

## RCP i CT mecànics

1. **Cardiol J.** 2018 Oct 19. doi: 10.5603/CJ.a2018.0121. [Epub ahead of print]

### **The effect of chest compression frequency on the quality of resuscitation by lifeguards. A prospective randomized crossover multicenter simulation trial.**

Smereka J, Iskrzycki Ł, Makomaska-Szaroszyk E, Bielski K, Frass M, Robak O, Ruetzler K, Czekajło M, Rodríguez-Núñez A, López-Herce J, Szarpak Ł1.

#### **Abstract**

**BACKGROUND:** The ability to perform high-quality cardiopulmonary resuscitation is one of the basic skills for lifeguards. The aim of the study was to assess the influence of chest compression frequency on the quality of the parameters of chest compressions performed by lifeguards.

**METHODS:** This prospective observational, randomized, crossover simulation study was performed with 40 lifeguards working in Warsaw, Wroclaw, and Poznan, Poland. The subjects then participated in a target study, in which they were asked to perform 2-min cycles of metronome-guided chest compressions at different rates: 80, 90, 100, 110, 120, 130, 140, and 150 compressions per minute (CPM).

**RESULTS:** The study involved 40 lifeguards. Optimal chest compression score calculated by manikin software was achieved for 110-120 CPM. Chest compression depth achieved 53 (interquartile range [IQR] 52-54) mm, 56 (IQR 54-57) mm, 52.5 (IQR 50-54) mm, 53 (IQR 52-53) mm, 50 (IQR 49-51) mm, 47 (IQR 44-51) mm, 41 (IQR 40-42) mm, 38 (IQR 38-43) mm for 80, 90, 100, 110, 120, 130, 140 and 150 CPM respectively. The percentage of chest compressions with the correct depth was lower for rates exceeding 120 CPM.

**CONCLUSIONS:** The rate of 100-120 CPM, as recommended by international guidelines, is the optimal chest compression rate for cardiopulmonary resuscitation performed by lifeguards. A rate above 120 CPM was associated with a dramatic decrease in chest compression depth and overall chest compression quality. The role of full chest recoil should be emphasized in basic life support training.

## **REGISTRES, REVISIONS I EDITORIALS**

1. **Air Med J.** 2018 Sep;37(5):312-316. doi: 10.1016/j.amj.2018.05.004. Epub 2018 Jun 12.

### **Prognostic Factors of Cardiopulmonary Arrest Patients by a Physician-Staffed Helicopter.**

Omori K1, Ishikawa K2, Nagasawa H2, Takeuchi I2, Jitsuiki K2, Kondo A2, Ohsaka H2, Yanagawa Y2.

## Abstract

**OBJECTIVE:** The aim of this study was to identify the prognostic factors of cardiopulmonary arrest (CPA) patients transported by a physician-staffed helicopter who received cardiopulmonary resuscitation (CPR) using AutoPulse (ZOLL Circulation, Sunnyvale, CA).

**METHODS:** A total of 110 CPA patients who had CPR performed on them in the helicopter using AutoPulse were enrolled in this retrospective study. We used logistic regression analysis to examine the prognostic factors of CPA patients who were transported by a physician-staffed helicopter.

**RESULTS:** Of these patients, return of spontaneous circulation (ROSC) during transportation was observed in 19 (17.29%); 1 (.9%) survived through hospital discharge without neurologic disability. In multivariate analyses, bystander CPR ( $P = .023$ ) and the time from the first call to the arrival of a helicopter medical crew ( $P = .041$ ) were selected as independent factors associated with ROSC.

**CONCLUSION:** In our study, factors such as early contact from the first call to the arrival of a helicopter medical crew and the presence of bystander CPR appeared to play an important role in attaining ROSC of CPA patients who were transported by a physician-staffed helicopter using AutoPulse.

2. *Circ J.* 2018 Oct 18. doi: 10.1253/circj.CJ-18-0631. [Epub ahead of print]

## Renal Function and Outcome of Out-of-Hospital Cardiac Arrest - Multicenter Prospective Study (SOS-KANTO 2012 Study).

Tamura T1, Suzuki M2, Hayashida K1, Sasaki J1, Yonemoto N3, Sakurai A4, Tahara Y5, Nagao K6, Yaguchi A7, Morimura N8; SOS-KANTO 2012 Study Group.

## Abstract

**BACKGROUND:** Renal dysfunction is associated with increased cardiovascular-related mortality, but its impact on outcome of out-of-hospital cardiac arrest (OHCA) remains unclear. We assessed whether post-OHCA outcome correlated with renal function early after OHCA. **Methods and Results:** Of the 16,452 registered patients in the SOS-KANTO 2012 Study, 5,112 cardiogenic OHCA adults with creatinine measurement (mean age, 72 years; male, 64%) were examined. First-obtained creatinine was used to assess eGFR. Associations between eGFR groups,  $\geq 60$  ( $n=997$ ), 45-59 ( $n=1,311$ ), 30-44 ( $n=1,441$ ), and  $<30$  mL/min/1.73 m<sup>2</sup> ( $n=1,363$ ), and 3-month survival and neurological outcomes were examined. Favorable neurological outcome was defined as cerebral performance categories 1 or 2. Survival rate (15.1%, 9.7%, 3.9%, and 2.9%;  $P<0.001$ ) and proportion of favorable neurological outcome (12.3%, 7.4%, 2.6%, and 2.2%;  $P<0.001$ ) were determined for eGFR groups  $\geq 60$ , 45-59, 30-44, and  $<30$  mL/min/1.73 m<sup>2</sup>, respectively. The survival rate decreased with eGFR ( $<60$  mL/min/1.73 m<sup>2</sup>), and survival adjusted OR were 0.74 (95% CI: 0.54-1.03), 0.42 (95% CI: 0.28-0.62), and 0.43 (95% CI: 0.28-0.68) for eGFR 45-59, 30-44, and  $<30$  mL/min/1.73 m<sup>2</sup>, respectively. The

adjusted OR for favorable neurological outcome also decreased with eGFR: 0.74 (95% CI: 0.52-1.06), 0.40 (95% CI: 0.25-0.64), and 0.48 (95% CI: 0.29-0.81), respectively.

**CONCLUSIONS:** An independent and graded association was observed between decreased eGFR and 3-month survival and proportion of favorable neurological outcome in cardiogenic OHCA patients.

3. **Scand J Caring Sci.** 2018 Oct 17. doi: 10.1111/scs.12616. [Epub ahead of print]

### **Lived experiences of surviving in-hospital cardiac arrest.**

Bremer A<sup>1,2</sup>, Dahné T<sup>3,4</sup>, Stureson L<sup>5</sup>, Årestedt K<sup>1,6</sup>, Thylén I<sup>7</sup>.

#### **Abstract**

**BACKGROUND:** Out-of-hospital cardiac arrest survivors suffer from psychological distress and cognitive impairments. They experience existential insecurity and vulnerability and are striving to return to a life in which well-being and the meaning of life have partly changed. However, research highlighting the experiences of in-hospital cardiac arrest survivors is lacking. This means that evidence for postresuscitation care has largely been extrapolated from studies on out-of-hospital cardiac arrest survivors, without considering potential group differences. Studies investigating survivors' experiences of an in-hospital cardiac arrest are therefore needed.

**AIM:** To illuminate meanings of people's lived experiences of surviving an in-hospital cardiac arrest.

**DESIGN:** An explorative, phenomenological hermeneutic method to illuminate meanings of lived experiences.

**METHOD:** Participants were identified through the Swedish national register of cardiopulmonary resuscitation and recruited from two hospitals. A purposive sample of eight participants, 53-99 years old, who survived an in-hospital cardiac arrest 1-3 years earlier, was interviewed.

**FINDINGS:** The survivors were striving to live in everyday life and striving for security. The struggle to reach a new identity meant an existence between restlessness and a peace of mind, searching for emotional well-being and bodily abilities. The search for existential wholeness meant a quest for understanding and explanation of the fragmented cardiac arrest event and its existential consequences. The transition from hospital to home meant a transition from care and protection to uncertainty and vulnerability with feelings of abandonment, which called for a search for security and belonging, away from isolation and loneliness.

**CONCLUSION:** Surviving an in-hospital cardiac arrest can be further understood by means of the concept of hospital-to-home transition. Following hospital discharge, patients felt vulnerable and abandoned when pending between denial and

acceptance of the 'new' life. Hence, the healthcare system should play a significant role when it comes to facilitate cardiac arrest survivors' security during hospital-to-home transition.

4. **Heart.** 2018 Oct 16. pii: heartjnl-2018-313838. doi: 10.1136/heartjnl-2018-313838. [Epub ahead of print]

#### **Survival after out-of-hospital cardiac arrest is associated with area-level socioeconomic status.**

Jonsson M1, Härkönen J2, Ljungman P3, Rawshani A 4, Nordberg P1, Svensson L1, Herlitz J5, Hollenberg J1.

#### **Abstract**

**OBJECTIVE:** Out-of-hospital cardiac arrest (OHCA) is a major cause of death in the Western world. In this study we aimed to investigate the relationship between area-level socioeconomic status (SES) and 30-day survival after OHCA. We hypothesised that high SES at an area level is associated with an improved chance of 30-day survival.

**METHODS:** Patients with OHCA in Stockholm County between 1 January 2006 and 31 December 2015 were analysed retrospectively. To quantify area-level SES, we linked the patient's home address to 250 × 250/1000 × 1000 meter grids with aggregated information about income and education. We constructed multivariable logistic regression models in which area-level SES measures were adjusted for age, sex, emergency medical services response time, witnessed status, initial rhythm, aetiology, location and year of cardiac arrest.

**RESULTS:** We included 7431 OHCA. There was significantly greater 30-day survival ( $p=0.003$ ) in areas with a high proportion of university-educated people. No statistically significant association was seen between median disposable income and 30-day survival. The adjusted OR for 30-day survival among patients in the highest educational quintile was 1.70 (95% CI 1.15 to 2.51) compared with patients in the lowest educational quintile. We found no significant interaction for sex. Positive trend with increasing area-level education was seen in both men and women but the trend was only statistically significant among men ( $p=0.012$ )

**CONCLUSIONS:** Survival to 30 days after OHCA is positively associated with the average educational level of the residential area. Area-level income does not independently predict 30-day survival after OHCA.

#### **ACR INTRAHOSPITALÀRIA**

1. **Rev Bras Ter Intensiva.** 2018 Jul-Sept;30(3):366-375. doi: 10.5935/0103-507X.20180049.

## **Effectiveness of rapid response teams in reducing intrahospital cardiac arrests and deaths: a systematic review and meta-analysis.**

[Article in English, Portuguese; Abstract available in Portuguese from the publisher]

Rocha HAL<sup>1,2</sup>, Alcântara ACC<sup>3</sup>, Rocha SGMO<sup>2</sup>, Toscano CM<sup>4</sup>.

### **Abstract**

**OBJECTIVE:** To evaluate the effectiveness of rapid response teams using early identification of clinical deterioration in reducing the occurrence of in-hospital mortality and cardiorespiratory arrest.

**DATA SOURCES:** The MEDLINE, LILACS, Cochrane Library, Center for Reviews and Dissemination databases were searched.

**STUDY SELECTION:** We included studies that evaluated the effectiveness of rapid response teams in adult hospital units, published in English, Portuguese, or Spanish, from 2000 to 2016; systematic reviews, clinical trials, cohort studies, and prepost ecological studies were eligible for inclusion. The quality of studies was independently assessed by two researchers using the Newcastle-Ottawa, modified Jadad, and Assessment of Multiple Systematic Reviews scales.

