CHEST COMPRESSION METHODS IN SIMULATED COVID-19 PATIENT RESUSCITATION: A RANDOMIZED CROSS-OVER SIMULATION TRIAL

¹Evrin T., ²Bielski K., ³Dabrowska A., ⁴Smereka J., ⁵Ladny J. R., ²Malysz M., ⁶Yakubtsevich R., ⁷Szarpak L.

¹Ufuk University Medical Faculty, Dr. Ridvan Ege Education and Research Hospital, Ankara, Turkey

²Voivodeship Ambulance and Sanitary Transport Station in Warsaw, Warsaw, Poland; Polish Society of Disaster Medicine, Warsaw, Poland;

³Poznan University of Medical Sciences, Poznan, Poland; Polish Society of Disaster Medicine, Warsaw, Poland;

⁴Wroclaw Medical University, Wroclaw, Poland; Polish Society of Disaster Medicine, Warsaw, Poland;

⁵Medical University Bialystok, Bialystok, Poland; Polish Society of Disaster Medicine, Warsaw, Poland;

⁶Grodno State Medical University, Grodno, Belarus;

⁷Maria Sklodowska-Curie Medical Academy in Warsaw, Warsaw, Poland; Polish Society of Disaster Medicine, Warsaw, Poland; Bialystok Oncology Center, Bialystok, Poland

Background: High-quality chest compression is one of the key elements of resuscitation to return of spontaneous circulation. In the COVID-19 era, medical personnel should wear personal protective equipment (PPE) against aerosol generating procedures (AGP) during resuscitation. However, the use of this personal protection equipment may reduce the effectiveness of medical procedures performed.

Objective: We aimed to compare chest compression quality parameters between standard manual chest compression and chest compression with TrueCPR feedback device performed by medical students wearing full personal protractive equipment against aerosol generating procedure.

Methods: The study was designed as a randomized, cross-over, single-blinded simulation study. Thirty-two medical students wearing PPE-AGP performed 2-min continuous chest compression on an adult simulator with and without TrueCPR feedback device.

Results: Median chest compression depth with and without TrueCPR feedback device varied and amounted to 46 (IQR; 42-53) vs. 41 (IQR; 36-45) mm (MCC vs. TrueCPR, respectively). The manual chest compression rate was 117 (IQR; 112-125) compressions per minute (CPM) and was higher than with TrueCPR feedback device - 107 (IQR; 102-115; p = 0.017). Full chest relaxation in the manual's chest compression technique (without TrueCPR) was 33 (IQR; 26-42)% and was lower than with chest compression with TrueCPR feedback device - 58 (IQR; 40-75)% (p=0.002).

Conclusions: We conclude that a TrueCPR feedback device improves chest compression quality during simulated COVID-19 resuscitation performed by medical students wearing PPE-AGP.

***Keywords:** chest compression; cardiopulmonary resuscitation; quality; feedback device; TrueCPR; personal protective equipment; COVID-19; SARS-CoV-2; medical simulation.*

Background

High-quality chest compressions are essential elements of out-of-hospital cardiac arrest (OHCA) and in-hospital cardiac arrest (IHCA). The guidelines for cardiopulmonary resuscitation by the European Resuscitation Council (ERC) and the American Heart Association (AHA) place great emphasis on high-quality chest compressions, thus showing the reference conditions against which there is the greatest chance of a return of spontaneous circulation (ROSC) [1,2].

The world now faces the new pandemic infectious disease COVID-19 induced by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) [3] and asseverated to be transmitted from human-to-human by multiple meansby droplets, aerosols, and fomites [4,5]. By October 5, 2020, nearly 35.54 million cases of SARS-CoV-2 infection were recorded, including nearly 1.04 million deaths and over 24.57 million recoveries.

The US Centers for Disease Control and Prevention (CDC) defines "aerosol–generating procedures" (AGPs) as procedures with the potential to generate infectious respiratory particles at higher concentrations than breathing, coughing, sneezing, or talking, or procedures that create uncontrolled respiratory secretions. In turns the World Health Organization (WHO) has recommended that when

dealing with patients whom are performing any AGP on a suspected COVID-19 positive patient must wear an N95 or FFP2 mask. There is also a recommendation that a medical mask, gown, gloves, and eye protection is sufficient [6]. In Polish conditions, the personnel of emergency medical teams, conducting resuscitation in patients with suspected / confirmed COVID-19, conducts cardiopulmonary resuscitation in full personal protractive equipment (PPE) against aerosol generating procedures (AGP) suits, which is consistent with the suggestions Brown and Chan, where authors conclude that there are evidence for infection transmission during chest compressions and a precautionary approach with appropriate PPE is necessary to protect HCW from contracting a potentially fatal infection. [7].

