CPR did not cause a worse outcome than standard CPR, it is worrisome that rescuers reported that ACD CPR was difficult to do in 18% of patients. Future research may find a role for this device, but ACD CPR cannot be recommended for routine use at this time.

CPR has changed little since its introduction in 1960. It appears that benefits gained from a change in technique will be marginal. Currently, the best ways to improve CPR survival rates are to deliver defibrillation as quickly as possible and to identify sick and counsel patients for whom CPR would not be beneficial (3).

Kenneth A. Ballew, MD, MS
University of Virginia
Charlottesville, Virginia, USA

References