

## RCP MECÀNICA

1. Resuscitation. 2017 Jul 5. pii: S0300-9572(17)30269-1. doi: 10.1016/j.resuscitation.2017.06.026. [Epub ahead of print]

*Post-admission outcomes of participants in the PARAMEDIC trial: a cluster randomised trial of mechanical or manual chest compressions.*

Ji C1, Lall R1, Quinn T2, Kaye C1, Haywood K1, Horton J1, Gordon V1, Deakin CD3, Pocock H4, Carson A5, Smyth M6, Rees N7, Han K8, Byers S8, Brace-McDonnell S1, Gates S1, Perkins GD9; PARAMEDIC trial Collaborators.

Abstract

**BACKGROUND:** The PARAMEDIC cluster randomised trial evaluated the LUCAS mechanical chest compression device, and did not find evidence that use of mechanical chest compression led to an improvement in survival at 30 days. This paper reports patient outcomes from admission to hospital to 12 months after randomisation.

**METHODS:** Information about hospital length of stay and intensive care management were obtained through linkage with Hospital Episode Statistics and the Intensive Care National Audit and Research Centre. Patients surviving to hospital discharge were approached to complete questionnaires (SF-12v2, EQ-5D, MMSE, HADS and PTSD-CL) at 90days and 12 months. The study is registered with Current Controlled Trials, number ISRCTN08233942.

**RESULTS:** 377 patients in the LUCAS arm and 658 patients in the manual chest compression were admitted to hospital. Hospital and intensive care length of stay were similar. Long term follow-up assessments were limited by poor response rates (53.7% at 3 months and 55.6% at 12 months). Follow-up rates were lower in those with worse neurological function. Among respondents, long term health related quality of life outcomes and emotional well-being was similar between groups. Cognitive function, measured by MMSE, was marginally lower in the LUCAS arm mean 26.9 (SD 3.7) compared to control mean 28.0 (SD 2.3), adjusted mean difference -1.5 (95% CI -2.6 to -0.4).

**CONCLUSION:** There were no clinically important differences identified in outcomes at long term follow-up between those allocated to the mechanical chest compression compared to those receiving manual chest compression.

## RCP

1. Resuscitation. 2017 Jul 14. pii: S0300-9572(17)30295-2. doi: 10.1016/j.resuscitation.2017.07.014. [Epub ahead of print]

*Association of Bystander Interventions and Hospital Length of Stay and Admission to Intensive Care Unit in Out-of-Hospital Cardiac Arrest Survivors.*

Riddersholm S1, Kragholm K2, Mortensen RN3, Pape M3, Hansen CM4, Lippert FK5, Torp-Pedersen C6, Christiansen CF7, Rasmussen BS8.

Abstract

**BACKGROUND:** The impact of bystander interventions on post-arrest hospital course is sparsely studied. We examined the association between bystander interventions and length of hospital stay and admission to intensive care unit (ICU) in one-day survivors after OHCA.

**METHODS:** This cohort study linked data of 4,641 one-day OHCA survivors from 2001-2014 to data on hospital length of stay and ICU admission. We examined associations between bystander efforts and outcomes using regression, adjusted for age, sex, comorbidities, calendar year and witnessed status. We divided bystander efforts into three categories: 1. No bystander interventions; 2. Bystander CPR only; 3. Bystander defibrillation with or without bystander CPR.

**RESULTS:** For patients surviving to hospital discharge, hospital length of stay was 20days for patients without bystander interventions, compared to 16 for bystander CPR, and 13 for bystander defibrillation. 82% of patients without bystander interventions were admitted to ICU compared to 77.2% for bystander CPR, and 61.2% for bystander defibrillation. In-hospital

mortality was 60% in the first category compared to 40.5% and 21.7% in the two latter categories. In regression models, bystander CPR and bystander defibrillation were associated with a reduction of length of hospital stay of 21% (Estimate: 0.79 [95% CI: 0.72-0.86]) and 32% (Estimate: 0.68 [95% CI: 0.59-0.78]), respectively. Both bystander CPR (OR: 0.94 [95% CI: 0.91-0.97]) and bystander defibrillation (OR: 0.81 [0.76-0.85]), were associated with lower risk of ICU admission.

CONCLUSIONS: Bystander interventions were associated with reduced hospital length of stay and ICU admission, suggesting that these efforts improve recovery in OHCA survivors.

## TRAUMA

1. *Anesth Analg*. 2017 Jul 10. doi: 10.1213/ANE.0000000000002283. [Epub ahead of print]

*Low End-Tidal Carbon Dioxide at the Onset of Emergent Trauma Surgery Is Associated With Nonsurvival: A Case Series.*

Dudaryk R1, Bodzin DK, Ray JJ, Jabaley CS, McNeer RR, Epstein RH.

Abstract

BACKGROUND: End-tidal carbon dioxide (EtCO<sub>2</sub>) is a valuable marker of the return of adequate circulation following cardiac arrest due to medical causes. Previously, the prognostic value of capnography in trauma has been studied among limited populations in prehospital and emergency department settings. We aimed to investigate the relationship between early intraoperative EtCO<sub>2</sub> and nonsurvival of patients undergoing emergency surgery at a level 1 academic trauma center as a case series. If there is a threshold below which survival was extremely unlikely, it might be useful in guiding decision-making in the early termination of futile resuscitative efforts.

METHODS: Following institutional review board approval, a data set was created to investigate the relationship between EtCO<sub>2</sub> values at the onset of emergent trauma surgery and nonsurvival. Patients who were admitted and transferred to the operating room (OR) directly from a resuscitation bay were identified using the Ryder Center trauma registry (October 1, 2013, to June 30, 2016). Electronic records from the hospital's anesthesia information management system were queried to identify the matching anesthesia records. The maximum EtCO<sub>2</sub> values within 5 and 10 minutes of the onset of mechanical ventilation in the OR were determined for patients undergoing general anesthesia with mechanical ventilation. Patients were divided into 2 groups: those who were discharged from the hospital alive (survivors) and those who died in the hospital prior to discharge (nonsurvivors). The threshold EtCO<sub>2</sub> giving a positive predictive value of 100% for in-hospital mortality was determined from a graphical analysis of the data. Association of determined threshold and mortality was analyzed using the 2-tailed Fisher exact test.

RESULTS: There were 1135 patients who met the inclusion criteria. Within the first 5 minutes of the onset of mechanical ventilation in the OR, if the maximum EtCO<sub>2</sub> value was  $\leq$ 20 mm Hg, hospital mortality was 100% (21/21, 95% binomial confidence interval, 83.2% to 100%).

CONCLUSIONS: A maximum EtCO<sub>2</sub>  $\leq$ 20 mm Hg within 5 minutes of the onset of mechanical ventilation in the OR may be useful in decision-making related to the termination of resuscitative efforts during emergent trauma surgery. However, a large-scale study is needed to establish the statistical reliability of this finding before potential adoption.

2. *J Trauma Acute Care Surg*. 2017 Jul 8. doi: 10.1097/TA.0000000000001641. [Epub ahead of print]

*REBOA for the IVC? Resuscitative balloon occlusion of the inferior vena cava (REBOVC) to abate massive hemorrhage in retro-hepatic vena cava injuries.*

Reynolds CL1, Celio AC, Bridges LC, Mosquera C, O'Connell B, Bard MR, DeLa'o CM, Toschlog EA.

Abstract

**BACKGROUND:** The use of resuscitative endovascular balloon occlusion as a maneuver for occlusion of the aorta is well described. This technique has life-saving potential in other cases of traumatic hemorrhage. Retro-hepatic inferior vena cava (IVC) injuries have a high rate of mortality, in part, due to the difficulty in achieving total vascular isolation. This studies purpose was to investigate the ability of resuscitative balloon occlusion of the IVC (REBOVC) to control supra-hepatic IVC hemorrhage in a swine model of trauma.

**METHODS:** Thirteen swine were randomly assigned to control (7 animals) vs intervention (6 animals). In both groups, an injury was created to the IVC. Hepatic inflow control was obtained via clamping of the hepatoduodenal ligament and infra-hepatic IVC. In the intervention group, supra-hepatic IVC control was obtained via a REBOVC placed through the femoral vein. In the control group, no supra-hepatic IVC control was established. Vital signs, arterial blood gases and lactate were monitored until death. Primary endpoints were blood loss and time to death. Lactate, pH, and vital signs were secondary endpoints. Groups were compared using chi square and Student's T test with significance at  $p < 0.05$ .

**RESULTS:** Intervention group's time to death was significantly prolonged;  $59.3 (\pm 1.6)$  vs  $33.4 (\pm 12.0)$  minutes ( $p = 0.001$ ) and total blood loss was significantly reduced;  $333 (\pm 122)$  vs  $1701 (\pm 358)$  mL ( $p = 0.001$ ). In the intervention group, 5 of the 6 swine were alive at 1 hour (83.3%) compared to 0 of 7 (0%) in the control group ( $p = 0.002$ ). There was a trend toward worsening acidosis, hypothermia, elevated lactate and hemodynamic instability in the control group.

**CONCLUSIONS:** REBOVC demonstrates superior hemorrhage control and prolonged time to death in a swine model of liver hemorrhage. This technique may be considered as an adjunct to total hepatic vascular isolation in severe liver hemorrhage and could provide additional time needed for definitive repair.

**LEVEL OF EVIDENCE:** Level II, study type therapeutic.

3. World J Emerg Surg. 2017 Jul 14;12:30. doi: 10.1186/s13017-017-0142-5. eCollection 2017. *A meta-analysis of resuscitative endovascular balloon occlusion of the aorta (REBOA) or open aortic cross-clamping by resuscitative thoracotomy in non-compressible torso hemorrhage patients.*

Manzano Nunez R1, Naranjo MP1, Foianini E2, Ferrada P3, Rincon E1, García-Perdomo HA4, Burbano P5, Herrera JP6, García AF4, 7, Ordoñez CA4,7.

Abstract

**BACKGROUND:**

The objective of this systematic review and meta-analysis was to determine the effect of REBOA, compared to resuscitative thoracotomy, on mortality and among non-compressible torso hemorrhage trauma patients.

**METHODS:** relevant articles were identified by a literature search in MEDLINE and EMBASE. We included studies involving trauma patients suffering non-compressible torso hemorrhage. Studies were eligible if they evaluated REBOA and compared it to resuscitative thoracotomy. Two investigators independently assessed articles for inclusion and exclusion criteria and selected studies for final analysis. We conducted meta-analysis using random effect models.

**RESULTS:** We included three studies in our systematic review. These studies included a total of 1276 patients. An initial analysis found that although lower in REBOA-treated patients, the odds of mortality did not differ between the compared groups (OR 0.42; 95% CI 0.17-1.03). Sensitivity analysis showed that the risk of mortality was significantly lower among patients who underwent REBOA, compared to those who underwent resuscitative thoracotomy (RT) (RR 0.81; 95% CI 0.68-0.97).

**CONCLUSION:** Our meta-analysis, mainly from observational data, suggests a positive effect of REBOA on mortality among non-compressible torso hemorrhage patients. However, these results deserve further investigation.

4. J Trauma Acute Care Surg. 2017 Jul 19. doi: 10.1097/TA.0000000000001661. [Epub ahead of print]

*Military-civilian partnership in device innovation: development, commercialization and application of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA).*

Rasmussen TE1, Eliason JL.

