

# RPC I COMPRESSIONS TORÀCIQUES MECÀNIQUES

1. Croat Med J. 2019 Aug 31;60(4):325-332.

**Cardiopulmonary resuscitation performed by trained providers and shorter time to emergency medical team arrival increased patients' survival rates in Istra County, Croatia: a retrospective study.**

Bakran K, Šribar A, Šerić M, Antić-Šego G, Božić MA, Prijjić A, Lacković T, Peršec J(1).

## Abstract

**AIM:** To assess the effect of the time for emergency medical services (EMS) arrival on resuscitation outcome in the transition period of the EMS system in Istra County. **METHODS:** This retrospective study analyzed the data from 1440 patients resuscitated between 2011 and 2017. The effect of demographic data, period of the year, time for EMS arrival, initial cardiopulmonary resuscitation (CPR) provider, initial cardiac rhythm, and airway management method on CPR outcome was assessed with multivariate logistic regression. **RESULTS:** Survivors were younger than non-survivors (median of 66 vs 70 years,  $P < 0.001$ ) and had shorter time for EMS arrival (median of 6 vs 8 min,  $P < 0.001$ ). The proportion of non-survivors was significantly higher when initial basic life support (BLS) was performed by bystanders without training (83.8%) or when no CPR was performed before EMS team arrival (87.3%) than when BLS was performed by medical professionals (66.8%) ( $P < 0.001$ ). Sex, airway management, and tourist season had no effect on CPR outcome. **CONCLUSION:** Since the time for arrival and level of CPR provider training showed a significant effect on CPR outcome, further organizational effort should be made to reduce the time for EMS arrival and increase the number of individuals trained in BLS.

## FREE FULL TEXT

2. Acta Biomed. 2019 Sep 13;90(9-5):64-70. doi: 10.23750/abm.v90i9-5.8710.

**Out-of-hospital cardiac arrest (OHCA) Survey in Lombardy: data analysis through prospective short time period assessment.**

Villa GF(1), Kette F, Balzarini F, Riccò M, Manera M, Solaro N, Pagliosa A, Zoli A, Migliori M, Sechi GM, Odone A, Signorelli C.

## Abstract

**BACKGROUND AND AIM OF THE WORK:** The results of out-of-hospital cardiac arrests (OHCA) are usually reported through data collected collected via "ad hoc" registries, but in large populations, samples of short time periods can be used to apply the results to the entire population. We would like to describe the situation of Lombardy to provide evidence on successful procedures, which may be carried out in a larger context. **METHODS:** Observational, prospective, analytical, single cohort study in Lombardy population. Data of OHCA of cardiac aetiology, according to "Utstein Style", with resuscitation attempts started by the Emergency Medical Service (EMS), were collected for 40 days subdivided in 10-day-periods in all seasons 2014-15 via Operating System "Emergency Management" (EmMa). **RESULTS:** Of 1219 cases, 536 events of witnessed OHCA of presumed cardiac etiology were analyzed. Outcomes were: sustained Return Of Spontaneous Circulation ROSC (25.6%), Survival Event in Emergency Department (22.8%), Survival after 24 hours (21.2%) and Survival after hospital discharge at home 30 days after (11.2%). Statistically significant results were found in age, rhythm of presentation, and resuscitation by bystanders. Sex, seasonality and rescue timing did not differ statistically. **CONCLUSIONS:** Overall the thirty-day survival rate was similar to studies with larger databases. Our data are consistent with the concept that all emergency service should provide CPR instructions for every citizen who activate the EMS in the

suspect of a SCA; further investigation should clarify how long interval could be useful for ROSC and sustained ROSC in patients resuscitated by lay people using CPR instructions.

3. Pacing Clin Electrophysiol. 2019 Sep 10. doi: 10.1111/pace.13801. [Epub ahead of print]

### **Epidemiology, etiology, and outcomes of out-of-hospital cardiac arrest in young patients in Lebanon.**

Refaat MM(1), Kozhaya K(2), Abou-Zeid F(2), Abdulhai F(2), Faour K(2), Mourani SC(2), Abi-Gerges C(2), Bachir R(3), Musharrafieh U(4), El Sayed M(5).

#### **Abstract**

**BACKGROUND:** The burden of out-of-hospital cardiac arrest (OHCA) on different population segments in developing countries is not well studied. Previous studies from Lebanon report poor survival to hospital discharge (4.8%-5.5%). This study describes characteristics and outcomes of young OHCA victims in Beirut, Lebanon **METHODS:** This retrospective observational study included young patients (<35 years of age) with OHCA admitted to the emergency department (ED) of a tertiary care center in Lebanon over a 10-year period. **RESULTS:** Fifty-four patients with OHCA were identified. Most were males (74.1%, n = 40) and the mean age was 17.9 ± 10.9 years. The most common arrest location was home (44.4%, n = 24). The majority were witnessed (78.8%, n = 41) with 15.4% (n = 8) witnessed by emergency medical services (EMS). Prehospital cardiopulmonary resuscitation was done for 22 patients (41.5%) mostly by EMS (n = 19, 86.4%), 9.1% (n = 2) by a bystander, and 4.5% (n = 1) by a family member. Prehospital automated external defibrillator use was documented in 13% (n = 7) of cases. Most patients (n = 48, 88.9%) were resuscitated in the ED where the most common rhythm was asystole (55.6%, n = 30). Half of the patients (50%, n = 27) survived to hospital admission. Overall survival to hospital discharge was 16.7% (n = 9). Good neurologic outcome (cerebral performance category 1 or 2) was documented in seven patients (9.3%). **CONCLUSION:** Survival rate of young OHCA victims in Lebanon (16.7%) is higher than previously reported rates of OHCA in the overall population. Targeted community activities and medical oversight of EMS activities are needed to link EMS activities to clinical outcomes.