**DATA EXTRACTIONS:** The results were synthesized and tabulated. When risk measures were reported by the authors of the included studies, we estimated effectiveness as 1-RR or 1-OR. In pre-post studies, we estimated effectiveness as the percent decrease in rates following the intervention.

**RESULTS:** Overall, 278 studies were identified, 256 of which were excluded after abstract evaluation, and two of which were excluded after full text evaluation. In the meta-analysis of the studies reporting mortality data, we calculated a risk ratio of 0.85 (95%CI 0.76 - 0.94); and for studies reporting cardiac arrest data the estimated risk ratio was 0.65 (95%CI 0.49 - 0.87). Evidence was assessed as low quality due to the high heterogeneity and risk of bias in primary studies.

**CONCLUSION:** We conclude that rapid response teams may reduce in-hospital mortality and cardiac arrests, although the quality of evidence for both outcomes is low.

### **Free Article**

### **LESIONS I RCP**

1. *Int J Legal Med.* 2018 May;132(3):771-774. doi: 10.1007/s00414-017-1701-8. Epub 2017 Sep 29.

## **Cardiothoracic injuries after CardioPump CPR: a report of two cases and review of the literature.**

Kolopp M1, Franchi A2, Grafiadis P3, Martrille L3.

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3. CHRU Nancy, Service de Médecine Légale, 54000, Nancy, France.

### **Abstract**

Although many clinical trials have demonstrated its efficacy during active compression-decompression cardiopulmonary resuscitation (ACD-CPR), the Ambu® CardioPump seems likely to cause severe and sometimes lethal injuries. In this paper, we report two cases observed at the Institute of Legal Medicine of Nancy, France. A 67-year-old man collapsed in the street, in the presence of witnesses, and without any sign of trauma. The autopsy revealed a flail chest, a wound of the left ventricle, a rupture of the right ventricle, and a wrenching of the inferior vena cava. A 71-year-old woman was found in her apartment during an accidental fire. The autopsy revealed a sternal fracture, many rib fractures, and a perforation of the superior vena cava, the pericardium, and the heart. Despite articles focusing on complications of the use of the CardioPump in the late 1990s, this technique is still used in practice. These two cases emphasize that iatrogenic injuries must be taken into account in the CardioPump benefit/risk balance and the relevance of its daily use.

### **CAUSES DE L'ACR**

1. **Acute Med Surg.** 2018 Jun 25;5(4):369-373. doi: 10.1002/ams2.349. eCollection 2018 Oct.

### **Out-of-hospital cardiac arrests in the toilet in Japan: a population-based descriptive study.**

Kiyohara K1, Nishiyama C2, Kiguchi T3, Kobayashi D3, Iwami T3, Kitamura T4.

### **Abstract**

**Aim:** This study aimed to reveal the characteristics and outcomes of patients with out-of-hospital cardiac arrests (OHCAs) occurring in the toilet. These traits provide useful clues for the prevention of OHCAs and the improvement of prehospital care for these patients.

**Methods:** Out-of-hospital cardiac arrest data were obtained from the population-based, Utstein-style registry in Osaka City, Japan, between 2009 and 2015. This study identified patients with OHCA that occurred inside the toilet. The primary end-point was 1-month survival with favorable neurological outcome after OHCA.

**Results:** During the 7-year study period, a total of 18,458 OHCA were identified. Of these cases, 849 (4.6%) occurred inside the toilet. Among them, the analysis included 733 patients. The distribution depicting monthly OHCA occurrences showed that OHCA tended to occur in cold months (28.1% [206/733] from October to December and 30.0% [220/733] from January to March). Most OHCA occurring inside the toilet were of cardiac origin (91.5% [671/733]), and 36.2% (265/733) were witnessed by bystanders. The proportion of patients with ventricular fibrillation was 5.2% (38/733) and those receiving shocks by public-access automated external defibrillators was 0.4% (3/733). The proportion of patients with 1-month survival with favorable neurological outcome was 1.9% (14/733).

**Conclusions:** Out-of-hospital cardiac arrests occurring inside the toilet accounted for 4.6% of all OHCA and were frequently observed during cold months, and their outcome was poor. Establishment of preventive measures against OHCA occurring in the toilet as well as earlier recognition of OHCA are needed.

2. **Resuscitation.** 2018 Oct 10. pii: S0300-9572(18)30988-2. doi: 10.1016/j.resuscitation.2018.10.006. [Epub ahead of print]

### **Comorbidity and survival in out-of-hospital cardiac arrest.**

Hirlekar G1, Jonsson M2, Karlsson T3, Hollenberg J2, Albertsson P4, Herlitz J5.

#### **Abstract**

**BACKGROUND:** Patients suffering out-of-hospital cardiac arrest (OHCA) have a poor prognosis but survival among subgroups differs greatly. Previous studies have shown conflicting results on whether patient comorbidity affects outcome. The aim of this national study was to investigate the effect of comorbidity on outcome after OHCA in Sweden.

#### **METHODS:**

We included all patients with bystander-witnessed OHCA from 2011–2015 in the national Swedish Registry of Cardiopulmonary Resuscitation. In order to assess comorbidity, the database was merged with the comprehensive National Patient Registry, which includes all out-patient and in-patient care in Sweden. The Charlson comorbidity index (CCI) and the specific comorbidity conditions constituting the CCI was used to identify whether comorbidity was associated with outcome.

**RESULTS:** A total of 12,012 patients were included in the study. Of these, 1,598 patients survived to 30 days (13%). The most common comorbidities were a history of congestive heart failure (29%), myocardial infarction (24%), and diabetes without

complications (23%). Renal disease (odds ratio [OR] 0.53; 95% CI 0.53–0.72), diabetes with complications (OR 0.65; 95% CI 0.49–0.84), diabetes without complications (OR 0.63; 95% CI 0.52–0.75), congestive heart failure (OR 0.84; 95% CI 0.71–0.99), and metastatic carcinoma (OR 0.61; 95% CI 0.40–0.93) were significantly associated with a reduced chance of 30-day survival when adjusted for demographic characteristics and also resuscitation-associated factors such as shockable initial rhythm, bystander cardiopulmonary resuscitation (CPR), and place of arrest. With increasing comorbidity, the chance of 30-day survival decreased: adjusted OR was 0.82 (95% CI 0.68–0.99) for CCI 3–4, 0.62 (95% CI 0.47–0.83) for CCI 5–6, and 0.51 (95% CI 0.36–0.72) for CCI > 6, respectively, all in relation to those with CCI 0–2. Additionally, increasing morbidity was associated with reduced odds of return of spontaneous circulation (ROSC) and ROSC at hospital admission.

**CONCLUSION:** This large national study showed that increasing comorbidity decreased the chance of survival to 30 days in OHCA. This association remained after covariate adjustment.

## **ETCO<sub>2</sub>**

1. **Resuscitation.** 2018 Oct 12. pii: S0300-9572(18)30848-7. doi: 10.1016/j.resuscitation.2018.10.008. [Epub ahead of print]

### **A low end-tidal CO<sub>2</sub>/arterial CO<sub>2</sub> ratio during cardiopulmonary resuscitation suggests pulmonary embolism.**

Aagaard R1, Løfgren B2, Caap P3, Mygind-Klausen T4, Bøtker MT5, Granfeldt A6.

#### **Abstract**

**INTRODUCTION:** Identifying reversible causes of cardiac arrest is challenging. The diagnosis of pulmonary embolism is often missed. Pulmonary embolism increases alveolar dead space resulting in low end-tidal CO<sub>2</sub> (EtCO<sub>2</sub>) relative to arterial CO<sub>2</sub> (PaCO<sub>2</sub>) tension. Thus, a low EtCO<sub>2</sub>/PaCO<sub>2</sub> ratio during resuscitation may be a sign of pulmonary embolism.

**METHODS:** Post hoc analysis of data from two porcine studies comparing ultrasonographic measurements of right ventricular diameter during resuscitation from cardiac arrest of different causes. Pigs were grouped according to cause of arrest (pulmonary embolism, hypovolemia, primary arrhythmia, hypoxia, or hyperkalaemia) and EtCO<sub>2</sub>/PaCO<sub>2</sub> ratios were compared.

**RESULTS:** Data from 54 pigs were analysed. EtCO<sub>2</sub> levels at the third rhythm analysis were significantly lower when cardiac arrest was caused by pulmonary embolism than by primary arrhythmia, hypoxia and hyperkalaemia, but there was no significant difference between pulmonary embolism and hypovolemia. In contrast, PaCO<sub>2</sub> levels were higher in cardiac arrest caused by pulmonary embolism than in the other causes



of cardiac arrest. Consequently, the EtCO<sub>2</sub>/PaCO<sub>2</sub> ratio was lower in pulmonary embolism 0.2 (95%CI 0.1-0.4), than in hypovolaemia 0.5 (95%CI 0.3-0.6), primary arrhythmia 0.7 (95%CI 0.7-0.8), hypoxia 0.5 (95%CI 0.4-0.6), and hyperkalaemia 0.6 (95%CI 0.6-0.7).

**CONCLUSION:** A low EtCO<sub>2</sub>/PaCO<sub>2</sub> ratio during cardiopulmonary resuscitation suggests pulmonary embolism.

## **DONACIÓ D'ÒRGANS**

1. **Resuscitation.** 2018 Oct 12. pii: S0300-9572(18)30825-6. doi: 10.1016/j.resuscitation.2018.10.016. [Epub ahead of print]

**An integrated program of extracorporeal membrane oxygenation (ECMO) assisted cardiopulmonary resuscitation and uncontrolled donation after circulatory determination of death in refractory cardiac arrest.**

Roncon-Albuquerque R Jr1, Gaião S2, Figueiredo P 3, Príncipe N4, Basílio C4, Mergulhão P2, Silva S4, Honrado T4, Cruz F5, Pestana M6, Oliveira G7, Meira L8, França A9, Almeida-Sousa JP9, Araújo F10, Paiva JA2.

### **Abstract**

**AIM:** To assess the feasibility of an integrated program of extracorporeal cardiopulmonary resuscitation (ECPR) and uncontrolled donation after circulatory determination of death (uDCDD) in refractory cardiac arrest (rCA).

**METHODS:** Single center, prospective, observational study of selected patients with in-hospital (IHCA) and out-of-hospital (OHCA) rCA occurring in an urban area of ~1.5 million inhabitants, between October-2016 and May-2018. 65 year old or younger patients without significant bleeding or comorbidities with witnessed nonasystolic cardiac arrests were triaged to ECPR if they had a reversible cause and high quality CPR lasting < 60 min. Otherwise they were considered for uDCDD after a ten minute no touch period using normothermic regional perfusion.

**RESULTS:** 58 patients were included, of which 41 (71%) were OHCA and 18 (31%) had ECPR initiated. Median age was 52 (IQR 45-56) years. Cannulation was successful in 49/58 (84%) cases. Compared to ECPR, patients referred for uDCDD were more frequently OHCA (90 vs. 28%), had bystander CPR (28 vs. 83%) and prolonged low-flow period (40 (35-50) vs. 60 (49-78) min). Survival to hospital discharge with full neurological recovery (cerebral performance category 1) occurred in 6/18 (33%) ECPR patients. uDCDD resulted in transplantation of 44 kidneys.

