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Simulation and education

What is the best position to place and re-evaluate an unconscious but normally breathing victim? A randomised controlled human simulation trial on children

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Abstract

Background: Current resuscitation guidelines endorse placing the unconscious and normally breathing victims in the recovery position (RP), but this technique might hinder breathing evaluation.

Aim: To compare breathing evaluation and cardiac arrest detection: placing the victim in RP and checking breathing regularly, placing the victim in RP while re-evaluating breathing every minute, and placing the victim on his back, maintaining an open airway with the head-tilt-chin-lift technique and continuously checking breathing.

Methods: Schoolchildren aged 10–12 with no previous cardiopulmonary resuscitation (CPR) training, from three different primary schools were randomly allocated into groups to receive a CPR course involving one of the three strategies. Then a human simulation took place.

Result: 192 schoolchildren (64 per group) were randomly selected and received one of the courses. 182 participants who correctly assessed the victim were compared: 16 (26.2%) out of the 59 participants using RP and checking breathing regularly detected cardiac arrest before the end of the simulation, compared to 41 (67.20%) out of 61 using RP re-evaluating breathing every minute, and 56 (90.3%) out of 62 using head-tilt-chin-lift. Statistically significant differences were found between the RP groups ($p < 0.001$; OR = 5.766) as well as between the Head-tilt-chin-lift and both RP groups ($p < 0.001$; OR = 21.094), ($p = 0.002$; OR = 4.553).

Conclusion: The strategy involving head-tilt-chin-lift significantly increased the likelihood of detecting cardiac arrest. Re-evaluating every minute when the RP was used significantly increased the likelihood of detecting cardiac arrest.

Keywords: Recovery position, CPR, Breathing assessment, Out-of-hospital cardiac arrest, Head-tilt and chin-lift, Schoolchildren

Abbreviations: CPR, cardiopulmonary resuscitation; OHCA, out-of-hospital cardiac arrest; BLS, basic life support; HTCL, head tilt and chin lift technique; RP, recovery position; HTCL group, head tilt and chin lift group; RP regularly, recovery position, checking the victim regularly group; RP minute, recovery position, breathing re-evaluation every minute group; EMS, emergency medical services; ERC, European resuscitation guidelines.

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Introduction

Out-of-hospital cardiac arrest (OHCA) is one of the most prevalent causes of death and morbidity worldwide[1–4]. Immediate recognition of the situation is essential for a prompt initiation of bystander cardiopulmonary resuscitation (CPR) and early defibrillation[5,6] in order to improve the victim's outcome[6].

Breathing assessment is a key step for early OHCA recognition, but in the first minutes of witnessed primary OHCA, breathing assessment can be challenging[7,8]. According to animal[9,10] and human[11–14] studies, continuous spontaneous ventilatory activity similar to normal breathing can be present during the first minute after the beginning of a ventricular fibrillation (VF).

To prevent an erroneous evaluation· current guidelines recommend starting CPR if the victim is not breathing normally[6], but if the bystander makes a wrong first evaluation of an unconscious and normally breathing victim, a re-evaluation of the victim becomes even more necessary. According to a real victims study[11] 45% of lay bystanders did not detect the cardiac arrest. This situation could be more difficult to interpret because with the diffusion and use of high quality CPR the victim could show signs of breathing when in fact it is caused by cardiac compressions[15].

2015 CPR[6] resuscitation guidelines endorsed placing unresponsive and normally breathing victims in the recovery position and checking breathing regularly. Several studies[16,17], have been published warning that the recovery position could hinder a victim's breathing evaluation and cardiac arrest detection, thus delaying CPR. A statement[18] (never formally ratified by the European Resuscitation Council (ERC)) was emitted in the "ERC newsletter", proposing, until more evidence is produced, the use of RP but re-evaluating the victims every minute. Will this modification improve a victiḿs re-evaluation and cardiac arrest detection?

The aim of the study is to know whether children aged 10–12 are able to correctly assess an unconscious victim and to compare victims' breathing assessment and cardiac arrest detection: placing the victim in RP and checking breathing regularly, placing the victim in RP and re-evaluating the victim every minute, and leaving the victim placed on his back maintaining an open airway with the head-tilt-chin-lift (HTCL) technique and continuously checking breathing.