## **REGISTRES, REVISIONS I EDITORIALS**

1. Neoreviews. 2019 Sep;20(9):e513-e519. doi: 10.1542/neo.20-9-e513.

### **Caveats of Cooling: Available Evidence and Ongoing Investigations of Therapeutic Hypothermia.**

Parga-Belinkie J(1), Foglia EE(1), Flibotte J(1).

#### **Abstract**

Therapeutic hypothermia (TH) mitigates the long-term effects of neuronal excitotoxicity and cell death seen in hypoxic-ischemic encephalopathy (HIE). It remains the most evidence-based therapy for HIE, but it is not without clinical controversy. The literature abounds with questions, such as "When should we start cooling-as early as the delivery room?" "Given the efficacy of TH for moderate to severe HIE when started within 6 hours of birth, can we expand the therapy to infants with mild HIE?" "What should the target temperature be?" "What is the optimal duration of treatment?" "Is early discontinuation acceptable if the examination findings normalize?" These questions about TH, its incomplete neurologic rescue, and variations in the delivery of this therapy have

prompted this review. This article summarizes changing procedural considerations for TH, the level of neuromonitoring available, the use of sedation, and considerations for neuroimaging during and after TH.

2. Resuscitation. 2019 Aug 29. pii: S0300-9572(19)30557-X. doi: 10.1016/j.resuscitation.2019.08.002. [Epub ahead of print]

### **From changing four tyres to recalling the four H's and T's - Can the pit crew model work for in-hospital cardiac arrest?**

Field RA(1).

#### **Abstract**

Formula one pit crews are renowned for their teamwork and efficiency. Pit crew models have been successfully applied to pre-hospital resuscitation but their use in-hospital remains untested. In this issue of Resuscitation Spitzer and colleagues share their findings from the implementation of a pit crew model for cardiac arrest teams at their institution. Their study used several interventions

including mock codes and debriefing to implement the model. It is unclear if improved team communication is due to the pit crew model alone or other interventions. Further research is needed to define and evaluate pit crew models in the in-hospital environment.

3. Circ Cardiovasc Interv. 2019 Sep;12(9):e006071. doi:10.1161/CIRCINTERVENTIONS.118.006071. Epub 2019 Sep 12.

### **Invasive Management of Out of Hospital Cardiac Arrest.**

Kelly EM(1), Pinto DS(1).

#### **Abstract**

Out of hospital cardiac arrest (OHCA) is a major cause of morbidity and mortality worldwide. Clinical decision making is extremely difficult in this understudied patient population with high prevalence of neurological injury and inexorable shock states. As such, there are uncertain benefits from therapies available in the cardiac catheterization laboratory. Fear of futility and public reporting often affects decision making and can result in risk aversion. This review focuses on invasive management in OHCA care, with particular focus on coronary angiography, coronary revascularization, and mechanical support. Guidelines recommend emergency coronary angiography in patients with ST-segment elevations on ECG after OHCA, while the role of coronary angiography in patients without ST-segment elevations is less clear. Similar uncertainty remains in the appropriate revascularization strategy in these patients. As in other areas of cardiology, there is a growing interest in the role of mechanical circulatory support after OHCA, though the available literature shows mixed results. The many uncertainties associated with treating the patient with OHCA highlight the importance of clinical decision support tools and treatment algorithms in the care of this population. This review focuses on invasive management in OHCA care, with particular focus on coronary angiography, coronary revascularization, and mechanical support.

4. Resuscitation. 2019 Sep 6. pii: S0300-9572(19)30594-5. doi: 10.1016/j.resuscitation.2019.08.033. [Epub ahead of print]

### **Need for speed in out-of-hospital cardiac arrest.**

Wengenmayer T(1), Staudacher DL(1).

### **Abstract**

Extensive efforts have been undertaken to improve survival in the very heterogeneous group of patients with out-of-hospital cardiac arrest (OHCA).<sup>1</sup> The chain of survival has been established, visualizing the important steps in resuscitation care.<sup>2</sup> Early recognition of collapse and immediate bystander basic life support (BLS) are key determinants of favourable neurological outcome, by minimizing no-flow time. High quality advanced life support (ALS) with early defibrillation and detection of reversible causes increase chances for a return of spontaneous circulation (ROSC) keeping low-flow time as short as possible.

5. J Intensive Care Med. 2019 Sep 5:885066619873318. doi: 10.1177/0885066619873318. [Epub ahead of print]

### **Optimizing the Early Resuscitation After Out-of-Hospital Cardiac Arrest.**

Reardon PM(1)(2), Hickey M(1)(2), English SW(1)(3)(4), Hibbert B(5)(6), Simard T(5)(6), Hendin A(1)(2), Yadav K(2).