Abstract

Noncompressible torso hemorrhage (NCTH) and shock is a leading cause of trauma-related mortality and evidence suggests that survival from this injury pattern has not improved in decades. As such, innovating new approaches and devices, including technologies which can be used by providers within a short of time after severe injury, is a priority for the military. Guided by wartime observations, and through partnerships with civilian academia and private investment, the military has led an effort to define resuscitative endovascular balloon occlusion of the aorta (REBOA) and assess its potential to address this problem. The result of this effort is development and commercialization of new REBOA-specific device referred to as the ER-REBOA™ catheter. This device has been approved by regulatory agencies in the US and abroad and is now being used in civilian trauma centers and by military teams in the deployed setting. Despite excellent device performance and an empiric benefit of its use, there remains skepticism over this disruptive change in practice and an expressed need for more robust data to prove its effectiveness. This commentary reviews of the origins of the REBOA effort and the ER-REBOA™ catheter and outlines key factors influencing its development, commercialization and implementation. This essay also outlines post-market surveillance mechanisms which are tracking use of the ER-REBOA™ catheter as well as plans for prospective, multi-center studies of REBOA in the U.S. and U.K. With this reset on the origins, rationale and progress of REBOA, it's hoped that military-civilian partnerships in this endeavor can be strengthened and that debate of this topic can be evidence-based, balanced and productive.

5. BMJ Case Rep. 2017 Jul 17;2017. pii: bcr-2017-220885. doi: 10.1136/bcr-2017-220885.

*Acute rehabilitation after resuscitative endovascular balloon occlusion of the aorta (REBOA) in major trauma.*

Rich JA1, Coleman J2, Devaux C1, Hoffman K2.

Abstract

We report a 23-year-old woman admitted post cyclist versus heavy goods vehicle accident in December 2014. This was the second case the life-saving procedure, that is, resuscitative endovascular balloon occlusion of the aorta (REBOA) was performed on at the roadside. This advanced procedure was performed due to the extensive haemorrhage from this patient's complex pelvic fracture. As a result of REBOA, the patient consequently lost her left lower limb and underwent a variety of complex pelvic and lower limb surgeries. The patient was admitted to the acute critical care unit and underwent repeated operations and was not ready to start active rehabilitation until 12 days into her admission. Prior to this she was on movement restrictions and received physiotherapy for limb care and dietetics in order to meet her nutritional requirements. The patient was stepped down to a ward setting and started on an extensive physiotherapy programme and was then transferred to the rehabilitation unit for amputees at Roehampton.

## **ORGANITZACIÓ I ENTRENAMENT**

1. Int J Emerg Med. 2017 Dec;10(1):24. doi: 10.1186/s12245-017-0149-4. Epub 2017 Jul 14.

*Team communication patterns in emergency resuscitation: a mixed methods qualitative analysis.*

Calder LA1,2,3, Mastoras G4, Rahimpour M5, Sohmer B6, Weitzman B4, Cwinn AA4, Hobin T5, Parush A5.

Abstract

**BACKGROUND:** In order to enhance patient safety during resuscitation of critically ill patients, we need to optimize team communication and enhance team situational awareness but little is known about resuscitation team communication patterns. The objective of this study is to understand how teams communicate during resuscitation; specifically to assess for a shared mental model (organized understanding of a team's relationships) and information needs.

**METHODS:** We triangulated 3 methods to evaluate resuscitation team communication at a tertiary care academic trauma center: (1) interviews; (2) simulated resuscitation observations; (3) live resuscitation observations. We interviewed 18 resuscitation team members about shared mental models, roles and goals of team members and procedural expectations. We observed 30 simulated resuscitation video recordings and documented the timing, source and destination of communication and the information category. We observed 12 live resuscitations in the emergency department and recorded baseline characteristics of the type of resuscitations, nature of teams present and type and content of information exchanges. The data were analyzed using a qualitative communication analysis method.

**RESULTS:** We found that resuscitation team members described a shared mental model. Respondents understood the roles and goals of each team member in order to provide rapid, efficient and life-saving care with an overall need for situational awareness. The information flow described in the interviews was reflected during the simulated and live resuscitations with the most responsible physician and charting nurse being central to team communication. We consolidated communicated information into six categories: (1) time; (2) patient status; (3) patient history; (4) interventions; (5) assistance and consultations; (6) team members present.

**CONCLUSIONS:** Resuscitation team members expressed a shared mental model and prioritized situational awareness. Our findings support a need for cognitive aids to enhance team communication during resuscitations.

2. Eur J Cardiovasc Nurs. 2017 Jul 1:1474515117721010. doi: 10.1177/1474515117721010. [Epub ahead of print]

*Incorporating cardiopulmonary resuscitation training into a cardiac rehabilitation programme: A feasibility study.*

Cartledge S1,2, Finn J1,3, Bray JE1,2,3, Case R1,4,5, Barker L6, Missen D6, Shaw J2,6, Stub D1,2,6,7,8.

Abstract

**BACKGROUND:** Patients with a cardiac history are at future risk of cardiac events, including out-of-hospital cardiac arrest. Targeting cardiopulmonary resuscitation (CPR) training to family members of cardiac patients has long been advocated, but is an area in need of contemporary research evidence. An environment yet to be investigated for targeted training is cardiac rehabilitation.

**AIM:** To evaluate the feasibility of providing CPR training in a cardiac rehabilitation programme among patients, their family members and staff.

**METHODS:** A prospective before and after study design was used. CPR training was delivered using video self-instruction CPR training kits, facilitated by a cardiac nurse. Data was collected pre-training, post-training and at one month.

**RESULTS:** Cardiac patient participation rates in CPR classes were high (n = 56, 72.7% of eligible patients) with a further 27 family members attending training. Patients were predominantly male (60.2%), family members were predominantly female (81.5%), both with a mean age of 65 years. Confidence to perform CPR and willingness to use skills significantly increased post-training (both p<0.001). Post training participants demonstrated a mean compression rate of 112 beats/min and a mean depth of 48 mm. Training reach was doubled as participants shared the video self-instruction kit with a further 87 people. Patients, family members and cardiac rehabilitation staff had positive feedback about the training.

CONCLUSIONS: We demonstrated that cardiac rehabilitation is an effective and feasible environment to provide CPR training. Using video self-instruction CPR training kits enabled further training reach to the target population.

3. Simul Healthc. 2017 Jul 10. doi: 10.1097/SIH.0000000000000245. [Epub ahead of print] *Effect of Emergency Department Mattress Compressibility on Chest Compression Depth Using a Standardized Cardiopulmonary Resuscitation Board, a Slider Transfer Board, and a Flat Spine Board: A Simulation-Based Study.*

Cheng A1, Belanger C, Wan B, Davidson J, Lin Y.

Abstract

INTRODUCTION: Cardiopulmonary resuscitation (CPR) performed on a mattress decreases effective chest compression depth. Using a CPR board partially attenuates mattress compressibility. We aimed to determine the effect of a CPR board, a slider transfer board, a CPR board with a slider transfer board, and a flat spine board on chest compression depth with a mannequin placed on an emergency department mattress.

METHODS: The study used a cross-over study design. The CPR-certified healthcare providers performed 2 minutes of compressions on a mannequin in five conditions, an emergency department mattress with: (a) no hard surface, (b) a CPR board, (c) a slider transfer board, (d) a CPR board and slider transfer board, and (e) a flat spine board. Compression depths were measured from two sources for each condition: (a) an internal device measuring sternum-to-spine compression and (b) an external device measuring sternum-to-spine compression plus mattress compression. The difference of the two measures (ie, depleted compression depth) was summarized and compared between conditions.

RESULTS: A total of 10,203 individual compressions from 10 participants were analyzed. The mean depleted compression depths (percentage depletion) secondary to mattress effect were the following: 23.6 mm (29.7%) on a mattress only, 13.7 mm (19.5%) on a CPR board, 16.9 mm (23.1%) on a slider transfer board, 11.9 mm (17.3%) on a slider transfer board plus backboard, and 10.3 mm (15.4%) on a flat spine board. The differences in percentage depletion across conditions were statistically significant.

CONCLUSION: Cardiopulmonary resuscitation providers should use a CPR board and slider transfer board or a flat spine board alone because these conditions are associated with the smallest amount of mattress compressibility.

4. Eur J Anaesthesiol. 2017 Jul 20. doi: 10.1097/EJA.0000000000000675. [Epub ahead of print] *Serious game versus online course for pretraining medical students before a simulation-based mastery learning course on cardiopulmonary resuscitation: A randomised controlled study.*

Drummond D1, Delval P, Abdenouri S, Truchot J, Ceccaldi PF, Plaisance P, Hadchouel A, Tesnière A.

Abstract

BACKGROUND: Although both recorded lectures and serious games have been used to pretrain health professionals before simulation training on cardiopulmonary resuscitation, they have never been compared.

OBJECTIVE: The aim of this study was to compare an online course and a serious game for pretraining medical students before simulation-based mastery learning on the management of sudden cardiac arrest.

DESIGN: A randomised controlled trial. Participants were pretrained using the online course or the serious game on day 1 and day 7. On day 8, each participant was evaluated repeatedly on a scenario of cardiac arrest until reaching a minimum passing score.

SETTING: Department of Simulation in Healthcare in a French medical faculty.

PARTICIPANTS: Eighty-two volunteer second-year medical students participated between June and October 2016 and 79 were assessed for primary outcome.

INTERVENTIONS: The serious game used was Staying Alive, which involved a 3D realistic environment, and the online course involved a PowerPoint lecture.

MAIN OUTCOME MEASURES: The median total training time needed for students to reach the minimum passing score on day 8. This same outcome was also assessed 4 months later.

RESULTS: The median training time (interquartile range) necessary for students to reach the minimum passing score was similar between the two groups: 20.5 (15.8 to 30.3) minutes in the serious game group versus 23 (15 to 32) minutes in the online course group,  $P=0.51$ . Achieving an appropriate degree of chest compression was the most difficult requirement to fulfil for students in both groups. Four months later, the median training time decreased significantly in both groups, but no correlation was found at an individual level with the training times observed on day 8.

CONCLUSION: The serious game used in this study was not superior to an online course to pretrain medical students in the management of a cardiac arrest. The absence of any correlation between the performances of students evaluated during two training sessions separated by 4 months suggests that elements such as chest compression can only be learned by simulation-based training.

TRIAL REGISTRATION: [ClinicalTrials.gov-NCT02758119](https://clinicaltrials.gov/NCT02758119).

5. Resuscitation. 2017 Jul 15. pii: S0300-9572(17)30292-7. doi: 10.1016/j.resuscitation.2017.07.011. [Epub ahead of print]

*Viewing an Ultra-Brief Chest Compression Only Video Improves some measures of Bystander CPR Performance and Responsiveness at a Mass Gathering Event.*

Beskind DL1, Stolz U2, Thiede R2, Hoyer R2, Robertson W2, Brown J2, Ludgate M2, Tiutan T2, Shane R2, McMorrow D2, Pleasants M2, Kern KB2, Panchal AR2.

Abstract

BACKGROUND: CPR training at mass gathering events is an important part of health initiatives to improve cardiac arrest survival. However, it is unclear whether training lay bystanders using an ultra-brief video at a mass gathering event improves CPR quality and responsiveness.

