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Simulation and education

Effectiveness of simplified chest compression-only CPR training program with or without preparatory self-learning video: A randomized controlled trial☆

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ABSTRACT

Objectives: To evaluate the effectiveness of 1-h practical chest compression-only cardiopulmonary resuscitation (CPR) training with or without a preparatory self-learning video.
Methods: Participants were randomly assigned to either a control group or a video group who received a self-learning video before attending the 1-h chest compression-only CPR training program. The primary outcome measure was the total number of chest compressions during a 2-min test period.
Results: 214 participants were enrolled, 183 of whom completed this study. In a simulation test just before practical training began, 88 (92.6%) of the video group attempted chest compressions, while only 58 (64.4%) of the control group ($p < 0.001$) did so. The total number of chest compressions was significantly greater in the video group than in the control group (100.5 ± 61.5 versus 74.4 ± 55.5, $p = 0.012$). The proportion of those who attempted to use an automated external defibrillator (AED) was significantly greater in the video group (74.7% versus 28.7%, $p < 0.001$). After the 1-h practical training, the number of total chest compressions markedly increased regardless of the type of CPR training program and inter-group differences had almost disappeared (161.0 ± 31.8 in the video group and 159.0 ± 35.7 in the control group, $p = 0.628$).
Conclusions: 1-h chest compression-only CPR training makes it possible for the general public to perform satisfactory chest compressions. Although a self-learning video encouraged people to perform CPR, their performance levels were not sufficient, confirming that practical training as well is essential. (UMIN000001046).

1. Introduction

Sudden cardiac arrest is one of the leading causes of death both in Japan and other industrialized countries.[1–3] Over the years, though the survival rate for out-of-hospital cardiac arrest (OHCA) has been increasing, it is still low.[4–6]

It is widely accepted that successful resuscitation after OHCA depends on the prompt initiation of cardiopulmonary resuscitation (CPR) and defibrillation.[1,6,7] Despite the proven effectiveness of bystander CPR and the extensive efforts mounted to train the general public, the proportion of bystander CPR remains at approximately 20–30%.[2–6,8] Difficulties in learning and performing this complex psychomotor task, the fear of causing harm, and an aversion to mouth-to-mouth resuscitation are among the reasons given for this low rate of bystander CPR.[9–12] The lengthy instruction period required for the standard training program as well as the considerable expense of providing manikins and instructors are also cited as factors that inhibit the wider dissemination of CPR training.[13–15]

Several clinical studies have demonstrated the effectiveness of bystander-initiated chest compression-only CPR.[16–21] Our population-based observations have also indicated that chest compression-only resuscitation was similarly effective compared with conventional CPR for most OHCA cases.[3] Chest compression-only CPR is so simple that it could make general public perform effective chest compressions, even when the training program is short.[10,22]

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Recently, various types of CPR training programs have been developed and reported to be effective.[23] In terms of skill retention, it was shown that video-based self-instruction programs with a manikin were no less effective than instructor-based training.[24] Video learning has the advantage of allowing people to learn anytime, anywhere, and at any pace.[25] This study aimed to evaluate the effectiveness of 1-h practical chest compression-only CPR training with or without a preparatory self-learning video.

2. Methods

2.1. Study design

This study was designed as an open prospective individual randomized controlled trial. The study started in August 2006 and ended in December 2006.

2.2. Participant recruitment and randomization

People between 18 and 70 years of age were recruited in Suita City, Osaka, via local billboards and advertisements as well as by word of mouth from the current participants. Health care professionals, medical/co-medical students and those whom the program director considered unsuitable for resuscitation training were excluded.

Participants were randomly assigned to either the video group or the control group with stratification by sex and age (age < 40 or ≥40 years) using permuted blocks. The allocation results were concealed from all instructors until the day of training.