### **Abstract**

Resuscitation after out-of-hospital cardiac arrest can be one of the most challenging scenarios in acute-care medicine. The devastating effects of postcardiac arrest syndrome carry a substantial morbidity and mortality that persist long after return of spontaneous circulation. Management of these patients requires the clinician to simultaneously address multiple emergent priorities including the resuscitation of the patient and the efficient diagnosis and management of the underlying etiology. This review provides a concise evidence-based overview of the core concepts involved in the early postcardiac arrest resuscitation. It will highlight the components of an effective management strategy including addressing hemodynamic, oxygenation, and ventilation goals as well as carefully considering cardiac catheterization and targeted temperature management. An organized approach is paramount to providing effective care to patients in this vulnerable time period.

## **ACR intrahospitalària**

1. Clin Cardiol. 2019 Sep 11. doi: 10.1002/clc.23255. [Epub ahead of print]

### **Decision tree model for predicting in-hospital cardiac arrest among patients admitted with acute coronary syndrome.**

Li H(1), Wu TT(2), Yang DL(3), Guo YS(4), Liu PC(5), Chen Y(6), Xiao LP(7).

### **Abstract**

**BACKGROUND:** In-hospital cardiac arrest (IHCA) may be preventable, with patients often showing signs of physiological deterioration before an event. Our objective was to develop and validate a simple clinical prediction model to identify the IHCA risk among cardiac arrest (CA) patients hospitalized with acute coronary syndrome (ACS). **HYPOTHESIS:** A predicting model could help to identify the risk of IHCA among patients admitted with ACS. **METHODS:** We conducted a case-control study and analyzed 21 337 adult ACS patients, of whom 164 had experienced CA. Vital signs, demographic, and laboratory data were extracted from the electronic health record. Decision tree analysis was applied with 10-fold cross-validation to predict the risk of IHCA. **RESULTS:** The decision tree analysis detected seven explanatory variables, and the variables' importance is as

follows: VitalPAC Early Warning Score (VIEWS), fatal arrhythmia, Killip class, cardiac troponin I, blood urea nitrogen, age, and diabetes. The development decision tree model demonstrated a sensitivity of 0.762, a specificity of 0.882, and an area under the receiver operating characteristic curve (AUC) of 0.844 (95% CI, 0.805 to 0.849). A 10-fold cross-validated risk estimate was 0.198, while the optimism-corrected AUC was 0.823 (95% CI, 0.786 to 0.860). CONCLUSIONS: We have developed and internally validated a good discrimination decision tree model to predict the risk of IHCA. This simple prediction model may provide healthcare workers with a practical bedside tool and could positively impact decision-making with regard to deteriorating patients with ACS.

2. Crit Care Resusc. 2019 Sep;21(3):180-187.

### **The epidemiology of in-hospital cardiac arrests in Australia: a prospective multicentre observational study.**

Australia and New Zealand Cardiac Arrest Outcome and Determinants of ECMO (ANZ-CODE) Investigators(1).

#### **Abstract**

**BACKGROUND:** Australian in-hospital cardiac arrest (IHCA) literature is limited, and mostly published before rapid response teams (RRTs). Contemporary data may inform strategies to improve IHCA outcomes. **STUDY DESIGN:** Prospective observational study of ward adult IHCAs in seven Australian hospitals. **PARTICIPANTS AND OUTCOMES:** IHCA was defined as unresponsiveness, no respiratory effort, and commencement of external cardiac compressions. Data included IHCA frequency, patient demographics, resuscitation management, intensive care unit (ICU) management, and hospital discharge status. **RESULTS:** There were 15 953 RRT calls, 185 896 multiday admissions and 159 IHCAs in 152 patients (median age, 71.5 years; interquartile range [IQR], 61.6-81.3 years). The median IHCA frequency was 0.62 IHCAs per 1000 multiday admissions (IQR, 0.50-1.19). Most patients (93.4%) were admitted from home, and 68.4% (104/152) were medical admissions. Eighty-two IHCAs (51.6%) occurred within 4 days of admission, and 66.0% (105/159) of initial rhythms were non-shockable. The median resuscitation duration was 6.5 minutes (IQR, 2.0-18.0 minutes) and adrenaline was the most common intervention (95/159; 59.8%). Death on the ward occurred in 30.2% of IHCAs (48/159), and 49.7% (79/159) were admitted to the ICU, where vasoactive medications (75.9%), ventilation (82.3%), and renal replacement therapy (29.1%) use was extensive. Overall, 92 patients (60.5%) died and 40 (26.3%) were discharged home. **CONCLUSION:** Among seven Australian hospitals, IHCAs were infrequent, mostly occurred in older medical patients early in the hospital admission. Most were non-shockable, ICU therapy was extensive and nearly two-thirds of patients died in hospital. Further strategies are needed to prevent and improve ICHA outcomes.

3. J Formos Med Assoc. 2019 Sep 4. pii: S0929-6646(19)30569-8. doi:10.1016/j.jfma.2019.08.020. [Epub ahead of print]

### **Associations between early intra-arrest blood acidaemia and outcomes of adult in-hospital cardiac arrest: A retrospective cohort study.**

Wang CH(1), Chang WT(1), Huang CH(1), Tsai MS(1), Yu PH(2), Wu YW(3), Chen WJ(4).