OBJECTIVE: To determine if showing a chest-compression only (CCO) Ultra-Brief Video (UBV) at a mass gathering event is effective in teaching lay bystanders CCO-CPR.

METHODS: Prospective control trial in adults (age >18) who attended either a women's University of Arizona or a men's Phoenix Suns basketball game. Participants were evaluated using a standardized cardiac arrest scenario with Laerdal SkillReporter™ mannequins. CPR responsiveness (calling 911, time to calling 911, starting compressions within two minutes) and quality (compression rate, depth, hands-off time) were assessed for participants and data collected at Baseline and Post-intervention. Different participants were tested before and after the exposure of the UBV. Data were analyzed via the intention to treat principle using logistic regression for binary outcomes and median regression for continuous outcomes, controlling for clustering by venue.

RESULTS: A total of 96 people were consented (Baseline=45; Post intervention=51). CPR responsiveness post intervention improved with faster time to calling 911 (sec) and time to starting compressions (sec). Likewise, CPR quality improved with deeper compressions and improved hands-off time.

CONCLUSIONS: Showing a UBV at a mass gathering sporting event is associated with improved CPR responsiveness and performance for lay bystanders. This data provides further support for the use of mass media interventions.

6. Clin Exp Emerg Med. 2017 Jun 30;4(2):80-87. doi: 10.15441/ceem.16.160. eCollection 2017 Jun.

*Association between public cardiopulmonary resuscitation education and the willingness to perform bystander cardiopulmonary resuscitation: a metropolitan citywide survey.*

Son JW1, Ryoo HW1, Moon S1, Kim JY2, Ahn JY1, Park JB1, Seo KS1, Kim JK1, Kim YJ3.

## Abstract

**OBJECTIVE:** Bystander cardiopulmonary resuscitation (CPR) is an important factor associated with improved survival rates and neurologic prognoses in cases of out-of-hospital cardiac arrest. We assessed how factors related to CPR education including timing of education, period from the most recent education session, and content, affected CPR willingness.

**METHODS:** In February 2012, trained interviewers conducted an interview survey of 1,000 Daegu citizens through an organized questionnaire. The subjects were aged  $\geq 19$  years and were selected by quota sampling. Their social and demographic characteristics, as well as CPR and factors related to CPR education, were investigated. Chi-square tests and multivariate logistic regression analyses were used to evaluate how education-related factors affected the willingness to perform CPR.

**RESULTS:** Of total 1,000 cases, 48.0% were male. The multivariate analyses revealed several factors significantly associated with CPR willingness: didactic plus practice group (adjusted odds ratio [AOR], 3.38; 95% confidence interval [CI], 2.3 to 5.0), group with more than four CPR education session (AOR, 7.68; 95% CI, 3.21 to 18.35), interval of less than 6 months from the last CPR education (AOR, 4.47; 95% CI 1.29 to 15.52), and education with automated external defibrillator (AOR, 5.98; 95% CI 2.30 to 15.53).

**CONCLUSION:** The following were associated with increased willingness to perform CPR: practice sessions and automated electrical defibrillator training in public CPR education, more frequent CPR training, and shorter time period from the most recent CPR education sessions.

7. Med Intensiva. 2017 Jul 17. pii: S0210-5691(17)30202-4. doi: 10.1016/j.medin.2017.06.005. [Epub ahead of print]

*Effect of 3basic life support training programs in future primary school teachers. A quasi-experimental design.*

[Article in English, Spanish]

Navarro-Patón R1, Freire-Tellado M2, Basanta-Camiño S3, Barcala-Furelos R4, Arufe-Giraldez V5, Rodríguez-Fernández JE6.

## Abstract

**AIM:** To evaluate the learning of basic life support (BLS) measures on the part of laypersons after 3different teaching programs.

**DESIGN:** A quasi-experimental before-after study involving a non-probabilistic sample without a control group was carried out.

**SCOPE:** Primary school teacher students from the University of Santiago (Spain).

**PARTICIPANTS:** A total of 124 students (68.8% women and 31.2% men) aged 20-39 years ( $M=22.23$ ;  $SD=3.79$ ), with no previous knowledge of BLS, were studied.

**INTERVENTIONS:** Three teaching programs were used: a traditional course, an audio-visual approach and feedback devices.

**MAIN VARIABLES OF INTEREST:** Chest compressions as sole cardiopulmonary resuscitation skill evaluation: average compression depth, compression rate, chest recoil percentage and percentage of correct compressions. Automated external defibrillator: time needed to apply a shock before and after the course.

**RESULTS:** There were significant differences in the results obtained after 2minutes of chest compressions, depending on the training program received, with feedback devices having a clear advantage referred to average compression depth ( $p<0.001$ ), compression rate ( $p<0.001$ ), chest recoil percentage ( $p<0.001$ ) and percentage of correct compressions ( $p<0.001$ ). Regarding automated external defibrillator, statistically significant differences were found in Tafter ( $p=0.025$ ).

**CONCLUSIONS:** The teaching course using feedback devices obtained the best results in terms of the quality of chest compressions, followed by the traditional course and audio-visual approach. These favorable results were present in both men and women. All 3teaching methods reached the goal of reducing defibrillation time.



8. Public Health Nurs. 2017 May;34(3):238-244. doi: 10.1111/phn.12293. Epub 2016 Oct 5.  
*High School CPR/AED Training in Washington State.*

Salvatierra GG1,2, Palazzo SJ2,3, Emery A2.

Abstract

OBJECTIVE: Describe the rates of CPR/AED training in high schools in the state of Washington after passage of legislation mandating CPR/AED training.

DESIGN AND SAMPLE: A web-based survey was sent to administrators at 660 public and private high schools in the state of Washington.

RESULTS AND CONCLUSIONS: The survey was completed by 148 schools (22%); 64% reported providing CPR training and 54% provided AED training. Reported barriers to implementation included instructor availability, cost, and a lack of equipment. Descriptive statistics were used to describe the sample characteristics and implementation rates. Mandates without resources and support do not ensure implementation of CPR/AED training in high schools. Full public health benefits of a CPR mandate will not be realized until barriers to implementation are identified and eliminated through use of available, accessible public health resources.

## REGISTRES I REVISIONS

1. Resuscitation. 2017 Mar;112:1-10. doi: 10.1016/j.resuscitation.2016.12.011. Epub 2016 Dec 19.

*Prognostic factors for extracorporeal cardiopulmonary resuscitation recipients following out-of-hospital refractory cardiac arrest. A systematic review and meta-analysis.*

Debaty G1, Babaz V2, Durand M3, Gaide-Chevronnay L3, Fournel E3, Blancher M2, Bouvaist H4, Chavanon O5, Maignan M6, Bouzat P7, Albaladejo P8, Labarère J9.

Abstract

PURPOSE: Association estimates between baseline characteristics and outcomes are imprecise and inconsistent among extracorporeal cardiopulmonary resuscitation (ECPR) recipients following refractory out-of-hospital cardiac arrest (OHCA). This systematic review and meta-analysis aimed to investigate the prognostic significance of pre-specified characteristics for OHCA treated with ECPR.

METHODS: The Medline electronic database was searched via PubMed for articles published from January 2000 to September 2016. The electronic search was supplemented by scanning the reference lists of retrieved articles and contacting field experts. Eligible studies were historical and prospective cohort studies of adult patients undergoing ECPR following OHCA.

RESULTS: Fifteen primary studies were included, totaling 841 participants. The median prevalence of the primary outcome (i.e., short- or long-term survival for five studies and cerebral performance for ten studies) was 15% (range, 0-50%). The primary outcome was associated with an increased odds ratio of initial shockable cardiac rhythm (2.20; 95% confidence interval [CI], 1.30-3.72; P=0.003), shorter low-flow duration (geometric mean ratio, 0.90; 95% CI, 0.81-0.99; P=0.04), higher arterial pH value (difference, 0.12; 95% CI, 0.03-0.22; P=0.01) and lower serum lactate concentration (difference, -3.52mmol/L; 95% CI, -5.05 to -1.99; P<0.001). No significant association was found between the primary outcome and patient age (the odds of female gender and bystander CPR attempt).

CONCLUSION: Observational evidence from published primary studies indicates that shorter low-flow duration, shockable cardiac rhythm, higher arterial pH value and lower serum lactate concentration on hospital admission are associated with better outcomes for ECPR recipients after OHCA.

2. J Am Heart Assoc. 2017 Jul 12;6(7). pii: e005239. doi: 10.1161/JAHA.116.005239.

*National Institutes of Health-Funded Cardiac Arrest Research: A 10-Year Trend Analysis.*

Coute RA1,2, Panchal AR3, Mader TJ4, Neumar RW5,6.

## Abstract

**BACKGROUND:** Cardiac arrest (CA) is a leading cause of death in the United States, claiming over 450 000 lives annually. Improving survival depends on the ability to conduct CA research and on the translation and implementation of research findings into practice. Our objective was to provide a descriptive analysis of annual National Institutes of Health (NIH) funding for CA research over the past decade.

**METHOD AND RESULTS:** A search within NIH RePORTER for the years 2007 to 2016 was performed using the terms: "cardiac arrest" or "cardiopulmonary resuscitation" or "heart arrest" or "circulatory arrest" or "pulseless electrical activity" or "ventricular fibrillation" or "resuscitation." Grants were reviewed and categorized as CA research (yes/no) using predefined criteria. The annual NIH funding for CA research, number of individual grants, and principal investigators were tabulated. The total NIH investment in CA research for 2015 was calculated and compared to those for other leading causes of death within the United States. Interrater reliability among 3 independent reviewers for fiscal year 2015 was assessed using Fleiss  $\kappa$ . The search yielded 2763 NIH-funded grants, of which 745 (27.0%) were classified as CA research ( $\kappa=0.86$  [95%CI 0.80-0.93]). Total inflation-adjusted NIH funding for CA research was \$35.4 million in 2007, peaked at \$76.7 million in 2010, and has decreased to \$28.5 million in 2016. Per annual death, NIH invests  $\approx$ \$2200 for stroke,  $\approx$ \$2100 for heart disease, and  $\approx$ \$91 for CA.

**CONCLUSIONS:** This analysis demonstrates that the annual NIH investment in CA research is low relative to other leading causes of death in the United States and has declined over the past decade.

3. Resuscitation. 2017 Mar;112:28-33. doi: 10.1016/j.resuscitation.2016.12.013. Epub 2016 Dec 21.

*Out-of-hospital cardiac arrest without return of spontaneous circulation in the field: Who are the survivors?*

Xiong Y1, Zhan H2, Lu Y3, Guan K2, Okoro N4, Mitchell D4, Dwyer M4, Leatham A4, Salazar G4, Liao X2, Idris A5.

## Abstract

**BACKGROUND:** Return of spontaneous circulation (ROSC) in the field is a vital determinant contributing to survival from out-of-hospital cardiac arrest (OHCA). However, nearly one third of survivors at the Dallas-Fort Worth (DFW) Resuscitation Outcomes Consortium (ROC) site did not obtain ROSC in the field.

**METHODS:** A retrospective, observational analysis was performed on all adult patients with non-traumatic OHCA treated on scene and transported to hospital, who did not gain ROSC in the field at DFW ROC site between 2006 through 2011. We described the demographics, pre-hospital characteristics and outcomes of all enrolled cases. Those patients without ROSC in the field, who did and did not meet Termination of Resuscitation (TOR) criteria in the field, were also compared.

