



Standard cardiopulmonary resuscitation versus active compression-decompression cardiopulmonary resuscitation with augmentation of negative intrathoracic pressure for out-of-hospital cardiac arrest: a randomised trial

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Summary

Background

Active compression-decompression cardiopulmonary resuscitation (CPR) with decreased intrathoracic pressure in the decompression phase can lead to improved haemodynamics compared with standard CPR. We aimed to assess effectiveness and safety of this intervention on survival with favourable neurological function after out-of-hospital cardiac arrest.

Methods

In our randomised trial of 46 emergency medical service agencies (serving 2·3 million people) in urban, suburban, and rural areas of the USA, we assessed outcomes for patients with out-of-hospital cardiac arrest according to Utstein guidelines. We provisionally enrolled patients to receive standard CPR or active compression-decompression CPR with augmented negative intrathoracic pressure (via an impedance-threshold device) with a computer-generated block randomisation weekly schedule in a one-to-one ratio. Adults (presumed age or age ≥ 18 years) who had a non-traumatic arrest of presumed cardiac cause and met initial and final selection criteria received designated CPR and were included in the final analyses. The primary endpoint was survival to hospital discharge with favourable neurological function (modified Rankin scale score of ≤ 3). All investigators apart from initial rescuers were masked to treatment group assignment. This trial is registered with ClinicalTrials.gov, number [NCT00189423](#).

Findings

2470 provisionally enrolled patients were randomly allocated to treatment groups. 813 (68%) of 1201 patients assigned to the standard CPR group (controls) and 840 (66%) of 1269 assigned to intervention CPR received designated CPR and were included in the final analyses. 47 (6%) of 813 controls survived to hospital discharge with favourable neurological function compared with 75 (9%) of 840 patients in the intervention group (odds ratio 1·58, 95% CI 1·07—2·36; $p=0\cdot019$). 74 (9%) of 840 patients survived to 1 year in the intervention group compared with 48 (6%) of 813 controls ($p=0\cdot03$), with equivalent cognitive skills, disability ratings, and emotional-psychological statuses in both groups. The overall major adverse event rate did not differ between groups, but more patients had pulmonary oedema in the intervention group (94 [11%] of 840) than did controls (62 [7%] of 813; $p=0\cdot015$).

Interpretation

On the basis of our findings showing increased effectiveness and generalisability of the study intervention, active compression-decompression CPR with augmentation of negative intrathoracic pressure should be considered as an alternative to standard CPR to increase long-term survival after cardiac arrest.

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