#### **Abstract**

**BACKGROUND:** Resuscitation guidelines list acidaemia as a potentially reversible cause of cardiac arrest without specifying the threshold defining acidaemia. We examined the association between early intra-arrest arterial blood gas (ABG) data and outcomes of in-hospital cardiac arrest (IHCA). **METHODS:** This single-centred retrospective study reviewed patients with IHCA between 2006 and 2015. Early intra-arrest ABG data were measured within 10 min of initiating cardiopulmonary resuscitation. The ABG analysis included measurements of blood pH, PaCO<sub>2</sub>, and HCO<sub>3</sub><sup>-</sup>. **RESULTS:** Among the 1065 included patients, 60 (5.6%) achieved neurologically intact survival. Mean blood pH was 7.2. Mean PaCO<sub>2</sub> and HCO<sub>3</sub><sup>-</sup> levels were 59.7 mmHg and 22.1 mmol/L, respectively. A blood pH of 7.2 was identified by a generalised additive models plot to define severe acidaemia.

The PaCO<sub>2</sub> level was higher in patients with severe acidaemia (mean: 74.5 vs. 44.1 mmHg) than in those without. Multivariable logistic regression analyses indicated that blood pH > 7.2 was associated with a favourable neurological recovery (odds ratio [OR]: 2.79, 95% confidence interval [CI]: 1.43-5.46; p-value = 0.003) and blood pH was positively associated with survival at hospital discharge (OR: 5.80, 95% CI: 1.62-20.69; p-value = 0.007). CONCLUSION: Early intra-arrest blood pH was associated with IHCA outcomes, while levels of PaCO<sub>2</sub> and HCO<sub>3</sub><sup>-</sup> were not. A blood pH of 7.2 could be used as the threshold defining severe acidaemia during arrest and help profile patients with IHCA. Innovative interventions should be developed to improve the outcomes of patients with severe acidaemia, such as novel ventilation methods.

4. J Gen Intern Med. 2019 Sep 11. doi: 10.1007/s11606-019-05314-x. [Epub ahead of print]

#### **Predicting Outcomes of In-Hospital Cardiac Arrest: Retrospective US Validation of the Good Outcome Following Attempted Resuscitation Score.**

Rubins JB(1), Kinzie SD(2), Rubins DM(3).

##### **Abstract**

**BACKGROUND:** Providers should estimate a patient's chance of surviving an in-hospital cardiac arrest with good neurologic outcome when initially admitting a patient, in order to participate in shared decision making with patients about their code status. **OBJECTIVE:** To examine the utility of the "Good Outcome Following Attempted Resuscitation (GO-FAR)" score in predicting prognosis after in-hospital cardiac arrest in a US trauma center. **DESIGN:** Retrospective observational study **SETTING:** Level 1 trauma and academic hospital in Minneapolis, MN, USA **PARTICIPANTS:** All cases of pulseless in-hospital cardiac arrest occurring in adults (18 years or older) admitted to the hospital between Jan 2009 and Sept 2018 are included. For patients with more than one arrest, only the first was included in this analysis. **MAIN MEASURES:** For each patient with verified in-hospital cardiac arrest, we calculated a GO-FAR score based on variables present in the electronic health record at time of admission. Pre-determined outcomes included survival to discharge and survival to discharge with good neurologic outcome. **KEY RESULTS:** From 2009 to 2018, 403 adults suffered in-hospital cardiac arrest. A majority (65.5%) were male with a mean age of 60.3 years. Overall survival to discharge was 33.0%; survival to discharge with good neurologic outcome was 17.4%. GO-FAR score calculated at the time of admission correlated with survival to discharge with good neurologic outcome (AUC 0.68), which occurred in 5.3% of patients with below average survival likelihood by GO-FAR score, 22.5% with average survival likelihood, and 34.1% with above average survival likelihood. **CONCLUSIONS:** The GO-FAR score can estimate, at time of admission to the hospital, the probability that a patient will survive to discharge with good neurologic outcome after an in-hospital cardiac arrest. This prognostic information can help providers frame discussions with patients on admission regarding whether to attempt cardiopulmonary resuscitation in the event of cardiac arrest.

## **ETIOLOGIA DE L'ACR**

1. Crit Care Med. 2018 Apr;46(4):532-539. doi: 10.1097/CCM.0000000000002925.

#### **Cardiac Arrest and Mortality Related to Intubation Procedure in Critically Ill Adult Patients: A Multicenter Cohort Study.**

De Jong A(1)(2), Rolle A(1)(3), Molinari N(4), Paugam-Burtz C(5)(6), Constantin JM(7), Lefrant JY(8), Asehnoune K(9), Jung B(2)(10), Futier E(7), Chanques G(1)(2), Azoulay E(11), Jaber S(1)(2).

