

1. Resuscitation. 2016 May 4. pii: S0300-9572(16)30037-5. doi: 10.1016/j.resuscitation.2016.04.013. [Epub ahead of print]

**Why do Some Studies Find that CPR Fraction is not a Predictor of Survival?**

Wik L1, Olsen JA2, Persse D3, Sterz F4, Jr ML5, Brouwer MA6, Westfall M7, Souders CM3, Travis DT5, Herken UR8, Lerner EB9.

**Abstract**

**INTRODUCTION:** An 80% chest compression fraction (CCF) during resuscitation is recommended. However, heterogeneous results in CCF studies were found during the 2015 Consensus on Science (CoS), which may be because chest compressions are stopped for a wide variety of reasons including providing lifesaving care, provider distraction, fatigue, confusion, and inability to perform lifesaving skills efficiently.

**OBJECTIVE:** The effect of confounding variables on CCF to predict cardiac arrest survival.

**METHODS:** A secondary analysis of emergency medical services (EMS) treated out-of-hospital cardiac arrest (OHCA) patients who received manual compressions. CCF (percent of time patients received compressions) was determined from electronic defibrillator files. Two Sample Wilcoxon Rank Sum or regression determined a statistical association between CCF and age, gender, bystander CPR, public location, witnessed arrest, shockable rhythm, resuscitation duration, study site, and number of shocks. Univariate and multivariate logistic regressions were used to determine CCF effect on survival.

**RESULTS:** Of 2132 patients with manual compressions 1,997 had complete data. Shockable rhythm ( $p < 0.001$ ), public location ( $p < 0.004$ ), treatment duration ( $p < 0.001$ ), and number of shocks ( $p < 0.001$ ) were associated with lower CCF. Univariate logistic regression found that CCF was inversely associated with survival (OR 0.07; 95% CI 0.01-0.36). Multivariate regression controlling for factors associated with survival and/or CCF found that increasing CCF was associated with survival (OR 6.34; 95% CI 1.02-39.5).

**CONCLUSION:** CCF cannot be looked at in isolation as a predictor of survival, but in the context of other resuscitation activities. When controlling for the effects of other resuscitation activities, a higher CCF is predictive of survival. This may explain the heterogeneity of findings during the CoS review.

**REGISTRES Y REVISIONS**

1. Resuscitation. 2016 Apr 27. pii: S0300-9572(16)30022-3. doi: 10.1016/j.resuscitation.2016.04.009. [Epub ahead of print]

**Ischemia reperfusion injury as a modifiable therapeutic target for cardioprotection or neuroprotection in patients undergoing cardiopulmonary resuscitation.**

Madathil RJ1, Hira RS1, Stoeckl M2, Sterz F2, Elrod JB1, Nichol G3.

**Abstract**

Quick restoration of blood flow is essential in patients who have cardiac arrest or other conditions associated with local or global cessation of blood flow. This restoration of flow is associated with multiple deleterious cellular changes. We sought to review these changes to try to understand whether ischemia-reperfusion injury (RI) is a potentially modifiable therapeutic target for cardioprotection or neuroprotection in patients undergoing cardiopulmonary resuscitation. Remote ischemic conditioning (RIC) involves brief episodes of non-lethal ischemia and reperfusion applied to an organ or limb distal to the heart and brain. Induction of hypothermia involves cooling an ischemic organ or body. Both have pluripotent effects that reduce the potential harm associated with RI in the heart and brain by reduced opening of the mitochondrial permeability transition pore. Recent trials of RIC and induced hypothermia did not demonstrate these treatments to be effective. Assessment of the effect of these interventions in humans to date may have been modified by use of concurrent medications including propofol. Ongoing research is necessary to assess whether reduction of RI improves patient outcomes.

2. Medicine (Baltimore). 2016 May;95(18):e3561. doi: 10.1097/MD.0000000000003561.

### **Sex and Age Aspects in Patients Suffering From Out-Of-Hospital Cardiac Arrest: A Retrospective Analysis of 760 Consecutive Patients.**

Piegeler T1, Thoeni N, Kaserer A, Brueesch M, Sulser S, Mueller SM, Seifert B, Spahn DR, Ruetzler K.

#### **Abstract**

Cardiopulmonary resuscitation (CPR) is indicated in patients suffering from out-of-hospital cardiac arrest. Several studies suggest a sex- and age-based bias in the treatment of these patients. This particular bias may have a significant impact on the patient's outcome. However, the reasons for these findings are still unclear and discussed controversially. Therefore, the aim of this study was to retrospectively analyze treatment and out-of-hospital survival rates for potential sex- and age-based differences in patients requiring out-of-hospital CPR provided by an emergency physician in the city of Zurich, Switzerland. A total of 3961 consecutive patients (2003-2009) were included in this retrospective analysis to determine the frequency of out-of-hospital CPR and prehospital survival rate, and to identify potential sex- and age-based differences regarding survival and treatment of the patients. Seven hundred fifty-seven patients required CPR during the study period. Seventeen patients had to be excluded because of incomplete or inconclusive documentation, resulting in 743 patients (511 males, 229 females) undergoing further statistical analysis. Female patients were significantly older, compared with male patients ( $68 \pm 18$  [mean  $\pm$  SD] vs  $64 \pm 18$  years,  $P = .012$ ). Men were resuscitated slightly more often than women (86.4% vs 82.1%). Overall out-of-hospital mortality rate was found to be 81.2% (492/632 patients) with no differences between sexes (82.1% for males vs 79% for females, odds ratio 1.039, 95% confidence interval 0.961-1.123). No sex differences were detected in out-of-hospital treatment, as assessed by the different medications administered, initial prehospital Glasgow Coma Scale, and prehospital suspected leading diagnosis. The data of our study demonstrate that there was no sex-based bias in treating patients requiring CPR in the prehospital setting in our physician-led emergency ambulance service.

3. Eur J Emerg Med. 2016 May 4. [Epub ahead of print]

### **Commence, continue, withhold or terminate?: a systematic review of decision-making in out-of-hospital cardiac arrest.**

Anderson NE1, Gott M, Slark J.

#### **Abstract**

When faced with an out-of-hospital cardiac arrest patient, prehospital and emergency resuscitation providers have to decide when to commence, continue, withhold or terminate resuscitation efforts. Such decisions may be made difficult by incomplete information, clinical, resourcing or scene challenges and ethical dilemmas. This systematic integrative review identifies all research papers examining resuscitation providers' perspectives on resuscitation decision-making for out-of-hospital cardiac arrest patients. A total of 14 studies fulfilled the inclusion criteria: nine quantitative, four qualitative and one mixed-methods design. Five themes were identified, describing factors informing resuscitation provider decision-making: the arrest event; patient characteristics; the resuscitation scene; resuscitation provider perspectives; and medicolegal concerns. Established prognostic factors are generally considered important, but there is a lack of resuscitation provider consensus on other factors, indicating that decision-making is influenced by the perspective of resuscitation providers themselves. Resuscitation decision-making research typically draws conclusions from evaluation of cardiac arrest registry data or clinical notes, but these may not capture all salient factors. Future research should explore resuscitation provider perspectives to better understand these important decisions and the clinical, ethical, emotional and cognitive demands placed on resuscitation providers.

4. Syst Rev. 2016 Apr 7;5(1):55. doi: 10.1186/s13643-016-0234-4.

### **Disparities in a provision of in-hospital post-arrest interventions for out-of-hospital cardiac arrest (OHCA) in the elderly population-protocol for a systematic review.**

Bielecki JM1,2, Wong J1,2, Mitsakakis N1,2, Shah PS3,4,5, Krahn MD1,2,5, Rac VE6,7,8.

#### **Abstract**

**BACKGROUND:** Out-of-hospital cardiac arrest (OHCA) is a significant cause of death in developed countries. The majority of OHCA patients are elderly ( $\geq 65$  years), and it was documented that they were less likely than younger patients to receive the evidence-based interventions, even though the improvement in survival in the elderly age group was higher than in younger population. Our goal is to investigate any disparity in the provision of post-arrest care for the elderly with OHCA and a sustained return of spontaneous circulation (ROSC).

**METHODS/DESIGN:** Eight relevant, electronic databases will be systematically searched to identify eligible studies. The searches will be supplemented with gray literature searching of theses, dissertations, and hand searching of pertinent journals. Two independent reviewers will screen the titles and abstracts and select studies for full text analysis using Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) method, and both will extract information from the selected studies employing a form based on the Data Extraction Template for Cochrane Reviews. A team of three reviewers will assess the quality of the studies with the modified Downs and Black scale. Statistical methods for evidence synthesis, such as meta-analysis and meta-regression, will be applied to compare and combine the evidence regarding the association between age and intervention provision/utilization, adjusting for a number of significant confounders, such as patient characteristics and comorbidities and availability of intervention techniques, as well as study specific characteristics. The strength of evidence from the selected studies will be assessed using a modified Grades of Recommendation, Assessment, Development, and Evaluation (GRADE) system.

**DISCUSSION:** The findings obtained from this systematic review should inform whether disparity exists in the provision of post-arrest care for the elderly ( $\geq 65$  years old) with OHCA or not. Addressing this problem has a potential to substantially increase the number of  $> 65$ -year-old, long-term survivors. The results of our review might also point to the gaps in the published literature that specifically examines disparity in provision of care for this population. This systematic review was designed in accordance with the Preferred Reporting Guidelines for Systematic reviews and Meta-analyses (PRISMA statement), while the protocol follows the Preferred Reporting items for Systematic review and Meta-analysis protocols (PRISMA-P) statement.

**SYSTEMATIC REVIEW REGISTRATION:** PROSPERO CRD42015027822.

## ENTRENAMIENTO

1. Emerg Med Int. 2016;2016:3701468. doi: 10.1155/2016/3701468. Epub 2016 Apr 6.

### **Trainers' Attitudes towards Cardiopulmonary Resuscitation, Current Care Guidelines, and Training.**

Mäkinen M1, Castrén M2, Nurmi J3, Niemi-Murola L1.

#### **Abstract**

**Objectives.** Studies have shown that healthcare personnel hesitate to perform defibrillation due to individual or organisational attitudes. We aimed to assess trainers' attitudes towards cardiopulmonary resuscitation and defibrillation (CPR-D), Current Care Guidelines, and associated training. **Methods.** A questionnaire was distributed to CPR trainers attending seminars in Finland (N = 185) focusing on the updated national Current Care Guidelines 2011. The questions were answered using Likert scale (1 = totally disagree, 7 = totally agree). Factor loading of the questionnaire was made using maximum likelihood analysis and varimax rotation. Seven scales were constructed (Hesitation, Nurse's Role, Nontechnical Skill, Usefulness, Restrictions, Personal, and Organisation). Cronbach's alphas were 0.92-0.51. Statistics were Student's t-test, ANOVA, stepwise regression analysis, and Pearson Correlation. **Results.** The questionnaire was returned by 124/185, 67% CPR trainers, of whom two-thirds felt that their undergraduate training in CPR-D had not been adequate. Satisfaction with undergraduate defibrillation training correlated with the Nontechnical Skills scale ( $p < 0.01$ ). Participants scoring high on Hesitation scale ( $p < 0.01$ ) were less confident about their Nurse's Role ( $p < 0.01$ ) and Nontechnical Skills ( $p < 0.01$ ). **Conclusion.** Quality of undergraduate education affects the work of CPR trainers and some feel uncertain of defibrillation. The train-the-trainers courses and undergraduate medical education should focus more on practical scenarios with defibrillators and nontechnical skills.

2. Resuscitation. 2016 Apr 27. pii: S0300-9572(16)30021-1. doi: 10.1016/j.resuscitation.2016.04.008. [Epub ahead of print]

**Comparison of Team-Focused CPR vs Standard CPR in Resuscitation from Out-of-Hospital Cardiac Arrest: Results from a Statewide Quality Improvement Initiative.**

Pearson DA1, Nelson RD2, Monk L3, Tyson C3, Jollis JG3, Granger CB3, Corbett C4, Garvey L5, Runyon MS5.

**Abstract**

**BACKGROUND:**

Team-focused CPR (TFCPR) is a choreographed approach to cardiopulmonary resuscitation (CPR) with emphasis on minimally interrupted high-quality chest compressions, early defibrillation, and discourages endotracheal intubation and encourages use of the bag-valve-mask (BVM) and/or blind-insertion airway device (BIAD) with a ventilation rate of 8 to 10 breaths/minute to minimize hyperventilation. Widespread incorporation of TFCPR in North Carolina (NC) EMS agencies began in 2011, yet its impact on outcomes is unknown.

