

Streszczenie w języku angielskim

ASSESSMENT OF THE EFFECTS OF SELECTED FACTORS DETERMINING THE QUALITY OF CIRCULATORY RESPONSE AND BREATHING

Introduction

Sudden cardiac arrest (SCA) is the main cause of mortality both in Europe and Northern America. The cardiopulmonary resuscitation (CPR) performed quickly after CA may increase the chances of return of spontaneous circulation. Therefore the ability to perform a high quality of CPR should be a basic skill among healthcare professionals. Both European Resuscitation Council and American Heart Association/ American College of Cardiology in their guidelines recommend the shortening of pauses during chest compressions (CC). In addition CC should be conducted with the proper depth and frequency while allowing the complete relaxation of the chest between compressions. The problem of providing a high quality CC is present among accidental bystanders who initiate CPR as well as healthcare professionals.

Aim

The common aim of the series of presented studies in the monothematic article cycle, was the assessment of the influence of selected factors on quality of CPR provided by healthcare professionals in the environment of medical simulation.

Materials and Methods

Six studies, which were included in the monothematic cycle, were performed in the simulated CPR environment. Five of the six studies were prospective, randomized crossover studies. The aim of the first one was the assessment of selected body composition parameters and selected anthropometric factors on the quality of CC during CPR. There were 100 medical students during their last year of medical training enrolled. All of the students received training in CPR based on the guidelines provided by American Heart Association/ American College of

Cardiology. The anthropometric parameters of participants (sex, age) and parameters of body composition were correlated with the quality of CC. Tanita MC-980 MA Professional Body Analyser was used to analyze the body composition. The second study included 29 paramedics with at least 10 year work experience who performed CPR in 2 scenarios varying in positioning related to patient: a) next to the patient b) behind the head of the patient. During the third study, which was the continuation of the second, 36 nurses were performing CPR according to the protocol described in the second study. The fourth study involved 60 physicians performing hands-only CPR and the CPR utilizing TrueCPR device. In the fifth study the aim was to assess the difference of CPR quality between hands-only CPR and CPR utilizing CPREzy device. 57 nurses were enrolled in the fifth study. The sixth study included the teams of 3 paramedics performing CPR in 4 scenarios. In scenario I Automated External Defibrillator (AED) was utilized while the ventilation was performed with the bag valve mask (BVM) equipped with pocket mask. Scenario II included usage of manual external defibrillator with multiple use electrodes. Scenario III included the manual external defibrillator with self-adhesive electrodes, which was charged 10 second before the rhythm analysis while the ventilation was provided according to the scheme described in scenario II. The design of scenario IV included the manual defibrillator with self-adhesive electrodes, charged 10 seconds before rhythm analysis. In order to secure the airways supraglottic ventilation devices were used. The study was designed as a randomized crossover study.

Results

In the study evaluating the influence of anthropometric parameters and body composition on the quality of CC the research group characteristics of participants were: the average height 170.2 ± 8.3 cm, the average body weight was 65 ± 11.8 kg., the mean body mass index (BMI) 22.1 ± 2.7 and the mean lean body mass (FFM)/LBM 50.1 ± 10.5 kg. The average fat percentage (FAT%) was 22.9 ± 7.6 . BMR, FFM/LBM, muscle mass of the trunk, muscle mass of the left and right arm positively correlated with the depth of compressions of the chest (for all $p < 0.05$). The mean depth of CC [mm] was 49.7 ± 8.4 (for women 48.7 ± 7.9 , for men 42.4 ± 9.5 , $p = 0.144$). The frequency of CC in both groups was comparable to 114/min ($p = 0.769$). Multivariate regression analysis showed that the increase in arm muscle mass by 1 kg resulted in the increase of compression depth parameters by 7.3 mm, chest compressions performed by women caused a decrease in depth of compressions by 3.3 mm. In the case of the study

regarding the optimal position of the paramedic during cardiopulmonary resuscitation, the position of the paramedic did not affect the quality of the depth ($p=0.184$) or the frequency of chest compressions ($p=0.303$). Performing CPR was associated with shorter pauses in compressing the chest necessary for performing rescue breaths. In the study referring to the assessment of the optimal position of nurses during cardiopulmonary resuscitation, resuscitation from the head of the patient compared to the resuscitation on the side of the patient was associated with a more accurate frequency of compressions (115/min vs. 121/min, $p<0.001$), a higher level of chest relaxation (70 vs. 67%, $p=0.002$), a more correct place of chest compressions (100 vs. 83%, $p<0.001$), and shorter pauses in chest compressions (6 vs. 8s; $p<0.001$). The location of the resuscitation person did not affect the depth of chest compressions. In the study evaluating the effect of using the TrueCPR device on the quality of CC, the use of the TrueCPR device compared to the hands-only CC was associated with improved quality of resuscitation in the context of depth (55 vs. 47mm, $p<0.001$) and frequency (106 vs. 126/min $p<0.001$) of CC, as well as the level of incomplete decompressions of the chest (11 vs. 23%, $p<0.001$). In the study in which the quality of chest compressions was assessed with and without the CPREzy device, the quality of chest compressions was higher when using the CPREzy device in regard to the depth and frequency of compressions, as well as the level of incomplete decompressions of the chest ($p<0.001$). The use of CPREzy was associated with less accurate positioning of the hands on the chest than in the case of hands-only CPR ($p=0.034$). The study evaluating the impact of different resuscitation techniques showed that during the 10-minute resuscitation scenario, the use of a manual defibrillator with self-adhesive electrodes and performing asynchronous resuscitation combined with the use of a supraglottic ventilation device was associated with the best chest compressions - 92.2%. The worst rate was obtained with the use of AED and BVM (61.8%).

Conclusions

The research indicate that the lean mass of the upper body is positively correlated with the quality of chest compressions. The usage of devices monitoring in real-time both depth and frequency of chest compressions significantly improves the quality of chest compressions compared to the hands-only compressions of the chest. CPR performed with the usage of supraglottic devices for ventilation and thus asynchronous while using a manual defibrillator

with self-adhesive electrodes is the most effective method of CPR in the context of minimizing pauses in CC.