



BVM in OHCA

Key Article

- Idris AH, Ecenarro EA, Leroux B, et al. Bag-valve-mask ventilation and survival from out-of-hospital cardiac arrest: A multicenter study. *Circulation*. 2023; 148:1847-1856

Background

- More than 400,000 OHCA occur each year in the US.
- In contrast to studying and improving chest compression metrics, metrics on ventilation have not been well studied.
- It is uncertain whether the quality of ventilation or specific ventilation metrics affect patient outcomes.
- CPR alone does not generate sufficient tidal volume for gas exchange.
- Professional responders usually give some form of ventilation during CPR, usually with a BVM device.
- The tidal volume associated with a detectable chest rise is estimated to be about 300-500 ml.
- Thoracic bioimpedance recordings have been shown and validated to measure ventilation frequency during CPR.
- Thoracic bioimpedance can be captured through the defibrillator pads. During 30:2 CPR, once can assess ventilation using the impedance signal.

Objective

- Determine if incidence of bioimpedance-detected ventilation waveforms during BVM ventilation in 30:2 CPR and assess the association of detectable ventilation with outcomes in OHCA.

Method

- Secondary analysis from 6 sites that participated in the 30:2 arm of the Resuscitation Outcomes Consortium Trial of Continuous Compressions versus Standard CPR in Patients with Out-of-hospital Cardiac Arrest trial. (ROC-CCC Trial)
- Limited analysis to patients with OHCA assigned to the 30:2 arm of the study.
 - Inclusion criteria
 - Adults aged ≥ 18 years old
 - Nontraumatic cardiac arrest
 - Had defibrillator recordings with a minimum of 2 minutes of 30:2 CPR by EM providers.
 - Exclusion criteria
 - Those who received continuous chest compressions instead of the assigned 30:2 CPR.
 - Those who did not have obvious 30:2 CPR.
 - Those who had defibrillators other than LP11, LP15, or Philips MRx
- Ventilator Waveform Analysis

- Previously developed and validated criteria specifying ventilation bioimpedance waveform characteristics associated with lung inflation with BVM device.
- Determined that > 250 ml was a reasonable minimum tidal volume that can result in gas exchange.
- Threshold of 250 ml approximates the minimum amount of tidal volume needed to overcome anatomical and physiological dead space and produce meaningful gas exchange.
- Primary Outcome
 - Survival to hospital discharge
- Secondary Outcomes
 - ROSC at any time
 - Prehospital ROSC
 - ROSC on arrival to the ED
 - Survival to hospital admission
 - Survival with favorable neurologic outcome (mRS < or equal to 3)

Results

- 1,976 patients
 - Median age: 65 years
 - 66% male predominance
 - Total of 26,861 compression pauses in the 1,976 patients.
- Detectable lung inflation waveforms
 - < 50% of pauses: 60%
 - > 50% of pauses: 40%
 - More often in a public location, witnessed, bystander CPR, and initial shockable rhythm.
- Primary Outcome
 - Survival to Hospital Discharge
 - < 50% of pauses: 4.1%
 - > 50% of pauses: 13.5%
- Secondary Outcomes
 - ROSC on ED Arrival
 - < 50% of pauses: 18.7%
 - > 50% of pauses: 30.7%
 - Survival with Favorable Neurological Outcome
 - < 50% of pauses: 2.4%
 - > 50% of pauses: 10.6%

Limitations

- Defibrillator devices were from 2 manufacturers – several brands did not record bioimpedance tracings or were of poor quality.
- Excluded patients with continuous chest compressions.
- Study was a secondary analysis of a clinical trial whose purpose was not this question.
- Association between ventilation and outcomes may not represent causation.
- Characteristics about patients not known – patients with higher BMI may not have detectable ventilations from bioimpedance even if they were present.

Take Home Points

- Only 40% of patients received detectable lung inflation in more than half of pauses in CPR.
- Suggests overall poor oxygenation and ventilation during OHCA resuscitation using BVM.
- Detectable ventilations (> 250 ml) in more than 50% of CPR pauses was associated with increased ROSC rates, increased survival to hospital DC, and increased survival with favorable neurologic outcome.