Using PPE-AGP suits may affect the effectiveness of medical procedures by reducing their effectiveness and extending their duration. This applies to both the quality of chest compression [8,9], intravascular access [10,11] and instrumental airway management [12,13]. Regardless of the procedure should be sought alternative methods of influencing the actions taken to increase the effectiveness of medical devices by people dressed in the PPE-AGP.

Aim of the study

We aimed to compare chest compression quality parameters between standard manual chest compression and chest compression with TrueCPR feedback device performed by medical students wearing full personal protractive equipment against aerosol generating procedure.

Methods

The study was designed as single-blinded, multicenter, prospective, randomized, crossover simulation trial. The Institutional Review Board of the Polish Society of Disaster Medicine approved the study protocol (Approval no. 23.01.20.IRB). Study was conducted in Warsaw, Poznan and Wroclaw in the period from January to February 2020. The study is a continuation of the research undertaken by the authors, aimed at evaluating various methods of cardiopulmonary resuscitation during the use of PPE-AGP [8,14].

Participants

Thirty-two medical students who completed advanced cardiovascular life support training took part in the study. Exclusion criteria were: 1) no consent to participation in study; 2) symptoms of an infectious disease; 3) asthma; 4) injuries that may affect the quality of performed chest compression (including injuries to the wrist, back). Voluntary written informed consent was obtained from each participant.

Simulation scenario

To simulate a patient with COVID-19 requiring CPR, an advanced SimMan 3G simulator (Laerdal, Stavanger, Norway) was used and placed on a flat surface in a well-lit room.

All study participants underwent training on how to put on and remove a full PPE-AGP suit. For this purpose, Tychem F Level-C (DuPont, Wilmington, USA) suit, airway protection N95 respirator (3M Poland, Kajetany, Poland), face shield (3M Poland, Kajetany, Poland) including double nitrile gloves (MedaSEPT®, Poznan, Poland).

During the target study, participants performed a 2-minute cycle of continuous chest compression with and without TrueCPR feedback device (Figure 1).

Figure 1. – TrueCPR feedback device

Both the order of the participants and the methods of chest compression were random. For this purpose, the Research Randomizer program (randomizer. org) was used. We divided all participants using this program into two groups. The first group began chest compression with TrueCPR feedback device, while the second group started without TrueCPR device. After completing the 2-minute CPR cycle, participants had 20 minutes of rest and then performed chest compressions using a different method. We present a detailed randomization procedure on Figure 2.

Outcome measures

The chest compression quality parameters were recorded in real-time using the simulator control software - Laerdal Learning Application (LLEAP software, v.7.1.0; LaerdalInc, Stavanger, Norway). The study analyzed parameters such as the depth of chest compressions, the frequency of chest compressions, and the correctness of chest relaxation. We took the values recommended by the American Heart Association resuscitation guidelines as reference values [15]. After the study, we asked participants to define their preferences what method of chest compression they would use during real rescue operations.

Statistical analysis

Sample size calculations were performed based on a two-sided paired t-test assuming 80% power and a significance level of 0.05. Assumptions for expected results were based upon the work of Malysz et al. [14]. Those calculations indicated that a sample size of 32 participants would be required to power the trial adequately to detect a difference of 5 millimeters between the two modalities.