##### **Abstract**

**OBJECTIVES:** To determine the prevalence of and risk factors for cardiac arrest during intubation in ICU, as well as the association of ICU intubation-related cardiac arrest with 28-day mortality. **DESIGN:** Retrospective analysis of prospectively collected data. **SETTING:** Sixty-four French ICUs. **PATIENTS:** Critically ill patients requiring intubation in the ICU. **INTERVENTIONS:** None. **MEASUREMENTS AND MAIN RESULTS:** During the 1,847 intubation procedures included, 49 cardiac arrests (2.7%) occurred, including 14 without return of spontaneous circulation (28.6%) and 35 with return of spontaneous circulation (71.4%). In multivariate analysis, the main predictors of intubation-related cardiac arrest were arterial hypotension (systolic blood pressure < 90 mm Hg) prior to intubation (odds ratio = 3.406 [1.797-6.454];  $p = 0.0002$ ), hypoxemia prior to intubation (odds ratio = 3.991 [2.101-7.583];  $p < 0.0001$ ), absence of preoxygenation (odds ratio = 3.584 [1.287-9.985];  $p = 0.0146$ ), overweight/obesity (body mass index > 25 kg/m; odds ratio = 2.005 [1.017-3.951];  $p = 0.0445$ ), and age more than 75 years old (odds ratio = 2.251 [1.080-4.678];  $p = 0.0297$ ). Overall 28-day mortality rate was 31.2% (577/1,847) and was significantly higher in patients who experienced intubation-related cardiac arrest than in noncardiac arrest patients (73.5% vs 30.1%;  $p < 0.001$ ). After multivariate analysis, intubation-related cardiac arrest was an independent risk factor for 28-day mortality (hazard ratio = 3.9 [2.4-6.3];  $p < 0.0001$ ). **CONCLUSIONS:** ICU intubation-related cardiac arrest occurs in one of 40 procedures with high immediate and 28-day mortality. We identified five independent risk factors for cardiac arrest, three of which are modifiable, possibly to decrease intubation-related cardiac arrest prevalence and 28-day ICU mortality.

2. *Int Heart J.* 2019 Sep 4. doi: 10.1536/ihj.18-712. [Epub ahead of print]

### **Association Between Multivessel Coronary Artery Disease and Return of Spontaneous Circulation Interval in Acute Coronary Syndrome Patients with Out-of-Hospital Cardiac Arrest.**

Tateishi K(1), Abe D(2), Suzuki K(2), Hamabe Y(3), Aonuma K(4), Sato A(4).

#### **Abstract**

Acute coronary syndrome (ACS) is the major cause of out-of-hospital cardiac arrest (OHCA). The relationship between the findings from the study of coronary images and return of spontaneous circulation (ROSC) interval is still unknown. Hence, we investigated this relationship in ACS patients with OHCA. A cohort of 2779 patients was admitted to our emergency center due to cardiopulmonary arrest (CPA) between April 2011 and March 2015. We included ACS patients who had CPA with ventricular fibrillation (VF) as an initial rhythm, were successfully resuscitated, underwent coronary angiography (CAG), had a culprit lesion, and were diagnosed with ACS ( $n = 58$ ; age,  $63.7 \pm 12.0$  years; 93.1% male). We divided the 58 patients into two groups, an early ROSC group (ROSC  $\leq 20$  minutes: E-ROSC) and a late ROSC group (ROSC > 20 minutes: L-ROSC), and then analyzed their characteristics. The finding of a collateral artery for the culprit lesion location, Rentrop II-III, and TIMI III flow on CAG on arrival presented no significant differences between the two groups (Rentrop II-III: 25.0% versus 23.5%,  $P = 0.90$ ; TIMI III: 33.3% versus 35.3%,  $P = 0.88$ ). The incidence of multivessel coronary artery disease (MVD) was lower in the E-ROSC group than in the L-ROSC group (16.7% versus 58.8%,  $P = 0.001$ ). Collateral and TIMI flow were not associated with ease of resuscitation, but MVD may have a negative impact on resuscitation, especially in VF patients.

#### **FREE FULL TEXT**

3. *Acta Pharmacol Sin.* 2019 Apr;40(4):486-491. doi: 10.1038/s41401-018-0080-0. Epub 2018 Jul 10.

### **Low serum osteocalcin levels are correlated with left ventricular systolic dysfunction and cardiac death in Chinese men.**

Zhang XL(1), Shen Y(1), Ma XJ(1), Lu ZG(2), Xu YT(1), Xiong Q(1), Bao YQ(3).

#### **Abstract**

Osteocalcin is a newly identified type of cytokine secreted by osteoblasts, which has an endocrine function, mediates energy and glycol-lipid metabolism, and is closely related to cardiovascular diseases. In this study, we investigated the value of serum osteocalcin levels in predicting left ventricular systolic dysfunction and cardiac death. A total of 258 patients in the Department of Cardiology were included. Two-dimensional echocardiography was performed in all the subjects. The cardiac death of subjects occurring with a median follow-up of 4.6 years was informed via phone calls or the electronic medical records. The serum osteocalcin levels were measured using electrochemiluminescent immunoassay. We found that the median left ventricular ejection fractions (LVEFs) were 62% in men and 63% in women. In the men with a LVEF > 62%, the serum osteocalcin levels were significantly higher than in those with LVEF ≤ 62% (P = 0.042), whereas this difference was absent in the women. Both the serum osteocalcin ( $\beta = 0.095$ , P = 0.028) and serum N-terminal pro-brain natriuretic peptide (NT-pro-BNP;  $\beta = -0.003$ , P < 0.01) levels remained independently significantly correlated with LVEF in the men but not in the women. Receiver operating characteristic (ROC) analyses of the men revealed that the serum osteocalcin (P = 0.007), serum NT-pro-BNP (P = 0.018) and serum osteocalcin + NT-pro-BNP (P < 0.01) levels were all significant in identifying left ventricular systolic dysfunction at baseline, but the pairwise comparisons of the three areas under the curves (AUCs) were all non-significant. The men in the lower osteocalcin level group at baseline suffered a greater risk of future cardiac death than those in the higher osteocalcin level group, whereas the result for NT-pro-BNP exhibited the opposite pattern. In conclusion, lower serum osteocalcin levels in the men could identify left ventricular systolic dysfunction and cardiac death in a manner that was not inferior to high serum NT-pro-BNP levels.

