Spectrum Journal of Innovation, Reforms and Development
Volume 15, May, 2023 | ISSN (E): 2751-1731
Website: www.sjird.journalspark.org

THE ROLE OF SIMULATION TRAINING IN TEACHING HIGH-QUALITY CARDIOPULMONARY RESUSCITATION TO MEDICAL STUDENTS

Parpibaeva D. A.,
Ergashov N. Sh.,
Salaeva M. S.,
Salimova N. D.,
Boltaboev X.Q.,
Turbanova U.V.
Tashkent Medical Academy, Tashkent, Uzbekistan

ABSTRACT

Introduction

Most medical schools teach cardiopulmonary resuscitation (CPR) to prepare students for first aid in clinical emergencies. Little is known about the optimal way to teach this important skill. Standard mannequins were used to practice practical skill and increase knowledge. In this study, we evaluated the comparative effectiveness of high-fidelity simulation training and standard mannequin training to teach quality CPR instructions to students of the Tashkent Medical Academy as outlined in the International Clinical Guidelines.

Methods

During 1 week, 60 4th year students were divided into 2 groups, i.e. simulation training (SIM) and standard training (STD) groups. The SIM team learned high-quality CPR through a three-hour hands-on session based on ERC (European Resuscitation Council) guidelines, which included training in a high-definition simulator and a PowerPoint presentation. The STD group trained using a low-quality Resusci Anne® CPR manikin. Outcomes were assessed based on specific cardiac arrest scenarios.

Results

Students in the SIM group performed CPR more closely adhered to ERC guidelines. In this case, the quality level of compression performance was also higher. The mean compression depth was 5.35 centimeters (cm) (95% confidence interval [CI] [5.22–5.82]) for the SIM group and 3.95 cm (95% CI [3, 80-4.32], p=0.02) There was no significant difference between the groups in compression rate or chest recoil.

Conclusion

High-fidelity simulation training is superior to low-fidelity CPR manikin training for teaching fourth-year medical students the implementation of high-quality CPR for chest compression depth and compression speed.

Introduction

Cardiovascular diseases (CVDs) are the leading cause of death globally, taking an estimated 17.9 million lives each year. CVDs are a group of disorders of the heart and blood vessels and include coronary heart disease, cerebrovascular disease, rheumatic heart disease, and other conditions. More than four out of five CVD deaths are due to heart attacks and strokes, and one-third of these deaths occur prematurely in people under 70 years of age.

In 2015, approximately 357,000 people experienced out-of-hospital cardiac arrest (OHCA) in the United States. Approximately 70%–90% of individuals with OHCA die before reaching the hospital. Approximately 209,000 people are treated for in-hospital cardiac arrest (IHCA) each year. Morbidity: Those who survive cardiac arrest are likely to suffer from injury to the brain and nervous system and other physical ailments. Additionally, nearly half of OHCA survivors suffer psychological distress such as anxiety, post-traumatic stress disorder, and depression.

Although the concepts of CPR are becoming better understood, there remains a large chasm between what we know and how it is performed on patients, in both out-of-hospital and in-hospital settings. Despite the fact that CPR is a critical link in the chain of survival, it is performed with inconsistent quality in both settings. The American Heart Association (AHA) CPR Guidelines emphasize that to close the knowledge-practice gap and save more lives, providers should develop a culture of measuring and ensuring high-quality CPR.

Human patient simulation provides the opportunity to address the knowledge-practice gap in the education, training, and implementation of high-quality CPR. Simulation encompasses any technology or process that re-creates a contextual background that allows a learner to experience success, mistakes, receive feedback, and gain confidence in a learner-oriented environment void of patient risk. The Institute of Medicine, the Educational Technology Section of the Academic Emergency Medicine Consensus Conference, and the public have advocated for increased simulation training to reduce medical errors. Basic life support (BLS) and Advanced Cardiac Life Support (ACLS) have been recognized as the standard criteria for competency to manage patients in cardiac arrest. This study compares the effectiveness of high-fidelity simulation and conventional low-fidelity manikins on chest compression rate, compression depth, and chest recoil rates in TTA students according to ERC BLS CPR guidelines.

Materials and Methods

Students participated in practical training conducted by employees with BLS provider certificates based on a specific scenario in the simulation center of TTA.

Both groups received a didactic presentation of the ERC Guidelines for CPR via PowerPoint (Microsoft Corporation, Redmond, Washington).

