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Plastic blanket drowning kit: A protection barrier to immediate resuscitation at the beach in the Covid-19 era. A pilot study.

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Abstract

Objective: Introducing a new, simple and inexpensive portable equipment for lifeguards, consisting of a pre-assembled full-size plastic blanket with a mask and HEPA filter, which could offer significant time-saving advantages to reduce COVID-19 risk transmission in the first few minutes of CPR after water rescue, avoiding the negative impact of delayed ventilation.

Method: A pilot study was carried out to determine the feasibility of the pre-assembled kit of face-mask and HEPA filter adapted on a pre-set plastic-blanket. The first step consisted of washing hands, putting on safety glasses and gloves as the first personal protection equipment (PPE) and then covering the victim with an assembled plastic blanket. The second step consisted of 10 min of cardiopulmonary resuscitation (CPR) with PPE and plastic blanket, following the technical recommendations for ventilation during COVID-19.

Results: Ten rescuers took part in the pilot study. The average time to wear PPE and place the pre-assembly kit on the victim was 82 s [IC 58–105]. After 10 min the quality of the resuscitation (QCPR) was 91% [87–94]. Quality chest compressions (CC) were 22% better than ventilations (V). Most of the rescuers (60%) thought that placing the plastic blanket on the victim on the beach was somewhat simple or very simple.

Conclusions: Resuscitation techniques in COVID-19 era at the beach have added complexities for the correct use of PPE. Plastic blanket plus basic ventilations equipment resource could be a new alternative to be considered for lifeguards to keep ventilation on use while reducing risk transmission.

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1. Introduction

With the emergence of COVID-19 [1] disease, there has been a drastic change in the way emergency teams deal with out-of-hospital cardiac arrest and other emergencies.

New recommendations for Basic Life Support (BLS) from the European Resuscitation Council during the Covid-19 Era (ERC-COVID) [2], propose the use of protective personal equipment (PPE), which significantly delays the starting of chest compressions (CC) and ventilations (V) or do not recommend ventilation at all. Drowning is a critical time-dependent circumstance in which cardiac arrest is of an asphyxial origin, so ventilations are essential to revert systemic hypoxia [3] and achieve return of spontaneous circulation.

Ensuring consistent, correct use of PPE is challenging. It requires training and additional time for donning [4]. When cardiac arrest happens in aquatic environments and lifeguards have to put on and doffing PPE: certain maneuvers are initiated just after the rescue, in which instance both the victim and the lifeguards are wet; and environmental conditions such as hypothermia or hyperthermia difficult its use.

Additionally, considering that drowning kills 320,000 people worldwide every year, most of whom are in low to medium income countries (LMICs) [5], it seems unrealistic to assume that PPE will be available in most of settings.

We developed a simple, cost-effective and portable barrier kit to be used in case of drowning CPR. The primary aim of the study was to test the feasibility of this CPR kit designed for the COVID pandemic.
2. Material and method

The PPE kit consists of a pre-assembled full-size transparent plastic blanket with an adaptation to a ventilation face mask with a High Efficiency Particulate Air (HEPA) filter.

2.1. Description of the materials

- Waterproof general use, transparent plastic blanket, approximately 250 cm long by 150 cm wide, fitting any width and length victim and able to be fixed at the sand avoiding the wind blow away.
- 4–6 horseshoe spikes, necessary to fix the plastic in the sand or the ground and to prevent being lifted up by the wind.
- Standard face mask for medical use Ambu® Mark IV adult size (Ballerup, Denmark)
- HEPA filter able to adapted to the face mask.
- Adult size bag with oxygen reservoir.

2.2. Pre-assembly of the kit (Fig. 1)

To optimize the time to deployment, the stored lifeguard backpack kit should be ready to use. It is quite easy to prepare a small opening in the drape. This opening will allow the patient and BVM on the inside of the drape to be connected to the HEPA filter, oxygen bag, and rescuer on the outside of the drape. We placed this opening 50 cm from the superior border of the drape. The fixation is be secured by placing a waterproof tape around the connection.

2.3. Procedure (Fig. 2)

The full kit must be placed on the unconscious drowning victim without signs of life in 5 simple steps lasting just one minute, allowing immediate full CPR.

- Step 1. Remote signs of life assessment. If the victim is without signs of live, wash hands with hydroalcoholic gel, put on the gloves, FFP/N95 mask and protective glasses.
- Step 2. One of the lifeguards removes the plastic blanket kit (with HEPA filter and integrated mask) as well as the bag from the backpack. With the help of the second lifeguard, they cover the victim completely from head to toe.
- Step 3. The plastic blanked is attached to the sand placing one spike in each corner of the plastic. If needed, 2 additional spikes may be placed at the plastic sides.
- Step 4. Resuscitation is initiated with rescue ventilation (5 initial ventilations) according to European Resuscitation Council Guidelines for Resuscitation (ERCGR2015) drowning protocol [6].
- Step 5. The protocol of 30 compressions and 2 ventilations was followed [6].