4. Prehosp Emerg Care. 2019 Sep 12:1-13. doi: 10.1080/10903127.2019.1666944. [Epub ahead of print]

#### **Temporal trends in the incidence, characteristics and outcomes of hanging-related out-of-hospital cardiac arrest.**

Alqahtani S(1)(2), Nehme Z(1)(3)(4), Williams B(1), Bernard S(3)(4)(5), Smith K(1)(3)(4)(6).

#### **Abstract**

**AIM:** To describe temporal trends in the incidence, characteristics and outcomes of hanging-related out-of-hospital cardiac arrest (OHCA). **METHOD:** A retrospective study of all hanging-related OHCA in Victoria, Australia, between 2000 and 2017 was conducted. Trends in incidence, characteristics and outcomes were assessed using linear regression and a non-parametric test for trend, as appropriate. Predictors of survival to hospital discharge were identified using multivariable logistic regression. **RESULTS:** Between 2000 and 2017, emergency medical services (EMS)-attended 3891 cases of hanging-related OHCA, of which 876 cases (23%) received an attempted resuscitation. The overall incidence rate of EMS-attended cases was 3.8 cases per 100,000 person-years increasing from 2.3 cases per 100,000 person-years in 2000 to 4.7 cases in 2017 (p for trend <0.001). Incidence rates increased approximately two-fold in young adults (18-44 years) and three-fold in middle aged adults (45-64 years). Despite improvement in the rate of bystander cardiopulmonary resuscitation (from 49% in 2000-05 to 75% in 2012-17), the survival to hospital discharge rate remained unchanged (3% overall). Among adult survivors with 12-month follow-up, 10 of 14 patients survived to 12 months post-arrest (71%). Five patients responded to telephone interviews, of which three patients reported severe functional disability. An initial shockable rhythm (OR 23.17, 95% CI: 5.75, 93.36) or pulseless electrical activity (OR 13.14, 95% CI: 4.79, 36.03) were associated with survival. **CONCLUSION:** The incidence of hanging-related OHCA doubled over the 18 year period with no change to survival rates. New preventative strategies are needed to reduce the community burden of these events.

5. Resuscitation. 2019 Sep 9. pii: S0300-9572(19)30597-0. doi: 10.1016/j.resuscitation.2019.08.036. [Epub ahead of print]

#### **Long term trends in the epidemiology of out-of-hospital cardiac arrest precipitated by suspected drug overdose.**

Alqahtani S(1), Nehme Z(2), Williams B(3), Bernard S(4), Smith K(5).



## Abstract

**BACKGROUND:** Little is known about the long-term trends in the incidence and outcomes of drug overdose out-of-hospital cardiac arrests (OHCA). **METHOD:** Between 2000 and 2017, we retrospectively reviewed drug overdose OHCA from the Victorian Ambulance Cardiac Arrest Registry. Incidence was assessed using linear regression, and the baseline characteristics and survival outcomes were assessed using nonparametric test for trend. Arrest factors associated with survival to hospital discharge were assessed using logistic regression. The 12-month functional recovery and health related quality of life for survivors was summarised using descriptive statistics. **RESULTS:** The incidence of emergency medical services (EMS)-attended and EMS-treated cases was 5.8 and 2.0 per 100,000 person-years, respectively, with no significant changes in trend over time. Return of spontaneous circulation increased from 23% to 34% (p for trend = 0.001), event survival increased from 23% to 30% (p for trend = 0.007), and survival to hospital discharge increased from 4% to 13% (p for trend = 0.03). Age, arrest witnessed by bystander or EMS, initial shockable rhythm or pulseless electrical activity, intubation, epinephrine and sodium bicarbonate administration were independently associated with survival. The adjusted-temporal trend for survival was not significant (per year increase; OR 1.02, 95% CI: 0.98, 1.07; p = 0.244). Of the 12-month survivors, 50% of the responders reported good functional recovery, and few reported severe problems with mobility, self-care, daily activity, pain, and anxiety/depression. **CONCLUSION:** Although the incidence of drug overdose OHCA remained unchanged between 2000 and 2017, the rates of survival have significantly improved.

6. Europace. 2019 Aug 25. pii: euz221. doi: 10.1093/europace/euz221. [Epub ahead of print]

### **Out-of-hospital cardiac arrest due to idiopathic ventricular fibrillation in patients with normal electrocardiograms: results from a multicentre long-term registry.**

Conte G(1), Belhassen B(2), Lambiase P(3), Ciconte G(4), de Asmundis C(5), Arbelo E(6), Schaer B(7), Frontera A(8), Burri H(9), Calo' L(10), Letsas KP(11), Leyva F(12), Porter B(13), Saenen J(14), Zacà V(15), Berne P(16), Ammann P(17), Zardini M(18), Luani B(19), Rordorf R(20), Sarquella Brugada G(21)(22), Medeiros-Domingo A(23), Geller JC(24), de Potter T(25), Stokke MK(26), Márquez MF(27), Michowitz Y(2), Honarbakhsh S(3), Conti M(4), Sticherling C(7), Martino A(10), Zegard A(12), Özkartal T(1), Caputo ML(1), Regoli F(1), Braun-Dullaeus RC(19), Notarangelo F(18), Moccetti T(1), Casu G(16), Rinaldi CA(13), Levinstein M(28), Haugaa KH(26), Derval N(8), Klersy C(29), Curti M(29), Pappone C(4), Heidbuchel H(14), Brugada J(6), Haïssaguerre M(8), Brugada P(5), Auricchio A(1).

