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Short paper

Cardiac Arrest Bundle of cARE Trial (CABARET) survey of current UK neuroprotective CPR practice

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Abstract

Despite low out of hospital cardiac arrest (OOHCA) survival rates within the UK, animal studies hint at improved cerebral blood flow via a bundled neuroprotective CPR approach. The CABARET study introduces three key devices: the Head Up Position (HUP), Active Compression/Decompression (ACD) CPR, and the Impedance Threshold Device (ITD). A survey involving 27 UK pre-hospital critical care services indicated none are using these interventions widely, either alone or bundled. The CABARET team is now initiating a pilot study to investigate the feasibility of this CPR bundle, aiming to fill the prevailing evidence void in resuscitation research.

Keywords: Head Up CPR (HUP), Impedance Threshold Device (ITD), Active compression/decompression CPR (ACE), Neuroprotective CPR

Despite continued efforts across the spectrum of resuscitation survival from out of hospital cardiac arrest in the UK remains extremely poor.^{1,2} Published animal data has created a plausible biological signal that improvements in blood flow to the brain are possible using a bundle approach to neuroprotective cardiopulmonary resuscitation (CPR).^{3,4} The synergistic and complementary effect of the 3 devices that make up the bundle of care in the CABARET study may lead to better organ perfusion during CPR and therefore better rates of survival. The 3 devices in question do this in different complementary ways:

- Head Up Position (HUP) - graduated elevation of the head after CPR has been initiated which improves cerebral blood flow during CPR. This has been studied predominantly in porcine models. HUP-CPR enhances venous return and reduces intracranial pressure during the decompression phase of CPR. This results in improved cerebral perfusion pressure and improves cerebral blood flow.
- Active compression/decompression (ACD) CPR uses a device with a suction cup placed on the thorax that via active decompression generates a negative intrathoracic pressure on each upward stroke, meaning that venous return to the

heart improves during each cycle of CPR, allowing more blood to then be pumped to the brain on the next compressive cycle.

- Impedance Threshold Device (ITD) which works by limiting air entry into the lungs during chest recoil between chest compressions thereby enhancing the negative intrathoracic pressure achieved by active decompression.

As far as we are aware, no randomised control trial is currently being undertaken to test this hypothesis. One study has published retrospective data with a strong signal to suggest that improved outcomes are possible using this approach.⁵ Despite the lack of good evidence application of the bundle in human subjects in cardiac arrest is already underway in certain emergency medical systems.

The planned Cardiac Arrest Bundle of CARE Trial (CABARET) study addresses the evidence gap. We sought to establish the use of any element or combination of elements of the bundle (HUP, ACD and/or ITD) within UK Pre-Hospital Critical Care. With assistance from the National HEMS Research and Audit Forum (we sent a questionnaire to all 27 UK pre-hospital critical care services asking 4 questions:

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- Q1. Does your service use an Active Compression Decompression (ACD) device?
- Q2. Does your service use an Impedance Threshold Device (ITD)?
- Q3. Does your service use head up CPR?
- Q4. Are you using two or more devices as a bundle approach?

We received 14 responses (52% response rate), all responses were negative for all four questions. In addition some of the organisations who did not respond only dispatch teams to trauma cases and do not attend cases of OOHCA.

Our survey showed that there is no widespread use of HUP, ACD and ITD either as individual elements or as a bundle within the UK. The CABARET team are currently preparing a pilot study to determine the feasibility of delivering a bundle approach to neuroprotective CPR using HUP, ACD and ITD <https://classic.clinicaltrials.gov/ct2/show/NCT05917717>.

CRediT authorship contribution statement

James Raitt: Conceptualization, Writing – review & editing. **Emma Maxwell:** Conceptualization, Writing – review & editing. **James Plumb:** Conceptualization, Writing – review & editing. **Martina Brown:** Conceptualization, Writing – review & editing. **Helen Pocock:** Conceptualization, Writing – review & editing. **Julian Hannah:** Conceptualization, Writing – review & editing. **Charles Deakin:** Conceptualization, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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