Methods

Design, sample and setting

Sample

192 students aged 10–12 years old from three primary school centres from Galicia (Spain), without any previous CPR knowledge or training, make up the sample of this study. The sample size was determined from data of the Ministry of Culture, Education and University Planning for academic year 2015–16 from Galicia (Spain). They were given the opportunity to receive a programmed CPR course in their physical education class.

Their participation in the study was voluntary. Their parents or the legal guardian of each participant signed an informed consent, authorising the children to participate and the transfer of their data for the study. The research project was approved by the ethical committee of the University of Santiago de Compostela, respecting the ethical principles of the Helsinki Convention.

Study design

The 192 schoolchildren (organised by gender, year of birth and class position number), without physical or mental disability, were assigned through simple random distribution into three clusters controlled by the corresponding author. They were given a basic life support (BLS) training course according to current CPR guidelines[6] with one difference : when the assessment concluded in an unresponsive and normally breathing victim, the students in the first group (RPregularly) were taught to place the victim in the recovery position and then to check breathing regularly according to 2015 guidelines[19]. The students in the second group (RPminute) were taught to use the recovery position and re-evaluate breathing every minute according to a 2017 ERC newsletter (*not formally ratified by the ERC)[18]. And finally, the students in the third group (HTCL group) received the same training but they were taught to leave the unconscious and normally breathing victim lying on their back with the student at the victiḿs side maintaining an open airway with the HTLC technique, continuously monitoring victiḿs breathing[17]. All of the three courses highlighted the importance of starting CPR if they were not certain if the victim was breathing normally. They were also informed of the difficulties involved in assessing breathing[7] and a detailed description of the main characteristics of abnormal breathing was given[8]. The participants in each group did not know the strategy taught to the other groups.

Immediately after the BLS course, an evaluation was carried out in an isolated room at the school. The participants were informed that the purpose of the study was to evaluate cardiac arrest situations in a simulation carried out by a real actor who played the victim. They were provided with a smartphone, and then came into the room where the simulation was going to take place one by one. The actor, a simulation-trained scuba diver then simulated an episode of severe chest pain followed by a sharp fall to the ground and unconsciousness. The actor was breathing normally at the time of the fall[9] and during the first minute, but his breathing pattern became progressively slower and deteriorated over the following minute (agonal breathing) and concluded in breathing arrest at the beginning of the third minute and then the actor remained in apnoea for another two minutes[9,12]. The simulation ended 3 min after the starting time or at the time the participants attempted to deliver CPR (chest compressions). Because current basic life support guidelines[6] endorsed that "patients who are unresponsive and not breathing normally should be presumed to be in cardiac arrest", we assume that if the actor was able to reproduce the mentioned respiratory diagnostic signs, then we can assume the situation to be cardiac arrest.

An observer in charge of assessing the participants' actions and recording times, and a third person, who was responsible for the actoŕs safety, were also inside the room during the whole process. The observer had to be aware of the technique being applied, and so the study design was a simple blinding. The data was collected on individual pre-designed paper sheets and then introduced into excel software.

The primary aim of the study was to assess the association between the victims' position (RPregularly, RPminute and HTCL groups) and the percentage of participants who recognized cardiac arrest (abnormal breathing or breathing arrest). The participant was only included in the data analysis of the study if their first assessment had concluded with a correct evaluation (an unresponsive and normally breathing victim). The secondary aim was to discover if the children were able to correctly assess a simulated victim, and determining that the victim was unconscious and normally breathing was considered to be the right evaluation.

Data analysis

Pearson's Chi-squared test and *odds ratio* (OR) were used to evaluate the differences between groups regarding researcher observations. The ANOVA test was used to investigate differences between mean times and the Bonferroni test was used to check the statistical significance of results between different groups. Significance of difference was set at the $p < .05$ level with the corresponding 95% confidence interval (95%CI).

All the data was processed using the SPSS version 20 statistical package for MS Windows (SPSS Inc., IBM, USA).

Results

192 student volunteers aged 10–12 (M = 10.94; SD = 0.74), 50% male and 50% female) (see Fig. 1) were randomised and received the CPR courses. At the end of initial assessment, only 86 (47.25%) participants were male and 96 (52.75%) female. The whole process was completed between April and May 2017 as planned. All the evaluations took place immediately after finishing the course.

After the victiḿs initial assessment (secondary outcome), 182 (94.79%) participants evaluated the victim's state as unresponsive but normally breathing, which was considered the right evaluation (see Fig. 1), two children (initially allocated to the RPregularly group) evaluated the victim as unconscious and abnormally breathing and they started cardiac compressions (wrong evaluation) and 8 participants were unable to assess the victim. These last 10 children were excluded from the analysis of the primary outcome.

