Cardiopulmonary Resuscitation Training for a Layperson Through Conventional Instructor-led Training and a Self-learning Program Using the CPR Anytime Kit

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Purpose: We aimed to investigate whether a trained layperson could perform high quality Cardiopulmonary Resuscitation (CPR) after conventional training and a self-learning program using the “CPR Anytime” kit.

Methods: Traditional CPR training for a lay rescuer was conducted two weeks before a CPR contest for high school students. “CPR Anytime” training kits were distributed to the students for their practical training at home or in school. The students were tested in pairs for two-person CPR with rescuer breaths and an automated external defibrillator. The quantitative and qualitative data regarding the quality of CPR, including chest compression and rescuer breaths, were collected using a standardized checklist and a skill reporter.

Results: A total of 161 teams with 322 students, including 116 males and 206 females, participated in the CPR contest in pairs. The mean depth and rate for the chest compression were 49.0 ± 8.2 mm and 110.2 ± 10.2 /min, respectively. The mean tidal volume for the rescue breaths was 604.8 ± 208.7 ml. The percentage of participants satisfying the correct chest compression rate of ≥100/min and depth of ≥50 mm was 87.3% and 52.2%, respectively. Only 25.2% of the participants satisfied an optimal tidal volume (between 500 ml and 600 ml). Shallow compression (57.5%) and under-ventilation (44.4%) were the major causes of incorrect compression and ventilation, respectively.

Conclusion: The quality of CPR with rescuer breaths in the trained lay rescuer was not adequate, especially for mouth-to-mouth rescue breathing. Therefore, the development of teaching methods to improve rescue breathing or omit mouth-to-mouth ventilation in training should be considered.

Key Words: Cardiopulmonary Resuscitation, Basic Cardiac Life Support, Mouth-to-Mouth Resuscitation, Education

Introduction

Survival after out-of-hospital cardiac arrest (OHCA) is dependent on the “chain of survival” and the quality of pre-hospital resuscitation is important to achieve return-of-spontaneous circulation (ROSC). The quality of chest compressions and defibrillation are the cornerstones of cardiopulmonary resuscitation (CPR), improving the outcome of cardiac arrest1).

However, the quality of unprompted CPR during both in-hospital and out-of-hospital cardiac arrest events is often poor even when performed by trained laypersons or healthcare providers2-5). The American Heart Association (AHA) and European Resuscitation Council (ERC) 2010 guidelines for Basic Life Support (BLS) increased focus on methods to ensure that high-quality CPR is performed6,7).

In the AHA and ERC 2010 guidelines for BLS, if a bystander is trained in CPR and able to perform rescue breaths, the bystander should add rescue breaths at a ratio of 30 compressions to 2 breaths. However, the quality of CPR in such trained lay rescuers has been questioned.

We aimed to investigate whether the trained layperson can perform high quality CPR after conventional instructor-led training and self-learning programs using the CPR Anytime kit for 2 weeks.

Materials and Methods

This retrospective study had the primary objective of
evaluating the CPR quality after conventional instructor-led training for a lay rescuer and unsupervised learning using the CPR Anytime kit for 2 weeks. This study used the data from a CPR contest for high school students held in 2011. The National Emergency Medical Center in Korea holds a CPR contest for high school students to alert them to the importance of bystander CPR every year. The contest was supported by the Ministry of Health and Welfare and the National Medical Center. High school students were recruited to participate in the contest via an official document to high schools across the country in July. All participants were lay people without previous CPR training. A total of 322 students from 98 schools were recruited. The participants went through preliminary rounds of the contest in regional emergency medical information centers during August and September. Awards and prize money were given to the winners. The study protocol was approved by the Institutional Review Board of Seoul National University Bundang Hospital.

1. BLS training before the CPR contest

Conventional CPR training for lay rescuers was conducted 2 weeks prior to the contest. The training courses were conducted by AHA-certified instructors based on the AHA and ERC 2010 guidelines for Basic Life Support (BLS). The CPR training course consisted of a 1-hour lecture on the basic concepts of resuscitation and hands-on practice using manikins (Resusci Anne SkillGuide, Laerdal Medical, Stavanger, Norway) for 2 hours. Adult BLS with an automated external defibrillator (AED) and rescue breathing was taught in the CPR training course for the contest. Each training course was conducted in small groups, in which the student to instructor ratio did not exceed 6:1, and the student to manikin ratio did not exceed 3:1. CPR Anytime® training kits (Laerdal Medical, Stavanger, Norway) were distributed to the respective students for their practical training for 2 weeks prior to the skills testing date. The kit consisted of a poly-bagged Mini Anne® CPR personal manikin, an instructional Digital Versatile Disc (DVD), a Mini Anne® replacement lung, and a CPR Anytime® Skills Reminder Card. The participants were asked to complete the self-training by themselves on their own time.

2. Skill assessment and data collection

In the contest, The students conducted conventional 2-person CPR with rescuer breaths and used the AED in pairs. One participant performed 5 cycles of chest compressions, and the other participant conducted mouth to mouth rescue breathing using a face shield attaching and using an AED. After an assessment of 5 cycles of chest compressions, they switched their roles. Three AHA basic life support instructors conducted a skill performance test using a standardized check list and a skill reporter. The total score of the skill performance test (100 points) was calculated by adding both a standardized check list (50 points) and a skill reporter (50 points). We evaluated the students’ CPR skills including their initial assessment, call for emergency responders, chest compressions, ventilations and use of the AED. The quantitative and qualitative data about the quality of the CPR including the chest compressions and rescuer breaths were collected automatically with the Resusci® Anne Skill Reporter (Laerdal Medical). The data for incorrect CPR performances were also counted by the skill reporter during the 5 cycles of CPR. Hands-off time was measured by a stopwatch and the participants received points according to the hands-off seconds (5 points for ≤6 seconds, 4 points for between 6 and 8 seconds, 3 points for between 8 and 10 seconds, 2 points for between 10 and 12 seconds, and 1 point for >12 seconds). The points were totaled and included in the stan-

<table>
<thead>
<tr>
<th>Variables</th>
<th>Results (Mean ± SD)</th>
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</thead>
<tbody>
<tr>
<td>Mean compression depth (mm)</td>
<td>49.0±8.2</td>
</tr>
<tr>
<td>Mean compression rate (rate min⁻¹)</td>
<td>110.2±10.2</td>
</tr>
<tr>
<td>Mean number of chest compressions delivered per minute</td>
<td>74.9±8.3</td>
</tr>
<tr>
<td>Mean tidal volume (ml)</td>
<td>604.8±208.7</td>
</tr>
<tr>
<td>Hands-off time (points)</td>
<td>4.3±0.7</td>
</tr>
</tbody>
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CPR: Digital Versatile Disc, SD: Standard Deviation, CPR: cardiopulmonary resuscitation