The practical skills part of the study took place immediately after the lecture. The purpose of this training was to train medical students to perform high-quality CPR as specifically defined and emphasized in the ERC guidelines. High-quality CPR components include indicators such as chest compression rate, compression depth, and chest recoil. Students practiced CPR focusing on these components. During this session, education and training were identical between groups, except for the types of simulator trainers used (high-fidelity vs. low-fidelity). The high-resolution mannequin provided students with real-time feedback on chest compression rate, compression depth, and chest recoil during CPR. A low-resolution mannequin does not provide this kind of real-time feedback. Participants in the control group were given feedback after performing CPR, and because low-resolution mannequins do not provide real-time feedback.

High-fidelity simulation software allows for real-time chest compression rate, compression depth, and chest recoil data collection. The degree of compression accuracy corresponds to the nearest full compression, depth to the millimeter, and rebound to the nearest percent (100% rebound on release indicates that all compressions performed during the cycle were accompanied by adequate chest retraction).

We defined performance metrics prior to study implementation. Compression rate was defined as the number of chest compressions delivered per minute. Compression depth was defined as the depth of chest compression from the neutral position of the sternum in centimeters. We defined chest recoil as allowing the sternum to fully (100%) return to its neutral position before the next chest compression. Compression fraction was defined as the proportion of time CPR was delivered while the patient was without a perfusing rhythm. The total time measured for the absence of a perfusing rhythm began with the initiation of ventricular fibrillation and ended with the completion of the tenth cycle of CPR. For those subjects who chose the hands-only CPR methods, the end time was marked when they delivered 150 compressions. This allowed measurement of their performance after the same 150 compressions delivered in the 5-cycle CPR group.

Human resources used for the evaluation scenarios consisted of a full-time simulation specialist, a researcher to oversee the correct implementation of the study protocol, and a confederate in the scenario to provide ancillary support.

Utilizing standardized data abstraction sheets, data was entered. The definitions of the performance measures and instructions for entering data into collection sheets were covered in a training workshop for data abstractors. To reduce random data abstraction errors, we used double data entering. Reviewing the original data in the recordings to confirm abstraction accuracy helped to clear up discrepancies. All information is entered into a main spreadsheet file.

Results

High quality rate was defined as ≥100 compressions/minute, depth ≥5 centimeters (cm), allowing full (100%) chest recoil, and a compression fraction that approached 100%. All outcome data were obtained during a high-fidelity cardiac arrest simulation scenario.

Analysis

Data from the master data collection sheet were converted to Stata file format and analyzed with Stata (version 12.0; StataCorp, College Station, Texas). We reported continuous variables as means with 95% confidence intervals (CI) using the Kruskal-Wallis rank sum test. A two-tailed alpha <0.05 represented statistical significance. Our sample size calculations were based on effect size (difference in means) of a 5-millimeter (mm) difference in compression depth between the two groups. With a two-tailed alpha (α) of <0.05, and a beta (β) of 0.2, we needed 34 subjects per group to detect a difference between groups with a power of 0.8.

For our main outcome, the mean compression depth was 5.35 cm (95% CI [5.22–5.82]) for the SIM group and 3.95 cm (95% CI [3.80–4.32]) for the standard (STD) groups, p = 0.02. The mean compression rate was 112.7 per minute (95% CI [106.8–118.5]) for the simulation group (SIM) and 117.5 per minute (95% CI [110.9–122.1]) for the STD group, p = 0.06. The mean percentage of chest compressions that were accompanied by full chest retraction was 0.965 (95% CI [0.935–0.983]) for the SIM group and 0.862 (95% CI [0.845–0.963]) for the STD group, p = 0.83 (Table).

Table Main outcome variables according to the teaching method.

Variable	Teaching method	Mean	95% CI	P value
Compression rate/min	STD	117.5	109.9–121.2	.06
	SIM	112.7	106.8–118.5	
Depth (cm)	STD	3.95	3.80–4.32	.02
	SIM	5.35	5.22–5.82	
Recoil proportion	STD	0.862	.874–.985	.83
	SIM	0.965	.925–.978	

SIM, simulation training group; *STD*, standard training group; *CI*, confidence interval; *cm*, centimeter; Compression rate/min = a number of chest compressions delivered per minute; recoil proportion = proportion of compressions accompanied by 100% chest recoil.

DISCUSSION

In our prospective, randomized, parallel-group study evaluating the comparative effectiveness of high-fidelity simulation training vs. standard training, we found that high-fidelity simulation training yielded CPR performance that more closely adhered to the ERC CPR guidelines.

Our findings that simulation results in student performance that adheres more closely to ERC standards are in accordance with a growing body of literature that supports the use of simulation in resuscitation research and teaching. High-fidelity simulation has also been demonstrated to aid in the learning, retention, and acquisition of CPR knowledge and abilities.