**CONCLUSIONS:** An integrated program for rCA consisting of a formal pathway to uDCDD referral in ECPR ineligible patients is feasible. ECPR-referred patients had a

reasonable survival with full neurologic recovery. Successful kidney transplantation was achieved with uDCDD.

## **TRAUMA**

### **1. Resuscitative Endovascular Balloon Occlusion of the Aorta for Control of Non-Compressible Truncal Hemorrhage: A Review of Clinical Effectiveness and Guidelines [Internet].**

Editors

Richardson R, Adcock L.

Ottawa (ON): Canadian Agency for Drugs and Technologies in Health; 2018 Mar.

CADTH Rapid Response Reports.

#### **Excerpt**

The purpose of this report is to examine the comparative clinical effectiveness and safety of resuscitative endovascular balloon occlusion of the aorta (REBOA) versus usual treatment (e.g., rapid evacuation, administration of blood product) in pre-hospital settings, and to examine clinical guidelines regarding the use of REBOA in prehospital settings.

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## **ORGANITZACIÓ I FORMACIÓ**

1. **Resuscitation.** 2018 Oct 11. pii: S0300-9572(18)30996-1. doi: 10.1016/j.resuscitation.2018.10.011. [Epub ahead of print]

**'We're going to do CPR': a linguistic study of the words used to initiate dispatcher-assisted CPR and their association with caller agreement.**

Riou M1, Ball S2, Whiteside A3, Bray J4, Perkins GD5, Smith K6, O'Halloran KL7, Fatovich DM8, Inoue M2, Bailey P9, Cameron P10, Brink D9, Finn J11.

#### **Abstract**

**BACKGROUND:** In emergency ambulance calls for out-of-hospital cardiac arrest (OHCA), dispatcher-assisted cardiopulmonary resuscitation (CPR) plays a crucial role

in patient survival. We examined whether the language used by dispatchers to initiate CPR had an impact on callers' agreement to perform CPR.

**METHODS:** We analysed 424 emergency calls relating to cases of paramedic-confirmed OHCA where OHCA was recognised by the dispatcher, the caller was with the patient, and resuscitation was attempted by paramedics. We investigated the linguistic choices used by dispatchers to initiate CPR, and the impact of those choices on caller agreement to perform CPR.

**RESULTS:** Overall, CPR occurred in 85% of calls. Caller agreement was low (43%) when dispatchers used terms of willingness ("do you want to do CPR?"). Caller agreement was high (97% and 84% respectively) when dispatchers talked about CPR in terms of futurity ("we are going to do CPR") or obligation ("we need to do CPR"). In 38% (25/66) of calls where the caller initially declined CPR, the dispatcher eventually secured their agreement by making several attempts at initiating CPR.

**CONCLUSION:** There is potential for increased agreement to perform CPR if dispatchers are trained to initiate CPR with words of futurity and/or obligation.

## **CURES POST-RCE**

1. **Resuscitation.** 2018 Oct 11. pii: S0300-9572(18)30990-0. doi: 10.1016/j.resuscitation.2018.10.007. [Epub ahead of print]

## **Performance of Coronary Angiography and Intervention after Out of Hospital Cardiac Arrest.**

Kearney K1, Maynard C2, Smith B1, Rea TD3, Beatty A4, McCabe JM5.

### **Abstract**

**AIMS:** Out of Hospital Cardiac Arrest (OHCA) is frequently attributed to coronary artery disease, thus guidelines recommend coronary angiography (CAG) for survivors of OHCA. However, the real-world application of these guidelines is unknown, and we sought to evaluate CAG practices in the contemporary OHCA population.

**METHODS:** The Clinical Outcomes Assessment Program (COAP), a Washington State public reporting system, and the Cardiac Arrest Registry to Enhance Survival (CARES), a national registry of OHCA, were matched to characterize OHCA presentations between 2014 and 2015. Adults presenting to PCI-capable centers after OHCA were included. Logistic regression analyses were performed to assess predictors of undergoing CAG after OHCA.

**RESULTS:** 2361 subjects were included with 729 (31%) proceeding to CAG, and 354 (15%) receiving PCI. The majority had return of spontaneous circulation (ROSC) at hospital arrival without identified ST elevations (72.2%). Of those with ST elevations

and ROSC, 69% underwent CAG. OHCA without ST elevations underwent CAG in 29.6% and PCI in 12.6%. After adjustment, older patients (aOR 0.73, 95% CI 0.72-0.84 per decade) and women (aOR 0.53, 95% CI 0.41-0.67) were less likely to proceed to CAG. Patients with witnessed arrest (aOR 2.07, 95% CI 1.62-2.67), VT/VF (aOR 6.11, 95% CI 4.85-7.69), ST elevations (aOR 3.82, 95% CI 2.71-5.38) and sustained ROSC (aOR 3.64, 95% CI 2.62-5.04) were more likely to undergo CAG.

**CONCLUSION:** Only one-third of patients presenting to PCI-capable hospitals underwent CAG after OHCA. Patient selection for an invasive strategy after OHCA appeared to be heavily influenced by pre-hospital presentation variables.

## **TARGET TEMPERATURE MANAGEMENT**

1. **Resuscitation.** 2018 Oct 11. pii: S0300-9572(18)30981-X. doi: 10.1016/j.resuscitation.2018.10.004. [Epub ahead of print]

**The effect of different target temperatures in targeted temperature management on neurologically favorable outcome after out-of-hospital cardiac arrest: a nationwide multicenter observational study in Japan (the JAAM-OHCA registry).**

Irisawa T1, Matsuyama T2, Iwami T3, Yamada T4, Hayakawa K5, Yoshiya K3, Noguchi K6, Nishimura T7, Uejima T8, Yagi Y9, Kiguchi T10, Kishimoto M11, Matsuura M12, Hayashi Y13, Sogabe T14, Morooka T15, Kitamura T16, Shimazu T17; CRITICAL Study investigators.

### **Abstract**

**BACKGROUND:** It has been insufficiently investigated whether neurological function after out-of-hospital cardiac arrest (OHCA) would differ by 1 °C change in ordered target temperature of 33-36 °C among patients undergoing targeted temperature management (TTM) in the real-world setting.

**METHODS:** This nationwide hospital-based observational study (The Japanese Association for Acute Medicine-OHCA Registry) conducted between June 2014 and December 2015 in Japan included OHCA patients aged ≥18 years who were treated with TTM. The primary outcome was one-month survival with neurologically favorable outcomes defined by cerebral performance category 1 or 2. To investigate the effect of TTM by 1 °C change in ordered target temperature of 33-36 °C on each outcome, random effects logistic regression analyses were performed.

**RESULTS:** The final analysis included 738 patients. The proportion of patients with neurologically favorable outcome was 30.4% (7/23), 31.7% (175/552), 28.9% (11/38), and 30.4% (38/125) in the 33 °C, 34 °C, 35 °C, and 36 °C groups, respectively. In the multivariable logistic regression analysis, no group had a higher proportion of neurologically favorable outcome compared with the 34 °C group (vs. 33 °C group,

adjusted odds ratio [AOR] 0.90; 95% confidence interval [CI] 0.25-3.12, vs. 35 °C group, AOR 1.17; 95% CI 0.44-3.13, vs. 36 °C group, AOR 1.26; 95% CI 0.78-2.02)

**CONCLUSIONS:** In this population, we evaluated the difference in outcomes after adult OHCA patients received TTM by 1 °C change in ordered target temperature of 33-36 °C and demonstrated that there was no statistically significant difference in neurologically favorable outcomes after OHCA irrespective of target temperature.

## **ECMO**

1. **Resuscitation.** 2018 Oct 15. pii: S0300-9572(18)30999-7. doi: 10.1016/j.resuscitation.2018.10.014. [Epub ahead of print]

### **Extracorporeal Life Support in the Emergency Department: A Narrative Review for the Emergency Physician.**

Swol J1, Belohlávek J2, Brodie D3, Bellezzo J4, Weingart SD5, Shinar Z6, Schober A7, Bachetta M8, Haft JW9, Ichiba S10, Sakamoto T11, Peek GJ12, Lorusso R13, Conrad SA14.

#### **Abstract**

**BACKGROUND:** Extracorporeal life support (ECLS) describes the use of blood perfusion devices to provide advanced cardiac or respiratory support. Advances in percutaneous vascular cannula insertion, centrifugal pump technologies, and the miniaturization of extracorporeal devices have simplified ECLS. The intention of this discussion is to review the role of ECLS as a potential rescue method for emergency department (ED) clinicians in critical clinical scenarios and to focus on the prerequisites for managing an ECLS program in an ED setting.

**DISCUSSION:** Possible indications for ECLS cannulation in the ED include ongoing circulatory arrest, shock or refractory hypoxemia and pulmonary embolism with refractory shock. Severe trauma, foreign body obstruction, hypothermia and near drowning are situations in which patients may potentially benefit from ECLS. Early stabilization in the ED can provide a time window for a diagnostic workup and/or urgent procedures, including percutaneous coronary intervention, rewarming or damage control surgery in trauma. The use of ECLS is resource intensive and can be associated with a high risk of complications, especially when performed without previous training. Therefore, ECLS should only be used when the underlying problem is potentially reversible, and the resources are available to address the etiology of organ dysfunction.

**CONCLUSION:** Emergent ECLS has a role in the ED for selected indications in the face of life-threatening conditions. ECLS provides a bridge to recovery, definitive therapy, intervention or surgery. ECLS program requires an appropriately trained staff

(physicians, nurses and ECLS specialists), equipment resources and logistical planning.

## **PEDIATRIA**

1. **Neurophysiol Clin.** 2018 Oct 12. pii: S0987-7053(18)30064-9. doi: 10.1016/j.neucli.2018.09.002. [Epub ahead of print]

### **Prognostic value of continuous electroencephalography in children undergoing therapeutic hypothermia after cardiac arrest: A pilot study.**

Prajongkit T1, Veeravigrom M2, Samransamruajkit R3.

#### **Abstract**

**OBJECTIVE:** To determine the prognostic value of continuous electroencephalography (EEG) in children undergoing therapeutic hypothermia after cardiac arrest.

**METHOD:** We retrospectively reviewed medical records and continuous EEG of all patients undergoing therapeutic hypothermia after cardiac arrest from November 2013 to September 2016. Demographic, clinical data and immediate complications were collected. Characteristics of continuous EEG including EEG background, time to normal trace (TTNT) and electrographic seizures were reviewed by investigators. Cerebral performance category scales at 6 months' follow up were evaluated and divided into good (grade 1-2) and poor (grade 3-5) outcome groups.

**RESULT:** Six patients were included (two boys and four girls) with median age of 19.5 months (range 13-128 months). Five patients (83.3%) presented with cardiac arrest from near-drowning and one patient with underlying acute lymphocytic leukemia presented an in-hospital cardiac arrest. Initial EKG rhythm was asystole in 3 patients (50%), pulseless activity in 1 patient (16.7%) and initially unknown in 2 patients (33.3%). Two patients (33.3%) who had EEG reactivity and TTNT within 5 minutes and 2.5 hours had good neurological outcome (CPC1). Four patients (66.7%) with absent EEG reactivity had poor neurological outcome (CPC4, 5 in 3 and 1 children respectively). Three patients from the poor outcome group had electrographic seizures, of whom 2/3 progressed to status epilepticus. Three out of four patients in the poor outcome group had the following complications: pneumonia, bleeding and pancreatitis.