**OBJECTIVES:**

To determine whether TFCPR improves survival with good neurological outcome in out-of-hospital cardiac arrest (OHCA) patients compared to standard CPR.

**METHODS:**

This retrospective cohort analysis of NC EMS agencies reporting data to the Cardiac Arrest Registry for Enhanced Survival (CARES) database from January 2010 to June 2014 included adult, non-traumatic OHCA with presumed cardiac etiology where EMS performed CPR or patient received defibrillation. Exclusions were arrest terminated per EMS policy or DNR. EMS agencies self-reported the TFCPR implementation dates. Patients were categorized as receiving either TFCPR or standard CPR. The primary outcome was good neurologic outcome at time of hospital discharge defined as Pittsburgh Cerebral Performance Category (CPC) 1-2.

**RESULTS:**

Of 14,994 OHCA, 14,129 patients were included for analysis with a mean age 65 (IQR 50-81) years, 61% male, 7.3% with good neurologic outcome, 24.3% with shockable initial rhythm, and 71.5% receiving TFCPR. Of the 3,427 (24.3%) with an initial shockable rhythm, 739 (71.9%) had a good neurological outcome. Good neurologic outcome was higher with TFCPR [836 (8.3%, 95%CI 7.7-8.8%)] vs. standard CPR [193 (4.8%, 95%CI 4.2-5.5%)]. Logistic regression controlling for demographic and arrest characteristics revealed TFCPR (OR 1.5), witnessed arrest (OR 4.3), initial shockable rhythm (OR 7.1), and in-hospital hypothermia were associated with good neurologic outcome. Mechanical CPR device (OR 0.68), CPR feedback device (OR 0.47), and endotracheal intubation (OR 0.44) were associated with less likelihood for a good neurologic outcome.

**CONCLUSION:**

In our statewide OHCA cohort, TFCPR was associated with improved survival with good neurological outcome.

## **PEDIATRIA**

1. Cochrane Database Syst Rev. 2016 May 5;5:CD001240. [Epub ahead of print]

**Prophylactic barbiturate use for the prevention of morbidity and mortality following perinatal asphyxia.**

Young L1, Berg M, Soll R.

**Abstract**

**BACKGROUND:** Seizures are common following perinatal asphyxia and may exacerbate secondary neuronal injury. Barbiturate therapy has been used for infants with perinatal asphyxia in order to prevent seizures. However, barbiturate therapy may adversely affect neurodevelopment leading to concern regarding aggressive use in neonates.

**OBJECTIVES:** To determine the effect of administering prophylactic barbiturate therapy on death or neurodevelopmental disability in term and late preterm infants following perinatal asphyxia.

**SEARCH METHODS:** We used the standard search strategy of the Cochrane Neonatal Review group to search the Cochrane Central Register of Controlled Trials (CENTRAL, 2015, Issue 11),

MEDLINE via PubMed (1966 to 30 November 2015), EMBASE (1980 to 30 November 2015), and CINAHL (1982 to 30 November 2015). We also searched clinical trials databases, conference proceedings, and the reference lists of retrieved articles for randomized controlled trials (RCT) and quasi-RCTs.

**SELECTION CRITERIA:** We included all RCTs or quasi-RCTs of prophylactic barbiturate therapy in term and late preterm infants without clinical or electroencephalographic evidence of seizures compared to controls following perinatal asphyxia.

**DATA COLLECTION AND ANALYSIS:** Three review authors independently selected, assessed the quality of, and extracted data from the included studies. We assessed methodologic quality and validity of studies without consideration of the results. The review authors independently extracted data and performed meta-analyses using risk ratios (RR) and risk differences (RD) for dichotomous data and mean difference for continuous data with 95% confidence intervals (CI). For significant results, we calculated the number needed to treat for an additional beneficial outcome (NNTB) or for an additional harmful outcome (NNTH).

**MAIN RESULTS:** In this updated review, we identified nine RCTs of any barbiturate therapy in term and late preterm infants aged less than three days old with perinatal asphyxia without evidence of seizures. Eight of these studies compared prophylactic barbiturate therapy to conventional treatment (enrolling 439 infants) and one study compared barbiturate therapy to treatment with phenytoin (enrolling 17 infants). Prophylactic barbiturate therapy versus conventional treatment: one small trial reported a decreased risk of death or severe neurodevelopmental disability for barbiturate therapy (phenobarbital) versus conventional treatment (RR 0.33, 95% CI 0.14 to 0.78; RD -0.55, 95% CI -0.84 to -0.25; NNTB 2, 95% CI 1 to 4; 1 study, 31 infants) (very low quality evidence). Eight trials comparing prophylactic barbiturate therapy with conventional treatment following perinatal asphyxia demonstrated no significant impact on the risk of death (typical RR 0.88, 95% CI 0.55 to 1.42; typical RD -0.02, 95% CI -0.08 to 0.05; 8 trials, 429 infants) (low quality evidence) and the one small trial noted above reported a significant decrease in the risk of severe neurodevelopmental disability (RR 0.24, 95% CI 0.06 to 0.92; RD -0.43, 95% CI -0.73 to -0.13; NNTB 2, 95% CI 1 to 8; 1 study, 31 infants) (very low quality evidence). A meta-analysis of the six trials reporting on seizures in the neonatal period demonstrated a statistically significant reduction in seizures in the prophylactic barbiturate group versus conventional treatment (typical RR 0.62, 95% CI 0.48 to 0.81; typical RD -0.18, 95% CI -0.27 to -0.09; NNTB 5, 95% CI 4 to 11; 6 studies, 319 infants) (low quality evidence). There were similar results in subgroup analyses based on type of barbiturate and Sarnat score. Prophylactic barbiturate therapy versus other prophylactic anticonvulsant therapy: one study reported on prophylactic barbiturate versus prophylactic phenytoin. There was no significant difference in seizure activity in the neonatal period between the two study groups (RR 0.89, 95% CI 0.07 to 12.00; 1 trial, 17 infants).

**AUTHORS' CONCLUSIONS:** We found only low or very low quality evidence addressing the use of prophylactic barbiturates in infants with perinatal asphyxia. Although the administration of prophylactic barbiturate therapy to infants following perinatal asphyxia did reduce the risk of seizures, there was no reduction seen in mortality and there were few data addressing long-term outcomes. The administration of prophylactic barbiturate therapy for late preterm and term infants in the immediate period following perinatal asphyxia cannot be recommended for routine clinical practice. If used at all, barbiturates should be reserved for the treatment of seizures. The results of the current review support the use of prophylactic barbiturate therapy as a promising area of research. Future studies should be of sufficient size and duration to detect clinically important reductions in mortality and severe neurodevelopmental disability and should be conducted in the context of the current standard of care, including the use of therapeutic hypothermia.

2. J Emerg Med. 2016 Apr 25. pii: S0736-4679(16)00218-3. doi: 10.1016/j.jemermed.2016.03.003. [Epub ahead of print]

**Gum-Elastic Bougie Efficacy for Tracheal Intubation During Continuous Chest Compression in Infants-A Crossover Simulation Trial.**

Cho T1, Komazawa N2, Hattori K2, Mihara R2, Minami T2.

**Abstract**

**BACKGROUND:** Recent guidelines for infant cardiopulmonary resuscitation emphasize that all rescuers should minimize interruption of chest compression, even for endotracheal intubation. **OBJECTIVE:** We compared the utility of application of a gum-elastic bougie (GEB) plus Miller laryngoscope (Mil) with the Mil alone during chest compression on an infant mannequin. **METHODS:** Sixteen anesthesiologists with more than 2 years of experience performed tracheal intubation on an infant mannequin using the Mil or Mil plus 6Fr GEB, with or without chest compression. Intubation success rate, intubation time, and subjective difficulty scores of laryngoscopy and tube passage through the glottis were measured. **RESULTS:** In Mil trials, none of the participants failed without compression, whereas four failed with compression ( $p = 0.03$ ). In Mil-plus-GEB trials, all participants succeeded regardless of chest compression. Intubation time was significantly longer with chest compression in both Mil and Mil-plus-GEB trials ( $p < 0.001$ ). The intubation time during chest compression was significantly longer in Mil than in Mil-plus-GEB trials ( $p < 0.001$ ). Difficulty of operation on a visual analog scale (VAS) for laryngoscopy did not significantly differ between Mil and Mil-plus-GEB trials during chest compression, whereas the VAS for tube passage through the glottis was significantly higher in Mil than in Mil-plus-GEB trials. **CONCLUSIONS:** GEB use shortened the intubation time and improved the success rate of infant tracheal intubation during chest compression by anesthesiologists in simulations.

## TARGET TEMPERATURE MANAGEMENT

1. Ir J Med Sci. 2016 May 4. [Epub ahead of print]

### **Targeted temperature management in cardiovascular disease complicated by cardiac arrest.**

Gorecka M1, Hanley A2, Burke F3, Nolan P2, Crowley J2.

#### **Abstract**

##### **PURPOSE:**

The majority of cardiac arrests occur due to cardiovascular etiology. Targeted temperature management (TTM) (32-34 °C) is a part of the standard post arrest care. We hypothesized that lower body temperature may lead to reduced cardiac metabolic demand and potentially have a beneficial effect on myocardial function.

##### **METHODS:**

We performed a retrospective study on patients admitted to the intensive care unit following cardiac arrest secondary to cardiovascular etiology over a 9 year period. We assessed the impact of TTM on neurological and cardiac outcomes.

##### **RESULTS:**

There were 57 patients in the cohort; 21 patients in the TTM group and 36 in the non-TTM group. Demographic characteristics were similar in both groups-the majority of patients (86 vs 80 %, respectively) were males in their 60s. Neurological outcomes were similar; 24 % of patients died during the ICU admission in the TTM group vs 18 % in the non-TTM group. Mean GCS on admission to the ICU was 4 vs 7, respectively, and 11 at discharge in both groups. Majority of patients recovered good neurological function (GCS  $\geq$  13)-57 % in the TTM group vs 64 % in the non-TTM group. The change in left ventricular function over a 6 month follow up period was significantly better in patients who received targeted temperature management-mean change of +4.4 vs -3.3 %, respectively. This proved to be statistically significant ( $p = 0.02$ ).

##### **CONCLUSIONS:**

The study demonstrates a possible beneficial effect of TTM on long-term cardiac function, when instituted following cardiac arrest.

2. Trials. 2016 May 4;17(1):228. doi: 10.1186/s13063-016-1338-9.

### **Time-differentiated target temperature management after out-of-hospital cardiac arrest: a multicentre, randomised, parallel-group, assessor-blinded clinical trial (the TTH48 trial): study protocol for a randomised controlled trial.**

Kirkegaard H1, Rasmussen BS2, de Haas I2, Nielsen JF3, Ilkjær S4, Kaltoft A5, Jeppesen AN6, Grejs A6, Duez CH6, Larsen AI7,8, Pettilä V9,10, Toome V11, Arus U12, Taccone FS13, Storm C14, Skrifvars MB9, Søreide E15,16.

#### **Abstract**

## BACKGROUND:

The application of therapeutic hypothermia (TH) for 12 to 24 hours following out-of-hospital cardiac arrest (OHCA) has been associated with decreased mortality and improved neurological function. However, the optimal duration of cooling is not known. We aimed to investigate whether targeted temperature management (TTM) at  $33 \pm 1$  °C for 48 hours compared to 24 hours results in a better long-term neurological outcome.

## METHODS:

The TTH48 trial is an investigator-initiated pragmatic international trial in which patients resuscitated from OHCA are randomised to TTM at  $33 \pm 1$  °C for either 24 or 48 hours. Inclusion criteria are: age older than 17 and below 80 years; presumed cardiac origin of arrest; and Glasgow Coma Score (GCS) <8, on admission. The primary outcome is neurological outcome at 6 months using the Cerebral Performance Category score (CPC) by an assessor blinded to treatment allocation and dichotomised to good (CPC 1-2) or poor (CPC 3-5) outcome. Secondary outcomes are: 6-month mortality, incidence of infection, bleeding and organ failure and CPC at hospital discharge, at day 28 and at day 90 following OHCA. Assuming that 50 % of the patients treated for 24 hours will have a poor outcome at 6 months, a study including 350 patients (175/arm) will have 80 % power (with a significance level of 5 %) to detect an absolute 15 % difference in primary outcome between treatment groups. A safety interim analysis was performed after the inclusion of 175 patients.