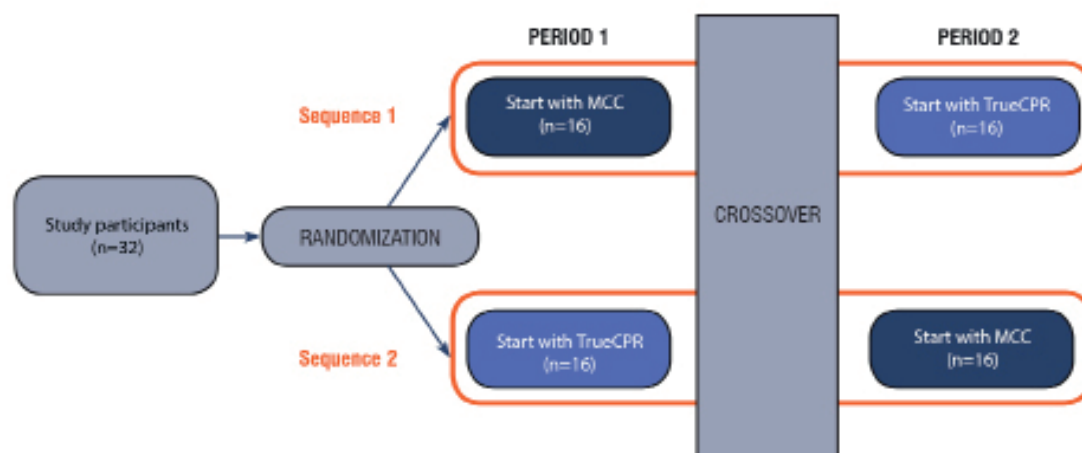For the purposes of statistical analysis, the results of the study were blinded.The data were fed into

Figure 2. – Randomization flow chart

the computer having Statistica 13.3EN (TibcoInc, Tulsa, OK, USA). All statistical tests were two-sided. The occurrence of normal distribution was confirmed by the Kolmogorov-Smirnov test. We described variables using percentages for qualitative variables and using median with interquartile range for quantitative variables. The Friedman test was used for the intra-group analysis, and the Wilcoxon signed-rank test for the pairwise comparison. A P-value of<.05 was considered statistically significant.Graphs were prepared with GraphPad Prism 6.0 (GraphPad Software, San Diego, CA) software.

Results

The study includes thirty-two medical students who had previously successfully completed the Advanced Cardiovascular Life Support course conducted by accredited American Heart Association instructors.

Median chest compression depth with and without TrueCPR feedback device varied and amounted to 46 (IQR; 42-53) vs. 41 (IQR; 36-45) mm (MCC vs. TrueCPR, respectively).

The manual chest compression rate was 117 (IQR; 112-125) compressions per minute (CPM) and was higher than with TrueCPR feedback device - 107 (IQR; 102-115; p = 0.017.

Full chest relaxation in the manual's chest compression technique (without TrueCPR) was 33 (IQR; 26-42)% and was lower than with chest compression with TrueCPR feedback device - 58 (IQR; 40-75)% (p=0.002).

90.6% of all participants showed TrueCPR as a method of chest compression that they would use in real cardiopulmonary resuscitation of a patient with COVID-19. 3 persons (9.4%) showed manual chest compression as the preferred method (p <0.001).

Discussion

The objectives of our study were to evaluate the performance of chest compression with and without TrueCPR feedback device by medical students in PPE-AGP conditions. Our study shows that the chest compression with TrueCPR offer higher CC quality than manual chest compression (without TrueCPR).

High-quality chest compression is based on several important parameters, which include, among others, the depth of chest compression, the frequency of compressions or relaxation of the chest following compressions. According to the guidelines for CPR recommended by the American Heart Association, the depth of chest compression in an adult should be 5 to 6 cm, the compression rate should be higher than 100 CPM and no more than 120 CPM, and each chest compression should be full her relaxation [15].

Chest compression depth is strongly related to chest compression rate, and both are independently associated with survival [16]. Results got by Vadeboncoeur et al. suggest that adhering to the 2010 AHA Guideline-recommended depth of at least 51mm could improve outcomes for victims of OHCA [17]. Steill et al. found that maximum survival was in the depth interval of 40.3 to 55.3 mm (peak, 45.6 mm), suggesting that the 2010 American Heart Association cardiopulmonary resuscitation guideline target may be too high [18].The depth of chest compressions in our study was lower than the depth recommended by the AHA guidelines and the European Resuscitation Council (ERC) guidelines. It is worth emphasizing, that the use of TrueCPR feedback device resulted in an increase in the depth of compressions compared to the group where CPR was conducted without CPR feedback device. Also, other studies where CPR was conducted without the use of PPE-AGP suits show that CPR feedback devices improve both the depth and frequency of chest compressions [19-22].