**CONCLUSION:** Early TTNT and EEG reactivity help to predict good neurological outcome in children undergoing therapeutic hypothermia after cardiac arrest. Seizures and status epilepticus may predict poor neurological outcome.

2. **Eur J Trauma Emerg Surg.** 2018 Jun;44(3):407-410. doi: 10.1007/s00068-017-0815-5. Epub 2017 Jul 15.

## **Pediatric out-of-hospital cardiopulmonary resuscitation by helicopter emergency medical service, does it has added value compared to regular emergency medical service?**

Moors XRJ<sup>1,2</sup>, Rijs K<sup>3</sup>, Den Hartog D<sup>4</sup>, Stolker RJ<sup>3</sup>.

### **Abstract**

**PURPOSE:** To determine the outcome of out-of-hospital (OOH) cardiopulmonary resuscitation (CPR) and the advanced life support (ALS) procedures provided in pediatrics by the Rotterdam Helicopter Emergency Medical Service (HEMS)

**METHODS:** Retrospective evaluation of all pediatric (0-17 years) OOH cardiopulmonary arrests within a 6-year period and attended by the Rotterdam HEMS team.

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

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

### **Free Article**

## **RECERCA EXPERIMENTAL**

1. Shock. 2018 Oct 17. doi: 10.1097/SHK.0000000000001276. [Epub ahead of print]

## **Early Initiation of Continuous Renal Replacement Therapy Induces Fast Hypothermia and Improves Post-Cardiac Arrest Syndrome in a Porcine Model.**

Xu J<sup>1,2,3</sup>, Chen Q<sup>1,2,4</sup>, Jin X<sup>1,2,5</sup>, Wu C<sup>1,2</sup>, Li Z<sup>3</sup>, Zhou G<sup>1,2</sup>, Xu Y<sup>1,2</sup>, Qian A<sup>1,2</sup>, Li Y<sup>1,2</sup>, Zhang M<sup>1,2</sup>.

### **Abstract**

Rapid induction of hypothermia early after resuscitation can be an effective strategy against post-cardiac arrest syndrome (PCAS). Preliminary data suggested that continuous renal replacement therapy (CRRT) might be an efficient method to rapidly induce hypothermia. In this study, we investigated the efficacy of cooling induced by

CRRT and its effects on the outcomes of PCAS in a porcine model. Thirty-two male domestic pigs weighing  $36 \pm 2$  kg were randomized into 4 groups: sham control (n=5), normothermia (n=9), surface cooling (SC, n=9), and CRRT (n=9). Sham animals underwent the surgical preparation only. The animal model was established by 8 min of untreated ventricular fibrillation and then 5 min of cardiopulmonary resuscitation. At 5 min after resuscitation, the animals were cooled by either the combination of an earlier 8-h CRRT and later 16-h SC or the whole 24-h SC in the two hypothermic groups. For the other two groups, a normal temperature of  $38.0 \pm 0.5^\circ\text{C}$  was maintained throughout the experiment. Blood temperature was decreased to  $33^\circ\text{C}$  within 28 min in animals treated with CRRT, which was significantly faster than that in the SC group requiring 185 min to achieve target temperature. Post-resuscitation myocardial dysfunction, brain injury and systemic inflammation were significantly improved in the two hypothermic groups compared to the normothermia group. However, the improvement was significantly greater in the CRRT group than in the SC group. In conclusion, fast hypothermia was successfully induced by CRRT and significantly alleviated the severity of PCAS in a porcine model.

2. **J Cell Biochem.** 2018 Oct 15. doi: 10.1002/jcb.27647. [Epub ahead of print]

**Selective beta-blocker esmolol improves cerebral cortex microcirculation in a swine ventricular fibrillation model.**

Li Z1, Yuan W2, Li J3, Li J4, Wu J2, Zhao Y2, Li C2.

**Abstract**

**OBJECTIVE:** This study aimed to identify whether esmolol attenuates cerebral cortex microcirculation blood flow due to epinephrine in prolonged ventricular fibrillation (VF) and cardiopulmonary resuscitation (CPR), and may improve neurological prognosis.

**METHODS:** Male pigs were randomized into the esmolol+epinephrine group (group EE), the epinephrine group (group EP), and the normal saline group (group NS) (n = 8 each group). Untreated VF for 8 minutes was induced in pigs. After CPR for 2 minutes, group EE received esmolol (500  $\mu\text{g}/\text{kg}$ )+epinephrine (20  $\mu\text{g}/\text{kg}$ ), group EP received epinephrine 20  $\mu\text{g}/\text{kg}$ , and group NS received 5 mL normal saline. Then, a 120 J electric shock was delivered. If the return of spontaneous circulation (ROSC) failed, epinephrine (20  $\mu\text{g}/\text{kg}$ ) was repeated in group EP and EE, followed by another 2 minutes of CPR, a 150 J electric shock was delivered every 2 minutes until ROSC. Cerebral microcirculation images were obtained at 0.5, 6, 12, and 24 hours by cranial windows after ROSC. Cerebral performance category scores and neurological deficit scores (NDS) were calculated. The frontal cortices were harvested after the animals were euthanized.



**RESULTS:** The NDS, the perfused vessel density, and the microcirculatory flow index of group EE were better than other two groups. The morphology of endothelial cells in the group EE remained intact; however, it was destroyed in the group EP.

**CONCLUSIONS:** Administration of esmolol with epinephrine may alleviate the impairment of cerebral microcirculation blood flow caused by the administration of epinephrine in prolonged VF and thereby improves neurological outcomes in a swine model.

## **CASE REPORTS**

1. Case Rep Cardiol. 2018 Sep 19;2018:1465867. doi: 10.1155/2018/1465867. eCollection 2018.

### **A Lucky Accident: Brugada Syndrome Associated with Out-of-Hospital Cardiac Arrest.**

Lee MT<sup>1</sup>, Marah N<sup>1,2</sup>.

#### **Abstract**

About 350,000 cases of out-of-hospital cardiac arrest (OHCA) occur yearly in the United States. Unfortunately, even with treatment from emergency medical service (EMS) staff and hospitalization, only 12% survive past discharge for multiple reasons. Classically, Brugada syndrome (BrS) initially presents as a new syncopal episode in young males without obstructive coronary artery disease (CAD). However, in this case report, a patient who emergently presented with a ST-elevation myocardial infarction (STEMI) challenges the stereotypical presentation. Despite successful stent placement for relatively minor obstructive CAD, new ST-segment elevations appeared on electrocardiogram (ECG) and persistent ventricular fibrillation arrests may signify an additional underlying pathology of BrS.

#### **Free Article**

2. Medicine (Baltimore). 2018 Oct;97(42):e12823. doi: 10.1097/MD.00000000000012823.

### **A case report of unexpected sudden cardiac death due to aortic rupture following laparoscopic appendectomy.**

Joo C<sup>1</sup>, Min JW<sup>2</sup>, Noh G<sup>1</sup>, Seo J<sup>3</sup>.

#### **Abstract**

**INTRODUCTION:** Aortic dissection is a very rare but life-threatening condition associated with a high mortality. Unexpected sudden cardiac death due to aortic

rupture following laparoscopic appendectomy is very rare and may be difficult to diagnose. However, early diagnosis of aortic dissection is essential for the timely treatment and outcome of aortic dissection.

**CASE PRESENTATION:** A 50-year-old man underwent a laparoscopic appendectomy. Postoperatively, the patient complained of dyspnea and chest pain. In 25 minutes after arrival in the postanesthesia care unit (PACU), the patient was in asystole. Then, he underwent cardiopulmonary resuscitation (CPR) according to advanced cardiac life support (ACLS) protocol using 1mg of epinephrine, one 200J DC shock for ventricular fibrillation (V-fib). After that, his noninvasive blood pressure (NIBP) was 80/40mm Hg, pulse rate (PR) was 140beats/min, and peripheral oxygen saturation (SpO<sub>2</sub>) was 84%. His electrocardiogram (ECG) finding was atrial fibrillation (A-fib). After 20minutes, the patient developed asystole rhythm again and CPR was restarted. He remained severely hypotensive despite vasopressors and died after 5hours CPR. A forensic autopsy was performed postmortem and thoracic and abdominal aortic dissection along the root of ascending aorta was present and massive hematoma within right and left thorax was present.

**CONCLUSION:** Acute aortic disease can be difficult to recognize; therefore, diagnosis is sometimes delayed or missed. It is important to recognize the atypical symptoms of aortic dissection and maintain a broad differential diagnosis if patients complained of abdominal pain.

## RCP i COMPRESSORS TORÀCICS MECÀNICS

1. **Eur Heart J.** 2018 Oct 31. doi: 10.1093/eurheartj/ehy687. [Epub ahead of print]

### **Bystander cardiopulmonary resuscitation and long-term outcomes in out-of-hospital cardiac arrest according to location of arrest.**

Sondergaard KB<sup>1</sup>, Wissenberg M<sup>1,2</sup>, Gerds TA<sup>3</sup>, Rajan S<sup>1</sup>, Karlsson L<sup>1,2</sup>, Kragholm K<sup>4,5</sup>, Pape M<sup>4</sup>, Lippert FK<sup>2</sup>, Gislason GH<sup>1,6,7</sup>, Folke F<sup>1,2</sup>, Torp-Pedersen C<sup>4,5,8</sup>, Hansen SM<sup>4</sup>.

#### **Abstract**

**Aims:** Bystander cardiopulmonary resuscitation (CPR) has increased in several countries following nationwide initiatives to facilitate bystander resuscitative efforts in out-of-hospital cardiac arrest (OHCA). We examined the importance of public or residential location of arrest on temporal changes in bystander CPR and outcomes.

**Methods and results:** From the nationwide Danish Cardiac Arrest Registry, all OHCAs from 2001 to 2014 of presumed cardiac cause and between 18 and 100 years of age were identified. Arrests witnessed by emergency medical services personnel were excluded. Of 25 505 OHCAs, 26.4% (n = 6738) and 73.6% (n = 18 767) were in public and residential locations, respectively. Bystander CPR increased during 2001-2014 in both locations: from 36.4% [95% confidence interval (CI) 30.6-42.6%] to 83.1% (95% CI 80.0-85.8%)

in public ( $P < 0.001$ ) and from 16.0% (95% CI 13.2-19.3%) to 61.0% (95% CI 58.7-63.2%) in residential locations ( $P < 0.001$ ). Concurrently, 30-day survival increased in public from 6.4% (95% CI 4.0-10.0%) to 25.2% (95% CI 22.1-28.7%) ( $P < 0.001$ ), and in residential from 2.9% (95% CI 1.8-4.5%) to 10.0% (95% CI 8.7-11.4%) ( $P < 0.001$ ). Among 2281 30-day survivors, 1-year risk of anoxic brain damage/nursing home admission during 2001-2014 decreased from 18.8% (95% CI 6.6-43.0%) to 6.8% (95% CI 3.9-11.8%) in public ( $P < 0.001$ ), whereas the corresponding change was insignificant in residential locations from 11.8% (95% CI 3.3-34.3) to 17.6% (95% CI 12.7-23.9%) ( $P = 0.52$ ).