## DISCUSSION:

This is the first randomised trial to investigate the effect of the duration of TTM at  $33 \pm 1$  °C in adult OHCA patients. We anticipate that the results of this trial will add significant knowledge regarding the management of cooling procedures in OHCA patients

3. Ther Hypothermia Temp Manag. 2016 May 2. [Epub ahead of print]

### **Early Absent Pupillary Light Reflexes After Cardiac Arrest in Patients Treated with Therapeutic Hypothermia.**

Dhaka LP1,2, Sen A3, Stanko CM4, Rawal B5, Heckman MG5, Hoyne JB6, Dimberg EL2, Freeman ML1, Ng LK1,2,7, Rabinstein AA8, 9, Freeman WD1,2,7.

#### **Abstract**

Loss of pupillary light reactivity is one recognized indicator of poor prognosis after cardiopulmonary resuscitation (CPR). However, drug overdose, low cardiac output, and/or resuscitation drugs can lead to impaired pupillary light reflex. To investigate pupillary light reflex status before therapeutic hypothermia (TH) in relation to neurological outcome, we retrospectively reviewed the data of a prospectively implemented TH protocol in patients with cardiac arrest (CA) at Mayo Clinic in Jacksonville, Florida (January 2006-January 2012), and Mayo Clinic in Scottsdale, Arizona (August 2010-March 2014). During this period, all CA patients who underwent hypothermia were included. These patients were selected from an institutional database and hypothermia data set. The Cerebral Performance Category (CPC) at time of discharge was our primary outcome measure. A CPC of 1 to 2 was defined as good outcome and a CPC from 3 to 5 was defined as poor outcome. We identified 99 patients who had CA treated with TH. Twenty-nine patients (29%) had pupils that were nonreactive to light on admission examination before TH, eight of whom later had return of pupil reactivity by day 3. Two of these 29 patients (6.9%) had good outcome, compared to 24 of 70 patients (34.3%) with pupils that were reactive to light ( $p = 0.005$ ). Both of these patients had CA after illicit drug overdose. Early nonreactive pupils occurred in almost a third of patients after CPR and before TH in our patient population. Recovery of pupillary light reactivity is possible, and in a small minority of those cases (particularly when CA is preceded by the use of illicit drugs), a good outcome can be achieved.

## AESP

1. Resuscitation. 2016 Apr 30. pii: S0300-9572(16)30016-8. doi: 10.1016/j.resuscitation.2016.03.029. [Epub ahead of print]

**ECG patterns in early pulseless electrical activity - Associations with aetiology and survival of in-hospital cardiac arrest.**

Bergum D1, Skjeflo GW2, Nordseth T3, Mjølstad OC4, Haugen BO4, Skogvoll E5, Loennechen JP4.

### **Abstract**

**INTRODUCTION:** Pulseless electrical activity (PEA) is an increasingly common presentation in cardiac arrest. The aim of this study was to investigate possible associations between early ECG patterns in PEA and the underlying causes and survival of in-hospital cardiac arrest (IHCA).

**METHODS:** Prospectively observed episodes of IHCA presenting as PEA between January 2009 and August 2013, with a reliable cause of arrest and corresponding defibrillator ECG recordings, were analysed. QRS width, QT interval, Bazett's corrected QT interval, presence of P waves and heart rate (HR) was determined. QRS width and HR were considered to be normal below 120ms and within 60-100 cardiac cycles per minute, respectively.

**RESULTS:** Fifty-one episodes fulfilled the inclusion criteria. The defibrillator was attached after a median of one minute (75th percentile; 3min) after the onset of arrest. Ninety percent (46/51) had widened QRS complexes, 63% (32/51) were defined as 'wide-slow' due to QRS-widened bradycardia, and only 6% (3/51) episodes were categorized as normal. No unique cause-specific ECG pattern could be identified. Further 7 episodes with a corresponding defibrillator file, but without a reliable cause, were included in analysis of survival. Abnormal ECG patterns were seen in all survivors. None of the patients with 'normal' PEA survived.

**CONCLUSION:** Abnormal ECG patterns were frequent at the early stage of in-hospital PEA. No unique patterns were associated with the underlying causes or survival.

### **RECERCA EXPERIMENTAL**

1. Am J Emerg Med. 2016 Apr 23. pii: S0735-6757(16)30050-X. doi: 10.1016/j.ajem.2016.04.026. [Epub ahead of print]

#### **Intravenous lipid emulsion in the resuscitation of cocaine-induced cardiovascular arrest in a rat model.**

Chai PR1, Hack JB2.

### **Abstract**

**CONTEXT:** Intravenous lipid emulsion (ILE) is a potential antidote for severe overdose of certain lipophilic drugs. Cocaine overdose is often fatal and has no antidote. The use of ILE after cocaine-induced cardiac arrest has been suggested but is not well characterized.

**OBJECTIVE:** The objective of the study is to determine if ILE would reverse cocaine-induced cardiac arrest in a rat model.

**MATERIALS AND METHODS:** Twelve Sprague-Dawley rats with intra-arterial and intravenous access were sedated with isoflurane and split into 2 cocaine dose groups, then given either ILE or normal saline (NS) intravenously (IV)-group A, 7 animals received cocaine (10 mg/kg IV) with 6 of 7 given ILE (15 mg/kg IV) and 1 of 7 given NS (equal volume); group B, 5 animals received cocaine (5 mg/kg IV) with 3 of 5 given ILE (15 mg/kg IV) and 2 of 5 given NS (equal volume). Closed chest compressions were initiated for asystole and continued for 15 minutes with rhythm checks every minute.

**RESULTS:** All 12 rats experienced cardiac arrest after cocaine bolus. Resuscitation was successful in 1 of 7 rats in group A and 0 of 5 in group B.

**CONCLUSIONS:** Intravenous lipid emulsion administration did not affect outcome of cocaine-induced cardiac arrest compared with control in this model.

### **CASE REPORTS**

1. Scand J Trauma Resusc Emerg Med. 2016 Apr 30;24(1):64. doi: 10.1186/s13049-016-0253-0. **Arterial blood pressure differences between AutoPulse™ and Lucas2™ during mechanic cardiopulmonary resuscitation.**

Frey M1, Lötscher S1, Theiler L1, Albrecht R2.

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## **Abstract**

We present a 39-year-old patient under constant mechanical CPR with an arterial line in place. The use of AutoPulse™ resulted in higher arterial pressures than the use of LUCAS2™.

2. BMJ Case Rep. 2016 May 6;2016. pii: bcr2014208659. doi: 10.1136/bcr-2014-208659.

### **Cardiac arrest due to a missed diagnosis of Boerhaave's syndrome.**

Davies J1, Spitzer D2, Phylactou M3, Glasser M4.

## **Abstract**

A 91-year-old presented with a rare cause of cardiac arrest. He was initially admitted with severe back pain following vomiting and diagnosed with probable aspiration pneumonia. On day 3 of admission, he was discovered in cardiac arrest and cardiopulmonary resuscitation was started. On intubation, a left-sided pneumothorax and subcutaneous emphysema were noted. Needle decompression showed gastric fluid leaking from the cannula. The patient regained a cardiac output, and a subsequent CT scan confirmed a large pneumomediastinum with air tracking to the neck and chest, and bilateral pneumothoraces. A diagnosis of Boerhaave's syndrome was made. The patient was transferred to the intensive care unit but did not survive. This case demonstrates the importance of looking for and treating the rarer reversible causes of cardiac arrest, and of maintaining a high index of suspicion for Boerhaave's syndrome. Despite its rarity, Boerhaave's syndrome is often misdiagnosed on initial presentation, leading to delayed treatment and poor outcomes.

3. Acta Clin Belg. 2016 May 4:1-5. [Epub ahead of print]

### **Spontaneous tension pneumoperitoneum presenting as an out of hospital cardiac arrest: A case report and review of the literature.**

De Smet R1, De Paepe P1, Buylaert W1, Hachimi Idrissi S1 .

## **Abstract**

### **OBJECTIVES:**

It is known that tension pneumoperitoneum (TPP) can lead to cardiopulmonary arrest but it does not figure in the advanced life support algorithms. Therefore we discuss a case of TPP together with the literature review of its aetiology and treatment.

### **PATIENT:**

We describe an out of hospital cardiac arrest due to a spontaneous TPP secondary to a perforated duodenal ulcer.

### **CONCLUSION:**

Emergency personnel should consider the possibility of TPP in a patient with a distended abdomen and a cardiac arrest, even in the absence of known traumatic and iatrogenic causes for TPP. We believe that TPP should be added as a reversible cause for pulseless electrical activity in the resuscitation guidelines.

## **RCP MECÀNICA**

1. Circ J. 2016 May 13. [Epub ahead of print]

### **Mechanical Cardiopulmonary Resuscitation In and On the Way to the Cardiac Catheterization Laboratory.**

William P1, Rao P, Kanakadandi UB, Asencio A, Kern KB.

## **Abstract**

Cardiac arrest, though not common during coronary angiography, is increasingly occurring in the catheterization laboratory because of the expanding complexity of percutaneous interventions (PCI) and the patient population being treated. Manual chest compression in the cath lab is not easily performed, often interrupted, and can result in the provider experiencing excessive radiation exposure. Mechanical cardiopulmonary resuscitation (CPR) provides unique advantages over manual performance of chest compression for treating cardiac arrest in the cardiac cath lab. Such advantages include the potential for uninterrupted chest compressions, less radiation exposure, better quality chest compressions, and less crowded conditions around the catheterization table, allowing more attention to ongoing PCI efforts during CPR. Out-of-hospital cardiac arrest patients not responding to standard ACLS therapy can be transported to the hospital while mechanical CPR is being performed to provide safe

and continuous chest compressions en route. Once at the hospital, advanced circulatory support can be instituted during ongoing mechanical CPR. This article summarizes the epidemiology, pathophysiology and nature of cardiac arrest in the cardiac cath lab and discusses the mechanics of CPR and defibrillation in that setting. It also reviews the various types of mechanical CPR and their potential roles in and on the way to the laboratory.

## REGISTRES I REVISIONS

1. Int J Cardiol. 2016 Apr 13;216:194-199. doi: 10.1016/j.ijcard.2016.04.013. [Epub ahead of print]

### **A 20-year perspective of in hospital cardiac arrest: Experiences from a university hospital with focus on wards with and without monitoring facilities.**

Adielsson A1, Karlsson T2, Aune S3, Lundin S4, Hirlekar G5, Herlitz J6, Ravn-Fischer A5.

#### **Abstract**

##### BACKGROUND:

Knowledge about change in the characteristics and outcome of in hospital cardiac arrests (IHCA) is insufficient.

##### AIM:

To describe a 20year perspective of in hospital cardiac arrest (IHCA) in wards with and without monitoring capabilities.

##### SETTINGS:

Sahlgrenska University Hospital (800 beds). The number of beds varied during the time of survey from 850-746 TIME: 1994-2013.

##### METHODS:

Retrospective registry study. Patients were assessed in four five year intervals.

##### INCLUSION CRITERIA:

Witnessed and non-witnessed IHCA when cardiopulmonary resuscitation (CPR) was attempted.

##### EXCLUSION CRITERIA:

Age below 18years.

##### RESULTS:

In all, there were 2340 patients with IHCA during the time of the survey. 30-Day survival increased significantly in wards with monitoring facilities from 43.5% to 55.6% ( $p=0.002$ ) for trend but not in wards without such facilities ( $p=0.003$  for interaction between wards with/without monitoring facilities and time period). The CPC-score among survivors did not change significantly in any of the two types of wards. In wards with monitoring facilities there was a significant reduction of the delay time from collapse to start of CPR and an increase in the proportion of patients who were defibrillated before the arrival of the rescue team. In wards without such facilities there was a significant reduction of the delay from collapse to defibrillation. However, the latter observation corresponds to a marked decrease in the proportion of patients found in ventricular fibrillation.

##### CONCLUSION:

In a 20 year perspective the treatment of in hospital cardiac arrest was characterized by a more rapid start of treatment. This was reflected in a significant increase in 30-day survival in wards with monitoring facilities. In wards without such facilities there was a decrease in patients found in ventricular fibrillation.

## ENTRENAMENT

1. Resuscitation. 2016 May 18. pii: S0300-9572(16)30058-2. doi: 10.1016/j.resuscitation.2016.04.028. [Epub ahead of print]

### **A systematic review of basic life support training targeted to family members of high-risk cardiac patients.**

Cartledge S1, Bray JE2, Leary M3, Stub D 4, Finn J5.

#### **Abstract**

##### AIM:

Targeting basic life support (BLS) training to bystanders who are most likely to witness an out of hospital cardiac arrest (OHCA) is an important public health intervention. We performed a systematic review examining the evidence of the effectiveness of providing BLS training to family members of high-risk cardiac patients.

