Resuscitation 83 (2012) 494–499

Contents lists available at SciVerse ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Simulation and education

Video analysis of dispatcher–rescuer teamwork–Effects on CPR technique and performance☆

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ARTICLE INFO

Article history:
Received 1 June 2011
Received in revised form 29 August 2011
Accepted 22 September 2011

Keywords:
Elderly
Chest compression
Ventilation
Simulation
Dispatcher
Communication

ABSTRACT

Objective: We wanted to study the effect of continuous dispatcher communication on CPR technique and performance during 10 min of simulated cardiac arrest.

Method: We reviewed video recordings and manikin data from 30 CPR trained lay people who where left alone in a simulated cardiac arrest situation with a manikin in a home-like environment (in a small, confined kitchen with the disturbing noise of a radio).

CPR was performed for 10 min with continuous telephone instructions via speaker function from a dispatcher. The dispatcher was blinded for CPR performance and video.

Dispatcher communication, compression technique and ventilation technique was scored as accomplished or failed in the 1st and 10th minute.

Results: 29/30 rescuers were able to hear instructions, answer questions from the dispatcher and perform CPR in parallel. Rescuer position beside manikin was initially correct for 13/30, improving to 21/30 ($p = 0.008$). Compression technique was adequate for the whole episode, with an insignificant trend for improvement; 29 to 30/30 using straight arms, 28 to 30/30 in a vertical position over chest and 24 to 27/30 counting loudly. 17/29 placed their hands between the nipples initially, improving to 24/29 ($p = 0.065$). Mean compression rate improved from 84 to 101 min^{-1} ($p < 0.001$), and compression depth maintained adequate (43 to 42 mm). Initially, 17/29 used chin-lift manoeuvre, 14/30 used head-tilt and 19/29 used nose pinch to manage open airways, compared to 18, 20 and 22/29 (ns) in the 10th minute, respectively. Successful delivery of ventilation improved from 13/30 to 23/30 ($p = 0.006$).

Conclusion: Bystander and dispatcher can communicate successfully during ongoing CPR using a telephone with speaker function. CPR technique and quality improved or did not change over 10 min with continuous dispatcher assistance. These results suggest a potential for improved bystander CPR using rescuer–dispatcher teamwork.

1. Background

Sudden, unexpected out-of-hospital cardiac arrest affects 50–60 per 100,000 inhabitants per year in industrialized countries.[1,2] Early initiation of bystander cardiopulmonary resuscitation (CPR) more than doubles the chances of survival[3,4] despite poor CPR performance being reported in many manikin studies.[5,6]

The most likely witness to a cardiac arrest victim is a family member of the same age group. Studies have shown that 60–80% of cardiac arrests occur in a home and that bystander and victim are known to each other in more than 90% of these situations.[7,8]

Guidelines[8] recommend change in rescuers every 2 min, when feasible, to prevent rescuer fatigue. This recommendation is based on multiple observations of performance decay and question people's ability to perform good CPR for a prolonged period.[5,6,9] Contrary to this, Neset et al. found in 2008 that elderly lay people were capable in performing good CPR for 10 min with and without feedback in a classroom environment.[10] A follow-up simulation study with continuous dispatcher assistance over 10 min and increased realism confirmed these findings.[11]

☆ A Spanish translated version of the abstract of this article appears as Appendix in the final online version at doi:10.1016/j.resuscitation.2011.09.021.

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doi:10.1016/j.resuscitation.2011.09.021

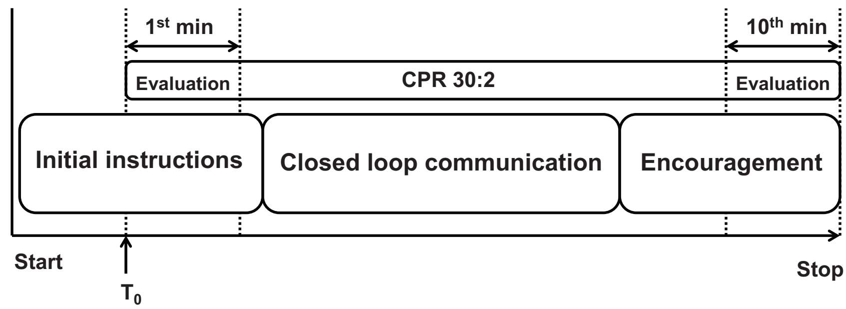

Fig. 1. Phases of continuous telephone CPR. The continuous telephone CPR was divided into three different phases, with evaluation of technique and performance in the 1st and 10th minute of CPR.