**Conclusion:** During 2001-2014, bystander CPR and 30-day survival more than doubled in both public and residential OHCA locations. A significant decrease in anoxic brain damage/nursing home admission was observed among 30-day survivors in public, but not among survivors from residential OHCA.

## REGISTRES, REVISIONS I EDITORIALS

1. *J Adv Nurs*. 2018 Oct 30. doi: 10.1111/jan.13886. [Epub ahead of print]

### **Public knowledge and expectations regarding dispatcher assistance in out-of-hospital cardiac arrest.**

Mathiesen WT<sup>1,2</sup>, Birkenes TS<sup>3</sup>, Lund H<sup>4</sup>, Ushakova A<sup>5</sup>, Søreide E<sup>6,7</sup>, Bjørshol CA<sup>7,8,9</sup>.

#### **Abstract**

**AIM:** To assess the factors associated with the knowledge and expectations among the general public regarding dispatcher assistance in out-of-hospital cardiac arrest incidents.

**BACKGROUND:** In medical dispatch centres, emergency calls are frequently operated by specially trained nurses as dispatchers. In cardiac arrest incidents, efficient communication between the dispatcher and the caller is vital for prompt recognition and treatment of the cardiac arrest.

**DESIGN:** A cross-sectional observational survey containing six questions and seven demographic items.

**METHOD:** From January - June 2017 we conducted standardised interviews among 500 members of the general public in Norway. In addition to explorative statistical methods, we used multivariate logistic analysis.

**RESULTS:** Most participants expected cardiopulmonary resuscitation instructions, while few expected "help in deciding what to do". More than half regarded the bystanders present to be responsible for the decision to initiate cardiopulmonary resuscitation. Most participants were able to provide the correct emergency medical telephone number. The majority knew that the emergency call would not be terminated until the ambulance arrived at the scene. However, only one-third knew that the emergency telephone number operator was a trained nurse.

**CONCLUSION:** The public expect cardiopulmonary resuscitation instructions from the emergency medical dispatcher. However, the majority assume it is the responsibility of the bystanders to make the decision to initiate CPR or not. Based on these findings, cardiopulmonary resuscitation training initiatives and public campaigns should focus more on the role of the emergency medical dispatcher as the team leader of the first resuscitation team in cardiac arrest incidents.

2. *J Am Heart Assoc*. 2018 Sep 18;7(18):e009873. doi: 10.1161/JAHA.118.009873.

## **Association of Bystander and First-Responder Efforts and Outcomes According to Sex: Results From the North Carolina HeartRescue Statewide Quality Improvement Initiative.**

Malta Hansen C1,2,3, Kragholm K1, Dupre ME1,4, Pearson DA5, Tyson C1,6, Monk L1, Rea TD7, Starks MA1, Nelson D8, Jollis JG1, McNally B9,10, Corbett CM11, Granger CB1.

### **Abstract**

**Background** The Institute of Medicine has called for actions to understand and target sex-related differences in care and outcomes for out-of-hospital cardiac arrest patients. We assessed changes in bystander and first-responder interventions and outcomes for males versus females after statewide efforts to improve cardiac arrest care. **Methods and Results** We identified out-of-hospital cardiac arrests from North Carolina (2010-2014) through the CARES (Cardiac Arrest Registry to Enhance Survival) registry. Outcomes for men versus women were examined through multivariable logistic regression analyses adjusted for (1) nonmodifiable factors (age, witnessed status, and initial heart rhythm) and (2) nonmodifiable plus modifiable factors (bystander cardiopulmonary resuscitation and defibrillation before emergency medical services), including interactions between sex and time (ie, year and year<sup>2</sup>). Of 8100 patients, 38.1% were women. From 2010 to 2014, there was an increase in bystander cardiopulmonary resuscitation (men, 40.5%-50.6%; women, 35.3%-51.8%; *P* for each <0.0001) and in the combination of bystander cardiopulmonary resuscitation and first-responder defibrillation (men, 15.8%-23.0%, *P*=0.007; women, 8.5%-23.7%, *P*=0.004). From 2010 to 2014, the unadjusted predicted probability of favorable neurologic outcome was higher and increased more for men (men, from 6.5% [95% confidence interval (CI), 5.1-8.0] to 9.7% [95% CI, 8.1-11.3]; women, from 6.3% [95% CI, 4.4-8.3] to 7.4% [95% CI, 5.5-9.3%]); while adjusted for nonmodifiable factors, it was slightly higher but with a nonsignificant increase for women (from 9.2% [95% CI, 6.8-11.8] to 10.2% [95% CI, 8.0-12.5]; men, from 5.8% [95% CI, 4.6-7.0] to 8.4% [95% CI, 7.1-9.7]). Adding bystander cardiopulmonary resuscitation and defibrillation before EMS (modifiable factors) did not substantially change the results. **Conclusions** Bystander and first-responder interventions increased for men and women, but outcomes improved significantly only for men. Additional strategies may be necessary to improve survival among female cardiac arrest patients.

### **Free Article**

3. *J Am Heart Assoc.* 2018 Aug 21;7(16):e009831. doi: 10.1161/JAHA.118.009831.

## **Improvement in Non-Traumatic, Out-Of-Hospital Cardiac Arrest Survival in Detroit From 2014 to 2016.**

May S1, Zhang L2, Foley D1, Brennan E1, O'Neil B1, Bork E1, Levy P1, Dunne R1.

### **Abstract**

**Background** In 2002, the out-of-hospital cardiac arrest (OHCA) survival rate in Detroit was the lowest in the nation. Concerted efforts sought to improve the city's chain of survival with a focus on emergency medical services (EMS). This study assesses the impact on OHCA survival rates and describe factors associated with survival. **Methods and Results** Data for non-traumatic OHCA cases in Detroit from 2014 to 2016 were extracted from CARES (Cardiac Arrest Registry to Enhance Survival). Chi-squared tests, non-parametric tests, and a multivariable logistic regression analysis were employed to examine the associations between overall survival and its covariates. A total of 2359 non-traumatic OHCA cases were examined. The overall survival rate increased from 3.7% in 2014 to 5.4% in 2015, and 6.4% in 2016 (*P*<0.01), reflecting a 73% improvement in survival over the 3-year period. EMS median on-scene time decreased over the study period, while the rate at which EMS initiated cardiopulmonary resuscitation and applied an automated external defibrillator (AED) greatly increased (*P*<0.001). The factors significantly associated with survival were female sex (odds

ratio=1.70,  $P < 0.05$ ), a public setting (odds ratio=2.31,  $P < 0.01$ ), an EMS witness (odds ratio=6.18,  $P < 0.01$ ), and the presence of an initial shockable rhythm (odds ratio=1.88,  $P < 0.05$ ). Conclusions From 2014 to 2016, the overall survival rate for OHCA patients in Detroit, MI significantly improved. Our results suggest that an improved chain of survival may explain this progress. This study is an example of how OHCA data analysis and EMS improvement can improve end OHCA outcomes in a resource-limited urban setting.

#### **FREE ARTICLE**

4. **Medicine** (Baltimore). 2018 Nov;97(44):e13070. doi: 10.1097/MD.0000000000013070.

#### **Difference of achievements between physicians from public hospitals and emergency medical center in prehospital emergency.**

Ni T1, Chen M1, Zhou W1, Zhao J2, Jia D2.

#### **Abstract**

The benefit gained by replacing physicians in the prehospital service is still controversial. The present study compared the difference of achievements of pre-hospital emergency between the physicians from public hospitals and those from the Emergency Medical Center. We included prehospital emergency patients who were sent to the hospital by ambulance after emergency calls from February 1 to May 31, 2016, in Shanghai (24,250,000 inhabitants). Cohort characteristics and diagnoses were described, and the data were analyzed using the Shanghai Emergency Medical Center's database software. We determined whether the physicians from public hospitals were associated with greater success rate of cardiopulmonary resuscitation (CPR) and examined the diseases category and the number of patients with cardiac arrest in prehospital emergency patients. During February 1, 2016, to May 31, 2016, the total turnout of ambulances in the urban area of Shanghai was 107,341 times, among which, first aid was 55,053 times. The number of patients with cardiac arrest was 3012, the 3 principal causes for cardiac arrest were Unknown diagnosis (45.19%), Cardiovascular disease (28.02%) and Respiratory diseases (11.09%), and the successful rate of CPR was 1.56%. The number of critically ill patients, encountered by the physicians from public hospitals, was 10.33% as compared to those from the Emergency Medical Center, which was 11.77% ( $P < .001$ ). Although the success rate of CPR of the physicians from public hospitals was lower than that of the physicians from the Emergency Medical Center (1.22-1.58%), it did not achieve statistical significance ( $P > .05$ ). Transferring the physicians from public hospitals to work in Emergency Medical Center showed no improvement in the success rates of resuscitation.

#### **Free Article**

#### **FEEDBACK**

1. **Sci Rep**. 2018 Oct 29;8(1):15964. doi: 10.1038/s41598-018-34367-x.

#### **Quantitative pupillometry and neuron-specific enolase independently predict return of spontaneous circulation following cardiogenic out-of-hospital cardiac arrest: a prospective pilot study.**

Yokobori S1, Wang KKK2, Yang Z2, Zhu T2,3, Tyndall JA4, Mondello S5,6, Shibata Y7,8, Tominaga N7, Kanaya T 7, Takiguchi T7, Igarashi Y7, Hagiwara J7, Nakae R7, Onda H7, Masuno T7, Fuse A7, Yokota H7.

## Abstract

This study aimed to identify neurological and pathophysiological factors that predicted return of spontaneous circulation (ROSC) among patients with out-of-hospital cardiac arrest (OHCA). This prospective 1-year observational study evaluated patients with cardiogenic OHCA who were admitted to a tertiary medical center, Nippon Medical School Hospital. Physiological and neurological examinations were performed at admission for quantitative infrared pupillometry (measured with NPi-200, NeurOptics, CA, USA), arterial blood gas, and blood chemistry. Simultaneous blood samples were also collected to determine levels of neuron-specific enolase (NSE), S-100b, phosphorylated neurofilament heavy subunit, and interleukin-6. In-hospital standard advanced cardiac life support was performed for 30 minutes. The ROSC (n = 26) and non-ROSC (n = 26) groups were compared, which revealed significantly higher pupillary light reflex ratio, which was defined as the percent change between maximum pupil diameter before light stimuli and minimum pupil diameter after light stimuli, in the ROSC group (median: 1.3% [interquartile range (IQR): 0.0-2.0%] vs. non-ROSC: (median: 0%), (Cut-off: 0.63%). Furthermore, NSE provided the great sensitivity and specificity for predicting ROSC, with an area under the receiver operating characteristic curve of 0.86, which was created by plotting sensitivity and 1-specificity. Multivariable logistic regression analyses revealed that the independent predictors of ROSC were maximum pupillary diameter (odds ratio: 0.25, 95% confidence interval: 0.07-0.94, P = 0.04) and NSE at admission (odds ratio: 0.96, 95% confidence interval: 0.93-0.99, P = 0.04). Pupillary diameter was also significantly correlated with NSE concentrations (r = 0.31, P = 0.027). Conclusively, the strongest predictors of ROSC among patients with OHCA were accurate pupillary diameter and a neuronal biomarker, NSE. Quantitative pupillometry may help guide the decision to terminate resuscitation in emergency departments using a neuropathological rationale. Further large-scale studies are needed.