In our study, the rate of chest compressions during the study was within the limits recommended by the AHA. Although there is no consensus among researchers regarding the optimal rate of chest compression, Idris et al. indicated that compression rates between 100 and 120 per minute were associated with greatest survival to hospital discharge [23]. Duval et al. suggest that the combination of 107 compressions per minute and a depth of 47mm is associated with significantly improved outcomes for out-of-hospital cardiac arrest [24]. Study performed by Kilgannon et al. showed that chest compression rates above the recommended 100-

120 compressions/min may improve the chances of ROSC among IHCA patients [25].

Another important element influencing the quality of CPR is the correctness of chest relaxation after each compression. Full chest decompression affects higher cerebral blood flow [26, 27]. The conducted study showed a statistically significant improvement in the level of chest decompression with TrueCPR feedback device.

CPR feedback devices are becoming more and more appreciated in cardiopulmonary resuscitation. By showing the parameters of chest compression in real time, they improve the quality of compression. As indicated by the study by Katipoglu et al. observing real-time chest compression quality parameters during Basic Life Support training may improve the quality of chest compression one month after the training including correct hand positioning, compressions depth and rate compliance [28]. The study by Buléon et al. shows the use of CPR feedback devices, especially in the aspect of prolonged resuscitation [29].

The conducted study has limitations. Firstly, it was carried out in medical simulation conditions, not in clinical conditions, however, because of the COVID-19 pandemic, performing tests under medical simulation conditions allows for safe performance of medical procedures and their full standardization [30,31]. The second limitation is the use of only TrueCPR feedback device in the study, however, it is the most advanced device of this type. The third limitation is the inclusion of only medical students in the study, however, such a choice was deliberate and was dictated that this group did not deal with CPR feedback devices, so an improvement in the quality of chest compression could be observed among people who have undergone only a short instructional training in CPR feedback devices.

Conclusions

We conclude that TrueCPR feedback device improves chest compression quality during simulated COVID-19 resuscitation performed by medical students wearing PPE-AGP.

Acknowledgements

References

1. Perkins GD, Handley AJ, Koster RW, Castrén M, Smyth MA, Olasveengen T, Monsieurs KG, Raffay V, Gräsner JT, Wenzel V, Ristagno G, Soar J. European Resuscitation Council Guidelines for Resuscitation 2015: Section 2. Adult basic life support and automated external defibrillation. *Resuscitation.* 2015;95:81-99. doi: 10.1016/j.resuscitation.2015.07.015.

2. Link MS, Berkow LC, Kudenchuk PJ, Halperin HR, Hess EP, Moitra VK, Neumar RW, O'Neil BJ, Paxton JH, Silvers SM, White RD, Yannopoulos D, Donnino MW. Part 7: Adult Advanced Cardiovascular Life Support: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation.* 2015;132(18 Suppl 2):S444-64. doi: 10.1161/CIR.0000000000000261.

3. Khoo EJ, Lantos JD. Lessons learned from the COVID-19 pandemic. *Acta Paediatr.* 2020;109(7):1323-1325. doi: 10.1111/apa.15307.

4. Sommerstein R, Fux CA, Vuichard-Gysin D, Abbas M, Marschall J, Balmelli C, Troillet N, Harbarth S, Schlegel M, Widmer A, Swissnoso. Risk of SARS-CoV-2 transmission by aerosols, the rational use of masks, and protection of healthcare workers from COVID-19. *Antimicrob. Resist. Infect. Control.* 2020;9(1):100. doi: 10.1186/s13756-020-00763-0.

5. Dzieciatkowski T, Szarpak L, Filipiak KJ, Jaguszewski M, Ladny JR, Smereka J. COVID-19 challenge for modern medicine. *Cardiol. J.* 2020;27(2):175-183. doi: 10.5603/CJ.a2020.0055.

6. World Health Organisation. Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19). Interim guidance [Internet]. Geneva: World Health Organisation; 2020. Available from: https://www.who.int/publications/i/item/rational-use-of-personal-protective-equipment-for-coronavirus-disease-(covid-19)-and-considerations-during-severe-shortages).