**RESULTS:** Among a total of 5099 treated and transported non-traumatic OHCA cases, 83.2% (4243) were included in this study as patients without ROSC gained in the field, of which 66.6% (2827) met TOR criteria but still were treated and transported; 1.9% (79) survived to hospital discharge. Further analysis showed that 39.2% (31) of survivors met TOR rule, accounting for 1.1% of those patients who should have been declared dead in the field. Shockable initial rhythms, EMS-witnessed arrest, bystander CPR and age were factors significant to predict survival from OHCA without ROSC in the field. Of concern, 1.7% (47) of patients who met TOR presented initially shockable rhythms but no shocks were delivered in the field.

**CONCLUSIONS:** We suggest that all treated non-traumatic OHCA patients should be transported to hospital.

4. Resuscitation. 2017 Jun 23. pii: S0300-9572(17)30237-X. doi: 10.1016/j.resuscitation.2017.05.028. [Epub ahead of print]

☆2015 Revised Utstein-Style Recommended Guidelines for Uniform Reporting of Data From Drowning-Related Resuscitation: An ILCOR Advisory Statement.

Idris AH, Bierens JJLM, Perkins GD, Wenzel V, Nadkarni V, Morley P, Warner DS, Topjian A, Venema AM, Branche CM, Szpilman D, Morizot-Leite L, Nitta M, Løfgren B, Webber J, Gräsner JT, Beerman SB, Youn CS, Jost U, Quan L, Dezfulian C, Handley AJ, Hazinski MF.

Abstract

BACKGROUND:

Utstein-style guidelines use an established consensus process, endorsed by the international resuscitation community, to facilitate and structure resuscitation research and publication. The first "Guidelines for Uniform Reporting of Data From Drowning" were published over a decade ago. During the intervening years, resuscitation science has advanced considerably, thus making revision of the guidelines timely. In particular, measurement of cardiopulmonary resuscitation elements and neurological outcomes reporting have advanced substantially. The purpose of this report is to provide updated guidelines for reporting data from studies of resuscitation from drowning.

METHODS: An international group with scientific expertise in the fields of drowning research, resuscitation research, emergency medical services, public health, and development of guidelines met in Potsdam, Germany, to determine the data that should be reported in scientific articles on the subject of resuscitation from drowning. At the Utstein-style meeting, participants discussed data elements in detail, defined the data, determined data priority, and decided how data should be reported, including scoring methods and category details.

RESULTS: The template for reporting data from drowning research was revised extensively, with new emphasis on measurement of quality of resuscitation, neurological outcomes, and deletion of data that have proved to be less relevant or difficult to capture.

CONCLUSIONS: The report describes the consensus process, rationale for selecting data elements to be reported, definitions and priority of data, and scoring methods. These guidelines are intended to improve the clarity of scientific communication and the comparability of scientific investigations.

5. *Medicine (Baltimore)*. 2017 Jul;96(29):e7570. doi: 10.1097/MD.00000000000007570.

*Measuring the impact of emergency medical services (EMS) on out-of-hospital cardiac arrest survival in a developing country: A key metric for EMS systems' performance.*

El Sayed M1, Al Assad R, Abi Aad Y, Gharios N, Refaat MM, Tamim H.

Abstract

Out-of-hospital cardiac arrest (OHCA) can be used to evaluate the overall performance of the emergency medical services' (EMS) system. This study assessed the impact of EMS on OHCA survival rates in a setting where the prehospital system is underdeveloped. A retrospective chart review was carried out over a 5-year period of all adult OHCA patients admitted to the emergency department (ED) of a tertiary care center in Lebanon. A total of 271 patients with OHCA (179 [66.1%] men, mean age of 69.9 [standard deviation = 15.0 years] were enrolled. The most common OHCA location was residence/home (58.7%). The majority of arrests were witnessed (51.7%) with 6.1% witnessed by EMS; 211 patients (75.6%) were transported to the ED by EMS. Prehospital cardiopulmonary resuscitation (CPR) was done by EMS for 43.2% of the patients, whereas only 4.4% received CPR from a family member/bystander. Prehospital automated external defibrillator use was documented in 1.5% of cases in the prehospital setting. Only 2 patients had return of spontaneous circulation prior to ED arrival. Most patients (96.7%) were resuscitated in the ED. Patients presented to the ED mostly in asystole (79.3%). Forty-three patients (15.9%) survived to hospital admission and 13 (4.8%) were discharged alive with over half of them (53.8%) had a good neurological outcome upon discharge (cerebral performance category 1 or 2). Survival of EMS-treated OHCA victims in Lebanon is not as expected. Medical oversight of EMS activities is needed to link EMS activities to clinical outcomes and improve survival from cardiac arrest in Lebanon.

6. Clin Exp Emerg Med. 2017 Jun 30;4(2):80-87. doi: 10.15441/ceem.16.160. eCollection 2017 Jun.

*Association between public cardiopulmonary resuscitation education and the willingness to perform bystander cardiopulmonary resuscitation: a metropolitan citywide survey.*

Son JW1, Ryoo HW1, Moon S1, Kim JY2, Ahn JY1, Park JB1, Seo KS1, Kim JK1, Kim YJ3.

Abstract

**OBJECTIVE:** Bystander cardiopulmonary resuscitation (CPR) is an important factor associated with improved survival rates and neurologic prognoses in cases of out-of-hospital cardiac arrest. We assessed how factors related to CPR education including timing of education, period from the most recent education session, and content, affected CPR willingness.

**METHODS:** In February 2012, trained interviewers conducted an interview survey of 1,000 Daegu citizens through an organized questionnaire. The subjects were aged  $\geq 19$  years and were selected by quota sampling. Their social and demographic characteristics, as well as CPR and factors related to CPR education, were investigated. Chi-square tests and multivariate logistic regression analyses were used to evaluate how education-related factors affected the willingness to perform CPR.

**RESULTS:** Of total 1,000 cases, 48.0% were male. The multivariate analyses revealed several factors significantly associated with CPR willingness: didactic plus practice group (adjusted odds ratio [AOR], 3.38; 95% confidence interval [CI], 2.3 to 5.0), group with more than four CPR education session (AOR, 7.68; 95% CI, 3.21 to 18.35), interval of less than 6 months from the last CPR education (AOR, 4.47; 95% CI 1.29 to 15.52), and education with automated external defibrillator (AOR, 5.98; 95% CI 2.30 to 15.53).

**CONCLUSION:** The following were associated with increased willingness to perform CPR: practice sessions and automated electrical defibrillator training in public CPR education, more frequent CPR training, and shorter time period from the most recent CPR education sessions.

7. Resuscitation. 2017 Jul 13. pii: S0300-9572(17)30285-X. doi: 10.1016/j.resuscitation.2017.07.004. [Epub ahead of print]

*Implementation of the universal BLS termination of resuscitation rule in a rural EMS system.*

Jordan MR1, O'Keefe MF2, Weiss D3, Cubberley CW 2, MacLean CD4, Wolfson DL5.

Abstract

**BACKGROUND:** Emergency Medical Services (EMS) are often the first medical providers to begin resuscitation of out-of-hospital cardiac arrest (OHCA) victims. The universal Basic Life Support Termination of Resuscitation (BLS-TOR) rule is a validated clinical prediction tool used to identify patients in which continued resuscitation efforts are futile.

**OBJECTIVE:** The primary aim is to compare the rate of transport of OHCA cases before and after the implementation of a BLS-TOR protocol and to determine the compliance rate of EMS personnel with the new protocol in a largely volunteer, rural system.

**METHODS:**

A retrospective cohort study was conducted using the statewide EMS electronic patient care report system. Cases were identified by searching for any incident that had a primary impression of "cardiac arrest" or a primary symptom of "cardiorespiratory arrest" or "death." Data were collected from the two years prior to and following implementation of the BLS-TOR rule from January 1, 2012 through March 31, 2016.

**RESULTS:** There were 702 OHCA cases were identified, with 329 cases meeting inclusion criteria. The transport rate was 91.1% in the pre-intervention group compared with 69.4% in the post-intervention group ( $\chi^2=24.8$ ;  $p<0.001$ ). EMS compliance rate with the BLS-TOR rule was 66.7%. Of the 265 patients transported during the study, 87 patients met (post-intervention group;  $n=22$ ) or retrospectively met (pre-intervention group;  $n=65$ ) the BLS-TOR requirements for field termination of resuscitation. None of these patients survived to hospital discharge.

CONCLUSION: Rural EMS systems may benefit from implementation and utilization of the universal BLS-TOR rule.

## TRACTAMENT POST ROSC

1. J Crit Care. 2017 Jul 4;42:85-91. doi: 10.1016/j.jcrc.2017.07.010. [Epub ahead of print] *Clinical and laboratory predictors of Infectious Complications in patients after Out-of-Hospital Cardiac Arrest.*

Kroupa J1, Knot J1, Ulman J1, Bednar F1, Dohnalova A2, Motovska Z3.

Abstract

PURPOSE: Identification of clinical and laboratory predictors related to Infectious Complications (ICs) in patients after Out-of-Hospital Cardiac Arrest (OHCA).

METHODS: Patients, aged >18, after an OHCA between 9/2013 and 11/2015, surviving >24h, were studied.

RESULTS: Study group consisted of 42 patients (mean age 63.4years, 88.1% men). Forty percent of patients had IC; lower respiratory tract infections were most common (87.5% of cases). ICs were more common in patients receiving Targeted Temperature Management (50% vs. 10%;  $p=0.032$ ). Antibiotics were used in 85.7% of patients. The mean time to therapy initiation was 9.6 (SD 7.1) hours after admission. The mean course of treatment was 9.0 (SD 6.2) days. Fifty-three percent of patients receiving early antibiotic treatment didn't have IC. Initial antibiotic therapy was changed more often in patients with IC (75% vs. 38.9%;  $p=0.045$ ). C-Reactive Protein, Procalcitonin, Troponin and White Blood Cell count values were higher in patients with IC.

CONCLUSION: Early initiated antibiotic treatment is overused in patients after OHCA. This practice is associated with necessitating antibiotic change in the majority of patients with IC. Assessment of clinical and laboratory parameters in the first days after OHCA increases the likelihood of appropriate ATB therapy.

2. Clin Exp Emerg Med. 2017 Jun 30;4(2):65-72. doi: 10.15441/ceem.16.167. eCollection 2017 Jun.

*Impact of early coronary angiography on the survival to discharge after out-of-hospital cardiac arrest.*

Shin J1, Ko E1, Cha WC1, Lee TR1, Yoon H1, Hwang SY1, Shin TG1, Sim MS1, Jo IJ1, Song KJ1, Rhee JE1, Jeong YK1, Choi JH1.

Abstract

OBJECTIVE: Acute myocardial infarction is a major cause of out-of-hospital cardiac arrest (OHCA). Coronary angiography (CAG) enables diagnostic confirmation of coronary artery disease and subsequent revascularization, which might improve the prognosis of OHCA survivors. Non-randomized data has shown a favorable impact of CAG on prognosis for this population. However, the optimal timing of CAG has been debated.