## FREE ARTICLE

### TRAUMA

1. **IEEE Trans Biomed Eng.** 2018 Nov 1. doi: 10.1109/TBME.2018.2878642. [Epub ahead of print]

#### **Automated Balloon Control in Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA).**

McCarthy C, Kanterman I, Trauzettel F, Jaeger HA, Goetz AA, Colvard B, Swanstrom L, Cantillon-Murphy P.

#### Abstract

**OBJECTIVE:** The goal of this work was to demonstrate technical feasibility of automated balloon pressure management during REBOA in the pre-clinical setting.

**METHODS:** This paper presents an intelligent balloon management device which automates the balloon inflation process, preventing the possibility of balloon over or under inflation, optimizes inflation pressure and if indicated, deflates automating partial REBOA to allow distal organ perfusion. Edwards TruWave pressure transducers are used to monitor the blood pressure proximal and distal to the balloon, as well as the internal balloon pressure. A faux PID controller, implemented on an Arduino platform, is used in a feedback control loop to allow a user defined mean arterial pressure setpoint to be reached, via a syringe driver which allows intelligent inflation and deflation of the catheter balloon.

**RESULTS:** Ex vivo testing on a vascular perfusion simulator provided the characteristic behavior of a fully occluded aorta, namely the decrease of distal pressure to zero. In vivo testing on live porcine models indicated that automated partial REBOA is achievable and by enabling partial occlusion may offer improved medical outcomes compared to manual control.

**CONCLUSION:** Automated balloon pressure management of endovascular occlusion is feasible and can be successfully implemented without changes on current clinical workflows.

**SIGNIFICANCE:** With further development, automated balloon management may significantly improve clinical outcomes in REBOA.

2. **World J Emerg Surg.** 2018 Oct 25;13:49. doi: 10.1186/s13017-018-0210-5. eCollection 2018.

**Effect of resuscitative endovascular balloon occlusion of the aorta in hemodynamically unstable patients with multiple severe torso trauma: a retrospective study.**

Otsuka H1, Sato T1, Sakurai K1, Aoki H1, Yamagiwa T1, Iizuka S1, Inokuchi S1.

**Abstract**

**Background:** Although resuscitative endovascular balloon occlusion of the aorta (REBOA) may be effective in trauma management, its effect in patients with severe multiple torso trauma remains unclear.

**Methods:** We performed a retrospective study to evaluate trauma management with REBOA in hemodynamically unstable patients with severe multiple trauma. Of 5899 severe trauma patients admitted to our hospital between January 2011 and January 2018, we selected 107 patients with severe torso trauma (Injury Severity Score > 16) who displayed persistent hypotension [ $\geq 2$  systolic blood pressure (SBP) values  $\leq 90$  mmHg] regardless of primary resuscitation. Patients were divided into two groups: trauma management with REBOA (n = 15) and without REBOA (n = 92). The primary endpoint was the effectiveness of trauma management with REBOA with respect to in-hospital mortality. Secondary endpoints included time from arrival to the start of hemostasis. Multivariable logistic regression analysis, adjusted for clinically important variables, was performed to evaluate clinical outcomes.

**Results:** Trauma management with REBOA was significantly associated with decreased mortality (adjusted odds ratio of survival, 7.430; 95% confidence interval, 1.081-51.062; p = 0.041). The median time (interquartile range) from admission to initiation of hemostasis was not significantly different between the two groups [with REBOA 53.0 (40.0-80.3) min vs. without REBOA 57.0 (35.0-100.0) min]. The time from arrival to the start of balloon occlusion was  $55.7 \pm 34.2$  min. SBP before insertion of REBOA was  $48.2 \pm 10.5$  mmHg. Total balloon occlusion time was  $32.5 \pm 18.2$  min.

**Conclusions:** The use of REBOA without a delay in initiating resuscitative hemostasis may improve the outcomes in patients with multiple severe torso trauma. However, optimal use may be essential for success.

**VENTILATION**

1. **Resuscitation.** 2018 Oct 29. pii: S0300-9572(18)30984-5. doi: 10.1016/j.resuscitation.2018.10.005. [Epub ahead of print]

**Comparison of video laryngoscopy versus direct laryngoscopy for intubation in emergency department patients with cardiac arrest: A multicentre study.**

Okamoto H1, Goto T2, Wong ZSY1, Hagiwara Y3, Watase H4, Hasegawa K5; Japanese Emergency Medicine Network investigators.

## Abstract

**AIM:** To compare the tracheal intubation performance between video laryngoscopy (VL) and direct laryngoscopy (DL) in patients with cardiac arrest in the ED.

**METHODS:** This is an analysis of the data from a prospective, multicentre study of 15 EDs in Japan. We included consecutive adult patients with cardiac arrest who underwent intubation with VL or DL from 2012 through 2016. The primary outcome was first-attempt success. The secondary outcomes were glottic visualisation assessed with Cormack grade (1 vs. 2-4) and occurrence of oesophageal intubation. To examine the between-device difference in outcome risks, we analysed the whole data and 1:1 propensity score matched data.

**RESULTS:** Among 9,694 patients who underwent intubation in the EDs, 3,360 cardiac arrests (35%) were included in the analysis (90% were non-traumatic cardiac arrests). The first-attempt success rate was higher in the VL group compared to those in the DL (78% vs 70%; unadjusted OR 1.61 [95%CI 1.26-2.06]  $P < 0.001$ ). This association remained significant after adjusting for six potential confounders and within-ED clustering (adjusted OR 1.33 [95%CI 1.03-1.73]  $P = 0.03$ ). VL use was also associated with a better glottic visualisation (adjusted OR 3.84 [95%CI 2.81-5.26]  $P < 0.001$ ) and lower rate of oesophageal intubation (adjusted OR 0.45 [95%CI 0.24-0.85]  $P = 0.01$ ) compared to DL. These results were consistent in the propensity score matched analysis.

**CONCLUSIONS:** Based on large multicentre prospective data of ED patients with cardiac arrest, the use of VL was associated with a higher first-attempt success rate compared to DL, with a better glottic visualisation and lower oesophageal intubation rate.

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## ORGANISATION AND TRAINING

1. **BMC Emerg Med.** 2018 Oct 29;18(1):37. doi: 10.1186/s12873-018-0190-5.

**Evaluation of public awareness, knowledge and attitudes towards basic life support: a cross-sectional study.**

Jarrah S1, Judeh M2, AbuRuz ME3,4.

## Abstract

**BACKGROUND:** Out-of-hospital cardiac arrest is a major cause of mortality worldwide. When basic life support techniques are implemented quickly, the chance of survival is doubled. Therefore, this study evaluated public awareness, knowledge and attitudes towards basic life support in Jordan.

**METHODS:** A descriptive, cross-sectional design with a convenience sample of 300 Jordanian adults aged over 18 years, recruited from three metropolitan areas in the northern, middle and southern regions.

**RESULTS:** A total of 87 participants (29%) stated that they have received training about cardiopulmonary resuscitation (CPR). Among them, 20 participants (23%) received their training through the media. The highest response rate for cardiac arrest signs was chest pain ( $n = 129$ , 43%). Participants who received training had greater knowledge of the three signs of consciousness evaluation. The numbers of participants who received training and performed chest compression, mouth-to-mouth ventilation, and both compression and ventilation were higher than those who did not receive training. Overall, 256 participants (88.3%) reported that they would perform CPR on



someone from their family without hesitation. The most important concern about performing CPR was making a mistake.

**CONCLUSIONS:** Improving knowledge about cardiopulmonary resuscitation is an important topic, which can be achieved by training the general population. Media can play an important role in this issue.

#### **Free Article**

2. **Resuscitation.** 2018 Oct 29. pii: S0300-9572(18)31064-5. doi: 10.1016/j.resuscitation.2018.10.029. [Epub ahead of print]

#### **A nationwide investigation of CPR courses, books, and skill retention.**

Jensen TW<sup>1</sup>, Møller TP<sup>2</sup>, Viereck S<sup>2</sup>, Roland J<sup>3</sup>, Pedersen TE<sup>4</sup>, Ersbøll AK<sup>5</sup>, Lassen JF<sup>6</sup>, Folke F<sup>2</sup>, Østergaard D<sup>7</sup>, Lippert FK<sup>8</sup>.

#### **Abstract**

**INTRODUCTION:** Survival from Out-of-Hospital Cardiac Arrest is highly associated with bystander cardiopulmonary resuscitation. The quality of bystander CPR is influenced by citizens attending Basic Life Support (BLS) courses and the quality of these courses. The purpose of the study was to investigate content, quality and compliance with the European Resuscitation Council (ERC) guidelines in national Danish BLS courses and the skill retention.

**METHOD:** Books from 16 different course providers were analyzed for compliance with guidelines using the principle of mutually exclusive and collectively exhaustive questioning. Observation of 56 BLS courses were conducted using an evaluation sheet, with a five-point Likert scale including theoretical, technical, and non-technical skills. BLS skills of participants were assessed with a follow-up test 4-6 months after a course using a modified Cardiff Test.

**RESULTS:** Analysis of the books, showed compliance with ERC guidelines of 69% on the examined items. Courses using ERC educational structure and having maximum six participants per instructor were associated with high quality in the course observations and a better follow-up test. Especially, the use of automated external defibrillator showed significant odds ratio (OR) of 21.8 (95% CI 4.1-114.7) to 31.3 (95% CI 3.7- 265.1) of achieving high quality on courses with similar results in the follow-up test.

**CONCLUSION:** National BLS courses had significant variation in the content of books, and compliance to ERC guidelines during courses and in skills retention 4-6 months after the courses. This study can be used to further improve and standardize BLS courses.

3. **JNMA J Nepal Med Assoc.** 2018 Jul-Aug;56(212):774-780.

#### **An Experience of Video Based Training on Basic Life Support.**

Shrestha R<sup>1</sup>, Shrestha A<sup>2</sup>, Batajoo KH<sup>3</sup>, Thapa R<sup>4</sup>, Acharya S<sup>2</sup>, Bajracharya S<sup>2</sup>, Singh S<sup>5</sup>.

#### **Abstract**

**INTRODUCTION:** Basic life support is foundation to save lives. In contrast to the developed countries, there is still no national standard BLS training module in Nepal. Basic life support training is being provided by various institutions but lack in consistency and coordination. The Nepal basic life support Course is the video based training in Nepali language with reference to recent advances which was intended for all health care personnel of Nepal in urban as well as rural setting. We aimed to describe the features of this video based training module in local language, to analyse the differences of knowledge before and after the training and to find out the participants perception and satisfaction with this course.

**METHODS:** This is a descriptive cross-sectional study based on data of trainings conducted over the study period. Ethical approval was taken. The post-test score was recorded and compared with the occupational using ANOVA. On the spot and delayed feedbacks from the participants were collected voluntarily and summarized.

**RESULTS:** Total of 576 participants (435 clinical doctors, 92 nurses/paramedics, 18 non-clinical doctors and 41 intern doctors) successfully completed the training. The difference in post test scores (mean = 12.9±1.8) among the different occupational background was not significant (P=0.159). The feedbacks from the participants were mostly positive and encouraging.

**CONCLUSIONS:** The knowledge of basic life support improved significantly irrespective of the occupation of the participants. A universal, nationwide video based training module in Nepali language should be developed focusing all health care personnel of urban as well rural Nepal.