7. Brown E, Chan LM. Should chest compressions be considered an aerosol-generating procedure? A literature review in response to recent guidelines on personal protective equipment for patients with suspected COVID-19. *Clin. Med.* (Lond). 2020;20(5):e154-e159. doi: 10.7861/clinmed.2020-0258.

8. Malysz M, Dabrowski M, Böttiger BW, Smereka J, Kulak K, Szarpak A, Jaguszewski M, Filipiak KJ, Ladny JR, Ruetzler K, Szarpak L. Resuscitation of the patient with suspected/confirmed COVID-19 when wearing personal protective equipment: A randomized multicenter crossover simulation trial. *Cardiol. J.* 2020;27(5)497-506. doi: 10.5603/CJ.a2020.0068.

9. Szarpak L, Truszewski Z, Gałązkowski R, Czyzewski L. Comparison of two chest compression techniques when using CBRN-PPE: a randomized crossover manikin trial. *Am. J. Emerg Med.* 2016;34(5):913-5. doi: 10.1016/j.ajem.2016.02.029.

10. Robak O, Pruc M, Malysz M, Smereka J, Szarpak L, Bielski K, Ladny JR, Ludwin K. Pre-filled syringes with adrenaline during cardiopulmonary resuscitation in non-shockable rhythms. Pilot randomised crossover simulation study. *Disaster Emerg. Med. J.* 2020;5(2):79-84. doi: 10.5603/DEMJ.a2020.0025.

11. Smereka J, Szarpak L, Filipiak KJ, Jaguszewski M, Ladny JR. Which intravascular access should we use in patients with suspected/confirmed COVID-19? *Resuscitation.* 2020;151:8-9. doi: 10.1016/j.resuscitation.2020.04.014.

12. Ludwin K, Bialka S, Czyzewski L, Smereka J, Dabrowski M, Dabrowska A, Ladny JR, Ruetzler K, Szarpaket L. Video laryngoscopy for endotracheal intubation of adult patients with suspected/confirmed COVID-19. A systematic review and meta-analysis of randomized controlled trials. *Disaster Emerg. Med. J.* 2020;5(2):85-97. doi: 10.5603/DEMJ.a2020.0023.

13. Maslanka M, Smereka J, Czyzewski L, Ladny JR, Dabrowski M, Szarpak L. Vie scope® laryngoscope versus Macintosh laryngoscope with personal protective equipment during intubation of COVID-19 resuscitation patient.

Am. J. Emerg. Med. 2020;Sep 4:S0735-6757(20)30779-8. doi: 10.1016/j.ajem.2020.08.085. Epub ahead of print.

14. Malysz M, Jaguszewski MJ, Szarpak L, Telecka-Gadek D, Bielski K, Dabrowska A, Smereka J, Filipiak KJ. Comparison of different chest compression positions for use while wearing CBRN-PPE: a randomized crossover simulation trial. *Disaster Emerg. Med. J.* 2020;5(3):127-133. doi: 10.5603/DEMJ.a2020.0034.

15. Kleinman ME, Brennan EE, Goldberger ZD, Swor RA, Terry M, Bobrow BJ, Gazmuri RJ, Travers AH, Rea T. Part 5: Adult Basic Life Support and Cardiopulmonary Resuscitation Quality: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation.* 2015;132(18 Suppl 2):S414-35. doi: 10.1161/CIR.0000000000000259.

16. Stiell IG, Brown SP, Christenson J, Cheskes S, Nichol G, Powell J, Bigham B, Morrison LJ, Larsen J, Hess E, Vaillancourt C, Davis DP, Callaway CW; Resuscitation Outcomes Consortium (ROC) Investigators. What is the role of chest compression depth during out-of-hospital cardiac arrest resuscitation? *Crit. Care Med.* 2012;40(4):1192-1198. doi: 10.1097/CCM.0b013e31823bc8bb.

17. Vadeboncoeur T, Stolz U, Panchal A, Silver A, Venuti M, Tobin J, Smith G, Nunez M, Karamooz M, Spaite D, Bobrow B. Chest compression depth and survival in out-of-hospital cardiac arrest. *Resuscitation.* 2014;85(2):182-8. doi: 10.1016/j.resuscitation.2013.10.002.