METHODS: The clinical outcomes of 607 OHCA patients registered in CAPTURES (Cardiac Arrest Pursuit Trial with Unique Registration and Epidemiologic Surveillance), a nationwide multicenter registry performed in 27 hospitals, were analyzed. Early CAG was defined as CAG performed within 24 hours of emergency department admission. The primary outcome was survival to discharge, with neurologically favorable status defined by cerebral performance category scores  $\leq 2$ .

RESULTS: Compared to patients without CAG ( $n=469$ ), patients who underwent early CAG ( $n=138$ ) were younger, more likely to be male, and more likely to have received bystander cardiopulmonary resuscitation, pre-hospital defibrillation, and revascularization ( $P<0.01$  for all). Analysis of 115 propensity score-matched pairs showed that early CAG is associated with a 2.3-fold increase in survival to discharge with neurologically favorable status ( $P<0.001$ , all). Survival

to discharge increased consistently according to the time interval between emergency department visit and CAG ( $P < 0.05$ ).

CONCLUSION: Early CAG of OHCA patients was associated with better survival and favorable neurologic outcomes at discharge. However, there was no clear time threshold for CAG that predicted survival to discharge.

3. Eur Heart J Acute Cardiovasc Care. 2017 Jul 1:2048872617722486. doi: 10.1177/2048872617722486. [Epub ahead of print]

*Clinical value of ST-segment change after return of spontaneous cardiac arrest and emergent coronary angiography in patients with out-of-hospital cardiac arrest: Diagnostic and therapeutic importance of vasospastic angina.*

Tateishi K1, Abe D1, Iwama T1, Hamabe Y2, Aonuma K3, Sato A3.

Abstract

BACKGROUND: We investigated the association between initial ST-segment change after return of spontaneous circulation (ROSC) and the incidence of acute coronary lesions in patients with out-of-hospital cardiac arrest (OHCA), and clinical outcomes of patients with OHCA caused by vasospastic angina pectoris (VSA).

METHODS: Among 2779 OHCA patients in our institution, all patients with ROSC underwent emergent coronary angiography (CAG) except for those with an obvious extra-cardiac cause of OHCA. Initial ST-segment changes after ROSC were reviewed, and 30-day survival and neurological outcome (Cerebral Performance Category) were evaluated.

RESULTS: Of the 155 patients, 52 (34%) had ST-segment elevation (STE) and 103 (66%) had non-STE. Significant coronary culprit lesions were present in 81% of patients with STE and in 33% of patients with non-STE ( $P < .001$ ). Percutaneous coronary intervention (PCI) was successful in 60 patients (93.8%) and failed in 4 patients (6.2%). Among 155 patients, 74 patients (47.7%) had favorable neurological prognosis, and 104 patients (67.1%) were alive at 30 days. ST-segment analysis showed good positive predictive value (81%) but low negative predictive value (68%) in diagnosing the presence of acute coronary lesions. VSA was found in 5 patients (9.6%) in the STE group and in 12 patients (11.7%) in the non-STE group. Of these 17 patients, 9 (52.9%) had favorable neurological outcome and 14 (82.4%) were alive at 30 days.

CONCLUSION: An acute culprit lesion may be the cause of OHCA even in the absence of STE. In survivors of OHCA with normal coronary arteries, spasm provocation testing should be performed to detect VSA as a cause of the arrest.

4. Am J Cardiol. 2017 Jun 15. pii: S0002-9149(17)30968-2. doi: 10.1016/j.amjcard.2017.06.010. [Epub ahead of print]

*Outcomes of ST Elevation Myocardial Infarction Complicated by Out-of-Hospital Cardiac Arrest (from the Los Angeles County Regional System).*

Shavelle DM1, Bosson N2, Thomas JL3, Kaji AH4, Sung G5, French WJ3, Niemann JT4.

Abstract

The objective of this study was to evaluate the time to primary percutaneous coronary intervention (PCI) and the outcome for patients with ST elevation myocardial infarction (STEMI) complicated by out-of-hospital cardiac arrest (OHCA). In this regional system, all patients with STEMI and/or OHCA with return of spontaneous circulation were transported to STEMI Receiving Centers. The outcomes registry was queried for patients with STEMI who underwent primary PCI from April 2011 to December 2014. Patients with STEMI complicated by OHCA were compared with a reference group of STEMI without OHCA. The primary end point was the first medical contact-to-device time. Of 4,729 patients with STEMI who underwent primary PCI, 422 patients (9%) suffered OHCA. Patients with OHCA were on average 2 years (95% confidence interval 0.7 to 3.0) older and had a slightly higher male predominance. The first medical contact-to-device time was longer in STEMI with OHCA compared with STEMI alone ( $94 \pm 37$  vs.  $86 \pm 34$  minutes,  $p < 0.0001$ ). In-hospital mortality was higher after OHCA, 38% versus 6% in STEMI

alone, odds ratio 6.3 (95% confidence interval 5.3 to 7.4). Among OHCA survivors, 193 (73%) were discharged with a cerebral performance category score of 1 or 2.

In conclusion, despite longer treatment intervals, neurologic outcome was good in nearly half of the surviving patients with STEMI complicated by OHCA, suggesting that these patients can be effectively treated with primary PCI in a regionalized system of care.

## TARGET TEMPERATURE MANAGEMENT

1. Crit Care Med. 2017 Aug;45(8):1337-1343. doi: 10.1097/CCM.0000000000002367.

*Dysglycemia, Glycemic Variability, and Outcome After Cardiac Arrest and Temperature Management at 33°C and 36°C.*

Borgquist O1, Wise MP, Nielsen N, Al-Subaie N, Cranshaw J, Cronberg T, Glover G, Hassager C, Kjaergaard J, Kuiper M, Smid O, Walden A, Friberg H; TTM-Trial Investigators.

Abstract

**OBJECTIVES:** Dysglycemia and glycemic variability are associated with poor outcomes in critically ill patients. Targeted temperature management alters blood glucose homeostasis. We investigated the association between blood glucose concentrations and glycemic variability and the neurologic outcomes of patients randomized to targeted temperature management at 33°C or 36°C after cardiac arrest.

**DESIGN:** Post hoc analysis of the multicenter TTM-trial. Primary outcome of this analysis was neurologic outcome after 6 months, referred to as "Cerebral Performance Category."

**SETTING:** Thirty-six sites in Europe and Australia.

**PATIENTS:** All 939 patients with out-of-hospital cardiac arrest of presumed cardiac cause that had been included in the TTM-trial.

**INTERVENTIONS:** Targeted temperature management at 33°C or 36°C.

**MEASUREMENTS AND MAIN RESULTS:** Nonparametric tests as well as multiple logistic regression and mixed effects logistic regression models were used. Median glucose concentrations on hospital admission differed significantly between Cerebral Performance Category outcomes ( $p < 0.0001$ ). Hyper- and hypoglycemia were associated with poor neurologic outcome ( $p = 0.001$  and  $p = 0.054$ ). In the multiple logistic regression models, the median glycemic level was an independent predictor of poor Cerebral Performance Category (Cerebral Performance Category, 3-5) with an odds ratio (OR) of 1.13 in the adjusted model ( $p = 0.008$ ; 95% CI, 1.03-1.24). It was also a predictor in the mixed model, which served as a sensitivity analysis to adjust for the multiple time points. The proportion of hyperglycemia was higher in the 33°C group compared with the 36°C group.

**CONCLUSION:** Higher blood glucose levels at admission and during the first 36 hours, and higher glycemic variability, were associated with poor neurologic outcome and death. More patients in the 33°C treatment arm had hyperglycemia.

2. Cardiol J. 2017 Jul 11. doi: 10.5603/CJ.a2017.0080. [Epub ahead of print]

*Adaptation of global hemostasis to therapeutic hypothermia in patients with out-of-hospital cardiac arrest: Thromboelastography study.*

Trąbka-Zawicki A1, Tomala M, Zeliaś A, Paszek E, Zajdel W, Stępień E, Żmudka K.

Abstract

**BACKGROUND:** The use of mild therapeutic hypothermia (MTH) in patients after out-of-hospital cardiac arrest (OHCA) who are undergoing primary percutaneous coronary intervention (pPCI) can protect patients from thromboembolic complications. The aim of the study was to evaluate the adaptive mechanisms of the coagulation system in MTH-treated comatose OHCA survivors.

**METHODS:** Twenty one comatose OHCA survivors with acute coronary syndrome undergoing immediate pPCI were treated with MTH. Quantitative and qualitative analyses of physical clot properties were performed using thromboelastography (TEG). Two analysis time points were

proposed: 1) during MTH with in vitro rewarming conditions (37°C) and 2) after restoration of normothermia (NT) under normal (37°C) and in vitro cooling conditions (32°C).

RESULTS: During MTH compared to NT, reaction time (R) was lengthened, clot kinetic parameter ( $\alpha$ ) was significantly reduced, but no effect on clot strength (MA) was observed. Finally, the coagulation index (CI) was significantly reduced with clot fibrinolysis attenuated during MTH. The clot lysis time (CLT) was shortened, and clot stability (LY<sup>60</sup>) was lower compared with those values during NT. In vitro cooling generally influenced clot kinetics and reduced clot stability after treatment.

CONCLUSIONS: Thromboelastography is a useful method for evaluation of coagulation system dysfunction in OHCA survivors undergoing MTH. Coagulation impairment in hypothermia was associated with a reduced rate of clot formation, increased weakness of clot strength, and disturbances of fibrinolysis. Blood sample analyses performed at 32°C during MTH, instead of the standard 37°C, seems to enhance the accuracy of the evaluation of coagulation impairment in hypothermia.

3. Scand J Trauma Resusc Emerg Med. 2017 Jul 11;25(1):68. doi: 10.1186/s13049-017-0417-6.

*Hypothermia induced alteration of repolarization - impact on acute and long-term outcome: a prospective cohort study.*

von Ulmenstein S1, Storm C2, Breuer TGK3, Lask S4, Attanasio P5, Mügge A4, Wutzler A5,4.

Abstract

BACKGROUND:

The effects of target temperature management (TTM) on the heart aren't thoroughly studied yet. Several studies showed the prolongation of various ECG parameters including Tpeak-Tend-time under TTM. Our study's goal is to evaluate the acute and long-term outcome of these prolongations.

METHODS: In this study we included patients with successful resuscitation after cardiac arrest who were admitted to the Charité Virchow Klinikum Berlin or the Heart and Vascular Centre of the Ruhr University Bochum between February 2006 and July 2013 (Berlin) or May 2014 to November 2015 (Bochum). For analysis, one ECG during TTM was recorded after reaching the target temperature (33-34 °C) or in the first 6 h of TTM. If possible, another ECG was taken after TTM. The patients were being followed until February 2016. Primary endpoint was ventricular arrhythmia during TTM, secondary endpoints were death and hospitalization due to cardiovascular diseases during follow-up.