**METHODS:**

A search of Ovid MEDLINE, CINAL, EMBASE, Informit, Cochrane Library, Web of Science, Scopus, ERIC and ProQuest Dissertations and Theses Global was conducted. We included all studies training adult family members of high-risk cardiac patients regardless of methods used for cardiopulmonary resuscitation (CPR) or BLS training. Two reviewers independently extracted data and evaluated the quality of evidence using GRADE (Grades of Recommendation, Assessment, Development and Evaluation).

**RESULTS:**

We included 26 of the 1172 studies identified. The majority of studies were non-randomised controlled trials (n=18), of very low to moderate quality. Currently, there is insufficient evidence to indicate a benefit of this intervention for patients; largely because of low numbers of OHCA events and high loss to follow-up. However, the majority of trained individuals were able to competently perform BLS skills, reported a willingness to use these skills and experienced lower anxiety.

**CONCLUSION:**

Whilst there is no current evidence for improvement in patient outcomes from targeted BLS training for family members, this group are willing and capable to learn these skills. Future research may need to examine longer periods of follow-up using alternate methods (e.g. cardiac arrest registries), and examine the effectiveness of training in the modern era.

2. Eur J Emerg Med. 2016 May 19. [Epub ahead of print]

**Teaching basic life support with an automated external defibrillator using the two-stage or the four-stage teaching technique.**

Bjørnshave K1, Krogh LQ, Hansen SB, Nebsbjerg MA, Thim T, Løfgren B.

**Abstract**

**INTRODUCTION:**

Laypersons often hesitate to perform basic life support (BLS) and use an automated external defibrillator (AED) because of self-perceived lack of knowledge and skills. Training may reduce the barrier to intervene. Reduced training time and costs may allow training of more laypersons. The aim of this study was to compare BLS/AED skills' acquisition and self-evaluated BLS/AED skills after instructor-led training with a two-stage versus a four-stage teaching technique.

**METHODS:**

Laypersons were randomized to either two-stage or four-stage teaching technique courses. Immediately after training, the participants were tested in a simulated cardiac arrest scenario to assess their BLS/AED skills. Skills were assessed using the European Resuscitation Council BLS/AED assessment form. The primary endpoint was passing the test (17 of 17 skills adequately performed). A prespecified noninferiority margin of 20% was used.

**RESULTS:**

The two-stage teaching technique (n=72, pass rate 57%) was noninferior to the four-stage technique (n=70, pass rate 59%), with a difference in pass rates of -2%; 95% confidence interval: -18 to 15%. Neither were there significant differences between the two-stage and four-stage groups in the chest compression rate (114±12 vs. 115±14/min), chest compression depth (47±9 vs. 48±9 mm) and number of sufficient rescue breaths between compression cycles (1.7±0.5 vs. 1.6±0.7). In both groups, all participants believed that their training had improved their skills.

**CONCLUSION:**

Teaching laypersons BLS/AED using the two-stage teaching technique was noninferior to the four-stage teaching technique, although the pass rate was -2% (95% confidence interval: -18 to 15%) lower with the two-stage teaching technique.

**CURES POST**

1. Crit Care. 2016 May 15;20(1):146. doi: 10.1186/s13054-016-1297-2.

### **Is venous congestion associated with reduced cerebral oxygenation and worse neurological outcome after cardiac arrest?**

Ameloot K1, Genbrugge C2,3, Meex I2,3, Eertmans W2, 3, Jans F2,3, De Deyne C2,3, Dens J4,3, Mullens W4,3, Ferdinande B4, Dupont M4.

#### **Abstract**

##### **BACKGROUND:**

Post-cardiac arrest (CA) patients are at risk of secondary ischemic damage in the case of suboptimal brain oxygenation during an ICU stay. We hypothesized that elevated central venous pressures (CVP) would impair cerebral perfusion and oxygenation (venous cerebral congestion). The aim of the present study was to investigate the relationship between CVP, cerebral tissue oxygen saturation (SctO<sub>2</sub>) as assessed with near-infrared spectroscopy (NIRS) and outcome in post-CA patients.

##### **METHODS:**

This was an observational study in 48 post-CA patients with continuous CVP and SctO<sub>2</sub> monitoring during therapeutic hypothermia.

##### **RESULTS:**

The relationship between CVP and mean SctO<sub>2</sub> was best described by an S-shaped, third-degree polynomial regression curve ( $SctO_2 = -0.002 \times CVP(3) + 0.08 \times CVP(2) - 1.07 \times CVP + 69.78 \%$ ,  $R(2) 0.89$ ,  $n = 1,949,108$  data points) with high CVP (>20 mmHg) being associated with cerebral desaturation. Multivariate linear regression revealed CVP to be a more important determinant of SctO<sub>2</sub> than mean arterial pressure (MAP) without important interaction between both ( $SctO_2 = 0.01 \times MAP - 0.20 \times CVP + 0.001 \times MAP \times CVP + 65.55 \%$ ). CVP and cardiac output were independent determinants of SctO<sub>2</sub> with some interaction between both ( $SctO_2 = 1.86 \times CO - 0.09 \times CVP - 0.05 \times CO \times CVP + 60.04 \%$ ). Logistic regression revealed that a higher percentage of time with CVP above 5 mmHg was associated with lower chance of survival with a good neurological outcome (cerebral performance category (CPC) 1-2) at 180 days (OR 0.96, 95 % CI 0.92-1.00,  $p = 0.04$ ). In a multivariate model, the negative association between CVP and outcome persisted after correction for hemodynamic variables, including ejection fraction and MAP.

##### **CONCLUSIONS:**

Elevated CVP results in lower brain saturation and is associated with worse outcome in post-CA patients. This pilot study provides support that venous cerebral congestion as indicated by high CVP may be detrimental for post-CA patients.

## **FEEDBACK**

1. Crit Care. 2016 May 17;20(1):147. doi: 10.1186/s13054-016-1296-3.

### **Effect of the Cardio First Angel™ device on CPR indices: a randomized controlled clinical trial.**

Vahedian-Azimi A1, Hajiesmaeili M2, Amirsavadkouhi A3, Jamaati H4, Izadi M5, Madani SJ6, Hashemian SM7, Miller AC8.

#### **Abstract**

##### **BACKGROUND:**

A number of cardiopulmonary resuscitation (CPR) adjunct devices have been developed to improve the consistency and quality of manual chest compressions. We investigated whether a CPR feedback device would improve CPR quality and consistency, as well as patient survival.

##### **METHODS:**

We conducted a randomized controlled study of patients undergoing CPR for cardiac arrest in the mixed medical-surgical intensive care units of four academic teaching hospitals. Patients were randomized to receive either standard manual CPR or CPR using the Cardio First Angel™ CPR feedback device. Recorded variables included guideline adherence, CPR quality, return of spontaneous circulation (ROSC) rates, and CPR-associated morbidity.

##### **RESULTS:**

A total of 229 subjects were randomized; 149 were excluded; and 80 were included. Patient demographics were similar. Adherence to published CPR guidelines and CPR quality was significantly improved in the intervention group ( $p < 0.0001$ ), as were ROSC rates (72 % vs. 35

%;  $p = 0.001$ ). A significant decrease was observed in rib fractures (57 % vs. 85 %;  $p = 0.02$ ), but not sternum fractures (5 % vs. 17 %;  $p = 0.15$ ).

#### CONCLUSIONS:

Use of the Cardio First Angel™ CPR feedback device improved adherence to published CPR guidelines and CPR quality, and it was associated with increased rates of ROSC. A decrease in rib but not sternum fractures was observed with device use. Further independent prospective validation is warranted to determine if these results are reproducible in other acute care settings.

## VENTILACIÓ

1. PLoS One. 2016 May 19;11(5):e0155997. doi: 10.1371/journal.pone.0155997. eCollection 2016.

### **Hands-Off Time for Endotracheal Intubation during CPR Is Not Altered by the Use of the C-MAC Video-Laryngoscope Compared to Conventional Direct Laryngoscopy. A Randomized Crossover Manikin Study.**

Schuerner P1, Grande B1, Piegeler T1, Schlaepfer M1, Saager L2, Hutcherson MT2, Spahn DR1, Ruetzler K1,2.

#### **Abstract**

##### INTRODUCTION:

Sufficient ventilation and oxygenation through proper airway management is essential in patients undergoing cardio-pulmonary resuscitation (CPR). Although widely discussed, securing the airway using an endotracheal tube is considered the standard of care. Endotracheal intubation may be challenging and causes prolonged interruption of chest compressions. Videolaryngoscopes have been introduced to better visualize the vocal cords and accelerate intubation, which makes endotracheal intubation much safer and may contribute to intubation success. Therefore, we aimed to compare hands-off time and intubation success of direct laryngoscopy with videolaryngoscopy (C-MAC, Karl Storz, Tuttlingen, Germany) in a randomized, cross-over manikin study.

##### METHODS:

Twenty-six anesthesia residents and twelve anesthesia consultants of the University Hospital Zurich were recruited through a voluntary enrolment. All participants performed endotracheal intubation using direct laryngoscopy and C-MAC in a random order during ongoing chest compressions. Participants were strictly advised to stop chest compression only if necessary.

##### RESULTS:

The median hands-off time was 1.9 seconds in direct laryngoscopy, compared to 3 seconds in the C-MAC group. In direct laryngoscopy 39 intubation attempts were recorded, resulting in an overall first intubation attempt success rate of 97%, compared to 38 intubation attempts and 100% overall first intubation attempt success rate in the C-MAC group.

##### CONCLUSION:

As a conclusion, the results of our manikin-study demonstrate that video laryngoscopes might not be beneficial compared to conventional, direct laryngoscopy in easily accessible airways under CPR conditions and in experienced hands. The benefits of video laryngoscopes are of course more distinct in overcoming difficult airways, as it converts a potential "blind intubation" into an intubation under visual control.

2. J Clin Anesth. 2016 Jun;31:215-22. doi: 10.1016/j.jclinane.2016.01.039. Epub 2016 Apr 16.

### **The Easytube for airway management: a systematic review of clinical and simulation studies.**

Sanfilippo F1, Chiarenza F2, Maybauer DM3, Maybauer MO4.

#### **Abstract**

##### STUDY OBJECTIVE:

Endotracheal intubation is considered the criterion-standard technique for securing the airway. Supraglottic airway devices (SADs) represent a major advance in airway management and are recommended by the guidelines in difficult situations such as Advanced Life Support and "cannot ventilate-cannot intubate" scenarios. The Easytube (EzT) is an SAD introduced a decade ago but not included yet in the above guidelines.

##### DESIGN:

Systematic review of MEDLINE and EMBASE according to PRISMA guidelines available up to January 12, 2016.

**SETTING:**

We collected experimental and clinical evidence regarding EzT positioning performed by medical students, anesthesiologists, paramedics, or nurses.

**PATIENTS:**

Manikins, cadavers, or patients.

**INTERVENTIONS:**

EzT positioning in both clinical and simulation studies, both under standard and under difficult scenarios.

**MEASUREMENTS:**

Time to insertion and time to ventilation, success rate and operator's assessment of the device, change in ventilatory parameters, and major complications.

**MAIN RESULTS:**

Fifteen manuscripts were found: 6 prospective clinical studies and 9 conducted under experimental conditions (7 with a simulator and 2 on cadavers). The EzT inserted by both inexperienced and experienced personnel in most studies had high success rate, and it showed excellent results also during simulated cardiopulmonary resuscitation and in difficult airway scenarios. The EzT had better ventilatory parameters as compared with the Combitube and showed great airway sealing capacity, comparable to the Combitube and to the laryngeal mask airway and superior to other SADs. EzT allowed the insertion of large nasogastric tubes and has only mild adverse effects like other SADs. No major complications were described.

**CONCLUSION:**

The EzT appears to be a safe and a good alternative to established SADs. It may be considered among SADs by future guidelines on Advanced Life Support and "cannot ventilate-cannot intubate" scenarios.

3. Appl Ergon. 2016 May 11. pii: S0003-6870(16)30077-1. doi: 10.1016/j.apergo.2016.04.013. [Epub ahead of print]

**Investigation of low back and shoulder demand during cardiopulmonary resuscitation.**

Dainty RS1, Gregory DE2.