2.4. Pilot study and statistical analysis and preliminary results

A convenience sample of 10 first responders (5 lifeguards, 3 nurses and 2 medical doctors), in random teams of two rescuers, performed a pilot test to study the feasibility of the CPR technique with plastic blanket. We chose the drowning protocol according ERCGR2015 [6], adapted to the bag-valve mask handling recommendations, according to the ERC-COVID (one rescuer fixes the mask, and the other performs CC and V) [2].

The duration of each test was 10 min. After two minutes rescuers change the position without releasing the face mask. All tests were performed on the manikin Little Anne QCPR (Laerdal, Norway). The data was recorded with the APP CPR instructor (Laerdal, Norway) installed on an Iphone 6S (Apple Inc., California, USA).

The variables analyzed were:
- A) time(s) of complete placement of the plastic blanket. B) quality of resuscitation: quality V (QV), quality CC (QCQ) and quality CPR (QCPR) in percentage (%) according to the values offered by the software APP CPR instructor (Laerdal, Norway). C) Skills complexity scale.

In retrospective analysis, each rescuer provided feedback using a skills complexity scale (very difficult, difficult, neither difficult nor easy, somewhat simple, very simple) of three groups of skills (GS).

GS1: PPE protection (hydro-alcohol hand washing and wearing PPE), GS2: Kit preparation (removing the backpack, unrolling it) and GS3: Kit application (placing on the victim, fix with spikes and assemble the resuscitation balloon).

The data shows a description based on frequencies, means and confidence intervals. A non-parametric test (Wilcoxon test) for related samples was used in the comparison of the CPR variables. The analysis was performed with the SPSS software version 23.0 for Windows (IBM corp., Chicago, IL, USA). All participants authorized the use of data for this research.
3. Results

All teams (100%) finished the trial. For the first variable, the average time for washing hands, wear PPE (glasses and gloves) and placing the plastic blanket was 82 s [IC 58–105].

The second variable (Fig. 3), the mean QCPR over 10 min, teams of 2 rescuers, was 91% [IC 87–94]. QCC was higher than QV; QCC 96% [IC 61–86] vs QV 74% [IC 61–86], p = .04.

The third variable was the subjective analysis of the technical difficulty of putting on the PPE, analyzed by a complexity scale. Most rescuers (60%) considered as “difficult” to wear PPE on the beach, however, 60% considered “neither difficult nor easy” the kit preparation. Finally, one in two rescuers commented that the kit application was “simple” and only two participants (20%) considered this process as “difficult” or “very difficult” (Fig. 4).

4. Discussion

The aim of this report was to show a simple and low cost method, which can help lifeguards at the beach in various ways: as an extra protection attached to PPE, as initial protection when they are wet and cannot wear quickly or correctly PPE (gloves, glasses and plastic coat), in case they decide to provide CPR with a bag-valve mask with HEPA filter, or also in LMICs that do not have PPE (gloves, glasses and plastic coat), in case they decide to provide CPR with a bag-valve mask with HEPA filter.

In the COVID-19 pandemic the risk of transmission during medical attendance is high. This occurs in techniques or procedures that generate aerosols, such as intubation [7] or any invasive or non-invasive ventilation technique, including the use of bag-valve mask [8,9]. Chan et al. showed, how the use of bag-valve mask even with HEPA filter, does not prevent 100% air leakage, and how this air leak could reach the rescuer performing CC [8]. For this reason the use of plastic drapes/patient covering, begins to be explored, to add extra protection during airway interventions [7,10], protecting the laryngoscopist during airway interventions [11], or covering the patient during pre-hospital cardiopulmonary resuscitation [12]. These studies and our previous experience in lifesaving have inspired the authors to bring it to an environment with a higher more uncertainty and less control, like a beach.

4.1. Limitations - is the plastic-blanket a safe proposition?

An inadequate lifeguard evaluation – victim is not in cardiopulmonary arrest – may pose a theoretical limitation if victim is fully covered by interfering with the victim spontaneous breathing. This implies an extra lifeguard training to detect signs of life on the victim and be able to quickly remove the plastic cover. In other circumstances, rescuers may need to remove the blanket: usufoam is generated in drownings of all severity [3], so the face mask may have to be removed for cleaning up and this may pose a difficulty while using the plastic blanket; foam and water may be need to be aspirated; Automatic External Defibrillation (AED) may be need as part of BLS or the patient may need to be ECG monitored at some point.

In addition, some authors have warned of possible risks, such as the permanence of aerosols under the plastic, with the risk of dispersion upon removal [9]. Matava et al. has suggested the careful removal of the drape plastic to avoid the dispersion of aerosols [7]. An alternative to aerosol control could include a suction circuit under the drape [13], but this is not possible in an emergency on the beach.
We suggest, in case of use, remove it in an upwind direction, using the plastic as a shield between the patient and the lifeguards. The Sea Breeze would likely disperse the aerosols in the opposite direction of the lifeguard situation.