2.3. Interventions

The 1-h chest compression-only CPR training consisting of chest compressions and an AED operation (Table 1) was carried out using the on-site digital video disk instructional material originally produced for this study, along with Laerdal Resusci Anne CPR manikins®, and an AED trainer (Laerdal Medical, Stavanger, Norway). The video group members were provided with a 7-min self-learning video one week before attending the CPR training program and were recommended to learn the CPR procedures in advance. The self-learning video was produced by the Japanese Population-based Utstein-style Study with Basic and Advanced Life Support Education (J-PULSE) group in 2006, and was comprised of three parts: introduction (1 min), chest compression-only CPR for adults (2 min and 30 s), and use of an AED (3 min and 30 s) (Table 1). The control group members attended the CPR training program without access to that 7-min self-learning video. A total of twenty physicians, nurses and emergency medical technicians, all of whom were instructors of the Immediate Cardiac Life Support (ICLS) course certified by the Japanese Association for Acute Medicine (JAAM)[26] and specifically trained for this study to keep the quality of this training program, instructed the attendees with the instructor/participant ratio of 1:4.

Table 1
Outline of chest compression-only resuscitation training program and 7-min self-learning video.

Contents	Time (min)
Training program	
Part 1. Introduction	
Awareness of need for CPR	5:00
Part 2. Adults CPR	
1. Emergency call and recognition of cardiac arrest (check response/activates EMS system/check normal breathing)	8:00
2. Chest compressions	8:00
Part 3. AED	
1. Overview of AED	3:00
2. Step for using AED	12:00
Part 4. Practice	
Simulation	24:00
Total	60:00
7-min self-learning video program	
Part 1. Introduction	1:00
Awareness of need for CPR	
Part 2. Chest compression-only resuscitation for adults	2:30
1. Emergency call	
2. Recognition of cardiac arrest	
3. Chest compressions	
Part 3. Usage of AED	3:30
1. Overview of AED	
2. Steps for using AED	
3. Special situations	
Total	7:00

2.4. Data collection and outcomes

Using a case-based scenario, resuscitation skills were evaluated before and immediately after the training period. In this test, a participant was called individually into the testing room and told; "Imagine you are at a department store. Suddenly a man collapses in front of you. You are the only person around. Do whatever you can do to help this man." After presentation of the scenario, we evaluated their CPR skills including initial assessment, call for 119 (the emergency call number in Japan), call for an AED, and chest compressions for 2 min using the Laerdal Resusci Anne PC skill reporting manikin system®. After the 2-min CPR evaluation, AED was brought to the manikin by the instructor and participants were encouraged to use it.

The primary outcome measure was the total number of chest compressions during the 2-min test period. The secondary outcome measures included calls for 119 and AED, a chest compression attempt, number of appropriate chest compressions, time to the first chest compression, time without chest compressions, AED operation attempt, correct positioning of defibrillator pads, clearing the area and assuring safety of the victim, and time to the first defibrillation. An appropriate chest compression was defined as one with a depth of 3.5–5.5 cm, using the correct hand position, and completely recoiling according to the Japanese CPR guideline.[27]

2.5. Statistical methods

The sample size was calculated based on the total number of chest compressions performed during 1-min CPR by a medical student,[10] assuming it to be 50 times in the video group and 40 times in the control group. Under the conditions of an alpha error of 5% and a power of 80%, 64 subjects per group were needed. Projecting an almost 10% dropout, the appropriate sample size was estimated to be 150 subjects in total.

Analyses were performed on an intention-to-treat basis, but participants who were absent from the post-training evaluation were not included in the analyses. The data were compared across groups using chi-square test or Fisher's exact test for categorical variables and Student's *t*-test for continuous variables. An analysis of covariance was conducted to adjust for allocated factors, sex and age for primary outcome. Resuscitation skills before and after the training were compared using McNemar's test for categorical variables and paired *t*-test for continuous variables. Analyses were performed using SPSS Ver.12 (SPSS, Inc., Chicago, IL). A two-tailed value of $p < 0.05$ was considered statistically significant.