Author information:

**Abstract**

Limited research has examined the effect of different compression-ventilation ratios on the ergonomic demand of performing cardiopulmonary resuscitation (CPR) over time. This study aimed to compare the biomechanical demand of performing continuous chest compression CPR (CCC-CPR) and standard CPR (30:2 compression to breath ratio). Fifteen CPR certified individuals performed both standard CPR and CCC-CPR, randomly assigned, for three 2-min periods. Trunk and upper limb muscle activation, lumbar spine posture and compression force applied to a testing mannequin chest were measured throughout each CPR trial. No differences in muscle activation of spine posture were observed, however chest compression force decreased over the two minutes ( $p < 0.0001$ ). Further, this drop in force was larger and initiated immediately during the CCC-CPR trials. This immediate drop in force during the CCC-CPR trials may be an anticipatory adjustment in order to be able to sustain continuous compressions for the full 2 min duration.

**PEDIATRIA**

1. Resuscitation. 2016 May 13. pii: S0300-9572(16)30048-X. doi: 10.1016/j.resuscitation.2016.04.022. [Epub ahead of print]

**Risk factors and outcomes of in-hospital cardiac arrest following pediatric heart operations of varying complexity.**

Gupta P1, Rettiganti M2, Jeffries HE3, Scanlon MC4, Ghanayem NS5, Daufeldt J6, Rice TB4, Wetzel RC7.

**Abstract**

BACKGROUND:

Multi center data regarding cardiac arrest in children undergoing heart operations of varying complexity are limited.

#### METHODS:

Children <18 years undergoing heart surgery (with or without cardiopulmonary bypass) in the Virtual Pediatric Systems (VPS, LLC) Database (2009-2014) were included. Multivariable mixed logistic regression models were adjusted for patient's characteristics, surgical risk category (STS-EACTS Categories 1, 2, and 3 classified as "low" complexity and Categories 4 and 5 classified as "high" complexity), and hospital characteristics.

#### RESULTS:

Overall, 26,909 patients (62 centers) were included. Of these, 2.7% had cardiac arrest after cardiac surgery with an associated mortality of 31%. The prevalence of cardiac arrest was lower among patients undergoing low complexity operations (low complexity vs. high complexity: 1.7% vs. 5.9%). Unadjusted outcomes after cardiac arrest were significantly better among patients undergoing low complexity operations (mortality: 21.6% vs. 39.1%, good neurological outcomes: 78.7% vs. 71.6%). In adjusted models, odds of cardiac arrest were significantly lower among patients undergoing low complexity operations (OR: 0.55, 95% CI: 0.46-0.66). Adjusted models, however, showed no difference in mortality or neurological outcomes after cardiac arrest regardless of surgical complexity. Further, our results suggest that incidence of cardiac arrest and mortality after cardiac arrest are a function of patient characteristics, surgical risk category, and hospital characteristics. Presence of around the clock in-house attending level pediatric intensivist coverage was associated with lower incidence of post-operative cardiac arrest, and presence of a dedicated cardiac ICU was associated with lower mortality after cardiac arrest.

#### CONCLUSIONS:

This study suggests that the patients undergoing high complexity operations are a higher risk group with increased prevalence of post-operative cardiac arrest. These data further suggest that patients undergoing high complexity operations can be rescued after cardiac arrest with a high survival rate.

2. Resuscitation. 2016 May 13. pii: S0300-9572(16)30047-8. doi: 10.1016/j.resuscitation.2016.04.021. [Epub ahead of print]

#### **Therapeutic hypothermia and outcomes in paediatric out-of-hospital cardiac arrest: A nationwide observational study.**

Chang I1, Kwak YH2, Shin SD3, Ro YS 4, Lee EJ5, Ahn KO6, Kim DK7.

#### **Abstract**

##### OBJECTIVES:

This study aimed to analyse the association between mild therapeutic hypothermia (MTH) and outcomes in paediatric patients who survived out-of-hospital cardiac arrest (OHCA) by using their initial electrocardiogram (ECG) rhythm, which is the key factor used to predict prognosis in paediatric OHCA.

##### METHODS:

This cross-sectional observational study utilised the registry of paediatric OHCA patients who survived to admission from 2008 to 2014 in the national OHCA database. MTH was defined as all cooling methods applied after the return of spontaneous circulation. Primary and secondary outcomes were survival to discharge and good neurologic recovery, respectively. Multivariable logistic regression analysis with an interaction term between MTH and the initial ECG at the scene was conducted to calculate adjusted odds ratios (AORs) and 95% confidence intervals (CIs) after adjusting for potential confounders.

##### RESULTS:

Among the 663 enrolled patients, the rates of survival to discharge and good neurological recovery in the MTH and non-MTH groups were similar, at 48.1% vs. 40.2% (P=0.17, AOR 1.05 [0.59-1.88]) and 22.2% vs. 8.7% (P=0.45, AOR 1.22 [0.59-2.51]). In the interaction model, the AORs of MTH in shockable rhythm vs. non-shockable rhythm for survival to discharge (AOR 0.62 [0.15-2.52] vs. 1.17 [0.62-2.2]) and good neurological recovery (0.42 [0.12-1.45] vs. 2.22 [0.83-5.98]) were not significantly different.

##### CONCLUSION:

MTH and the effect of MTH across the initial ECG at the scene were not significantly associated with survival or good neurologic recovery in paediatric OHCA survivors.

## ECMO

1. Scand J Trauma Resusc Emerg Med. 2016 May 18;24(1):74. doi: 10.1186/s13049-016-0266-8.

### **Out-of-hospital cardiac arrest patients treated with cardiopulmonary resuscitation using extracorporeal membrane oxygenation: focus on survival rate and neurologic outcome.**

Lee JJ1, Han SJ2, Kim HS3, Hong KS2, Choi HH2, Park KT2, Seo JY4, Lee TH4, Kim HC5, Kim S1, Lee SH6, Hwang SM1, Ha SO4.

#### **Abstract**

##### BACKGROUND:

Extracorporeal membrane oxygenation (ECMO) is a useful treatment for refractory out-of-hospital cardiac arrest (OHCA). However, little is known about the predictors of survival and neurologic outcome after ECMO. We analyzed our institution's experience with ECMO for refractory OHCA and evaluated the predictors of survival and neurologic outcome after ECMO.

##### METHODS:

This was a retrospective review of the medical records of 23 patients who were treated with ECMO due to OHCA that was unresponsive to conventional cardiopulmonary resuscitation, between January 2009 and January 2014.

##### RESULTS:

Our ECMO team was activated within 10 min for refractory OHCA, and the 30-day survival rate was 43.5 %. In a multivariate analysis that evaluated independent factors contributing to mortality, urine output  $\leq 0.5 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$  (defined as oliguria) during the 24 h after ECMO was statistically significant (OR, 32.271; 95 % CI, 1.379-755.282;  $p = 0.031$ ). Just after ECMO implantation, 6 of the 9 patients (66.7 %) who had normal findings on brain computed tomography (CT) survived with a cerebral performance category (CPC) of grade 1. However, only 3 of the 11 patients (27 %) who had evidence of hypoxic brain damage on initial brain CT survived (their CPC grade was 4).

##### CONCLUSIONS:

Based on our findings, the survival rate can be improved by rapid implantation of ECMO, and oliguria seen during the first 24 h after ECMO may be an independent predictor of mortality. Furthermore, findings on brain CT just after ECMO and subsequent images may represent an important predictor for neurologic outcome after ECMO.

## RECERCA EXPERIMENTAL

1. Resuscitation. 2016 May 13. pii: S0300-9572(16)30050-8. doi: 10.1016/j.resuscitation.2016.04.024. [Epub ahead of print]

### **Thiamine as a neuroprotective agent after cardiac arrest.**

Ikeda K1, Liu X2, Kida K1, Marutani E1, Hirai S1, Sakaguchi M1, Andersen LW3, Bagchi A1, Cocchi MN4, Berg KM5, Ichinose F6, Donnino MW7.

#### **Abstract**

##### AIMS:

Reduction of pyruvate dehydrogenase (PDH) activity in the brain is associated with neurological deficits in animals resuscitated from cardiac arrest. Thiamine is an essential co-factor of PDH. The objective of this study was to examine whether administration of thiamine improves outcomes after cardiac arrest in mice. Secondly, we aimed to characterize the impact of cardiac arrest on PDH activity in mice and humans.

##### METHODS:

**Animal study:** Adult mice were subjected to cardiac arrest whereupon cardiopulmonary resuscitation was performed. Thiamine or vehicle was administered 2min before resuscitation and daily thereafter. Mortality, neurological outcome, and metabolic markers were evaluated. **Human study:** In a convenience sample of post-cardiac arrest patients, we measured serial PDH activity from peripheral blood mononuclear cells and compared them to healthy controls.

##### RESULTS:



Animal study: Mice treated with thiamine had increased 10-day survival (48% versus 17%,  $P < 0.01$ ) and improved neurological function when compared to vehicle-treated mice. In addition, thiamine markedly improved histological brain injury compared to vehicle. The beneficial effects of thiamine were accompanied by improved oxygen consumption in mitochondria, restored thiamine pyrophosphate levels, and increased PDH activity in the brain at 10 days. Human study: Post-cardiac arrest patients had lower PDH activity in mononuclear cells than did healthy volunteers (estimated difference:  $-5.80 \text{ D./min/mg protein}$ ,  $P < 0.001$ ).

#### CONCLUSIONS:

The provision of thiamine after cardiac arrest improved neurological outcome and 10-day survival in mice. PDH activity was markedly depressed in post-cardiac arrest patients suggesting that this pathway may represent a therapeutic target.

2. *Adv Exp Med Biol.* 2016;876:265-70. doi: 10.1007/978-1-4939-3023-4\_33.

#### **Aging Effect on Post-recovery Hypofusion and Mortality Following Cardiac Arrest and Resuscitation in Rats.**

Xu K1, Puchowicz MA2, LaManna JC3.

##### **Abstract**

In this study we investigated the effect of aging on brain blood flow following transient global ischemia. Male Fisher rats (6 and 24 months old) underwent cardiac arrest (15 min) and resuscitation. Regional brain (cortex, hippocampus, brainstem and cerebellum) blood flow was measured in non-arrested rats and 1-h recovery rats using [ $^{14}\text{C}$ ] iodoantipyrine (IAP) autoradiography; the 4-day survival rate was determined in the two age groups. The pre-arrest baseline blood flows were similar in cortex, brainstem and cerebellum between the 6-month and the 24-month old rats; however, the baseline blood flow in hippocampus was significantly lower in the 24-month old group. At 1 h following cardiac arrest and resuscitation, both 6-month and 24-month groups had significantly lower blood flows in all regions than the pre-arrest baseline values; compared to the 6-month old group, the blood flow was significantly lower (about 40% lower) in all regions in the 24-month old group. The 4-day survival rate for the 6-month old rats was 50% (3/6) whereas none of the 24-month old rats (0/10) survived for 4 days. The data suggest that there is an increased vulnerability to brain ischemic-reperfusion injury in the aged rats; the degree of post-recovery hypoperfusion may contribute to the high mortality in the aged rats following cardiac arrest and resuscitation

#### **CASE REPORTS**

1. *Intern Med.* 2016;55(10):1299-303. doi: 10.2169/internalmedicine.55.5762. Epub 2016 May 15.

#### **Internal Mammary Artery Injury Related to Chest Compressions in a Patient with Post-cardiac Arrest Syndrome.**

Kawakami S1, Noguchi T, Doi T, Tahara Y, Sanda Y, Fukuda T, Ogawa H, Yasuda S.

##### **Abstract**

Although high-quality cardiopulmonary resuscitation (CPR) is essential for survival from cardiac arrest, chest compressions can also sometimes lead to life-threatening chest injuries. In addition, post-cardiac arrest syndrome patients often have coagulopathy due to therapeutic hypothermia, mechanical hemodynamic support, or both. Therefore, when progressive anemia and prolonged shock are detected in patients who have received CPR, identifying the cause of hemorrhagic shock is crucial. We herein present an interesting case of hemorrhagic shock due to an internal mammary artery injury secondary to CPR that was detected by computed tomography and invasive angiography.

2. *CJEM.* 2016 May 16:1-4. [Epub ahead of print]

#### **CPR-associated right ventricular rupture in the setting of pulmonary embolism.**

Hickey TB1, Gill GG2, Seidman MA3, Webber DL1.

##### **Abstract**

Cardiopulmonary resuscitation (CPR) is an inherently traumatic procedure. Successful resuscitations are often complicated by iatrogenic injuries to structures of the neck, thorax, or abdomen. Rib and sternal fractures are the most frequently induced injuries. However, rare

and life-threatening trauma to vital organs such as the heart may also occur during CPR. We describe a novel case of CPR-associated right ventricular rupture in a woman with acute-on-chronic pulmonary embolism and no known pre-existing cardiac disease. We propose that chest compressions in the setting of elevated right ventricular pressure resulted in cardiac rupture, in this case.