## **CURES POST RCE**

1. **Resuscitation.** 2018 Oct 29. pii: S0300-9572(18)31063-3. doi: 10.1016/j.resuscitation.2018.10.028. [Epub ahead of print]

### **Detailed analysis of health-related quality of life after out-of-hospital cardiac arrest.**

Bohm M1, Lilja G2, Finnbogadóttir H3, Cronberg T 2, Undén J4, Friberg H5, Kjærgaard J6, Nielsen N7, Wise MP8, Åkerman Eg .

#### **Abstract**

**AIM:** To describe the detailed health-related quality of life (HRQoL) in survivors from the TTM-trial and to investigate potential differences related to sex and age.

**METHODS:** This is a cross-sectional study originating from a large prospective international, multicentre trial, including 442 respondents who answered the Short Form-36 item Questionnaire Health Survey version 2® (SF-36v2®) at a structured follow-up 6 months after out-of-hospital cardiac arrest (OHCA). Statistical analysis between independent groups were performed with Mann-Whitney U or Chi-square. Age was analysed primarily as a dichotomised variable.

**RESULTS:** Although overall physical and mental health were within the normal range, a substantial proportion of respondents had impaired function at domain-specific levels, particularly in Role-Physical (50%) and Role-Emotional (35%). Females scored significantly lower than males in; Physical Functioning (41.7 vs. 47.9,  $p < 0.001$ ), Role-Physical (40.4 vs. 44.3,  $p = 0.02$ ), General Health (47.0 vs. 50.5,  $p = 0.02$ ), Vitality (47.2 vs. 52.7,  $p < 0.001$ ), and Role-Emotional (41.5 vs. 46.2,  $p = 0.009$ ). Those  $\leq 65$  years scored significantly better in Physical Functioning (47.9 vs. 44.1  $p < 0.001$ ), while those  $> 65$  years scored significantly better in Vitality (50.8 vs. 53.7,  $p = 0.006$ ) and Mental Health (50.3 vs. 52.6,  $p = 0.04$ ).

CONCLUSIONS: Many OHCA survivors demonstrated impaired function in HRQoL at a domain level, despite most patients reporting an acceptable general HRQoL. Females reported worse HRQoL than males. Older age was associated with a worse Physical Functioning but better Vitality and Mental Health. Role-Physical and Role-Emotional aspects of health were especially affected, even when effects of age and sex were accounted for.

2. **JAMA Neurol.** 2018 Oct 29. doi: 10.1001/jamaneurol.2018.3223. [Epub ahead of print]

### **Serum Neurofilament Light Chain for Prognosis of Outcome After Cardiac Arrest.**

Moseby-Knappe M1, Mattsson N1,2, Nielsen N3, Zetterberg H4,5, 6,7, Blennow K4,5, Dankiewicz J8, Dragancea I1, Friberg H9, Lilja G1, Insel PS2, Rylander C10, Westhall E11, Kjaergaard J12, Wise MP13, Hassager C12, Kuiper MA 14, Stammet P15, Wanscher MCJ16, Wetterslev J17, Erlinge D8, Horn J18, Pellis T19, Cronberg T1.

#### **Abstract**

**Importance:** Prognostication of neurologic outcome after cardiac arrest is an important but challenging aspect of patient therapy management in critical care units.

**Objective:** To determine whether serum neurofilament light chain (NFL) levels can be used for prognostication of neurologic outcome after cardiac arrest.

**Design, Setting and Participants:** Prospective clinical biobank study of data from the randomized Target Temperature Management After Cardiac Arrest trial, an international, multicenter study with 29 participating sites. Patients were included between November 11, 2010, and January 10, 2013. Serum NFL levels were analyzed between August 1 and August 23, 2017, after trial completion. A total of 782 unconscious patients with out-of-hospital cardiac arrest of presumed cardiac origin were eligible.

**Exposures:** Serum NFL concentrations analyzed at 24, 48, and 72 hours after cardiac arrest with an ultrasensitive immunoassay.

**Main Outcomes and Measures:** Poor neurologic outcome at 6-month follow-up, defined according to the Cerebral Performance Category Scale as cerebral performance category 3 (severe cerebral disability), 4 (coma), or 5 (brain death).

**Results:** Of 782 eligible patients, 65 patients (8.3%) were excluded because of issues with aliquoting, missing sampling, missing outcome, or transport problems of samples. Of the 717 patients included (91.7%), 580 were men (80.9%) and median (interquartile range [IQR]) age was 65 (56-73) years. A total of 360 patients (50.2%) had poor neurologic outcome at 6 months. Median (IQR) serum NFL level was significantly increased in the patients with poor outcome vs good outcome at 24 hours (1426 [299-3577] vs 37 [20-70] pg/mL), 48 hours (3240 [623-8271] vs 46 [26-101] pg/mL), and 72 hours (3344 [845-7838] vs 54 [30-122] pg/mL) ( $P < .001$  at all time points), with high overall performance (area under the curve, 0.94-0.95) and high sensitivities at high specificities (eg, 69% sensitivity with 98% specificity at 24 hours). Serum NFL levels had significantly greater performance than the other biochemical serum markers (ie, tau, neuron-specific enolase, and S100). At comparable specificities, serum NFL levels had greater sensitivity for poor outcome compared with routine electroencephalogram, somatosensory-evoked potentials, head computed tomography, and both pupillary and corneal reflexes (ranging from 29.2% to 49.0% greater for serum NFL level).

**Conclusions and Relevance:** Findings from this study suggest that the serum NFL level is a highly predictive marker of long-term poor neurologic outcome at 24 hours after cardiac arrest and may be a useful complement to currently available neurologic prognostication methods.

## TARGET TEMPERATURE MANAGEMENT

1. *Ther Hypothermia Temp Manag.* 2018 Mar;8(1):18-23. doi: 10.1089/ther.2017.0023. Epub 2017 Sep 5.

### **The Effects of In-Hospital Intravenous Cold Saline in Postcardiac Arrest Patients Treated with Targeted Temperature Management.**

Suppogu N1, Panza GA1,2, Kilic S1, Gowdar S1, Kallur KR3, Jayaraman R4, Lundbye J5, Fernandez AB1.

#### **Abstract**

**BACKGROUND:** Recent data suggest that rapid infusion of intravenous (IV) cold saline for Targeted Temperature Management (TTM) after cardiac arrest is associated with higher rates of rearrest, pulmonary edema, and hypoxia, with no difference in neurologic outcomes or survival when administered by Emergency Medical Services. We sought to determine the effects of IV cold saline administration in the hospital setting in postcardiac arrest patients to achieve TTM and its effect on clinical parameters and neurologic outcomes.

**METHODS AND RESULTS:** A cohort of 132 patients who completed TTM after cardiac arrest in a single institution was retrospectively studied. Patients who did not receive cold saline were matched by age, gender, Glasgow coma scale, downtime, and presenting rhythm to patients who received cold saline. Demographics, cardiac rearrest, diuretic use, time to target temperature, and Cerebral Performance Category (CPC) scores were recorded among other variables. Patients who received cold saline achieved target temperature sooner (280 vs. 345 minutes,  $p = 0.05$ ), had lower lactate levels on day 1 ( $4.2 \pm 3.5$  mM vs.  $6.0 \pm 4.9$  mM,  $p = 0.019$ ) and day 2 ( $1.3 \pm 2.2$  mM vs.  $2.2 \pm 3.2$  mM,  $p = 0.046$ ), increased incidence of pulmonary edema (51.5% vs. 31.8%,  $p = 0.006$ ), and increased diuretic utilization (63.6% vs. 42.4%,  $p = 0.014$ ). There was no significant difference in cardiac rearrest, arterial oxygenation, and CPC scores ( $ps > 0.05$ ).

**CONCLUSIONS:** Infusion of IV cold saline is associated with shorter time to target temperature, increased incidence of pulmonary edema, and diuretic use, with no difference in cardiac rearrest, survival, and neurologic outcomes.

2. *Ther Hypothermia Temp Manag.* 2018 Oct 30. doi: 10.1089/ther.2018.0029. [Epub ahead of print]

### **Predictors of Futility in Near-Hanging and Therapeutic Hypothermia.**

Udekwa P1, Vincent R1, Petrarca D1, Farrell M1, Roy S1.

Author information:

1. WPP General Surgery/Trauma, WakeMed Health and Hospitals, Raleigh, North Carolina.

#### **Abstract**

Favorable neurologic outcomes have been reported in near-hanging (NH) victims treated with therapeutic hypothermia (TH), but variable methods and small samples sizes limit interpretability. This study examines the relationship between clinical predictors, TH, and outcomes in NH patients. A risk profile was created by examining relationships between variables. Categorical predictors were assessed with chi-square tests and continuous variables were assessed with t-tests. Logistic regression was conducted to evaluate the unique effect of TH. Thirty-seven NH patients were treated, 22 with

cardiac arrest (CA). Poor outcome was significantly associated with age, Glasgow Coma Scale-Motor (GCS-M), pupillary response, and out-of-hospital CA (OHCA) ( $p$ 's < 0.02). Patients with poor neurologic outcomes were older ( $M = 40.2$  vs.  $M = 27.6$ ) and had lower GCS-M scores ( $M = 1.1$  vs.  $M = 4.1$ ). Poor outcome probability was 76% in patients with GCS-M <3, 100% with nonreactive pupils, and 72.1% with OHCA. TH was associated with a worse outcome overall that was not significant after adjusting for GCS-M. Our study demonstrates no impact of TH on NH outcome when controlling for variables associated with poor outcome and relative certainty of poor outcome with CA, GCS-M 1, and nonreactive pupils. Study findings could assist in decisions on the utilization of TH.

## **ELECTROFISIOLOGIA I DESFIBRIL·LACIÓ**

1. **IEEE Trans Biomed Eng.** 2018 Oct 31. doi: 10.1109/TBME.2018.2878910. [Epub ahead of print]

### **A Machine Learning Shock Decision Algorithm for use during Piston-driven Chest Compressions.**

Isasi I, Irusta U, Elola A, Aramendi E, Ayala U, Alonso E, Kramer-Johansen J, Eftestol T.

#### **Abstract**

**GOAL:** Accurate shock decision methods during piston-driven cardiopulmonary resuscitation (CPR) would contribute to improve therapy and increase cardiac arrest survival rates. The best current methods are computationally demanding, and their accuracy could be improved. The objective of this work was to introduce a computationally efficient algorithm for shock decision during piston-driven CPR with increased accuracy.

**METHODS:** The study dataset contains 201 shockable and 844 nonshockable ECG segments from 230 cardiac arrest patients treated with the LUCAS 2 mechanical CPR device. Compression artifacts were removed using state of the art adaptive filters, and shock/no-shock discrimination features were extracted from the stationary wavelet transform analysis of the filtered ECG, and fed to a support vector machine (SVM) classifier. Quasi-stratified patient wise nested cross-validation was used for feature selection and SVM hyperparameter optimization. The procedure was repeated 50 times to statistically characterize the results.

**RESULTS:** Best results were obtained for a 6 feature classifier with mean (standard deviation) sensitivity, specificity, and total accuracy of 97.5 (0.4), 98.2 (0.4) and 98.1 (0.3), respectively. The algorithm presented a five-fold reduction in computational demands when compared to the best available methods, while improving their balanced accuracy by 3-points.

#### **CONCLUSIONS:**

The accuracy of the best available methods was improved while drastically reducing the computational demands.