RESULTS: One hundred fifty-eight patients were successfully resuscitated in the study period of which 95 patients had usable data (e.g. ECGs without artifacts). During TTM significant changes for different parameters of ventricular de- and repolarization were noted: QRS (103.2 ± 23.7 vs. 95.3 ± 18.1; p = 0.003), QT (405.8 ± 76.4 vs. 373.8 ± 75.0; p = 0.01), QTc (474.9 ± 59.7 vs. 431.0 ± 56.8; p < 0.001), JT (302.8 ± 69.4 vs. 278.5 ± 75.2; p = 0.043), JTc (354.3 ± 60.2 vs. 318.7 ± 59.1; p = 0.001). 13.7% of the patients had ventricular arrhythmias during TTM, however these patients showed no difference regarding their ECG parameters in comparison to those where no ventricular arrhythmias occurred. We were able to follow 69 Patients over an average period of 35 ± 31 months. The 14 (21.5%) patients who died during the follow-up had significant prolongations of the TpTe-time in the ECGs without TTM (103.9 ± 47.2 vs. 75.8 ± 28.6; p = 0.023).

CONCLUSION: Our results show a significant prolongation of ventricular repolarization during TH. However, there was no significant difference between the ECG parameters of those who developed a ventricular arrhythmia and those who did not. The temporary prolongation of the repolarization during TTM seems to be less important for the prognosis of the patient. Whereas the prolongation of the repolarization in the basal ECG is associated with a higher mortality in our study.

4. Anaesth Crit Care Pain Med. 2017 Jul 5. pii: S2352-5568(17)30163-7. doi: 10.1016/j.accpm.2017.06.003. [Epub ahead of print]



*Targeted temperature management in the ICU: guidelines from a French expert panel.*

Cariou A1, Payen JF2, Asehnoune K3, Audibert G4, Botte A5, Brissaud O6, Debaty G7, Deltour S8, Deye N9, Engrand N10, Francony G11, Legriel S12, Levy B13, Meyer P14, Orban JC15, Renolleau S16, Vigue B17, Blanquat LS18, Mathien C19, Velly L20.

Abstract

Over the recent period, the use of induced hypothermia has gained an increasing interest for critically ill patients, in particular in brain-injured patients. The term "targeted temperature management" (TTM) has now emerged as the most appropriate when referring to interventions used to reach and maintain a specific level temperature for each individual. TTM may be used to prevent fever, to maintain normothermia, or to lower core temperature. This treatment is widely used in intensive care units, mostly as a primary neuroprotective method. Indications are, however, associated with variable levels of evidence based on inhomogeneous or even contradictory literature. Our aim was to conduct a systematic analysis of the published data in order to provide guidelines. We present herein recommendations for the use of TTM in adult and paediatric critically ill patients developed using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) method. These guidelines were conducted by a group of experts from the French Intensive Care Society (Société de Réanimation de Langue Française [SRLF]) and the French Society of Anesthesia and Intensive Care Medicine (Société Française d'Anesthésie Réanimation [SFAR]) with the participation of the French Emergency Medicine Association (Société Française de Médecine d'Urgence [SFMU]), the French Group for Pediatric Intensive Care and Emergencies (Groupe Francophone de Réanimation et Urgences Pédiatriques [GFRUP]), the French National Association of Neuro-Anesthesiology and Critical Care (Association Nationale de Neuro-Anesthésie Réanimation Française [ANARLF]), and the French Neurovascular Society (Société Française Neurovasculaire [SFNV]). Fifteen experts and two coordinators agreed to consider questions concerning TTM and its practical implementation in five clinical situations: cardiac arrest, traumatic brain injury, stroke, other brain injuries, and shock. This resulted in 30 recommendations: 3 recommendations were strong (Grade 1), 13 were weak (Grade 2), and 14 were experts' opinions. After two rounds of rating and various amendments, a strong agreement from voting participants was obtained for all 30 (100%) recommendations, which are exposed in the present article.

5. Resuscitation. 2017 Mar;112:22-27. doi: 10.1016/j.resuscitation.2016.12.014. Epub 2016 Dec 21.

*Utilization of palliative care services for cardiac arrest patients undergoing therapeutic hypothermia: A retrospective analysis.*

Zern EK1, Young MN2, Triana T2, Xu M3, Holmes B2, Borges N2, McPherson JA2, Karlekar MB4.

Abstract

**BACKGROUND:** Palliative care (PC) services are integral to the care of patients with advanced medical illnesses. Given the significant morbidity and mortality associated with cardiac arrest, we sought to measure the use and impact of PC in the care of patients treated with therapeutic hypothermia (TH).

**METHODS:** We conducted a retrospective study of 317 consecutive patients undergoing TH after cardiac arrest. We compared intensive care unit (ICU) characteristics and clinical outcomes of subjects who received PC consultation (n=125) to those who did not (n=192).

**RESULTS:** The proportion of TH patients with PC consultations increased to greater than 60% by 2013, corresponding to our institution's expansion of PC services, development of a dedicated PC unit, and integration of this service into our published TH protocol. In the TH population, time to return of spontaneous circulation (ROSC) was associated with higher inpatient mortality (p<0.001) and placement of a PC consult (p=0.011). TH patients who received PC consultation had longer ICU stays (p=0.034), more ventilator days (p<0.001), and higher inpatient mortality (p<0.001). When these measures were analyzed cohort-wide comparing all TH patients pre- and

post-2013, at which time the frequency of PC consultation had dramatically increased, there were no statistically significant differences in ICU care or outcomes.

**CONCLUSION:** In our population of cardiac arrest patients undergoing TH, the utilization of PC services has increased over time, particularly for those patients with high morbidity and mortality. Future randomized studies may further delineate optimal patient selection for PC consultation to better facilitate goals of care discussions and timely medical decision-making.

6. *Ther Hypothermia Temp Manag.* 2017 Mar;7(1):16-23. doi: 10.1089/ther.2016.0013. Epub 2016 Jul 12.

*Asian Targeted Temperature Management Task Panel Report.*

Aibiki M1, Chiang MC2, Muengtaweepongsa S3, Pothiawala S4, Huang CH5.

**Abstract**

In the fields of emergency and critical care, targeted temperature management has become a critical issue and particularly popular in clinical practices throughout Asia. As more research is carried out, evidence and concepts about targeted temperature management continue to evolve. Areas of interest include new 2015 resuscitation guidelines, temperature management in pediatrics, and integrated care and neurological monitoring for cardiac arrest patients. The Asian Targeted Temperature Management task panel includes colleagues from various Asian countries and allows them to exchange experiences in a professional environment. Some of the key issues include optimal therapeutic hypothermia temperature for postcardiac arrest syndrome pursuant to 2015 guidelines, an integral approach to postcardiac arrest syndrome with hemodynamic monitoring and stabilization, roles of percutaneous coronary intervention and extracorporeal membrane oxygenation, and temperature management for neonatal hypoxic-ischemic encephalopathy. Panel experts reviewed all of the aforementioned issues and discussed the feasibility and effectiveness of targeted temperature management based on the Asian population. These discussions can expand the perspectives with regard to applying targeted temperature management all over the world.

7. *Resuscitation.* 2017 Jul 13. pii: S0300-9572(17)30293-9. doi: 10.1016/j.resuscitation.2017.07.012. [Epub ahead of print]

*Auditory discrimination improvement predicts awakening of postanoxic comatose patients treated with targeted temperature management at 36°C.*

Pfeiffer C1, Nguissi NAN2, Chytiris M2, Bidlingmeyer P2, Haenggi M3, Kurmann R4, Zubler F4, Oddo M5, Rossetti AO6, De Lucia M2.

**Abstract**

**BACKGROUND:** Outcome prognostication in postanoxic comatose patients is more accurate in predicting poor than good recovery. Using electroencephalography recordings in patients treated with targeted temperature management at 33°C (TTM 33), we have previously shown that improvement in auditory discrimination over the first days of coma predicted awakening. Given the increased application of a 36°C temperature target (TTM 36), here we aimed at validating the predictive value of auditory discrimination in the TTM 36 setting.

**METHODS:** In this prospective multicenter study, we analyzed the EEG responses to auditory stimuli from 60 consecutive patients from the first and second coma day. A semiautomatic decoding analysis was applied to single patient data to quantify discrimination performance between frequently repeated and deviant sounds. The decoding change from the first to second day was used for predicting patient outcome.

**RESULTS:** We observed an increase in auditory discrimination in 25 out of 60 patients. Among them, 17 awoke from coma (68% positive predictive value; 95% confidence interval: 0.46-0.85). By excluding patients with electroencephalographic epileptiform features, 15 of 18 exhibited improvement in auditory discrimination (83% positive predictive value; 95% confidence interval: 0.59-0.96). Specificity of good outcome prediction increased after adding auditory discrimination to EEG reactivity.

**CONCLUSION:** These results suggest that tracking of auditory discrimination over time is informative of good recovery independent of the temperature target. This quantitative test provides complementary information to existing clinical tools by identifying patients with high chances of recovery and encouraging the maintenance of life support.

## **ECMO**

1. *Perfusion*. 2017 Jul 1;267659117720493. doi: 10.1177/0267659117720493. [Epub ahead of print]

*Scedosporium apiospermum* infection: lethal complication after extracorporeal cardiopulmonary resuscitation.

Mei Y1, Chen X1, Sun K1, Lv J1, Sun H1, Zhang J1.

Abstract

In recent years, the development of extracorporeal membrane oxygenation (ECMO) technology has led to its extensive use in clinical practice. In particular, ECMO can play an important role in cardiopulmonary resuscitation (CPR). The American Heart Association CPR guidelines recommend its use in patients with cardiac arrest due to reversible disorders, along with high-quality CPR. This is called extracorporeal cardiopulmonary resuscitation (ECPR). However, it is important to be aware of the possibility of infection-related complications. Here, we report on a patient who suffered a cardiac arrest in hospital and was rescued with ECMO, but who subsequently developed an infection with *Scedosporium apiospermum*.

2. *Resuscitation*. 2017 Mar;112:34-40. doi: 10.1016/j.resuscitation.2016.12.009. Epub 2016 Dec 16.

*ECMO Cardio-Pulmonary Resuscitation (ECPR), trends in survival from an international multicentre cohort study over 12-years.*

Richardson AS1, Schmidt M2, Bailey M3, Pellegrino VA4, Rycus PT5, Pilcher DV4.

Abstract

**BACKGROUND:** Use of Extracorporeal Membrane Oxygenation during cardiopulmonary resuscitation (ECPR) is increasingly being deployed as an adjunct to conventional CPR. It is unknown if this has been associated with improved outcomes.

**AIMS:** To describe trends in survival and patient demographics for ECPR patients in the international Extracorporeal Life Support Organisation (ELSO) database over the past 12 years and identify factors associated with changes in survival.

**METHODS:** Patients greater than 16 years of age who received ECPR between January 2003 and December 2014 were extracted from the ELSO registry and were divided into three 4-year cohorts (Cohort 1: 2003-2006, Cohort 2: 2007-2010, Cohort 3: 2011-2014). Univariable analysis was performed to compare demographics and outcomes of patients across the three cohorts. Univariable and multivariable analyses were then performed to identify factors independently associated with survival.

**RESULTS:** 1796 patients treated with ECPR were extracted from the registry, aged 50 ( $\pm 18.5$ ) years. Annual ECPR episodes increased over 10-fold, from 35 to over 400 per year. Survival to hospital discharge was 29% overall (27% cohort 1, 28% cohort 2, 30% cohort 3 ( $p=0.71$ )). Age, body weight and documented comorbidities increased over time. There was a reduction in complications associated with ECMO usage. After adjusting for confounders there was no change in the odds of survival over the time period examined.