First assessment results are shown in Table 1.

The mean time required by the 184 participants to complete the first assessment was 37.95 s (SD = 9.17) in the RPregularly group, 43.16 s (SD = 1178) in the RPminute group and 40.70 s (SD = 15.33) in

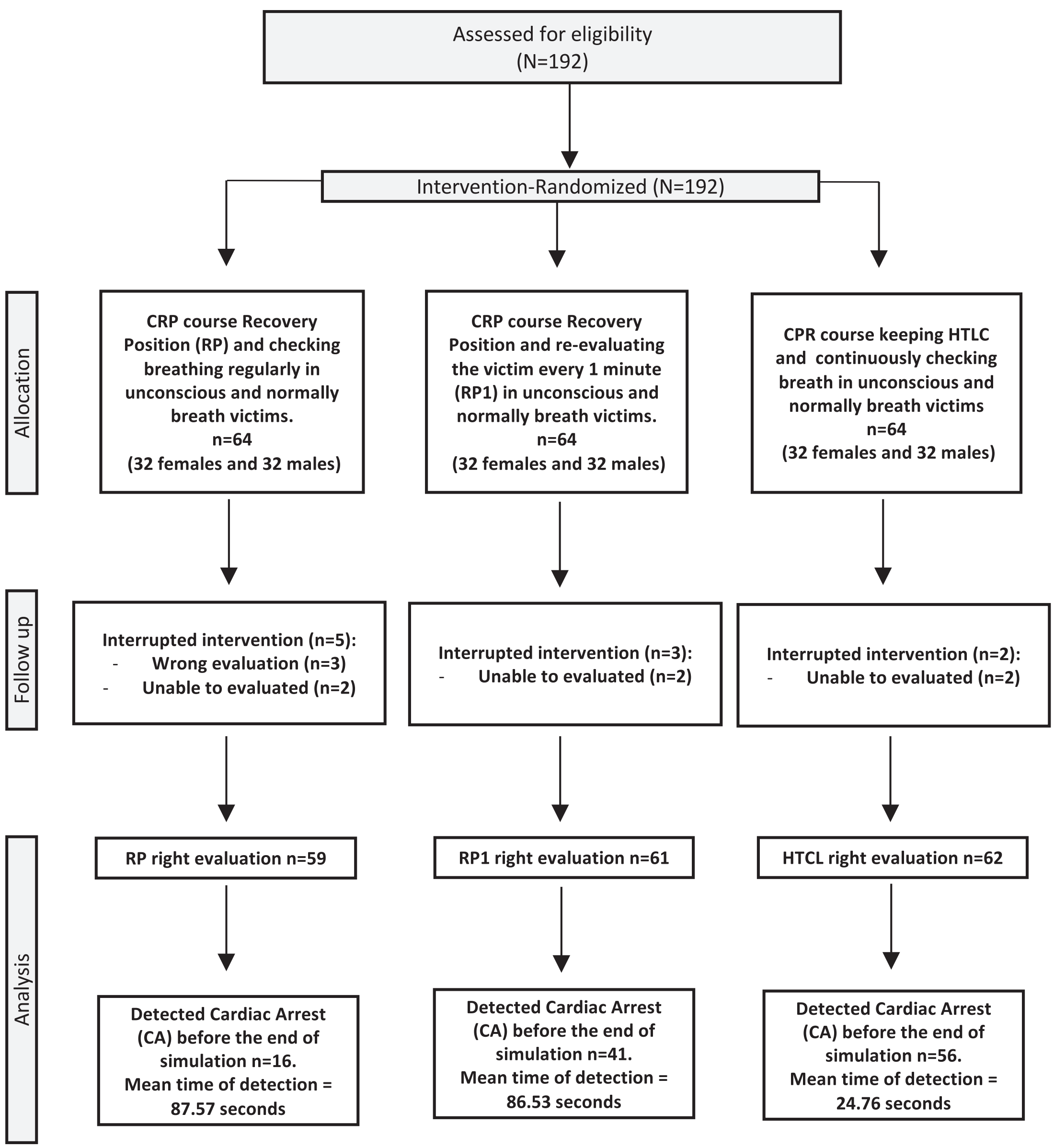

Fig. 1 – Flow Chart.

Table 1 – Results for the descriptive analysis of the variables analyzed. Researcher observations.