18. Stiell IG, Brown SP, Nichol G, Cheskes S, Vaillancourt C, Callaway CW, Morrison LJ, Christenson J, Aufderheide TP, Davis DP, Free C, Hostler D, Stouffer JA, Idris AH; Resuscitation Outcomes Consortium Investigators. What is the optimal chest compression depth during out-of-hospital cardiac arrest resuscitation of adult patients? *Circulation.* 2014;130(22):1962-70. doi:10.1161/CIRCULATIONAHA.114.008671.

19. Tanaka S, Tsukigase K, Hara T, Sagisaka R, Myklebust H, Birkenes TS, Takahashi H, Iwata A, Kidokoro Y, Yamada M, Ueta H, Takyu H, Tanaka H. Effect of real-time visual feedback device 'Quality Cardiopulmonary Resuscitation (QCPR) Classroom' with a metronome sound on layperson CPR training in Japan: a cluster randomized control trial. *BMJ Open.* 2019;9(6):e026140. doi: 10.1136/bmjopen-2018-026140.

20. Smereka J, Szarpak L, Czekajlo M, Abelson A, Zwolinski P, Plusa T, Dunder D, Dabrowski M, Wiesniewska Z, Robak O, Frass M, Sivrikaya G U, Ruetzler K. The TrueCPR device in the process of teaching cardiopulmonary resuscitation: A randomized simulation trial. *Medicine (Baltimore).* 2019;98(27):e15995. doi: 10.1097/MD.0000000000015995.

21. Buléon C, Parienti JJ, Morilland-Lecoq E, Halbout L, Cesaréo E, Dubien PY, Jardel B, Boyer C, Husson K, Andriamirado F, Benet X, Morel-Marechal E, Aubrion A, Muntean C, Dupire E, Roupie E, Hubert H, Vilhelm C, Gueugniaud PY; CILICA-HS study group. Impacts of chest compression cycle length and real-time feedback with a CPRmeter® on chest compression quality in out-of-hospital cardiac arrest: study protocol for a multicenter randomized controlled factorial plan trial. *Trials.* 2020;21(1):627. doi: 10.1186/s13063-020-04536-3.

22. Goharani R, Vahedian-Azimi A, Farzanegan B, Bashar FR, Hajiesmaeili M, Shojaei S, Madani SJ, Gohari-Moghaddam K, Hatamian S, Mosavinasab SMM, Khoshfetrat M, Khabiri Khatir MA, Miller AC. Real-time compression feedback for patients with in-hospital cardiac arrest: a multi-center randomized controlled clinical trial. *J. Intensive Care.* 2019;7:5. doi: 10.1186/s40560-019-0357-5.

23. Idris AH, Guffey D, Pepe PE, Brown SP, Brooks SC, Callaway CW, Christenson J, Davis DP, Daya MR, Gray R, Kudenchuk PJ, Larsen J, Lin S, Menegazzi JJ, Sheehan K, Sopko G, Stiell I, Nichol G, Aufderheide TP; Resuscitation Outcomes Consortium Investigators. Chest compression rates and survival following out-of-hospital cardiac arrest. *Crit. Care Med.* 2015;43(4):840-8. doi: 10.1097/CCM.0000000000000824.

24. Duval S, Pepe PE, Aufderheide TP, Goodloe JM, Debaty G, Labarère J, Sugiyama A, Yannopoulos D. Optimal Combination of Compression Rate and Depth During Cardiopulmonary Resuscitation for Functionally Favorable Survival. *JAMA Cardiol.* 2019;4(9):900-908. doi: 10.1001/jamacardio.2019.2717.

25. Kilgannon JH, Kirchhoff M, Pierce L, Aunchman N, Trzeciak S, Roberts BW. Association between chest compression rates and clinical outcomes following in-hospital cardiac arrest at an academic tertiary hospital. *Resuscitation.* 2017;110:154-161. doi: 10.1016/j.resuscitation.2016.09.015.

26. Aufderheide TP, Pirrallo RG, Yannopoulos D, Klein JP, von Briesen C, Sparks CW, Deja KA, Kitscha DJ, Provo TA, Lurie KG. Incomplete chest wall decompression: a clinical evaluation of CPR performance by trained laypersons and an assessment of alternative manual chest compression-decompression techniques. *Resuscitation.* 2006;71(3):341-51. doi: 10.1016/j.resuscitation.2006.03.021.