## RCP

1. Resuscitation. 2016 May 17. pii: S0300-9572(16)30057-0. doi: 10.1016/j.resuscitation.2016.05.004. [Epub ahead of print]

### **Prolonged Cardiopulmonary Resuscitation and Outcomes after Out-of-Hospital Cardiac Arrest.**

Rajan S1, Folke F2, Kragholm K3, Hansen CM4, Granger CB5, Hansen SM6, Peterson ED5, Lippert FK7, Søndergaard KB4, Køber L8, Gislason GH9, Torp-Pedersen C6, Wissenberg M10.

#### **Abstract**

##### AIM:

It is unclear whether prolonged resuscitation can result in successful outcome following out-of-hospital cardiac arrests (OHCA). We assessed associations between duration of pre-hospital resuscitation on survival and functional outcome following OHCA in patients achieving pre-hospital return of spontaneous circulation (ROSC).

##### METHODS:

We included 1,316 adult OHCA individuals with pre-hospital ROSC (2005-2011) handled by the largest nationwide ambulance provider in Denmark. Patients were stratified into 0-5, 6-10, 11-15, 16-20, 21-25 and >25minutes of cardiopulmonary resuscitation (CPR) by emergency medical services until ROSC was achieved. Nursing home admission and diagnosis of anoxic brain damage were measured as proxies of poor neurological/functional outcomes.

##### FINDINGS:

Median time from CPR initiation to ROSC was 12minutes (IQR: 7-18) while 20.4% achieved ROSC after >25minutes. Overall, 37.5% (494) of the study population achieved 30-day survival. Thirty-day survival was inversely related to minutes of CPR to ROSC: ranging from 59.6% (127/213) for ≤5minutes to 13.8% (19/138) for >25minutes. If bystander initiated CPR before ambulance arrival, corresponding values ranged from 70.4% (107/152) to 21.8% (12/55). Of 30-day survivors, patients discharged to own home rather than nursing home ranged from 95.0% (124/127) to 84.7% (18/19), respectively. Of 30-day survivors, patients discharged without diagnosis of anoxic brain damage ranged from 98.4% (125/127) to 73.7% (14/19) for corresponding intervals.

##### CONCLUSION:

Even those requiring prolonged resuscitation duration prior to ROSC had meaningful survival rates with the majority of survivors able to return to live in own homes. These data suggest that prolonged resuscitation is not futile.

## DEA

1. Int J Health Geogr. 2016 May 25;15(1):17. doi: 10.1186/s12942-016-0046-8.

### **Spatial decision on allocating automated external defibrillators (AED) in communities by multi-criterion two-step floating catchment area (MC2SFCA).**

Lin BC1, Chen CW2,3, Chen CC1, Kuo CL 1,4, Fan IC1,5, Ho CK6,7, Liu IC8, Chan TC9.

#### **Abstract**

##### BACKGROUND:

The occurrence of out-of-hospital cardiac arrest (OHCA) is a critical life-threatening event which frequently warrants early defibrillation with an automated external defibrillator (AED). The optimization of allocating a limited number of AEDs in various types of communities is challenging. We aimed to propose a two-stage modeling framework including spatial accessibility evaluation and priority ranking to identify the highest gaps between demand and supply for allocating AEDs.

##### METHODS:

In this study, a total of 6135 OHCA patients were defined as demand, and the existing 476 publicly available AEDs locations and 51 emergency medical service (EMS) stations were defined as supply. To identify the demand for AEDs, Bayesian spatial analysis with the integrated nested Laplace approximation (INLA) method is applied to estimate the composite spatial risks from multiple factors. The population density, proportion of elderly people, and land use classifications are identified as risk factors. Then, the multi-criterion two-step floating catchment area (MC2SFCA) method is used to measure spatial accessibility of AEDs between the spatial risks and the supply of AEDs. Priority ranking is utilized for prioritizing deployment of AEDs among communities because of limited resources.

#### RESULTS:

Among 6135 OHCA patients, 56.85 % were older than 65 years old, and 79.04 % were in a residential area. The spatial distribution of OHCA incidents was found to be concentrated in the metropolitan area of Kaohsiung City, Taiwan. According to the posterior mean estimated by INLA, the spatial effects including population density and proportion of elderly people, and land use classifications are positively associated with the OHCA incidence. Utilizing the MC2SFCA for spatial accessibility, we found that supply of AEDs is less than demand in most areas, especially in rural areas. Under limited resources, we identify priority places for deploying AEDs based on transportation time to the nearest hospital and population size of the communities.

#### CONCLUSION:

The proposed method will be beneficial for optimizing resource allocation while considering multiple local risks. The optimized deployment of AEDs can broaden EMS coverage and minimize the problems of the disparity in urban areas and the deficiency in rural areas.

## REGISTRES I REVISIONS

1. Trends Cardiovasc Med. 2016 Apr 9. pii: S1050-1738(16)30018-4. doi: 10.1016/j.tcm.2016.04.001. [Epub ahead of print]

### **Chronic obstructive pulmonary disease and sudden cardiac death: A systematic review.**

van den Berg ME1, Stricker BH2, Brusselle GG3, Lahousse L4.

#### **Abstract**

Both chronic obstructive pulmonary disease (COPD) and sudden cardiac death (SCD) are major health burdens. A number of studies have addressed their interrelationship, but currently no systematic review has been published. Our objective is to give an overview of the literature of the association between COPD and SCD. A search on PubMed with both MeSH headings and free-text keywords was performed. We selected all original articles of studies in humans that assessed COPD on the one hand and SCD, electrocardiographic markers for SCD, ventricular arrhythmias, or asystole on the other. The electronic search yielded 251 articles, from which 27 full publications were selected after careful evaluation of the full-text articles. In these studies, COPD was associated with a prolonged and shortened QT interval. In patients with a myocardial infarction (MI), COPD was associated with an increased risk of ventricular arrhythmias and decreased survival. COPD was a risk factor for SCD both in cardiovascular patient groups and in community-based studies, independent from cardiovascular risk profile. Studies of the potential impact of respiratory treatment on the occurrence of SCD showed conflicting results. In conclusion, cumulating evidence associates COPD with an increased risk of SCD. Asystole and pulseless electric activity could be more common than VT/VF in deaths associated with COPD. Underlying mechanisms explaining this association require further investigation.

2. J Pain Symptom Manage. 2016 May 21. pii: S0885-3924(16)30101-4. doi: 10.1016/j.jpainsymman.2016.01.013. [Epub ahead of print]

### **Differences in Terminal Hospitalization Care Between U.S. Men and Women.**

Just E1, Casarett DJ2, Asch DA3, Dai D4, Feudtner C5.

#### **Abstract**

##### CONTEXT:

In many settings, men and women receive different care.

##### OBJECTIVES:

We sought to determine whether men and women receive different care during terminal hospitalizations.

**METHODS:**

We analyzed data of 98,314 adult patients who died while hospitalized in 458 acute care hospitals in the United States during 2011. We examined sex-based differences in length of stay, resuscitation status, and intensive interventions and processes of care, adjusting for patient- and hospital-level characteristics.

**RESULTS:**

Women represented half of the sample (48,509; 49.34%), were older than men (73.8 vs. 70.6 years of age,  $P < 0.0001$ ), and less likely to be married (27.7% vs. 48.3%,  $P < 0.001$ ). Among all patients, median length of stay was four days (IQR 2,10). 19.1% of subjects received cardiopulmonary resuscitation (CPR); 37.6% had a do-not-resuscitate (DNR) order during the admission; and 51.6% received mechanical ventilation. Compared with men, women had slightly shorter hospitalizations (adjusted length of stay: -0.16 days; 95% confidence interval [CI] -0.19, -0.12) and were more likely to have a DNR order (odds ratio [OR] 1.08; 95% CI 1.05, 1.11). Women remained less likely to receive care in an intensive care unit (ICU) (OR: 0.95; 95% CI 0.93, 0.98), CPR (OR 0.83; 95% CI 0.80, 0.86), MV (OR 0.94; 95% CI 0.91, 0.97), hemodialysis (adjusted OR 0.81; 95% CI 0.78, 0.86), or surgical procedures (OR 0.88; 95% CI 0.84, 0.93).

**CONCLUSION:**

Men who die in hospitals receive more aggressive care than women. Further research should examine potential causes of this overall pattern.

3. Am J Emerg Med. 2016 Apr 30. pii: S0735-6757(16)30092-4. doi: 10.1016/j.ajem.2016.04.042. [Epub ahead of print]

**Are the current guideline recommendations for neonatal cardiopulmonary resuscitation safe and effective?**

Rottenberg EM1.

**Abstract**

A recently published review of approaches to optimize chest compressions in the resuscitation of asphyxiated newborns discussed the current recommendations and explored potential determinants of effective neonatal cardiopulmonary resuscitation (CPR). However, not all potential determinants of effective neonatal CPR were explored. Chest compression shallower than the current guideline recommendation of approximately 33% of the anterior-posterior (AP) chest diameter may be safer and more effective. From a physiological standpoint, high-velocity brief duration shallower compression may be more effective than current recommendations. The application of a 1- or 2-finger method of high-impulse CPR, which would depend on the size of the subject, may be more effective than using a 2-thumb (TT) encircling hands method of CPR. Adrenaline should not be used in the treatment of asphyxiated neonates and when necessary titrated vasopressin should be used.

4. J Occup Environ Med. 2016 May 23. [Epub ahead of print]

**Characteristics of Cardiac Arrest Occurring in the Workplace: A Post Hoc Analysis of the Paris Area Fire Brigade Registry.**

Palaghita A1, Jost D, Despreaux T, Bougouin W, Beganton F, Loeb T, Tourtier JP, Descatha A.

**Abstract**

**OBJECTIVES:**

The aim of this study was to describe the characteristics of out-of-hospital cardiac arrest (OHCA) in different workplaces, their management, and the survival rate.

**METHODS:**

A post hoc analysis included all the OHCA cases that occurred at the workplace and were listed in the Fire Brigade of Paris database registry (2010 to 2014). Utstein-style variables, survival, and types of workplace were analyzed.

**RESULTS:**

The study included 298 OHCA cases, mostly young (44% between 18 and 50 years), male (86%), and nontraumatic (86%). Differences in the survival chain were found to be related to the types of work location: bystander cardiopulmonary resuscitation was performed in 0% to

55% of cases, and workplace-automated external defibrillators were used in 0% to 20% of cases. Long-term survival without major incapacity was 0% to 23%.

#### CONCLUSIONS:

The characteristics of OHCA differ as a function of the type of workplace

### ENTRENAMENT A LES ESCOLES

1. Intern Emerg Med. 2016 May 27. [Epub ahead of print]

#### **"You can also save a life!": children's drawings as a non-verbal assessment of the impact of cardiopulmonary resuscitation training.**

Petriş AO1, Tatu-Chiţoiu G2, Cimpoeşu D3, Ionescu DF 4, Pop C5, Oprea N6, Jînt D7.

#### **Abstract**

Drawings made by training children into cardiopulmonary resuscitation (CPR) during the special education week called "School otherwise" can be used as non-verbal means of expression and communication to assess the impact of such training. We analyzed the questionnaires and drawings completed by 327 schoolchildren in different stages of education. After a brief overview of the basic life support (BLS) steps and after watching a video presenting the dynamic performance of the BLS sequence, subjects were asked to complete a questionnaire and make a drawing to express main CPR messages. Questionnaires were filled completely in 97.6 % and drawings were done in 90.2 % cases. Half of the subjects had already witnessed a kind of medical emergency and 96.94 % knew the correct "112" emergency phone number. The drawings were single images (83.81 %) and less cartoon strips (16.18 %). Main themes of the slogans were "Save a life!", "Help!", "Call 112!", "Do not be indifferent/insensible/apathic!" through the use of drawings interpretation, CPR trainers can use art as a way to build a better relation with schoolchildren, to connect to their thoughts and feelings and obtain the highest quality education.

2. Nurs Child Young People. 2016 May 9;28(4):97. doi: 10.7748/ncyp.28.4.97.s94.

#### **PO15 - PBLs and primary school teachers: survey on training needs in first aid environment.**

Tonello MC1, Persico A2, Borrelli G1.

#### **Abstract**

Theme: School health.

#### INTRODUCTION:

Only 15% of European cases of CPR are performed by a witness. Prompt interventions can increase the person's chances of survival. Secular training programs are gaining even more importance.

