Resuscitation (2008) **76**, 256—260

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

MANIKIN AND SIMULATION STUDY

Role of dominant versus non-dominant hand position during uninterrupted chest compression CPR by novice rescuers: A randomized double-blind crossover study☆

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Received 13 June 2007; received in revised form 1 July 2007; accepted 11 July 2007

KEYWORDS
Cardiopulmonary resuscitation (CPR);
Chest compression;
Manikin;
Basic life support

Summary
Background: Previous research has suggested improved quality of chest compressions when the dominant hand was in contact with the sternum. However, the study was in health care professionals and during conventional chest compression-ventilation CPR. The aim of this study was to test the hypothesis, in null form, that the quality of external chest compressions (ECC) in novice rescuers during 5 min of uninterrupted chest compression CPR (UCC-CPR) is independent of the hand in contact with the sternum. Confirmation of the hypothesis would allow the use of either hand by the novice rescuers during UCC-CPR.
Methods: Fifty-nine first year public heath students participated in this randomised double-blind crossover study. After completion of a standard adult BLS course, they performed single rescuer adult UCC-CPR for 5 min on a recording Resusci Anne®. One week later they changed the hand of contact with the sternum while performing ECC. The quality of ECC was recorded by the skill meter for the dominant and non-dominant hand during 5 min ECC.
Results: The total number of correct chest compressions in the dominant hand group (DH), mean 183 ± 152, was not statistically different from the non-dominant hand group (NH), mean 152 ± 135 ($P = 0.09$). The number of ECC with inadequate depth in the DH group, mean 197 ± 174 and NH group, mean 196 ± 173 were comparable ($P = 0.1$). The incidence of ECC exceeding the recommended depth in the DH group, mean 51 ± 110 and NH group, mean 32 ± 75 were comparable ($P = 0.1$).
Conclusions: Although there is a trend to increased incidence of correct chest compressions with positioning the dominant hand in contact with the sternum, it does not reach statistical significance during UCC-CPR by the novice rescuers for 5 min.

☆ A Spanish translated version of the summary of this article appears as Appendix in the final online version at 10.1016/j.resuscitation.2007.07.032.

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doi:10.1016/j.resuscitation.2007.07.032

Introduction

Chest compression has been one of the principal elements of circulatory support during cardiopulmonary resuscitation (CPR) for more than 40 years.[1] To date, the early performance of adequate chest compressions is a standard of care that is considered to provide the optimal outcome in cardiopulmonary arrest.[2]

They are especially important if the first shock is delivered more than 5 min after collapse.[3,4] Several components of chest compressions can alter its effectiveness: hand position, position of the rescuer, position of the victim, depth and rate of compression, decompression, and duty cycle.[5] A manikin study in healthcare professionals showed improved quality of chest compressions when the dominant hand was in contact with the sternum.[6] According to this study, ILCOR 2005 guidelines recommend that is reasonable for laypeople and healthcare professionals to be taught to position the heel of their dominant hand in the centre of the chest of an adult victim, with the non-dominant hand on top.[7] These guidelines also recommend that rescuers should be encouraged to do UCC-CPR if they are unwilling to do airway and breathing manoeuvers or if they are not trained in CPR or are uncertain how to do CPR.[7]

Considering the fact that rescuer fatigue may affect the quality of ECC,[8–10] this study was designed to evaluate whether the position of the rescuer's dominant hand in relation to the non-dominant hand has any influence on the quality of UCC-CPR for 5 min by first year public health students. We also evaluated the gender differences in the continuous chest compression CPR.

Materials and method

This randomized double-blind crossover study was conducted in 2006 at Fasa University of Medical Sciences in Iran. The study was approved by the faculty review board. First year public heath students were recruited to participate in a study involving an 'experimental' resuscitation technique in conjunction with their elective CPR training module. No incentive was offered initially for the participation in the study, however, once enrolled; students were offered $20 as an incentive to be retested 1 week later. Those students with arm, shoulder, or back pain were excluded from the study. Also students who had previously participated in any CPR courses were excluded. Seventy students who had never trained in CPR signed informed consent for the participation in the study.

For each subject the following demographic parameters were recorded: rescuer sex, age, weight, and height. At the end of the standard BLS course, they performed 5 min of continuous chest compressions on a manikin aiming for a rate of 100 min^{-1} either using the dominant or non-dominant hand in contact with the sternum, without revealing the purpose of the study.

The students determined their hand status during chest compression by opening a sealed envelop. In the dominant hand group (DH), the subject's dominant hand was in contact with the sternum, with the non-dependent hand on top; and in the non-dominant hand group (NH); the same subject's non-dominant hand was in contact with the sternum with the dominant hand on top.

A recording Resusci Anne® manikin located on the floor was used in this study. The students had to inform the investigator at the precise moment when they believed that fatigue was affecting the quality of their chest compressions, although they had to continue for 5 min of resuscitation (or until they noticed great fatigue or pain). A beep sound provided by a speaker guided the students to maintain a constant compression rate of 100 min^{-1}. One week later, they were asked to perform 5 min of chest compression with the other hand using the same manikin after a brief time of practice on the manikin. Total number of chest compressions, number of correct chest compressions, inadequate compressions, too strong compressions, wrong hand placement, moment of appearance of fatigue, and duration of continuous ECC by each participant were recorded during the two sessions. The sample size was calculated by assumption that the mean percentage of correct compressions would decrease at least 20% by changing from dominant to non-dominant hand. For an alpha error of 5% and a power of 85% it was estimated that it was necessary to recruit 41 subjects. Sixty subjects were selected to compensate for possible dropouts. Data were analysed using SPSS version 13 (Chicago, Ill). Paired Student's *t*-tests were used for analysis of paired observations in each participant. Change in performance over time of chest compressions within subjects was analysed using Friedman's non-parametric repeated measures analysis of variance (ANOVA) with Dunn's multiple comparisons correction used as appropriate. Data were expressed as mean $\pm$ S.D. and a P value <0.05 was considered to be significant.

Results

Of a class of 120 public heath students attended the course, 70 agreed to participate and provided informed consent before their participation in the project. Three of them did not participate. Of the 67 students involved in the initial testing, 60 returned to retest. One of the students was excluded in the second session of the evaluation because of her wrist pain. Fifty-nine students completed both the dominant hand-CPR and the non-dominant hand-CPR branches of the study. Median age of the participants was 19 years (18—23) and of these 29 students (49%) were female. Six students were left handed. Male subjects were significantly heavier (mean 67.9 ± 9 versus 55.6 ± 5 kg) ($P < 0.001$) and taller (175 ± 7 versus 158 ± 8 cm) than their female counterparts ($P < 0.0001$). The two groups were comparable with regard to total number of ECC ($P = 0.16$). After excluding the subjects who were unable to complete the 5-min period because of exhaustion, the number of compressions attempted was well maintained at approximately 100 min^{-1}. The total number of correct chest compressions in the DH group, mean 183 ± 152, was not statistically different from the NH group, mean 152 ± 135 ($P = 0.09$) (Table 1). The mean of correct chest compressions in each minute was not statistically different in the DH and NH groups except at fifth minute ($P = 0.008$) (Figure 1). The difference between the dominant and non-dominant hand in the total number of correct chest compressions was also not significant in either