**INTERPRETATION:** Over the period 2003-2014, survival to hospital discharge was 29% for patients who require ECPR. Despite advances in provision of ECMO care and increasing comorbidities of patients, there has been no change in risk-adjusted survival over time.

## **DESFIBRIL-LACIÓ**

1. Circ Cardiovasc Qual Outcomes. 2017 Jul;10(7). pii: e003577. doi: 10.1161/CIRCOUTCOMES.116.003577.

*Manual Versus Semiautomatic Rhythm Analysis and Defibrillation for Out-of-Hospital Cardiac Arrest.*

Nehme Z1, Andrew E2, Nair R2, Bernard S2, Smith K2.

Abstract

**BACKGROUND:** Although manual and semiautomatic external defibrillation (SAED) are commonly used in the management of out-of-hospital cardiac arrest, the optimal strategy is not known. We hypothesized that SAED would reduce the time to first shock and lead to higher rates of cardioversion and survival compared with a manual strategy.

**METHODS AND RESULTS:**

Between July 2005 and June 2015, we included adult out-of-hospital cardiac arrest of presumed cardiac pathogenesis. On October 2012, a treatment protocol using SAED was introduced after years of manual defibrillation. The effect of the SAED implementation on the time to first shock, successful cardioversion, and patient outcomes was assessed using interrupted time series regression adjusting for arrest factors and temporal trend. Of the 14 776 cases, 10 224 (69.2%) and 4552 (30.8%) occurred during the manual and SAED protocols, respectively. Although the proportion of patients shocked within 2 minutes of arrival increased during the SAED protocol for initial shockable rhythms (from 58.9% to 69.2%;  $P<0.001$ ), there was no difference in unadjusted rate of successful cardioversion after first shock (from 12.3% to 13.8%;  $P=0.13$ ). After adjustment, the odds of delivering the first shock within 2 minutes of arrival increased under the SAED protocol (adjusted odds ratio [AOR], 1.72; 95% confidence interval [CI], 1.32-2.26;  $P<0.001$ ). Despite this, the SAED protocol was associated with a reduction in survival to hospital discharge (AOR, 0.71; 95% CI, 0.55-0.92;  $P=0.009$ ), event survival (AOR, 0.74; 95% CI, 0.62-0.88;  $P=0.001$ ), and prehospital return of spontaneous circulation (AOR, 0.81; 95% CI, 0.68-0.96;  $P=0.01$ ) when compared with the manual protocol. There was also no improvement in the rate of successful cardioversion after first shock (AOR, 0.73; 95% CI, 0.51-1.06;  $P=0.10$ ).

**CONCLUSIONS:** Although SAED improved the time to first shock, this did not translate into higher rates of successful cardioversion or survival after out-of-hospital cardiac arrest. Advanced life support providers should be trained to use a manual defibrillation protocol.

2. Resuscitation. 2017 Jul 5;118:49-54. doi: 10.1016/j.resuscitation.2017.07.002. [Epub ahead of print]

*Major regional differences in Automated External Defibrillator placement and Basic Life Support training in France: Further needs for coordinated implementation.*

Karam N1, Narayanan K2, Bougouin W2, Benameur N3, Beganton F2, Jost D4, Lamhaut L5, Perier MC6, Cariou A7, Celermajer DS8, Marijon E9, Jouven X9.

Abstract

**BACKGROUND:** Public Access Defibrillation (PAD) programs have emerged since mid-1990s with the aim of improving survival from Out-of-Hospital Cardiac Arrest (OHCA). The extent to which their implementation in the community differs among different areas has not been evaluated.

**METHODS:** We carried out a 5-year prospective national evaluation of PAD programs in 51 French districts (29.3 million inhabitants), through the cumulative density of Automated External Defibrillator (AEDs) and the proportion of persons educated in Basic Life Support (BLS).

**RESULTS:** Major regional discrepancies were observed with AED density from 5 to 3399 per 100,000 inhabitants per 1000km<sup>2</sup>, and BLS-educated inhabitants varying from 6955 to 36,636 per 100,000 inhabitants. Only 18 districts (35.3%) achieved both AED density and educational rate above median ( $>13,988$  and  $>22$ , respectively). Extrapolating the data from the French national registry on sports OHCA, mean survival rate was two-folds higher with AED density above the median (7.9% vs. 17.8%,  $P<0.001$ ) and four-fold higher with BLS-education above the median (5.0% vs. 20.9%,  $P<0.001$ ). In the group with both AED density and BLS-education level above the median, the survival rate reached up to 22.5%. Only the rate of population BLS

education remained independently associated with survival (OR 1.64, 95% Confidence Interval 1.17-2.31; P=0.0045).

CONCLUSIONS: Major heterogeneities in PAD programs exist, with significant room for better coordination in implementation. Population education in BLS provides an important benefit, regardless of the density of AEDs deployed, which should be taken into account in planning public health policies for improving OHCA survival.

## PEDIATRIA

1. *Pediatr Emerg Care*. 2017 Jul 11. doi: 10.1097/PEC.0000000000001208. [Epub ahead of print] *Effect of a Training Strategy in Improving Medication Fallacies During Pediatric Cardiopulmonary Resuscitation: A Before-and-After Study From a Developing Country*.

Sankar J1, Das RR, Mahapatro S, Sankar MJ .

Abstract

OBJECTIVE: This study aims to evaluate the effect of structured training on resident performance in improving medication fallacies during pediatric cardiopulmonary resuscitation (CPR).

METHODS: This before-and-after study was conducted in the pediatric acute care areas of tertiary care teaching hospitals of a developing country from August to December 2015. Case records of children younger than 18 years who underwent CPR were reviewed. Senior residents rotating through pediatric emergency department and pediatric intensive care unit were evaluated for their knowledge. Incidence of medication fallacies in pediatric CPR and change in the knowledge scores of residents posted in these areas were the main outcome measures.

RESULTS: One-hundred records were evaluated (pre-intervention, 54; post-intervention, 46). In the pre-intervention period, 25 had medication fallacies (documentation, 16; dosing, 9). In the post-intervention period, 7 fallacies pertaining to documentation (not dosing) were found. The incidence of severe fallacies decreased from 20% pretraining to 0% posttraining. The mean (SD) knowledge scores of residents increased from 7.9 (2.9) pretraining to 13 (1.4) posttraining. On univariate analysis, fallacies were found to be less if the resident was formally trained (pediatric advanced life support certified), if the patient was older, and during morning and night shifts as compared with evening shift. On multivariate analysis, however, only status of training (posttraining) (adjusted odds ratio, 0.12; 95% confidence interval, 0.02-0.68) and the morning shift (adjusted odds ratio, 0.03; 95% confidence interval, 0.001-0.72) remained significant with lower incidence of fallacies associated with these variables.

CONCLUSIONS: Rates of medication fallacies in pediatric CPR declined with structured training. Documentation fallacies may not be eliminated completely with only 1-time training.

2. *An Pediatr (Barc)*. 2017 Jul 5. pii: S1695-4033(17)30211-4. doi: 10.1016/j.anpedi.2017.05.010. [Epub ahead of print]

[Materials for the paediatric resuscitation trolley or backpack: Expert recommendations].

[Article in Spanish]

López-Herce Cid J1, Rodríguez Núñez A2, Carrillo Álvarez Á3, Zeballos Serrato G4, Martínez Fernández-Llamazares C5, Calvo Macías C6; Grupo Español de Reanimación Cardiopulmonar Pediátrica y Neonatal.

Abstract

Cardio-respiratory arrest (CPA) is infrequent in children, but it can occur in any place and at any time. This fact means that every health care facility must always have the staff and material ready to resuscitate a child. These recommendations are the consensus of experts of the Spanish Paediatric and Neonatal Resuscitation Group on the material and medication for paediatric and neonatal resuscitation and their distribution and use. CPR trolleys and backpacks must include the essential material to quickly and efficiently perform a paediatric CPR. At least one CPR trolley must be available in every Primary Care facility, Paediatric Intensive Care Unit, Emergency Department, and Pre-hospital Emergency Areas, as well as in paediatric wards, paediatric

ambulatory areas, and radiology suites. This trolley must be easily accessible and exclusively include the essential items to perform a CPR and to assist children (from newborns to adolescents) who present with a life-threatening event. Such material must be familiar to all healthcare staff and also include the needed spare parts, as well as enough drug doses. It must also be re-checked periodically. The standardisation and unification of the material and medication of paediatric CPR carts, trolleys, and backpacks, as well as the training of the personnel in their use are an essential part of the paediatric CPR.

3. Cochrane Database Syst Rev. 2017 Jul 14;7:CD004953. doi: 10.1002/14651858.CD004953.pub3. [Epub ahead of print]

*Sustained versus standard inflations during neonatal resuscitation to prevent mortality and improve respiratory outcomes.*

Bruschettini M1, O'Donnell CP, Davis PG, Morley CJ, Moja L, Zappettini S, Calevo MG.

Abstract

**BACKGROUND:** At birth, infants' lungs are fluid-filled. For newborns to have a successful transition, this fluid must be replaced by air to enable effective breathing. Some infants are judged to have inadequate breathing at birth and are resuscitated with positive pressure ventilation (PPV). Giving prolonged (sustained) inflations at the start of PPV may help clear lung fluid and establish gas volume within the lungs.

**OBJECTIVES:** To assess the efficacy of an initial sustained (> 1 second duration) lung inflation versus standard inflations ( $\leq$  1 second) in newly born infants receiving resuscitation with intermittent PPV.

**SEARCH METHODS:** We used the standard search strategy of the Cochrane Neonatal Review Group to search the Cochrane Central Register of Controlled Trials (CENTRAL; 2017, Issue 1), MEDLINE via PubMed (1966 to 17 February 2017), Embase (1980 to 17 February 2017), and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) (1982 to 17 February 2017). We also searched clinical trials databases, conference proceedings, and the reference lists of retrieved articles to identify randomised controlled trials and quasi-randomised trials.

**SELECTION CRITERIA:** Randomised controlled trials (RCTs) and quasi-RCTs comparing initial sustained lung inflation (SLI) versus standard inflations given to infants receiving resuscitation with PPV at birth.

**DATA COLLECTION AND ANALYSIS:** We assessed the methodological quality of included trials using Cochrane Effective Practice and Organisation of Care Group (EPOC) criteria (assessing randomisation, blinding, loss to follow-up, and handling of outcome data). We evaluated treatment effects using a fixed-effect model with risk ratio (RR) for categorical data and mean, standard deviation (SD), and weighted mean difference (WMD) for continuous data. We assessed the quality of evidence using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach.