## Abstract

**AIMS:** To define the clinical characteristics and long-term clinical outcomes of a large cohort of patients with idiopathic ventricular fibrillation (IVF) and normal 12-lead electrocardiograms (ECGs). **METHODS AND RESULTS:** Patients with ventricular fibrillation as the presenting rhythm, normal baseline, and follow-up ECGs with no signs of cardiac channelopathy including early repolarization or atrioventricular conduction abnormalities, and without structural heart disease were included in a registry. A total of 245 patients (median age: 38 years; males 59%) were recruited from 25 centres. An implantable cardioverter-defibrillator (ICD) was implanted in 226 patients (92%), while 18 patients (8%) were treated with drug therapy only. Over a median follow-up of 63 months (interquartile range: 25-110 months), 12 patients died (5%); in four of them (1.6%) the lethal event was of cardiac origin. Patients treated with antiarrhythmic drugs only had a higher rate of cardiovascular death compared to patients who received an ICD (16% vs. 0.4%, P = 0.001). Fifty-two patients (21%) experienced an arrhythmic recurrence. Age  $\leq$ 16 years at the time of the first ventricular arrhythmia was the only predictor of arrhythmic recurrence on multivariable analysis [hazard ratio (HR) 0.41, 95% confidence interval (CI) 0.18-0.92; P = 0.03]. **CONCLUSION:** Patients with IVF and persistently normal ECGs frequently have arrhythmic recurrences, but a good prognosis when treated with an ICD. Children are a category of IVF patients at higher risk of arrhythmic recurrences.

# END-TIDAL CO<sub>2</sub>

1. Anesth Analg. 2019 Sep 3. doi: 10.1213/ANE.0000000000004409. [Epub ahead of print]

**Ventilation Is an Important Confounding Variable When End-Tidal Carbon Dioxide Is Used to Help Guide Cardiopulmonary Resuscitation.**

Leinonen M(1), Gravenstein N, Giordano C.

**ABSTRACT NOT AVAILABLE**

# FEEDBACK

1. Simul Healthc. 2019 Sep 5. doi: 10.1097/SIH.0000000000000387. [Epub ahead of print]

**Use of a Virtual Reality Device for Basic Life Support Training: Prototype Testing and an Exploration of Users' Views and Experience.**

Bench S(1), Winter C, Francis G.

## **Abstract**

**INTRODUCTION:** Immediate initiation of cardiopulmonary resuscitation significantly increases the chances of survival after a cardiac arrest. Virtual reality devices allow the integration of features of real patients into training to facilitate interaction and feedback, thus improving performance. However, its use as a training tool remains underexplored. The aims of this study were to undertake initial testing of a virtual reality basic life support prototype and to explore users' views and experiences. **METHODS:** We recruited 23 adult staff members working at a Central London University in England and exposed them to a 5-minute virtual reality experience. Each participant completed a prequestionnaire and postquestionnaire and took part in a focus group discussion. Quantitative data were descriptively analyzed, whereas qualitative data underwent thematic analysis. **RESULTS:** Regardless of prior experience of using virtual reality and/or performing basic life support, most participants scored more than 90% for chest compressions and reported an increase in confidence and competence after the experience. Focus group discussions identified the following 4 key themes: experience and expectations; performance and feedback; interaction and immersion; and potential. **CONCLUSIONS:** Our study suggests that virtual reality is an enjoyable method by which to teach basic life support. Although concerns over the accuracy of the tracking system and the small sample size weaken our conclusions regarding its ability to assess performance, our exploratory data are of value to educators, researchers, and policy makers. Future work needs to address our study limitations, consider how virtual reality fits into the broader context of training, and attend to accreditation and resource issues.

# FÀRMACS

1. Eur Heart J Cardiovasc Pharmacother. 2019 Aug 10. pii: pvz038. doi:10.1093/ehjcvp/pvz038. [Epub ahead of print]

**Differential effects on out-of-hospital cardiac arrest of dihydropyridines: real-world data from population-based cohorts across two European countries.**

Eroglu TE(1), Mohr GH(2), Blom MT(1), Verkerk AO(1)(3), Souverein PC(4), Torp-Pedersen C(2)(5)(6)(7), Folke F(2), Wissenberg M(2), van den Brink L(8), Davis RP(8), de Boer A(4), Gislason GH(2)(9)(10), Tan HL(1).