CONCLUSION

In our prospective, randomized, parallel-group study evaluating the comparative effectiveness of high-fidelity simulation training vs. standard training, we found that high-fidelity simulation training yielded CPR performance that more closely adheres to ERC

CPR guidelines. Further research is needed to evaluate the most effective teaching methods for cardiac arrest care.

REFERENCES:

1. Roger VL, Go AS, Lloyd-Jones DM, et al. Heart disease and stoke statistics – 2011 update: a report from the American Heart Association. *Circulation.* 2011;123(6):e240. [Google Scholar]

2. Xu J, Kochanek KD, Murphy S, et al. Deaths: final data for 2007. Hyattsville, Md: National Center for Health Statistics. *Natl Vital Stat Rep.* 2010;58:1–135. [PubMed] [Google Scholar]

3. Nichol G, Thomas E, Callaway CW, et al. Regional variation in out-of-hospital cardiac arrest incidence and outcome. *JAMA.* 2008;300(12):1423–31. [PMC free article] [PubMed] [Google Scholar]

4. Rea TD, Helbock M, Perry S, et al. Increasing the use of cardiopulmonary resuscitation during out-of-hospital ventricular fibrillation arrest: survival implications of guideline changes. *Circulation.* 2006;114(25):2760–5. [PubMed] [Google Scholar]

5. Kellum MJ, Kennedy KW, Ewy GA. Cardiocerebral resuscitation improves survival of patients with out-of hospital cardiac arrest. *Am J Med.* 2006;119(4):335–40. [PubMed] [Google Scholar]

6. Bobrow BJ, Clark LL, Ewy GA, et al. Minimally interrupted cardiac resuscitation by emergency medical services for out-of-hospital cardiac arrest. *JAMA.* 2008;299(10):1158–65. [PubMed] [Google Scholar]

7. Wik L, Kramer-Johansen J, Myklebust H, et al. Quality of cardiopulmonary resuscitation during out-of-hospital cardiac arrest. *JAMA.* 2005;293(3):299–304. [PubMed] [Google Scholar]

8. Abella BS, Alvarado JP, Myklebust H, et al. Quality of cardiopulmonary resuscitation during in-hospital cardiac arrest. *JAMA.* 2005;293(3):305–10. [PubMed] [Google Scholar]

9. 2010 American Heart Association. Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science. *Circulation.* 2010;122(18 Suppl 3):S768–86. [PubMed] [Google Scholar]

10. Parpibaeva, D. A., Sh, E. N., Musaeva, M. A., Boltaboev, X. K., & Turbanova, U. V. (2023). SIMULATION TRAINING IN MEDICINE: FROM PROBLEM TO SOLUTION.

11. Parpibayeva, D. A., Salimova, N. D., Ergashov, N., Baltabayev, H. Q., & Sultanova, M. X. (2022). Tibbiyotda simulyatsion o'qitish: muammodan yechimgacha.

12. Najmutdinova, D. Q., Parpibaeva, D. A., Salaeva, M. S., Salimova, N. D., Ergashov, N. S., & Sultonova, D. A. (2023). The role of fenofibrate (tricor) in the complex treatment of microangiopathic complications in patients with type 2 diabetes.

13. Parpibaeva, D. A., Buvamukhamedova, N. T., Ergashev, N. S., Salimova, N. D., & Salaeva, M. S. (2023). Optimization of Functional State of the Liver in Patients with Chd on the Background of Rosuvastatin Intake. *Scholastic: Journal of Natural and Medical Education*, *2*(4), 8-12.

14. Ayupovna, P. D. (2023). EVALUATION OF THE EFFECTIVENESS OF SIMULATION TRAINING IN TEACHING HEART AND LUNG AUSCULTATION.
15. Abdurakhmanov, F. M., Korikhonov, D. N., Yakubov, I. Y., Kasimov, U. K., Atakov, S. S., Okhunov, A. O., & Yarkulov, A. S. (2023). Competency-Based Approach in the Scientific Research Process of Higher Medical Institutions' Teachers.
16. Бувамухамедова, Н., Жаббаров, О., Мирзаева, Г., & Рахматов, А. (2022). Перспективы Применения Ривароксабана В Лечении Пациентов С Хронической Ишемической Болезнью Сердца.
17. Мирзаева, Г. П., Жаббаров, О. О., Аликулов, И. Т., Бувамухамедова, Н. Т., & Рахматов, А. М. (2022). Особенности течения подагрического поражения почек у больных с ожирением.