	Group			
		RP (n = 61)	RP1 (n = 61)	HTCL (n = 62)
Consciousness evaluation	No	2 (3.28 %)	5 (8.20 %)	1(1.60 %)
	Yes	59 (96.72 %)	56 (91.80 %)	61 (98.40 %)
Ask for help	No	6 (9.84 %)	3 (4.90 %)	3 (4.83 %)
	Yes	55 (90.16 %)	58 (95.10 %)	59 (95.16 %)
Breathing evaluation	Incorrect	13 (21.31 %)	3 (4.90 %)	2 (3.20 %)
	Correct	48 (78.69 %)	58 (95.10 %)	60 (96.80 %)
Call emergency telephone number	No	12 (19.67 %)	13 (21.30 %)	3 (4.80 %)
	Yes	49 (80.33 %)	48 (78.70 %)	59 (95.20 %)

RP = Recovery Position; **RP1** = Recovery Position re-evaluating after 1 min; **HTCL** = Head tilt and chin lift technique; **n:** Number of subjects.

the HTCL group. No statistically significant differences were found: F (2, 182) = .898, p = 0.410.

182 children (86 males (47.25%) and 96 females (52.75%) were evaluated for the primary outcome (59 in the RPregularly group, 61 in RPminute group and 62 in the HTCL group). All of the 182 participants completed the intervention with the technique they had been allocated.

113 participants detected cardiac arrest before the end of the simulation: 16 (26.2%) out of the 59 participants in the RPregularly group, 41 (67.20%) out of 61 in the RPminute group, and 56 (90.3%) out of 62 in the HTCL group (See Fig. 1). Statistically significant differences were found between RPregularly and RPminute groups ($p < 0.001$; OR = 5.766, CI 2.63–12.60), RPregularly and HTCL groups ($p < 0.001$; OR = 21.094, CI 7.57–58.80) and between RPminute and HTCL groups (p = 0.002; OR = 4.553, CI 1.679–12.943).

When cardiac arrest was detected by the participants, the average time required for identification was 87.57 (SD = 19.06) seconds (range from 54 to 110 s) in the RPregularly group, 86.53 (SD = 17.52) (40–114 s) in the RPminute group and 24.76 s (SD = 22.81) (6–105.69 s) in the HTCL group. The differences were statistically significant: F (2, 111) = 124,892, $p < 0.001$, $\eta 2 = .70$.

With regard to the re-evaluation in the RPminute group, only two children waited the whole minute to re-evaluate the breathing.

Discussion

The present study shows that placing the unconscious and spontaneously breathing victim on his/her back maintaining an open airway with the head-tilt-chin-lift manoeuvre and continuously checking breathing significantly improved breathing assessment, cardiac arrest detection and the start of CPR, as compared to the strategies using the recovery position technique. A simple modification in the re-evaluation time in the RP groups from “check breathing regularly” to “re-evaluate the victim every minute” significantly improved cardiac arrest detection (success rate increased from 26% to 67%).

The study also demonstrates that schoolchildren aged 10–12 were able to correctly assess a victim and to detect cardiac arrest in a human simulation.

The knowledge and scientific evidence for the different positions to evaluate and to place the unconsciously and normally breathing victims are mostly based on studies reporting indirect outcome measures (not by comparing mortality or morbidity). The main issues of the use of these manoeuvres according a recent editorial[22] are as follows:

Re-evaluation and ability to detect cardiac arrest: Similar to previous breathing assessment studies[17,22], the present simulation study highlights the idea of the advantages of continuously monitoring breathing to detect cardiac arrest; but is based on simulation studies and there is only one clinical letter[16] reporting a small number of cases warning that the RP could hinder CA detection. Interestingly, the present study shows that a simple change, “re-evaluating the victim placed in the RP every minute”, significantly improved CA detection. The authors do not know if a different time period would have achieved better results, but the fact that the children did not wait for the whole minute to re-evaluate the victim and the difficulties for the children to roll the victim every minute might make using a shorter time period unadvisable. Interestingly, these results could suggest the importance of establishing a concrete period of time in the recommendations. Continuously monitoring the victim with HTCL might even complement the initial victims breathing evaluation given that the guidelines´ recommended time (less than ten seconds) only allows the assessment of one or two breaths in the case of a 12 breath per minute victim, and the extended time might facilitate the evaluation of the breathing quality (normal vs abnormal).