4.2. What are the practical implications for lifeguards?

Transport and easy use: the plastic blanket with the HEPA filter and mask can be folded and carried in an airtight bag, inside the lifeguard’s backpack (rescue bag) along with other rescue material including PPE for CPR. The Bag-valve mask should now be a permanent tool for the lifeguard, just like the fins, rescue tube or rescue buoy. Suitable for environmental conditions: wind, extreme heat, wet and/or hypothermia after rescue it is a handicap for a correct use/wear PPE, but not for use a blanket plastic. Quality CPR maneuvers are possible (at least in this pilot study). Both V and CC exceeded an average of 70%, an arbitrary value attributed to quality CPR. [14] An important fact is its low cost. Plastic blanket is cheap (less than €1), which can give access to rescuers without resources or without training in PPE use who want to have extra protection.

5. Conclusions

The need to use PPE during resuscitation of the drowning patient during the COVID pandemic has added difficulty to the resuscitation techniques on the beach. Plastic blanket could be an alternative to consider for lifeguards when the environment, training or resources require infection transmission protection. The method described here is not intended to replace materials specifically designed for virus transmission prevention. The results of this proposal must be interpreted with the limitations of an experimental model without tests in real patients. We encourage research groups with more resources and Emergency Medical/Lifeguards teams with real experiences using blanket-plastic to report their outcomes.

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Declaration of Competing Interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajem.2020.08.101.

References

[1] World Health Organization. Naming The Coronavirus Disease (COVID-2019) And The Virus That Causes It [Internet]. 2020 (May 11). Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it
[2] Nolan JP, et al. European resuscitation council COVID-19 guidelines executive summary. Resuscitation. 2020;153:45–55. https://doi.org/10.1016/j.resuscitation.2020.06.001.
[3] Szpilman D, Bierens JLM, Handley AJ, Orlowsky JP, Dronning N. Engl J Med. 2012;366(22):2102–10. https://doi.org/10.1056/NEJMra1013317.
[4] Díaz-Guiao DA, Ricardo-Zapata A, Ospina-Velez J, Gómez-Candamil G, Mora-Martinez S, Rodríguez-Morales AJ. Cognitive load and performance of health care professionals in donning and doffing PPE before and after a simulation-based educational intervention and its implications during the COVID-19 pandemic for biosafety. Int J Nurs Pract. 2020;28(Suppl. 1):111–7.
[5] World Health Organization. Violence and Injury Prevention—Drowning. World Health Organization 2019. Available from: https://www.who.int/health-topics/drowning; 2019. (Date accessed 21-07-2020).
[6] Truhlária A, Deakin CD, Soar J, Khalbisa GEA, Alfonsob A, Bierens JLM, et al. European resuscitation council guidelines for resuscitation 2015: section 4. Cardiac arrest in special circumstances. Resuscitation. 2015;95:148–54. https://doi.org/10.1016/j.resuscitation.2015.07.017.
[7] Matava CT, Yu J, Denning S. Clear plastic drapes may be effective at limiting aerosolization and droplet spray during extubation: implications for COVID-19. Can J Anaesth. 2020;67(7):902–4. https://doi.org/10.1002/cja.12630-020-01649-w.
[8] Chan MTV, Chow BM, Chu L, Hui DSC. Mask ventilation and dispersion of exhaled air. Am J Respir Crit Care Med. 2013;187(7):e12–4. https://doi.org/10.1164/rccm.201301-0137TM.
[9] Christian MD, Loutfy M, McDonald LC, Martinez XF, Ofner M, Wong T, et al. Possible SARS coronavirus transmission during cardiopulmonary resuscitation. Emerg Infect Dis. 2004;10(2):267–93. https://doi.org/10.3201/0012020200230700.
[10] Chow VLY, Chan JW, Ho VWY, Pang SYY, Lee GCC, Wong MMK, et al. Tracheostomy during COVID-19 pandemic—novel approach. Head Neck. 2020 [Internet]. (Jun 28). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7267533/ (in press) (Epub ahead of print).
[11] Brown S, Patrão F, Verma S, Lean A, Flack S, Polaner D. Barrier system for airway management of COVID-19 patients. Anesth Analg. 2020 [Internet]. (Jun 28). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7179052/ (in press) (Epub ahead of print).
[12] Allen B, Gardner C, O’Neill C, Gibbs M. Use of drape/patient covering during potentially aerosolizing procedures. Am J Emerg Med. 2020 [Internet]. [Jun 28]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7204666/.

[13] Endersby RVW, Spencer AQ, Ho ECY, Goldstein DH, Schubert E. Clear plastic drapes for aerosol-generating medical procedures in COVID-19 patients: questions still remain. Can J Anaesth. 2020;67(1465):1. https://doi.org/10.1007/s12630-020-01705-5 (May 11).

[14] Perkins GD, Colquhoun M, Simons R. ABC of Resuscitation. 5th ed. London: BMJ books; 2004; 97–101.