Telephone-instructed CPR by dispatchers has been shown to improve outcome and is now recommended.[8] It is possible that continuous telephone CPR, using instructions and feedback through closed loop communication can prevent performance decay.

We wanted to evaluate changes in CPR over 10 min of continuous telephone guided CPR and hypothesized that communicating with a dispatcher and performing CPR simultaneously was feasible for lay people, with no decay in CPR performance and technique.

2. Method

2.1. Study design

In this observational study, we reviewed video recordings and CPR performance in a simulated cardiac arrest in a constructed home environment. All participants were lay people with previous CPR training by video self instruction (MiniAnne without AED, Guidelines 2005 compatible, Laerdal Medical, Norway). They were invited to the test 6–9 months after training and they were asked to perform 10 min of CPR.[11] No further information was provided about the test format. Consent from all participants was obtained and the study was approved by the Regional Committee for Medical and Health Research Ethics (South-East).

Demographic information and participants' experience data were collected during interview and debriefing. Communication, CPR technique and performance was evaluated and scored for the first and last minute using a scoring template. The first chest compression, as indicated by T_0, defined the start of the 1st minute (see Fig. 1).

2.2. The test scenario

Participants were invited to the living room in a constructed apartment for an interview. The scenario started near the end of the interview, without notice to the participant. One of two researchers left the room for an adjacent kitchen. Shortly thereafter, a loud noise from falling tins was heard and the researcher left the kitchen. The other researcher then went to the kitchen, where a manikin had been placed on the floor (dressed like the first researcher), and called the emergency number. With the dispatcher on line and speaker function activated, the participant was then handed over the telephone and asked to do CPR, before left alone in the apartment. A kitchen radio was turned on quite loudly to possibly disturb communications. After 10 min of CPR the scenario ended and a debriefing followed to ensure that participants left with a positive experience.

2.3. Continuous telephone-instructed CPR

Initial CPR instructions were based on the Norwegian criteria based dispatch protocol.[12]

As the participants had been trained in CPR, they were instructed to do both compressions and ventilations with a ratio of 30:2. Following initial instructions, the dispatcher then addressed the topics of rescuer position, hand placement, chest compression technique, and ventilation technique in a closed loop communication dialogue with the participant (see Fig. 1 for an overview and Table 1 for the script). Each question was repeated until the rescuer answered. In the last few minutes of the scenario, the dispatcher focused on encouragement which included time information and positive comments. Instructions, questions and encouragement were typically delivered during each ventilation period. Three different health care professionals played the role of the dispatcher. They were in a different room and the telephone was their only source of information and communication means.

2.4. Data collection and evaluation

Audio recordings were used to evaluate communication. Communication was scored as accomplished when the dispatcher and the rescuer were able to listen and talk to each other.

One camera in the roof above the manikin and one camera on a tripod at the foot-end of the manikin were used to capture CPR technique. All audio and video recordings were synchronized and reviewed using Vegas Pro 9.0 (Sony Creative Software, Middleton, WI). Technique was scored as accomplished or failed, based on selected learning objectives from their last CPR training (Table 2): Chest compression technique was scored for rescuer sitting lateral to the chest, hand placement between the nipples, using straight arms, vertical position above manikin's chest, and counting loudly. Ventilation technique was scored for use of head tilt, chin lift and nose pinch for each ventilation.

The manikin was a Resusci Anne Skillreporter (Laerdal Medical, Norway) modified as described by Nysaether et al.[13] and connected to a laptop computer to record CPR performance data. Time to deliver initial instructions was extracted from audio recordings. Time between compression series and compression rate was analyzed using a custom analysis routine in MATLAB R2010a (Mathworks, Natick, MA).

2.5. Statistical analysis

The changes in proportions of accomplished/not accomplished communication and CPR technique between 1st and 10th minute were analyzed with McNemar test for paired proportions. Changes in chest compression rates were evaluated with Student's *t*-test. SPSS ver. 18 (SPSS Inc., Chicago, IL) was used for statistical analysis.

3. Results

Thirty-one lay people aged 50–75 participated in the study of whom 30 completed the tests. All were tested 6–9 months after