27. Smereka J, Szarpak L, Rodríguez-Núñez A, Ladny JR, Leung S, Ruetzler K. A randomized comparison of three chest compression techniques and associated hemodynamic effect during infant CPR: A randomized manikin study. *Am. J. Emerg. Med.* 2017;35(10):1420-1425. doi: 10.1016/j.ajem.2017.04.024.

28. Katipoglu B, Madziala MA, Evrin T, Gawlowski P, Szarpak A, Dabrowska A, Bialka S, Ladny JR, Szarpak L, Konert A, Smereka J. How should we teach cardiopulmonary resuscitation? Randomized multi-center study. *Cardiol J.* 2019;Sep 30. doi: 10.5603/CJ.a2019.0092. Epub ahead of print.

29. Buléon C, Delaunay J, Parienti JJ, Halbout L, Arrot X, Gérard JL, Hanouz JL. Impact of a feedback device on chest compression quality during extended manikin CPR: a randomized crossover study. *Am. J. Emerg. Med.* 2016;34(9):1754-60. doi: 10.1016/j.ajem.2016.05.077.

30. Szarpak L, Madziała M, Smereka J. Comparison of endotracheal intubation performed with 3 devices by paramedics wearing chemical, biological, radiological, and nuclear personal protective equipment. *Am. J. Emerg. Med.* 2016;34(9):1902-3. doi: 10.1016/j.ajem.2016.06.101.

31. Schumacher J, Arlidge J, Dudley D, Sicinski M, Ahmad I. The impact of respiratory protective equipment on difficult airway management: a randomised, crossover, simulation study. *Anaesthesia.* 2020;75(10):1301-1306. doi: 10.1111/anae.15102.

СПОСОБЫ КОМПРЕССИИ ГРУДНОЙ КЛЕТКИ ПРИ МОДЕЛИРОВАНИИ РЕАНИМАЦИИ ПАЦИЕНТОВ С COVID-19: РАНДОМИЗИРОВАННОЕ ПЕРЕКРЕСТНОЕ ИМИТАЦИОННОЕ ИССЛЕДОВАНИЕ

[1]Эврин Т., [2]Бельски К., [3]Дабровска А., [4]Смерека Е., [5]Ладны Е.Р., [2]Малыш М., [6]Якубцевич Р.Э., [7]Чарпак Л.

[1]Медицинский факультет университета Уфук, Образовательный и исследовательский Госпиталь имени доктора Ридвана Эге, Анкара, Турция;

[2]Станция скорой помощи и санитарного транспорта воеводства в Варшаве, Варшава, Польша; Польское Общество Медицины Катастроф, Варшава, Польша;

[3]Познаньский Университет Медицинских наук, Познань, Польша; Польское Общество Медицины Катастроф, Варшава, Польша;

[4]Вроцлавский Медицинский Университет, Вроцлав, Польша; Польское Общество Медицины Катастроф, Варшава, Польша;

[5]Белостокский Медицинский Университет, Белосток, Польша; Польское Общество Медицины Катастроф, Варшава, Польша;

[6]Гродненский Государственный медицинский университет, Гродно, Беларусь;

[7]Медицинская Академия имени Марии Склодовской-Кюри в Варшаве, Варшава, Польша; Польское Общество Медицины Катастроф, Варшава, Польша; Белостокский Онкологический Центр, Белосток, Польша.

Введение: Качественное сжатие грудной клетки - один из ключевых элементов реанимации для восстановления спонтанного кровообращения. В эпоху COVID-19 медицинский персонал должен носить средства индивидуальной защиты (СИЗ) от процедур, генерирующих аэрозоль (ПГА) во время реанимации. Однако использование этого средства индивидуальной защиты может снизить эффективность выполняемых медицинских процедур.

Цель: сравнить параметры качества компрессии грудной клетки между стандартной ручной компрессией грудной клетки и компрессией грудной клетки с устройством обратной связи TrueCPR, выполняемой студентами-медиками, носящими СИЗ от ПГА.

Методы: проведено рандомизированное перекрестное имитационное исследование с одинарным слепым методом. Тридцать два студента-медика в СИЗ против ПГА выполнили 2-минутное непрерывное сжатие грудной клетки на симуляторе для взрослых с устройством обратной связи TrueCPR и без него.

