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Single rescuer cardiopulmonary resuscitation: Can anyone perform to the guidelines 2000 recommendations?☆

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Summary
Background: The Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care recommend that for adult cardiac arrest the single rescuer performs ''two quick breaths followed by 15 chest compressions.'' This cycle is continued until additional help arrives. Previous studies have shown that lay persons and medical students take 16 ± 1 and 14 ± 1 s, respectively, to perform these ''two quick breaths.'' The purpose of this study was to determine the time required for trained professional paramedic firefighters to deliver these two breaths and the effects that any increase in the time it takes to perform rescue breathing would have on the number of chest compressions delivered during single rescuer BLS CPR. We hypothesized that trained professional rescuers would also take substantially longer then the Guidelines recommendation for delivering the two rescue breaths before every 15 compressions during simulated single rescuer BLS CPR.
Methods: Twenty-four paramedic firefighters currently certified to perform BLS CPR were evaluated for their ability to deliver the two recommended breaths within 4 s according to the AHA 2000 CPR Guidelines. Alternatively, a simplified technique of continuous chest compression BLS CPR (CCC) was also taught and compared with standard BLS CPR (STD). Without revealing the purpose of the study the paramedics were asked to perform single rescuer BLS CPR on a recording Resusci Anne® while being videotaped.
Results: The mean length of time needed to provide the ''two quick breaths'' during STD-CPR was 10 ± 1 s. The mean number of chest compressions/min delivered with AHA BLS CPR was only 44 ± 2. Continuous chest compression CPR resulted in 88 ± 5 compressions delivered per minute (STD versus CCC; $p < 0.0001$).

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Conclusions: Trained professional emergency rescue workers perform rescue breathing somewhat faster than lay rescuers or medical students, but still require two and one half times longer than recommended. The time required to perform these breaths significantly decreases the number of chest compressions delivered per minute. This may affect outcome as experimental studies have shown that more than 80 compressions delivered per minute are necessary for survival from prolonged cardiac arrest.

Introduction

The American Heart Association Guidelines for CPR underwent major revisions in 2000 in an attempt to simplify the performance of cardiopulmonary resuscitation.[1] In spite of the recent removal of other technically difficult tasks for lay rescuers (i.e. pulse check), these Guidelines continued to advocate that the single lay rescuer perform two mouth-to-mouth breaths before each 15 chest compressions. This results in frequent interruptions of chest compressions. Chest compressions performed according to AHA Guidelines are delivered at a rate of 100 min^{-1} resulting in an elapsed time of 9 s for each set of 15. Studies in animals by Yu et al. suggest that survival from cardiac arrest improves considerably when the victim receives a minimum of 80 chest compressions in each minute of CPR.[2] To reach this goal while performing single rescuer CPR according to AHA guidelines the rescuer must pause for less than 4 s to deliver two rescue breaths. In 2000, Assar et al. showed that lay people performing single rescuer CPR take an average of 16 ± 1 s for the recommended two breaths.[3] These pauses resulted in the arrested subject receiving life saving compressions less than half of the time. Kern et al. have shown a significant improvement in survival with uninterrupted chest compression CPR (UCC-CPR) compared with standard CPR (STD-CPR) following prolonged cardiac arrest in a swine model when 16 s of chest compression interruption was used for two ventilations.[4] These findings are supported by the observations of other institutions that frequent and prolonged interruption of chest compressions for rescue breathing during single rescuer CPR are detrimental.[2,5] We have shown previously that healthy, enthusiastic medical students perform no better than lay rescuers, taking an average of 14 s to perform the recommended two breaths.[6] The question is whether trained, professional paramedic firefighters take as long to perform single rescuer assisted ventilations when compared to the lay public. As these experienced, professional rescuers may be considered the ''gold standard'' of CPR providers, it is reasonable to expect that their performance represents the most successful application of the AHA guidelines for CPR. If the provision of the recommended two breaths proved to take as long by trained professionals, it is unreasonable to expect that any single rescuer could perform successfully such tasks.

Materials and methods

Certified paramedic firefighters from the Tucson Fire Department were recruited through correspondence with the University of Arizona Sarver Heart Center to participate in a study evaluating a ''new method of CPR.'' No incentive was offered for participation in the study. However, participants were allowed to review their performance and received constructive feedback following their successful completion of the study. All subjects had received training in AHA CPR within the past 2 years according to the guidelines for recertification of healthcare professionals. No instruction was provided regarding the correct performance of AHA single rescuer CPR. Prior to testing, a second method of resuscitation was taught by the authors. This method, uninterrupted chest compression CPR (UCC-CPR), was explained to have only three steps. The first was to attempt to arouse the victim, the second was to activate the EMS system, and the third was to aim for the center of the chest and begin chest compressions until help arrived (or instructed to stop). No demonstration was provided and the subjects were not allowed to practice either technique prior to testing. The additional training in UCC-CPR took no more than 10 min.

Without revealing the purpose of the study the paramedics were asked to perform single rescuer BLS CPR on a recording Resusci Anne® while being videotaped. The 24 participating firefighter paramedics were asked to demonstrate both STD-CPR and UCC-CPR on recording Resusci Anne manikins (Laerdal, Wappingers Falls, NY). The method tested first was randomly assigned to control for order effects. Observations of resuscitation simulations were recorded using both video and Recording Resusci Anne manikins. The full record-