#### OBJECTIVE:

Investigate primary school teachers' level of CPR training in two provinces of Piedmont (Italy).

#### METHODS:

We interviewed 667 teachers of which 82% took part in the study. A questionnaire of 24 questions was created to assess the level of expertise.

#### RESULTS:

25 teachers had witnessed a student's cardiopulmonary arrest. Just 2 were able to perform a CPR on them. 38% of the survey participants had been trained in PBLs. 87% of the educators stated they would not be capable of using an AED and 58% of them declared their schools are not equipped with AEDs.

#### CONCLUSIONS:

This study shows how the majority of the teachers are not adequately trained and it proves the positive effect of a PBLs-D course.

### BYSTANDERS

1. BMJ Open. 2016 May 25;6(5):e010671. doi: 10.1136/bmjopen-2015-010671.

#### **Reactions and coping strategies in lay rescuers who have provided CPR to out-of-hospital cardiac arrest victims: a qualitative study.**

Mathiesen WT1, Bjørshol CA2, Braut GS3, Sørreide E 4.

#### **Abstract**

## OBJECTIVE:

Cardiopulmonary resuscitation (CPR) provided by community citizens is of paramount importance for out-of-hospital cardiac arrest (OHCA) victims' survival. Fortunately, CPR rates by community citizens seem to be rising. However, the experience of providing CPR is rarely investigated. The aim of this study was to explore reactions and coping strategies in lay rescuers who have provided CPR to OHCA victims.

## METHODS, PARTICIPANTS:

This is a qualitative study of 20 lay rescuers who have provided CPR to 18 OHCA victims. We used a semistructured interview guide focusing on their experiences after providing CPR.

## SETTING:

The study was conducted in the Stavanger region of Norway, an area with very high bystander CPR rates.

## RESULTS:

Three themes emerged from the interview analysis: concern, uncertainty and coping strategies. Providing CPR had been emotionally challenging for all lay rescuers and, for some, had consequences in terms of family and work life. Several lay rescuers experienced persistent mental recurrences of the OHCA incident and had concerns about the outcome for the cardiac arrest victim. Unknown or fatal outcomes often caused feelings of guilt and were particularly difficult to handle. Several reported the need to be acknowledged for their CPR attempts. Health-educated lay rescuers seemed to be less affected than others. A common coping strategy was confiding in close relations, preferably the health educated. However, some required professional help to cope with the OHCA incident.

## CONCLUSIONS:

Lay rescuers experience emotional and social challenges, and some struggle to cope in life after providing CPR in OHCA incidents. Experiencing a positive patient outcome and being a health-educated lay rescuer seem to mitigate concerns. Common coping strategies are attempts to reduce uncertainty towards patient outcome and own CPR quality. Further studies are needed to determine whether an organised professional follow-up can mitigate the concerns and uncertainty of lay rescuers.

## FEEDBACK

### 1. CADTH Health Technology Assessments

#### **Capnography for Monitoring End-Tidal CO<sub>2</sub> in Hospital and Pre-hospital Settings: A Health Technology Assessment** [Internet].

Editors

Richardson M, Moulton K, Rabb D, Kindopp S, Pishé T, Yan C, Akpınar I, Tsoi B, Chuck A.

Ottawa (ON): Canadian Agency for Drugs and Technologies in Health; 2016 Mar.

CADTH Health Technology Assessments.

#### **Excerpt**

Anesthesiologists have been using capnography for decades to monitor end-tidal carbon dioxide (ETCO<sub>2</sub>) in patients receiving general anesthesia. ETCO<sub>2</sub> monitoring using capnography devices has application across several hospital and pre-hospital settings, including monitoring the effectiveness of cardiopulmonary resuscitation (CPR), continuous monitoring of patients in the emergency room or intensive care unit (ICU), during ambulatory transport, to confirm the correct placement of an endotracheal tube (ETT), and monitoring post-operative patients with a history of sleep apnea or who have received high doses of opioids. Depending on the clinical area, the technology is at various stages of adoption. The growing utility of ETCO<sub>2</sub>-monitoring technology in diverse clinical settings, the uncertainty regarding the clinical and cost-effectiveness of capnography devices, and access and implementation issues were the main drivers for this health technology assessment (HTA).

2. Resuscitation. 2016 May 19. pii: S0300-9572(16)30049-1. doi: 10.1016/j.resuscitation.2016.04.023. [Epub ahead of print]

#### **An accurate method for real-time chest compression detection from the impedance signal.**

Kwok H1, Coult J2, Liu C3, Blackwood J4, Kudenchuk PJ5, Rea TD6, Sherman L7.

## **Abstract**

### **OBJECTIVE:**

Real-time feedback improves CPR performance. Chest compression data may be obtained from an accelerometer/force sensor, but the impedance signal would serve as a less costly, universally available alternative. The objective is to assess the performance of a method which detects the presence/absence of chest compressions and derives CPR quality metrics from the impedance signal in real-time at 1s intervals without any latency period.

### **METHODS:**

Defibrillator recordings from cardiac arrest cases were divided into derivation (N=119) and validation (N=105) datasets. With the force signal as reference, the presence/absence of chest compressions in the impedance signal was manually annotated (reference standard). The method classified the impedance signal at 1s intervals as Chest Compressions Present, Chest Compressions Absent or Indeterminate. Accuracy, sensitivity and specificity for chest compression detection were calculated for each case. Differences between method and reference standard chest compression fractions and rates were calculated on a minute-to-minute basis.

### **RESULTS:**

In the validation set, median accuracy was 0.99 (IQR 0.98, 0.99) with 2% of 1s intervals classified as Indeterminate. Median sensitivity and specificity were 0.99 (IQR 0.98, 1.0) and 0.98 (IQR 0.95, 1.0), respectively. Median chest compression fraction error was 0.00 (IQR -0.01, 0.00), and median chest compression rate error was 1.8 (IQR 0.6, 3.3) compressions per minute.

### **CONCLUSION:**

A real-time method detected chest compressions from the impedance signal with high sensitivity and specificity and accurately estimated chest compression fraction and rate. Future investigation should evaluate whether an impedance-based guidance system can provide an acceptable alternative to an accelerometer-based system.

3. Fed Regist. 2016 May 25;81(101):33128-34.

### **Cardiovascular Devices; Reclassification of External Cardiac Compressor; Reclassification of Cardiopulmonary Resuscitation Aids. Final order.**

Food and Drug Administration, HHS.

#### **Abstract**

The Food and Drug Administration (FDA) is issuing a final order to reclassify external cardiac compressors (ECC) (under FDA product code DRM), a preamendments class III device, into class II (special controls). FDA is also creating a separate classification regulation for a subgroup of devices previously included within this classification regulation, to be called cardiopulmonary resuscitation (CPR) aids, and reclassifying these devices from class III to class II for CPR aids with feedback and to class I for CPR aids without feedback.

## **TEMPERATURE TARGETED MANAGEMENT**

1. Ther Hypothermia Temp Manag. 2016 May 23. [Epub ahead of print]

### **Intracranial Pressure Increases During Rewarming Period After Mild Therapeutic Hypothermia in Postcardiac Arrest Patients.**

Naito H1, Isotani E2, Callaway CW1, Hagioka S3, Morimoto N3.

#### **Abstract**

Elevation of intracranial pressure (ICP) may worsen brain injury and neurological outcome. Studies on the use of therapeutic hypothermia (TH) for traumatic brain injury suggests that rapid rewarming from TH is associated with elevated ICP and poorer outcomes. However, few studies describe the time course of ICP changes during TH/rewarming after cardiac arrest (CA). In this study, we observed the changes in ICP during mild TH and rewarming after CA. Secondly, we examined whether ICP is related to outcome. We studied comatose patients resuscitated from CA, who were treated with TH and who had ICP monitored. Target core temperature was 34°C for 24 h and target rewarming rate was 0.25°C/h. ICP and cerebral perfusion pressure (CPP) were monitored during the period. Outcome was rated as cerebral

performance category. In nine patients, ICP increased during TH and rewarming (6.0 [4.0-9.0] mmHg to 16.0 [12.0-26.0] mmHg,  $p = 0.008$ ). CPP did not change during the period (83.3 [80.1-91.0] mmHg to 74.3 [52.0-87.3] mmHg). Higher ICP was associated with worse outcomes ( $p = 0.009$ ). All the cases with ICP >25 mmHg or CPP <40 mmHg died. Major ICP increment was observed during the rewarming period, although, some increase of ICP occurred even during the mild TH. ICP increment was higher in patients with worse outcomes.

2. Ther Hypothermia Temp Manag. 2016 May 26. [Epub ahead of print]

**Comparison of Outcomes Between Patients Treated by Therapeutic Hypothermia for Cardiac Arrest Due to Cardiac or Respiratory Causes.**

Sakurai A1, Kinoshita K1, Komatsu T1, Yamaguchi J1, Sugita A1, Ihara S1.

**Abstract**

Outcome for patients experiencing out-hospital cardiac arrest (OHCA) due to respiratory causes is poor, even with treatment by therapeutic hypothermia (TH). The purpose of this study is to clarify difference in outcome and respiratory state during resuscitation between cases due to respiratory causes versus those due to cardiac causes, to establish alternative strategies for the patient. This study was conducted as a retrospective analysis of patients with post CA syndrome who underwent TH. Patients were divided into two groups according to cause of CA: cardiac (C group) or respiratory (R group). Utstein Style data, outcome, and arterial blood gas (ABG) findings after emergency room admission of the two groups were compared. Of 74 patients treated with TH during the 2-year study period, 49 were placed in the C group and 19 in the R group. The rates of ventricular fibrillation/pulseless ventricular tachycardia at initial rhythm were significantly higher in the C group than in the R group. The rate of favorable neurological outcome was significantly higher in the C group (15/49: 30.6%) than in the R group (1/19: 5.3%) 30 days after resuscitation. In the ABG findings, PaCO<sub>2</sub> was significantly higher in the R group than in the C group. For patients experiencing OHCA from respiratory causes, TH was less effective and PaCO<sub>2</sub> accumulated immediately after admission. From this, interpretation of the significance of PaCO<sub>2</sub> in these patients at the early stage after return of spontaneous circulation should be seriously considered

3. Resuscitation. 2016 May 17. pii: S0300-9572(16)30056-9. doi: 10.1016/j.resuscitation.2016.04.027. [Epub ahead of print]

**Impaired biological response to aspirin in therapeutic hypothermia comatose patients resuscitated from out-of-hospital cardiac arrest.**

Llitjos JF1, Sideris G1, Voicu S2, Bal Dit Sollier C3, Deye N2, Megarbane B2, Drouet L3, Henry P1, Dillinger JG4.

**Abstract**

AIM OF THE STUDY:

Acute coronary syndrome is one of the main causes of out-of-hospital cardiac arrest (OHCA). OHCA patients are particularly exposed to high platelet reactivity (HPR) under aspirin (ASA) treatment. The aim was to evaluate HPR-ASA in therapeutic hypothermia comatose patients resuscitated from OHCA.

METHODS AND RESULTS:

Twenty-two consecutive patients with OHCA of cardiac origin were prospectively included after therapeutic hypothermia and randomized to receive ASA 100mg per day, either intravenously (n=13) or orally via a gastric tube (n=9). ADP inhibitors (prasugrel or, if contra-indicated, clopidogrel) were administered in the event of angioplasty. HPR-ASA was assessed by light transmission aggregometry (LTA) with arachidonic acid (AA) and by the PFA-100® system with collagen/epinephrine. Clinical, biological and angiographic characteristics were similar in both groups. Using LTA-AA, maximum aggregation intensity was significantly lower in the intravenous group compared to the oral group (15% vs. 29%, respectively;  $p=0.04$ ). Overall, 10 patients (45%) had HPR-ASA (38% intravenously vs 56% orally;  $p=0.7$ ). Similarly, closure time was significantly increased in the IV group (277s vs. 155s, respectively;  $p=0.04$ ).

CONCLUSION:

This study suggests that impaired response to both intravenous and oral aspirin is frequent in comatose patients resuscitated from OHCA.



4. Crit Care Med. 2016 Feb;44(2):308-18. doi: 10.1097/CCM.0000000000001390.

**Bradycardia During Targeted Temperature Management: An Early Marker of Lower Mortality and Favorable Neurologic Outcome in Comatose Out-of-Hospital Cardiac Arrest Patients.**

Thomsen JH1, Nielsen N, Hassager C, Wanscher M, Pehrson S, Køber L, Bro-Jeppesen J, Sjøholm H, Winther-Jensen M, Pellis T, Kuiper M, Erlinge D, Friberg H, Kjaergaard J.