Airway patency

Both RP and HTCL techniques are widely used and consolidated in CPR guidelines despite the lack of studies reporting direct outcomes (morbidity and mortality). A clinical study[23] associating the position to a specified clinical outcome related to airway patency (suspected aspiration pneumonia in poisoned comatose patients) showed that victims placed in a prone position (and semi-recumbent) had a lower incidence of suspected aspiration pneumonia when compared to the use of the lateral and supine positions. We were not be able to identify any studies comparing HTCL and RP reporting direct outcome measures (mortality or morbidity)[24]. The evidence for RP and HTCL is based on indirect outcome measures[24], (oxygen desaturation, stridor score, upper airway resistance . . .) mostly with anesthetised or obstructive sleep apnoea patients. Using HTCL is endorsed to open the airway, and to give mouth to mouth ventilation because it increases tidal volume by improving airway patency[25]. There is some evidence favourable to RP vs supine in studies reporting apnoea/hypopnoea index[24]. A study in anesthetised children[26] showed similar airway dimensions and stridor scores using lateral position and chin lift. Moreover, both parameters improved with the combined use of HTCL and RP. A recent study shows clinical benefit using RP, reducing the hospital admission rate of children[27] mostly with febrile seizures[28], non-febrile seizures and vasovagal syncope. However, the authors explain that future prospective studies recording clinical complications, and laboratory or radiological tests after admission are needed to explore the potential mechanism of the outcome. The study does not compare RP to a specific position because an array of manoeuvres (shaking, water on face, chest compressions . . .) were also reported.

Vomiting

The rationale of the gravitational effect, lateral positions using RP, logrolling techniques or simply putting the victim on his/her side should be used if vomiting is detected. Maintaining HTCL when the victim is placed on his/her[26] side might be useful in improving airway diameter and continuously monitoring the victim's breathing.

If foreign body airway obstruction is suspected, chest compressions should be delivered immediately in all unresponsive victims[29].

Traumatised victims: when spinal cord injury may have occurred. We were unable to identify any studies comparing HTCL and RP reporting clinical[30] outcomes measures (mortality or morbidity): In a clinical study in 18 patients with thoracic or lumbar spinal fractures, the log-rolling manoeuvre did not result in any neurological deterioration[31] HTCL is endorsed to open the airway in the victim's first assessment. Maintaining HTCL will probably not cause additional damage and might also cause less damage than RP (which involves the use of an additional technique) if it is used on unconscious spontaneously breathing traumatic victims. Despite the fact that some studies associate the use of the RP with spinal cord movement in healthy volunteers and in cadavers with injured cervical spine, no studies were found[30] reporting mortality or neurological deterioration.

Leaving the victim alone

The head-tilt chin-lift position requires the constant presence of the rescuer to maintain airway patency and to improve cardiac arrest detection, whereas RP is endorsed to allow leaving the victim alone in spite of the fact that abandoning the victim could be associated with a bad prognosis in the case of cardiac arrest and with an impairment[32] of arterial inflow in the dependent forearm. This could be an advantage when there are no phones or in situations of multiple casualties.

Teaching and learning

Both techniques are included and consolidated in the current guidelines. HTCL is used as a part of the initial unconscious victims' evaluation and also to deliver mouth to mouth ventilation and is associated with ease of use, even with children[33]. Learning RP probably takes longer (a study in Germany[34] reports an average teaching time of 51 min for CPR, 44 min for RP) and performance varies greatly (ranging from 8 to 87%)[35,36]. In the present study the performance of these techniques was not compared because of the unsolved question of how many steps[37] would be required to consider RP being carried out correctly.

Use of the strategies in dispatcher-assisted guidance: HTCL is explained by the dispatcher in the first assessment of the victim. Some Emergency Medical services endorse RP but in fact use an abbreviated "place the victim on his/her side"[38] in the telephone-guided steps because of the supposedly higher complexity of the recovery position[37].

The present study highlights the importance of re-evaluating the victims. In the twenty-first century, with the development of global mobile telephones[39] and mature emergency medical systems (EMS), the need to abandon the victim is limited and probably associated with a bad prognosis. Re-evaluating the victims placed in RP every minute improved cardiac arrest detection and could be applied to clinical practice. Using HTCL and continuously monitoring the victim, placing him/her on his/her side if vomiting is detected and starting chest compressions if a foreign body obstruction or cardiac arrest is detected could improve the percentage of witnesses starting CPR before EMS arrival. This would limit the use of RP to situations of abandoning the victim or of multiple victims. In addition, the EMS dispatcher could hold the line in all cases of unresponsive and normally breathing victims, guiding easy re-evaluations to improve cardiac arrest detection. HTCL-based strategy might be a reasonable real option, but clinical studies specifically designed to compare the use of both strategies are needed.