Результаты: Средняя глубина сжатия грудной клетки с устройством обратной связи TrueCPR и без него варьировала и составила 46 (IQR; 42-53) против 41 (IQR; 36-45) мм (ручное нажатие на грудную клетку против TrueCPR, соответственно). Частота сжатия грудной клетки вручную составляла 117 (IQR; 112-125) компрессий в минуту и была выше, чем с устройством обратной связи TrueCPR – 107 (IQR; 102-115; p = 0,017). Полное расслабление грудной клетки в методике сжатия грудной клетки, описанной в руководстве (без TrueCPR), составило 33 (IQR; 26-42)% и было ниже, чем при сжатии грудной клетки с устройством обратной связи TrueCPR - 58 (IQR; 40-75)% (p = 0,002).

Выводы: мы пришли к выводу, что устройство обратной связи TrueCPR улучшает качество компрессий грудной клетки во время имитации реанимации при COVID-19, выполняемой студентами-медиками, носящими СИЗ при ПГА.

Ключевые слова: компрессия грудной клетки; сердечно-легочная реанимация; качество; устройство обратной связи; TrueCPR; средства индивидуальной защиты; COVID-19; SARS-CoV-2; медицинская симуляция.

Об авторах / About the authors

Togay Evrin, PhD, MD, Department of Emergency Medicine, Ufuk University Medical Faculty, Dr. Ridvan Ege Education and Research Hospital, Ankara, Turkey.
Karol Bielski, PhD, Voivodeship Ambulance and Sanitary Transport Station in Warsaw, Warsaw, Poland; Polish Society of Disaster Medicine, Warsaw, Poland.
Agata Dabrowska, MSc, EMT-P, Department of Rescue Medical Service, Poznan University of Medical Sciences, Poznan, Poland; Polish Society of Disaster Medicine, Warsaw, Poland.
Smereka Jacek, Assoc Prof, MD, PhD, Department of Emergency Medical Service, Wroclaw Medical University, Wroclaw, Poland; Polish Society of Disaster Medicine, Warsaw, Poland, ORCID: 0000-0002-1427-4796
Ladny Jerzy R., Prof, MD, PhD, Clinic of Emergency Medicine, Medical University of Bialystok, Bialystok, Poland Polish Society of Disaster Medicine, Warsaw, Poland, ORCID: 0000-0003-4167-1962
Marek Malysz, MSc, EMT-P, Voivodeship Ambulance and Sanitary Transport Station in Warsaw, Warsaw, Poland; Polish Society of Disaster Medicine, Warsaw, Poland.
Ruslan Yakubtsevich, Prof. MD, PhD, Department of Anesthesiology and Intensive Care Grodno State Medical University, Grodno, Belarus, ORCID: 0000-0002-8699-8216
*Lukasz Szarpak, Assoc Prof. PhD, MBA, Maria Sklodowska-Curie Medical Academy in Warsaw, Warsaw, Poland; Polish Society of Disaster Medicine, Warsaw, Poland; Bialystok Oncology Center, Bialystok, Poland. e-mail: lukasz.szarpak@gmail.com ORCID: 0000-0002-0973-5455

Детские болезни в практике медицинской сестры с высшим образованием [Текст] : пособие для студентов учреждений высшего образования, обучающихся по специальности 1-79 01 06 "Сестринское дело" : рекомендовано учебно-методическим объединением по высшему медицинскому, фармацевтическому образованию / Министерство здравоохранения Республики Беларусь, Учреждение образования "Гродненский государственный медицинский университет", 1-я кафедра детских болезней ; [Н. А. Максимович, З. В. Сорокопыт, С. И. Байгот, Т. И. Ровбуть, Н. М. Тихон]. – Гродно : ГрГМУ, 2020. – 227 с. : табл., рис. – ISBN 978-985-595-292-4 : 4.25 р.

Пособие к практический занятиям по педиатрии включает блок теоретической информации и приложение. Разработано в соответствии с учебной программой для студентов медико-диагностического факультета и предназначено для самостоятельной подготовки студентов к практическим занятиям и экзаменам. Изложенный материал может быть использован также клиническими ординаторами, педиатрами и врачами общей практики при аттестации на рабочих местах и сдаче квалификационных экзаменов.