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Letter to the Editor

Reply to: Importance of effective ventilation during cardiopulmonary resuscitation on outcomes of out-of-hospital cardiac arrest

We thank Dr. Oh for his important comments about our study that examined the relationship between ventilation and outcomes during standard 30:2 cardiopulmonary resuscitation (CPR) for out-of-hospital cardiac arrest.[1]

The data for our study came from the Dallas-Fort Worth (DFW) site of the Resuscitation Outcomes Consortium (ROC) and the clinical study "trial of continuous or interrupted chest compressions during CPR" (CCC).[2] In that study, patients received either continuous chest compressions with no interruption for ventilation or cycles of 30 chest compressions interrupted for two ventilations with a bag-mask device. The trial enrolled over 23,000 patients and found no overall difference in survival, which was the primary outcome.

While the clinical trial did not measure ventilation, some may assume that patients in the 30:2 group received more ventilation than the group that had continuous chest compressions with bag-mask ventilation. Our study found that we should not assume anything about ventilation and that it must be measured to know whether ventilation attempts actually result in lung inflation. We found that the majority of ventilation attempts did not produce lung inflation in the 30:2 group.

Many defibrillators that emergency medical services (EMS) use record thoracic bioimpedance continuously as soon as the chest pads are applied. We had access to electronic defibrillator files that were recorded from patients enrolled in the CCC study at the DFW ROC site. After two years spent developing the methodology to identify bioimpedance ventilation waveforms,[3] we applied this to measure ventilation (lung inflation) in the 30:2 group to determine if ventilation affected outcomes. We found that patients who received more ventilation had improved outcomes compared with the group that received less ventilation. In the group that received less ventilation, the median (IQR) chest compression fraction (CCF) was 76% (67, 82), while in the group that received more ventilation it was 74% (63, 80) ($p = 0.14$).

Dr. Oh makes an important point about seemingly paradoxical results of CCF in some studies. One of the first ROC studies on CCF showed that survival was proportional to CCF.[4] However, other studies, including a later ROC study, showed worse outcomes with increasing CCF.[5,6] These studies did not measure ventilation and Dr. Oh suggests the possibility that differences in ventilation may have affected outcomes. He further suggests that we might be able to explore that question with data from our study.

Very few cases in our dataset had a CCF less than 60%. In order for an EMS agency to participate in the ROC CCC study, they had to meet minimum quality standards for performance of chest compressions during the run-in phase. One of the qualifications was a CCF of at least 60% in at least 80% of cases. Thus, we are unable to answer his question from the study dataset. We thank Dr. Oh for bringing this question to our attention. We agree that ventilation during CPR may be an important outcome-modifying factor. We think that future studies that address questions about the quality of CPR should include measurement of ventilations.

Conflict of interests

None.

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