**Comment in:** Heart Rate and the Post Cardiac Arrest Syndrome: Another Clue to Individualizing Care? [Crit Care Med. 2016]

**Abstract**

**OBJECTIVES:**

Bradycardia is common during targeted temperature management, likely being a physiologic response to lower body temperature, and has recently been associated with favorable outcome following out-of-hospital cardiac arrest in smaller observational studies. The present study sought to confirm this finding in a large multicenter cohort of patients treated with targeted temperature management at 33°C and explore the response to targeted temperature management targeting 36°C.

**DESIGN:**

Post hoc analysis of a prospective randomized study.

**SETTING:**

Thirty-six ICUs in 10 countries.

**PATIENTS:**

We studied 447 (targeted temperature management = 33°C) and 430 (targeted temperature management = 36°C) comatose out-of-hospital cardiac arrest patients with available heart rate data, randomly assigned in the targeted temperature management trial from 2010 to 2013.

**INTERVENTIONS:**

Targeted temperature management at 33°C and 36°C.

**MEASUREMENTS AND MAIN RESULTS:**

Endpoints were 180-day mortality and unfavorable neurologic function (cerebral performance category 3-5). Patients were stratified by target temperature and minimum heart rate during targeted temperature management (< 50, 50-59, and ≥ 60 beats/min [reference]) at 12, 20, and 28 hours after randomization. Heart rates less than 50 beats/min and 50-59 beats/min were recorded in 132 (30%) and 131 (29%) of the 33°C group, respectively. Crude 180-day mortality increased with increasing minimum heart rate (< 50 beats/min = 32%, 50-59 beats/min = 43%, and ≥ 60 beats/min = 60%; p(log-rank) < 0.0001). Bradycardia less than 50 beats/min was independently associated with lower 180-day mortality (hazard ratio(adjusted) = 0.50 [0.34-0.74; p < 0.001]) and lower odds of unfavorable neurologic outcome (odds ratio(adjusted) = 0.38 [0.21-0.68; p < 0.01]) in models adjusting for potential confounders including age, initial rhythm, time to return of spontaneous circulation, and lactate at admission. Similar, albeit less strong, independent associations of lower heart rates and favorable outcome were found in patients treated with targeted temperature management at 36°C.

**CONCLUSIONS:**

This study confirms an independent association of bradycardia and lower mortality and favorable neurologic outcome in a large cohort of comatose out-of-hospital cardiac arrest patients treated by targeted temperature management at 33°C. Bradycardia during targeted temperature management at 33°C may thus be a novel, early marker of favorable outcome.

## TRAUMA

1. World J Emerg Surg. 2016 May 20;11:20. doi: 10.1186/s13017-016-0076-3. eCollection 2016.

**Resuscitative endovascular balloon occlusion of the aorta for uncontrollable nonvariceal upper gastrointestinal bleeding.**

Sano H1, Tsurukiri J1, Hoshiai A1, Oomura T1, Tanaka Y1, Ohta S2.

**Abstract**

**BACKGROUND:**

Although resuscitative endovascular balloon occlusion of the aorta (REBOA) in various clinical settings was found to successfully elevate central blood pressure in hemorrhagic shock, this intervention is associated with high mortality and may represent a last-ditch option for trauma

patients. We conducted a retrospective study of patients with nonvariceal upper gastrointestinal bleeding (UGIB) who underwent REBOA to identify the effectiveness of REBOA and reviewed published literatures.

#### METHODS:

REBOA were performed by trained acute care physicians in the emergency room and intensive care unit. The deployment of balloon catheters was positioned using ultrasonography guidance. Collected data included clinical characteristics, hemorrhagic severity, blood cultures, metabolic values, blood transfusions, REBOA-related complications and mortality. A literature search using PUBMED to include "aortic occlusion" and "gastrointestinal bleeding" was conducted.

#### RESULTS:

REBOA was attempted in eight patients among 140 patients with UGIB and median age was 66 years. Systolic blood pressure significantly increased after REBOA ( $66 \pm 20$  vs.  $117 \pm 45$  mmHg,  $p < 0.01$ ) and the total occlusion time of REBOA was  $80 \pm 48$  min. Strong positive correlations were found between total occlusion time of REBOA and lactate concentration (Spearman's  $r=0.77$ ), clinical Rockwall score (Spearman's  $r=0.80$ ), and age (Spearman's  $r=0.88$ ), respectively.

#### CONCLUSION:

REBOA can be performed with a high degree of technical success and is effective at improving hemodynamic in patients with UGIB. Correlations between total occlusion time and high lactate levels, clinical Rockall score, and age may be important for successful use of REBOA.

## PEDIATRIA

1. Stud Health Technol Inform. 2016;224:141-5.

### **Adapting Guidelines for Google Glass: the Case of Pediatric CPR.**

Ehrler F1, Siebert J2, Haddad K2, Sahin A3, Schrurs P3, Diener R1, Gervais A2, Manzano S2, Lovis C1.

#### **Abstract**

Early recognition and management of patients at risk and more aggressive implementation of evidence-based resuscitation guidelines play a role to the reduction of patients' mortality. If, in paediatric emergency department, the proper adherence to the paediatric cardiac arrest guidelines is critical to increase the chance of survival, this adherence is unfortunately often suboptimal. Connected glasses, such as the Google Glass, offer an interesting support to provide guidelines at the point of care. However, existing guidelines format is not adapted to be used directly on the small screen of connected glasses. Their transformation to be displayed on the Google Glass is not a simple task. Problems such as the navigation and the formalization of the guidelines must be solved. In this article, we present the transformation process of the paediatric cardiac arrest algorithm from its paper version to its implementation on the Google Glass.

## RECERCA EXPERIMENTAL

1. Resuscitation. 2016 May 20;105:29-35. doi: 10.1016/j.resuscitation.2016.05.008. [Epub ahead of print]

### **Reperfusion injury protection during Basic Life Support improves circulation and survival outcomes in a porcine model of prolonged cardiac arrest.**

Debaty G1, Lurie K2, Metzger A2, Lick M2, Bartos JA3, Rees JN3, McKnite S3, Puertas L2, Pepe P4, Fowler R4, Yannopoulos D3.

#### **Abstract**

##### OBJECTIVE:

Ischemic postconditioning (PC) using three intentional pauses at the start of cardiopulmonary resuscitation (CPR) improves outcomes after cardiac arrest in pigs when epinephrine (epi) is used before defibrillation. We hypothesized PC, performed during basic life support (BLS) in the absence of epinephrine, would reduce reperfusion injury and enhance 24h functional recovery.

##### DESIGN:

Prospective animal investigation.

**SETTING:**

Animal laboratory SUBJECTS: Female farm pigs (n=46, 39±1kg).

**INTERVENTIONS:**

Protocol A: After 12min of ventricular fibrillation (VF), 28 pigs were randomized to four groups: (A) Standard CPR (SCPR), (B) active compression-decompression CPR with an impedance threshold device (ACD-ITD), (C) SCPR+PC (SCPR+PC) and (D) ACD-ITD CPR+PC. Protocol B: After 15min of VF, 18 pigs were randomized to ACD-ITD CPR or ACD-ITD+PC. The BLS duration was 2.75min in Protocol A and 5min in Protocol B. Following BLS, up to three shocks were delivered. Without return of spontaneous circulation (ROSC), CPR was resumed and epi (0.5mg) and defibrillation delivered. The primary end point was survival without major adverse events. Hemodynamic parameters and left ventricular ejection fraction (LVEF) were also measured. Data are presented as mean±SEM.

**MEASUREMENTS AND MAIN RESULTS:**

Protocol A: ACD-ITD+PC (group D) improved coronary perfusion pressure after 3min of BLS versus the three other groups (28±6, 35±7, 23±5 and 47±7 for groups A, B, C, D respectively, p=0.05). There were no significant differences in 24h survival between groups.

**PROTOCOL B:**

LVEF 4h post ROSC was significantly higher with ACD-ITD+PC vs ACD-ITD alone (52.5±3% vs. 37.5±6.6%, p=0.045). Survival rates were significantly higher with ACD-ITD+PC vs. ACD-ITD alone (p=0.027).

**CONCLUSIONS:**

BLS using ACD-ITD+PC reduced post resuscitation cardiac dysfunction and improved functional recovery after prolonged untreated VF in pigs.

2. Crit Care Med. 2016 Feb;44(2):e58-69. doi: 10.1097/CCM.0000000000001305.

**Thrombolytic-Enhanced Extracorporeal Cardiopulmonary Resuscitation After Prolonged Cardiac Arrest.**

Spinelli E1, Davis RP, Ren X, Sheth PS, Tooley TR, Iyengar A, Sowell B, Owens GE, Bocks ML, Jacobs TL, Yang LJ, Stacey WC, Bartlett RH, Rojas-Peña A, Neumar RW.

**Abstract****OBJECTIVE:**

To investigate the effects of the combination of extracorporeal cardiopulmonary resuscitation and thrombolytic therapy on the recovery of vital organ function after prolonged cardiac arrest.

**DESIGN:**

Laboratory investigation.

**SETTING:**

University laboratory.

**SUBJECTS:**

Pigs.

**INTERVENTIONS:**

Animals underwent 30-minute untreated ventricular fibrillation cardiac arrest followed by extracorporeal cardiopulmonary resuscitation for 6 hours. Animals were allocated into two experimental groups: t-extracorporeal cardiopulmonary resuscitation (t-ECPR) group, which received streptokinase 1 million units, and control extracorporeal cardiopulmonary resuscitation (c-ECPR), which did not receive streptokinase. In both groups, the resuscitation protocol included the following physiologic targets: mean arterial pressure greater than 70 mm Hg, cerebral perfusion pressure greater than 50 mm Hg, PaO<sub>2</sub> 150 ± 50 torr (20 ± 7 kPa), PaCO<sub>2</sub> 40 ± 5 torr (5 ± 1 kPa), and core temperature 33°C ± 1°C. Defibrillation was attempted after 30 minutes of extracorporeal cardiopulmonary resuscitation.

**MEASUREMENTS AND MAIN RESULTS:**

A cardiac resuscitability score was assessed on the basis of success of defibrillation, return of spontaneous heart beat, weanability from extracorporeal cardiopulmonary resuscitation, and left ventricular systolic function after weaning. The addition of thrombolytic to extracorporeal cardiopulmonary resuscitation significantly improved cardiac resuscitability (3.7 ± 1.6 in t-ECPR vs 1.0 ± 1.5 in c-ECPR). Arterial lactate clearance was higher in t-ECPR than in c-ECPR (40% ± 15% vs 18% ± 21%). At the end of the experiment, the intracranial pressure was significantly

higher in c-ECPR than in t-ECPR. Recovery of brain electrical activity, as assessed by quantitative analysis of electroencephalogram signal, and ischemic neuronal injury on histopathologic examination did not differ between groups. Animals in t-ECPR group did not have increased bleeding complications, including intracerebral hemorrhages.

#### CONCLUSIONS:

In a porcine model of prolonged cardiac arrest, t-ECPR improved cardiac resuscitability and reduced brain edema, without increasing bleeding complications. However, early electroencephalogram recovery and ischemic neuronal injury were not improved.

#### CASE REPORTS

1. Semin Cardiothorac Vasc Anesth. 2016 May 26. pii: 1089253216652223. [Epub ahead of print]

##### **Prolonged Intraoperative Cardiac Resuscitation Complicated by Intracardiac Thrombus in a Patient Undergoing Orthotopic Liver Transplantation.**

Kim S1, DeMaria S Jr2, Cohen E2, Silvey G 2, Zerillo J2.

#### **Abstract**

We report the case of successful resuscitation after prolonged cardiac arrest during orthotopic liver transplantation. After reperfusion, the patient developed ventricular tachycardia, complicated by intracardiac clot formation and massive hemorrhage. Transesophageal echocardiography demonstrated stunned and nonfunctioning right and left ventricles, with developing intracardiac clots. Treatment with heparin, massive transfusion and prolonged cardiopulmonary resuscitation ensued for 51 minutes. Serial arterial blood gases demonstrated adequate oxygenation and ventilation during cardiopulmonary resuscitation. Cardiothoracic surgery was consulted for potential use of extracorporeal membrane oxygenation, however, the myocardial function improved and the surgery was completed without further intervention. On postoperative day 6, the patient was extubated without neurologic or cardiac impairment. The patient continues to do well 2 years posttransplant, able to perform independent daily activities of living and his previous job. This case underscores the potential for positive outcomes with profoundly prolonged, effective advanced cardiovascular life support in patients who experience postreperfusion syndrome.