Limitations

Although the simulation model was dynamic (changing throughout different breathing patterns) and the differences in the results were significant, the study was just a simulation and it only reproduces the first 4 min of witnessed OHCA and one model of breathing deterioration. The evaluation was made immediately after the CPR courses with the objective of trying to mitigate the effect of the skills decay that might be greater in the most complicated technique, the RP[25].

Conclusions

School children aged 10–12 were able to correctly assess a victim and to detect cardiac arrest in a human simulation.

The strategy involving head-tilt-chin-lift significantly increased the likelihood of detecting cardiac arrest.

Changing the recommendation of re-evaluating the victim from "regularly" to "every minute" when the recovery position was used significantly increased the likelihood of detecting cardiac arrest.

Conflicts of interest

None of the authors have any source of funding related to this article.

REFERENCES

1. Berdowski J, Berg RA, Tijssen JG, Koster RW. Global incidences of out-of-hospital cardiac arrest and survival rates: systematic review of 67 prospective studies. Resuscitation 2010;81:1479–87.
2. Grasner JT, Herlitz J, Koster RW, Rosell-Ortiz F, Stamatakis L, Bossaert L. Quality management in resuscitation—towards a European cardiac arrest registry (EuReCa). Resuscitation 2011;82:989–94.
3. Grasner JT, Bossaert L. Epidemiology and management of cardiac arrest: what registries are revealing. Best Pract Res Clin Anaesthesiol 2013;27:293–306.
4. Gräsner JT, Lefering R, Koster RW, et al. EuReCa ONE-27 Nations, ONE Europe, ONE Registry: a prospective one month analysis of out-