**MAIN RESULTS:** Eight trials enrolling 941 infants met our inclusion criteria. Investigators in seven trials (932 infants) administered sustained inflation with no chest compressions. Use of sustained inflation had no impact on the primary outcomes of this review - mortality in the delivery room (typical RR 2.66, 95% confidence interval (CI) 0.11 to 63.40; participants = 479; studies = 5;  $I^2$  not applicable) and mortality during hospitalisation (typical RR 1.01, 95% CI 0.67 to 1.51; participants = 932; studies = 7;  $I^2$  = 19%); the quality of the evidence was low for death in the delivery room (limitations in study design and imprecision of estimates) and was moderate for death before discharge (limitations in study design of most included trials). Amongst secondary outcomes, duration of mechanical ventilation was shorter in the SLI group (mean difference (MD) -5.37 days, 95% CI -6.31 to -4.43; participants = 524; studies = 5;  $I^2$  = 95%; low-quality evidence). Heterogeneity, statistical significance, and magnitude of effects of this outcome are largely influenced by a single study: When this study was removed from the analysis, the effect was largely reduced (MD -1.71 days, 95% CI -3.04 to -0.39,  $I^2$  = 0%). Results revealed no differences in any of the other secondary outcomes (e.g. rate of endotracheal

intubation outside the delivery room by 72 hours of age (typical RR 0.93, 95% CI 0.79 to 1.09; participants = 811; studies = 5;  $I^2 = 0\%$ ); need for surfactant administration during hospital admission (typical RR 0.97, 95% CI 0.86 to 1.10; participants = 932; studies = 7;  $I^2 = 0\%$ ); rate of chronic lung disease (typical RR 0.95, 95% CI 0.74 to 1.22; participants = 683; studies = 5;  $I^2 = 47\%$ ); pneumothorax (typical RR 1.44, 95% CI 0.76 to 2.72; studies = 6, 851 infants;  $I^2 = 26\%$ ); or rate of patent ductus arteriosus requiring pharmacological treatment (typical RR 1.08, 95% CI 0.90 to 1.30; studies = 6, 745 infants;  $I^2 = 36\%$ ). The quality of evidence for these secondary outcomes was moderate (limitations in study design of most included trials - GRADE) except for pneumothorax (low quality: limitations in study design and imprecision of estimates - GRADE). **AUTHORS' CONCLUSIONS:** Sustained inflation was not better than intermittent ventilation for reducing mortality in the delivery room and during hospitalisation. The number of events across trials was limited, so differences cannot be excluded. When considering secondary outcomes, such as need for intubation, need for or duration of respiratory support, or bronchopulmonary dysplasia, we found no evidence of relevant benefit for sustained inflation over intermittent ventilation. The duration of mechanical ventilation was shortened in the SLI group. This result should be interpreted cautiously, as it can be influenced by study characteristics other than the intervention. Future RCTs should aim to enrol infants who are at higher risk of morbidity and mortality, should stratify participants by gestational age, and should provide more detailed monitoring of the procedure, including measurements of lung volume and presence of apnoea before or during the SLI.

4. Eur J Trauma Emerg Surg. 2017 Jul 15. doi: 10.1007/s00068-017-0815-5. [Epub ahead of print] *Pediatric out-of-hospital cardiopulmonary resuscitation by helicopter emergency medical service, does it has added value compared to regular emergency medical service?*

Moors XRJ1,2, Rijs K3, Den Hartog D4, Stolker RJ3.

Abstract

**PURPOSE:** To determine the outcome of out-of-hospital (OOH) cardiopulmonary resuscitation (CPR) and the advanced life support (ALS) procedures provided in pediatrics by the Rotterdam Helicopter Emergency Medical Service (HEMS) **METHODS:** Retrospective evaluation of all pediatric (0-17 years) OOH cardiopulmonary arrests within a 6-year period and attended by the Rotterdam HEMS team.

**RESULTS:** There were 201 OOH CPRs from October 2008 until October 2014. Endotracheal intubation was performed in 164 cases and done by HEMS in 104 patients (63%), intraosseous/intravenous cannulation 43/27 times, and additional medication given by HEMS in 70 patients (35%). The overall survival rate for OOH CPR was 15%, but in trauma was low. Twenty-seven of the 29 pediatric patients who survived until discharge are neurological well. Although the Dutch nationwide ambulance protocol states intubation, intravenous, or intraosseal excess and medication, in many patients, only HEMS provided additional ALS care.

**CONCLUSION:** The HEMS brings essential medical expertise in the field not provided by regular emergency medical service. HEMS provide a significant quantity of procedures, obviously needed by the OOH CPR of a pediatric patient.

## **CASE REPORTS**

1. Case Rep Neurol. 2017 Jun 14;9(2):156-160. doi: 10.1159/000477392. eCollection 2017 May-Aug.

*Safe Intravenous Thrombolysis after Traumatic Cardiopulmonary Resuscitation with Rib Fractures: A Case Report.*

Dressing A1, Graeter Z1, Bardutzky J1.

Abstract

We report a case of successful intravenous thrombolysis for a distal middle cerebral artery occlusion shortly after traumatic cardiopulmonary resuscitation due to an episode of ventricular

tachycardia. A high prevalence of fatal cardiac arrhythmias in acute stroke patients raises the question of safety when administering thrombolytic therapy after traumatic cardiopulmonary resuscitation; guidelines do not provide a satisfactory statement about this. Our case suggests that intravenous tissue-type plasminogen activator for acute ischemic stroke can be administered after a thorough risk-to-benefit evaluation without major adverse effects in patients after traumatic cardiopulmonary resuscitation, as bleeding complications seem rare and can be monitored and treated.

2. Scand J Trauma Resusc Emerg Med. 2017 Jul 10;25(1):66. doi: 10.1186/s13049-017-0412-y. *Controlled automated reperfusion of the whole body after 120 minutes of Cardiopulmonary resuscitation: first clinical report.*

Trummer G1,2, Supady A3, Beyersdorf F4, Scherer C4, Wengenmayer T3, Umhau M5, Benk C4.

Abstract

**BACKGROUND:** Cardiopulmonary resuscitation (CPR) is associated with a high mortality rate. Furthermore, the few survivors often have severe, persistent cerebral dysfunction. A potential cause for this unsatisfactory outcome after CPR is the combination of cardiac arrest (ischemia) and the inability to restore adequate hemodynamics during conventional CPR (reperfusion), resulting in ischemia/reperfusion injury of the whole body. Therefore we developed a concept counteracting this ischemia/reperfusion injury during the process of CPR.

**CASE PRESENTATION:** We present data from a patient, in whom the concept of a novel controlled automated reperfusion of the whole body (CARL) was applied after 120 min of CPR under normothermic conditions. The patient survived without cerebral deficits and showed full recovery of all organs after prolonged cardiac arrest (CA) except for the spinal cord, where a defect at the level of the 11th thoracic vertebra caused partial loss of motoric function of the legs.

**CONCLUSION:** This is the first reported clinical application of CARL after CA. The implementation of CARL resulted in unexpected survival and recovery after prolonged normothermic CA and CPR. In synopsis with the preclinical experience in pigs this case shows, that the new concept of CARL treating ischemia/reperfusion during the CPR may be an important element within the future treatment of CA.

3. Ther Hypothermia Temp Manag. 2017 Jul 14. doi: 10.1089/ther.2017.0018. [Epub ahead of print]

*Rectal Instillation of Cold Fluids for Targeted Temperature Management After Cardiac Arrest: A Case Report.*

Markota A1, Fluher J1, Sinkovič A1.

Abstract

The optimal method of temperature management after cardiac arrest remains unknown. Methods that are most effective are usually invasive and expensive. Noninvasive methods are not as effective and obstruct access to the patient. Temperature management via rectal cooling offers some potential advantages in survivors of cardiac arrest, namely, relatively large volumes of temperature-controlled fluids can be instilled, access to the patient is not obstructed, and fluid overload can be ameliorated by removal of a fraction of instilled fluid. We used rectal cooling in a 72-year-old male comatose survivor of cardiac arrest with an initial body temperature of 36.8°C. We instilled 3000 mL of normal saline at 4°C in 75 minutes, and ~2000 mL of effluent fluid was removed via gravity at 105 minutes after instillation. At 135 minutes, temperature decreased to a minimum of 35.2°C. No leakage was observed. Standard procedures (insertion of central venous and arterial catheters, electrocardiography, echocardiography, chest radiography) were performed with a rectal catheter in situ. At 210 minutes after instillation, the catheter was removed and there were no clinical signs of rectal injury after removal. To conclude, rectal instillation of cold fluids resulted in a significant



decrease of body temperature and we observed no major side effects. Fluid overloading was avoided by removing effluent fluid. Additional studies are needed if this technique is to gain more widespread use.

4. Scand J Trauma Resusc Emerg Med. 2017 Jul 17;25(1):73. doi: 10.1186/s13049-017-0418-5. *Swedish-Norwegian co-operation in the treatment of three hypothermia victims: a case report.* Carlsen AW1, Skjaervold NK1,2, Berg NJ3, Karlsen Ø1, Gunnarson E4, Wahba A5,6.

Abstract

**BACKGROUND:** Accidental hypothermia with cardiac arrest represents a challenge for pre-hospital rescuers as well as in-hospital staff. For pre-hospital personnel, the main focus is to get the patient to the correct destination without unnecessary delay. For in-hospital personnel early information is vital to assess the possibility for resuscitation with extracorporeal re-warming. The challenge is augmented when rescuers must cross national borders to reach and/or deliver the patients. We present a case where three adolescent boys suffered severe hypothermia after a canoeing accident in Sweden.

**CASE PRESENTATION:** Three 14-year-old boys were canoeing a mountain lake close to the Norwegian border when their boat capsized and they all fell into the cold water. The rescue operation was hampered by rough weather conditions, and immersion times spanned from 63 to 125 min. Flight times from the scene of accident to the nearest ECMO center in Norway (Trondheim) and Sweden (Umeå) were about 30 and 90 min respectively. Two of the victims showed no vital signs after retrieval from the water and had extremely low body temperatures. They were brought to Trondheim University Hospital where they were resuscitated successfully with extracorporeal re-warming. Unable to be weaned from ECMO in the initial phase, both patients were retrieved by mobile ECMO teams to Karolinska University Hospital, from where they were discharged to their homes with good outcomes, although with some sequelae. A third victim with moderate to severe hypothermia without cardiac arrest was treated at a local hospital, from where he after a short stay was discharged without physical sequelae.

**CONCLUSION:** These cases are a reminder of the traditional mantra that «no one is dead until warm and dead». Good communication between pre- and in-hospital staff can be vital for optimizing patient treatment when handling victims of severe hypothermia, and especially when there is multiple victims. Communication between neighboring countries, but even neighboring regions within the same country, can be challenging. We encourage regions similar to ours to review protocols regarding hypothermia management, making them more robust before incidents like this take place.

5. Am J Case Rep. 2017 Jul 21;18:817-821.

*Cardiac Arrest Following Drug Abuse with Intravenous Tapentadol: Case Report and Literature Review.*

Khaja M1, Lominadze G2, Millerman K2.

Abstract

**BACKGROUND** Tapentadol is a centrally acting opioid analgesic, with a dual mode of action, as a norepinephrine reuptake inhibitor and an agonist of the  $\mu$ -opioid receptor (MOR). Tapentadol is used for the management of musculoskeletal pain, and neuropathic pain associated with diabetic peripheral neuropathy. **CASE REPORT** A 32-year-old woman attended hospital for evaluation of an intractable headache. Computed tomography and magnetic resonance imaging of the brain were negative. She was found unresponsive in the bathroom on the day following hospital admission, and despite resuscitative measures, the patient died following cardiac arrest. Autopsy toxicology revealed significantly elevated levels of tapentadol, and bedside evidence suggested that the patient had self-administered this medication intravenously before her death. **CONCLUSIONS** We report a rare adverse effect of tapentadol causing respiratory depression leading to cardiac arrest. Medical examiners and forensic toxicologists should be aware of the toxicity of this novel opiate drug.