**SIGNIFICANCE:** An efficient and accurate method for shock decisions during mechanical CPR is now available to improve therapy and contribute to increase cardiac arrest survival.

## **PEDIATRIA**

1. **Heart Rhythm.** 2018 Jan;15(1):116-121. doi: 10.1016/j.hrthm.2017.08.014. Epub 2017 Aug 18.

### **Pediatric survivors of out-of-hospital ventricular fibrillation: Etiologies and outcomes.**

Silka MJ1, Kobayashi RL2, Hill AC2, Bar-Cohen Y2.

Comment in: Out-of-hospital cardiac arrest due to ventricular fibrillation in children-A call to action. [Heart Rhythm. 2018]

### **Abstract**

**BACKGROUND:** In general, the prognosis is poor for pediatric patients who experience out-of-hospital (OOH) cardiac arrest, with survival rates of 12% to 29%.

**OBJECTIVE:** The purpose of this study was to describe the causes and outcomes of pediatric patients with documented ventricular fibrillation (VF) at resuscitation from OOH cardiac arrest with sustained return of spontaneous circulation after defibrillation and survival to hospital admission.

**METHODS:** Retrospective analysis of OOH-VF patients <19 years of age evaluated between 2004 and 2016 was performed. Primary outcome measures included demographics, arrest and resuscitation parameters, cardiac diagnoses, survival, and neurologic outcome.

**RESULTS:** Forty-five patients fulfilled study criteria (median age 12 years; range 2 months to 18 years). Cardiac arrest occurred in public in 68% of cases, with bystander cardiopulmonary resuscitation in 42% before arrival of emergency medical services. All patients underwent defibrillation (1-6 shocks) with return of spontaneous circulation and survival to hospital admission. Underlying etiologies were primary electrical disease (33%), cardiomyopathy (27%), congenital heart disease (11%), other (13%), and unknown (16%). Before arrest, 40% of patients had a cardiac diagnosis and 26% had symptoms. Ultimately, 40 of 45 patients (89%) survived resuscitation to hospital discharge. During  $72 \pm 37$  months of follow-up, 38% of survivors had a normal neurologic outcome, whereas 32% had mild neurologic impairment and 30% had moderate-to-severe neurologic impairment.

**CONCLUSION:** In pediatric patients resuscitated from OOH-VF, a cardiovascular cause was identified in >80%. Regardless of cause, survival and neurologic prognosis appear improved compared to patients with asystole or pulseless electrical activity. These findings support early rhythm assessment and advanced cardiopulmonary resuscitation protocols in pediatric cardiac arrest victims.

### **RECERCA EXPERIMENTAL**

1. Ther Hypothermia Temp Manag. 2018 Jun;8(2):108-116. doi: 10.1089/ther.2017.0020. Epub 2018 Feb 26.

### **Precise Control of Target Temperature Using N6-Cyclohexyladenosine and Real-Time Control of Surface Temperature.**

Laughlin BW1,2, Bailey IR1,2, Rice SA1,2, Barati Z1, Bogren LK1, Drew KL1,2.

### **Abstract**

Targeted temperature management is standard of care for cardiac arrest and is in clinical trials for stroke. N6-cyclohexyladenosine (CHA), an A1 adenosine receptor (A1AR) agonist, inhibits thermogenesis and induces onset of hibernation in hibernating species. Despite promising thermolytic efficacy of CHA, prior work has failed to achieve and maintain a prescribed target core body temperature (Tb) between 32°C and 34°C for 24 hours. We instrumented Sprague-Dawley rats (n = 19) with indwelling arterial and venous cannulae and a transmitter for monitoring Tb and ECG, then

administered CHA via continuous IV infusion or intraperitoneal (IP) injection. In the first experiment (n = 11), we modulated ambient temperature and increased the dose of CHA in an attempt to manage Tb. In the second experiment (n = 8), we administered CHA (0.25 mg/[kg·h]) via continuous IV infusion and modulated cage surface temperature to control Tb. We rewarmed animals by increasing surface temperature at 1°C h<sup>-1</sup> and discontinued CHA after Tb reached 36.5°C. Tb, brain temperature (T<sub>brain</sub>), heart rate, blood gas, and electrolytes were also monitored. Results show that titrating dose to adjust for individual variation in response to CHA led to tolerance and failed to manage a prescribed Tb. Starting with a dose (0.25 mg/[kg·h]) and modulating surface temperature to prevent overcooling proved to be an effective means to achieve and maintain Tb between 32°C and 34°C for 24 hours. Increasing surface temperature to 37°C during CHA administration brought Tb back to normothermic levels. All animals treated in this way rewarmed without incident. During the initiation of cooling, we observed bradycardia within 30 minutes of the start of IV infusion, transient hyperglycemia, and a mild hypercapnia; the latter normalized via metabolic compensation. In conclusion, we describe an intravenous delivery protocol for CHA at 0.25 mg/(kg·h) that, when coupled with conductive cooling, achieves and maintains a prescribed and consistent target Tb between 32°C and 34°C for 24 hours.

2. Ther Hypothermia Temp Manag. 2018 Mar;8(1):45-52. doi: 10.1089/ther.2017.0031. Epub 2017 Nov 3.

### **Feasibility Study of a Novel High-Flow Cold Air Cooling Protocol of the Porcine Brain Using MRI Temperature Mapping.**

Sedlacik J1, Kjørstad Å1, Nagy Z1, Buhk JH 1, Behem CR2, Trepte CJ2, Fiehler J1, Temme F1.

#### **Abstract**

Early, prehospital cooling seeks to reduce and control the body temperature as early as possible to protect the brain and improve patient outcome in cardiac arrest, stroke, and traumatic brain injury. In this study, we investigate the feasibility of localized cooling of the porcine brain by using a novel high-flow cold air protocol, which utilizes the close proximity between the nasal cavity and the brain. Five adult pigs were anesthetized and temperature change was mapped before, during, and after cooling by using the proton resonance frequency method on a 3 T Siemens Magnetom Skyra system. Cooling was performed by inserting a tube blowing high-flow (250 L/min) cold air (-10°C) through the nasal cavity for 5-20 minutes. The brain temperature change was measured by using an MRI phase mapping technique utilizing the temperature-dependent proton resonance frequency change. MRI maps showed significant temperature reduction of the porcine brain. On average, a mean whole-brain cooling effect of  $-0.33^{\circ}\text{C} \pm 0.30^{\circ}\text{C}$  was found after 5 minutes of cooling. The anterior part of the brain was directly exposed to the cold and showed a significantly larger temperature drop ( $-0.83^{\circ}\text{C} \pm 0.51^{\circ}\text{C}$ ) than the posterior part ( $-0.03^{\circ}\text{C} \pm 0.21^{\circ}\text{C}$ ). However, a large variability of the temperature drop was observed between the animals. This variability may be caused by not well-controlled factors confounding the MRI temperature mapping, for example, subject movement, or cooling effectiveness, for example, core temperature or nasal patency. The results indicate that the proposed high-flow cold air protocol allows for localized cooling of the frontal porcine brain, which may be clinically relevant for traumatic injuries of the frontal brain where systemic cooling is unfavorable

3. Ther Hypothermia Temp Manag. 2018 Jun;8(2):76-82. doi: 10.1089/ther.2017.0032. Epub 2017 Oct 16.

### **The Molecular Mechanism and Neuroprotective Effect of Dihydrocapsaicin-Induced Mild Hypothermia After Cardiopulmonary Resuscitation in Rats.**

Zhong X1, Wang X1, Fei F2,3, Zhang M1, Ding P1, Zhang S3.

#### **Abstract**

To investigate the molecular mechanism of dihydrocapsaicin (DHC)-induced mild hypothermia in rats, and to compare its protective effect on the central nervous system with that of a conventional method of inducing hypothermia, 24 healthy male Sprague Dawley rats were randomly divided into four groups based on the following conditions: control group, cardiopulmonary resuscitation (CPR) group, body surface cooling group, and DHC group. Tracheal clipping was used to mimic asphyxia arrest. Rats were assessed for their neurological deficit scores. After sacrifice, immunohistochemical staining was used to examine caspase-3 expression in the cerebral cortex and TRPV1 (transient receptor potential vanilloid subfamily, member 1) expression in the hypothalamus. Terminal TdT-mediated dUTP-biotin nick end labeling (TUNEL) staining was used to evaluate cell apoptosis in the cerebral cortex. Furthermore, intracellular Ca<sup>2+</sup> concentration in the hypothalamus and arginine vasopressin (AVP) concentration in ventral septal tissues were also detected in these four groups. Results of our study showed that neurological deficit scores in the DHC group were significantly higher than those in the CPR and body surface cooling groups ( $p < 0.05$ ). Caspase-3 expression in the cerebral cortex of control group rats was significantly lower than that in other three groups ( $p < 0.05$ ). Hypothalamic TRPV1 expression, hypothalamic intracellular Ca<sup>2+</sup> concentration, and AVP concentration in the ventral septum in the DHC group were significantly higher than that in the other three groups ( $p < 0.05$ ). Within these three groups, there were significantly fewer apoptotic cells in the DHC and body surface cooling group rats than in the CPR group rats ( $p < 0.05$ ). DHC has the neuroprotective effect. DHC induced mild hypothermia and reduces apoptosis through a mechanism whereby DHC activates TRPV1 on hypothalamic cells to cause a large Ca<sup>2+</sup> influx, which alters corresponding physiological functions and causes the release of AVP to induce hypothermia.

4. Intensive Care Med Exp. 2018 Nov 1;6(1):45. doi: 10.1186/s40635-018-0211-4.

#### **A novel selective cooling system for the brain: feasibility study in rabbits vs piglets.**

Fazel Bakhsheshi M<sup>1,2</sup>, Keenlside L<sup>3</sup>, Lee TY<sup>3,4,5</sup>.

#### **Abstract**

**BACKGROUND:** Selective brain cooling (SBC) methods could alleviate the complications associated with systemic hypothermia. The authors (MFB, LK, and T-YL) have developed a simple and an effective nasopharyngeal SBC method using a vortex tube. The primary focus of the study is to evaluate the effectiveness of this approach on rabbits and compare it with our previous published finding on piglets, which are mammals without and with a carotid rete, respectively.

**METHODS:** Experiments were conducted on six rabbits. Body temperature was measured continuously using an esophageal temperature probe while brain temperature was measured with an implanted thermometer. Two successive experiments were performed on each animal. In the first experiment, brain cooling was initiated by blowing room temperature air from the hospital medical air outlet, at a flow rate of 14-15 L/min into both nostrils for 60 min. The second series of measurements and brain cooling was performed in the same manner as the first one but blowing cold air (-7 °C) at the same flow rate.

**RESULTS:** One hour post cooling with room temperature air at a flow rate of 14-15 L/min, the brain temperature was  $34.2 \pm 1.2$  °C which resulted in mean brain cooling rates of  $3.7 \pm 0.9$  °C/h. Brain temperature could be reduced more rapidly at mean rates of  $5.2 \pm 1.9$  °C/h, while the body temperature as measured by the esophageal temperature probe was maintained above 36 °C during cooling and maintaining period.

**CONCLUSIONS:** We have demonstrated that using the vortex tube allows initial rapid and SBC in rabbits. Moreover, comparing results between piglets and rabbits demonstrates clearly that the lack of a carotid rete does not prevent specific cooling of the brain by means of the nasopharyngeal method.