of-hospital cardiac arrest outcomes in 27 countries in Europe. Resuscitation 2016;105:188–95.
5. Hasselqvist-Ax I, Riva G, Herlitz J, et al. Early cardiopulmonary resuscitation in out-of-hospital cardiac arrest. N Engl J Med 2015;372:2307–15.
6. Perkins GD, Handley AJ, Koster RW, et al. European Resuscitation Council Guidelines for Resuscitation 2015: section 2. Adult basic life support and automated external defibrillation. Resuscitation 2015;95:81–99.
7. Perkins GD, Stephenson B, Hulme J, Monsieurs KG. Birmingham assessment of breathing study. Resuscitation 2005;64:109–13.
8. Perkins GD, Walker G, Christensen K, Hulme J, Monsieurs KG. Teaching recognition of agonal breathing improves accuracy of diagnosing cardiac arrest. Resuscitation 2006;70:432–7.
9. Zuercher M, Ewy GA, Hillwig RW, et al. Continued breathing followed by gasping or apnea in a swine model of ventricular fibrillation cardiac arrest. BMC Cardiovasc Disord 2010;10:36.
10. Haouzi P, Ahmadpour N, Bell HJ, et al. Breathing patterns during cardiac arrest. J Appl Physiol 2010;109(2):405–11.
11. Bobrow BJ, Zuercher M, Ewy GA, et al. Gasping during cardiac arrest is frequent and associated with improved survival. Circulation 2008;118:2550–4.
12. Breckwoldt J, Schloesser S, Arntz H-R. Perception of collapse and assessment of cardiac arrest by bystanders of out-of-hospital cardiac arrest. Resuscitation 2009;80:1108–13.
13. Fukushima H, Imanishi M, Iwami T, et al. Abnormal breathing of sudden cardiac arrest victims described by laypersons and its association with emergency medical service dispatcher-assisted cardiopulmonary resuscitation instruction. Emerg Med J Published 2015;32:314–7.
14. White L, Rogers J, Bloomingdale M, et al. Dispatcher-assisted cardiopulmonary resuscitation risks for patients not in cardiac arrest. Circulation 2010;121:91–7.
15. Olaussen A, Shepherd M, Nehme Z, Smith K, Bernard S, Mitra B. Return of consciousness during ongoing cardiopulmonary resuscitation: a systematic review. Resuscitation 2015;86:44–8.
16. Freire-Tellado M, Pavón-Prieto MP, Fernández-López M, Navarro-Patón R. Does the recovery position threaten cardiac arrest victiḿs safety assessment? Resuscitation 2016;105:e1.
17. Freire-Tellado M, Navarro-Patón R, Pavón-Prieto MP, et al. Does lying in the recovery position increase the likelihood of not delivering cardiopulmonary resuscitation? Resuscitation 2017;115:173–7.
18. ERC, Comments to "Does lying in recovery position increase the likelihood of not delivery cardiopulmonary resuscitation?" Newsletter, [cited 21 June 2017] recovered from: http://us13.campaign-archive2.com/?u=88a6939c2ba7251362ac5935d&id=1ee5124b05.
19. Zideman DA, De Buck EDJ, Singletary EM, et al. European resuscitation council guidelines for resuscitation 2015: section 9. First aid. Resuscitation 2015;95:278–87.
22. Freire-Tellado M, Navarro-Patón R, Mateos-Lorenzo J, Fernández-López M, Vázquez-Corveiras CJ, Castro-Trillo JA. Victim's assessment and cardiac arrest detection in a human simulation model. Resuscitation 2018;124:e5–6.
23. Adnet F, Borron SW, Finot MA, Minadeo J, Baud FJ. Relation of body position at the time of discovery with suspected aspiration pneumonia in poisoned comatose patients. Crit Care Med 1999;27:745–8.
24. Hydmo PK, Vist GE, Feyling AC, Rognas L, Magnusson V, Sandberg M. Is the supine position associated with loss of airway patency in unconscious trauma patients? A systematic review and meta-analysis. J Trauma Resusc Emerg Med 2015;23:50.
25. Guildner CW. Resuscitation-opening the airway. A comparative study of techniques for opening an airway obstructed by the tongue. JACEP 1976;5:588–90.
26. Arai YCP, Fukunaga K, Ueda W, Hamada M, Ikenaga H, Fukushima K. The endoscopically measured effects of airway maneuvers and the lateral position on airway patency in anesthetized children with adenotonsilar hypertophy. Anesth Analg 2005;100:949–52.
27. Julliand S, Desmarest M, Gonzalez L, et al. Recovery position significantly associated with a reduced admission rate of children with loss of consciousness. Arch Dis Child 2016;101(6):521–6.
28. Mastrangelo M, Midulla F, Moretti C. Actual insights into the clinical management of febrile seizures. Eur J Pediatr 2014;173:977–82.
29. Kinoshita K, Azuhata T, Kawano D, Kawahara Y. Relationships between pre-hospital characteristics and outcome in victims of foreign body airway obstruction during meals. Resuscitation 2015;88:63–7.
30. Hydmo PK, Vist GE, Feyling AC, Rognas L, Magnusson V, Sandberg M. Does turning trauma patients with an unstable spinal injury from the supine to a lateral position increase the risk of neurological deterioration? A systematic review. J Trauma Resusc Emerg Med 2015;23:65.
31. Rao S, Badani KM, Kumar J, McGuire P. Effect of the log-rolling maneuver on the unstable fractured spine. Neuro-Orthopedics 1993;15:25–30.
32. Rathgeber J, Panzer W, Gunther U, et al. Influence of different types of recovery positions on perfusion indices of the forearm. Resuscitation 1996;32:13–7.
33. Bollig G, Mykelebust AG, Ostringen K. Effects of first training in the kindergarten–a pilot study. J Trauma Resusc Emerg Med 2011;19:13.
34. Wagner P, Lingemann C, Arntz HR, Breckwold J. Official lay basic life support courses in Germany: is delivered content up to date with the guidelines? An observational study. Emerg Med J 2015;32:547–52.
35. De Buck E, Remoortel HV, Dieltjens T, et al. Evidence-based educational pathway for the integration of first aid training in school curricula. Resuscitation 2015;94:8–22.
36. Bollig G, Wahl HA, Svendsen MV. Primary school children are able to perform basic life-saving first aid measures. Resuscitation 2009;80:689–92.
37. Joshi MS, Lamb R. Less is more. Possible ways to improve tuition of the recovery position. Emerg Med J 2012;29:679–82.
38. García del Águila, López-Messa J, Rosell-Ortiz F, et al. Recomendaciones para el soporte telefónico a la reanimación por testigos desde los centros de coordinación de urgencias y emergencias. Med Intensiva 2015;39:298–302.
39. Mobility Report. Ericsson mobility report 2014. 2014.