## Abstract

**AIMS:** Various drugs increase the risk of out-of-hospital cardiac arrest (OHCA) in the general population by impacting cardiac ion channels, thereby causing ventricular tachycardia/fibrillation (VT/VF). Dihydropyridines block L-type calcium channels, but their association with OHCA risk is unknown. We aimed to study whether nifedipine and/or amlodipine, often-used dihydropyridines, are associated with increased OHCA risk, and how these drugs impact on cardiac electrophysiology. **METHODS AND RESULTS:** We conducted a case-control study with VT/VF-documented OHCA cases with presumed cardiac cause from ongoing population-based OHCA registries in the Netherlands and Denmark, and age/sex/index date-matched non-OHCA controls (Netherlands: PHARMO Database Network, Denmark: Danish Civil Registration System). We included 2503 OHCA cases, 10 543 non-OHCA controls in Netherlands, and 8101 OHCA cases, 40 505 non-OHCA controls in Denmark. To examine drug effects on cardiac electrophysiology, we performed single-cell patch-clamp studies in human-induced pluripotent stem cell-derived cardiomyocytes. Use of high-dose nifedipine ( $\geq 60$  mg/day), but not low-dose nifedipine ( $< 60$  mg/day) or amlodipine (any-dose), was associated with higher OHCA risk than non-use of dihydropyridines [Netherlands: adjusted odds ratios (ORadj) 1.45 (95% confidence interval 1.02-2.07), Denmark: 1.96 (1.18-3.25)] or use of amlodipine [Netherlands: 2.31 (1.54-3.47), Denmark: 2.20 (1.32-3.67)]. Out-of-hospital cardiac arrest risk of (high-dose) nifedipine use was not further increased in patients using nitrates, or with a history of ischaemic heart disease. Nifedipine and amlodipine blocked L-type calcium channels at similar concentrations, but, at clinically used concentrations, nifedipine caused more L-type calcium current block, resulting in more action potential shortening. **CONCLUSION:** High-dose nifedipine, but not low-dose nifedipine or any-dose amlodipine, is associated with increased OHCA risk in the general population. Careful titration of nifedipine dose should be considered.

# ORGANITZACIÓ I ENTRENAMENT

1. Emerg Med J. 2019 Aug 31. pii: emermed-2018-208234. doi:10.1136/emmermed-2018-208234. [Epub ahead of print]

**Public perception towards bystander cardiopulmonary resuscitation.**

Becker TK(#)(1), Gul SS(#)(2), Cohen SA(1), Maciel CB(3), Baron-Lee J(3), Murphy TW(1), Youn TS(3), Tyndall JA(1), Gibbons C(4), Hart L(4), Alviar CL(5); Florida Cardiac Arrest Resource Team.

## Abstract

**OBJECTIVE:** Bystander cardiopulmonary resuscitation (CPR) after out-of-hospital cardiac arrest (OHCA) improves survival and neurological outcomes. Nonetheless, many OHCA patients do not receive bystander CPR during a witnessed arrest. Our aim was to identify potential barriers to bystander CPR. **METHODS:** Participants at CPR

training events conducted in the USA between February and May 2018 answered a 14-question survey prior to training. Respondents were asked about their overall comfort level performing CPR, and about potential concerns specific to performing CPR on a middle-aged female, a geriatric male, and male and female adolescent patients. Open-ended responses were analysed qualitatively by categorising responses into themes. RESULTS: Of the 677 participants, 582 (86.0%) completed the survey, with 509 (88.1%) between 18 and 29 years of age, 341 (58.6%) without prior CPR training and 556 (96.0%) without prior CPR experience. Across all four scenarios of patients in cardiac arrest, less than 65% of respondents reported that they would be 'Extremely Likely' (20.6%-29.1%) or 'Moderately Likely' (26.9%-34.8%) to initiate CPR. The leading concerns were 'causing injury to patient' for geriatric (n=193, 63.1%), female (n=51, 20.5%) and adolescent (n=148, 50.9%) patients. Lack of appropriate skills was the second leading concern when the victim was a geriatric (n=41, 13.4%) or adolescent (n=68, 23.4%) patient, whereas for female patients, 35 (14.1%) were concerned about exposing the patient or the patient's breasts interfering with performance of CPR and 15 (6.0%) were concerned about being accused of sexual assault. Significant differences were observed in race, ethnicity and age regarding the likelihood of starting to perform CPR on female and adolescent patients. CONCLUSIONS: Participants at CPR training events have multiple concerns and fears related to performing bystander CPR. Causing additional harm and lack of skills were among the leading reservations reported. These findings should be considered for improved CPR training and public education.

2. J Emerg Med. 2019 Aug 28. pii: S0736-4679(19)30482-2. doi: 10.1016/j.jemermed.2019.06.021. [Epub ahead of print]

### **Mandated 30-minute Scene Time Interval Correlates With Improved Return of Spontaneous Circulation at Emergency Department Arrival: A Before and After Study.**

Eastin C(1), Karim S(2), Hawthorn C(3), Webb MH(4), Waheed MA(5), Buford A(6), Hutchison M(6), Mason C(6), Sexton K(7).

#### **Abstract**

BACKGROUND: Conflicting ideas exist about whether or not Emergency Medical Service (EMS) personnel should treat a cardiac arrest on scene or transport immediately. OBJECTIVE: Our aim was to examine patient outcomes before and after an urban EMS system implemented a protocol change mandating a 30-min scene time interval (STI) for out-of-hospital cardiac arrest (OHCA). METHODS: This was a retrospective, single-center, observational study of OHCA patients before and after an EMS protocol change mandating resuscitation on scene. Data were retrieved from an EMS cardiac arrest database for all adults with non-traumatic OHCA between January 2015 and August 2016. Descriptive statistics were used to summarize the study population, and a regression model was used to determine the associations of the protocol with the return of spontaneous circulation (ROSC). RESULTS: A total of 633 patients were included in the study population, which was primarily male (61.3%) with a mean age of 65 years. After the 30-min STI was implemented, ROSC from OHCA increased to 40.1% of cases compared to 27.3% before the protocol change ( $p = 0.001$ ; 95% confidence interval [CI] 0.053-0.203). The STI increased from 19 min 23 s to 29 min 40 s in the pre and post periods, respectively ( $p < 0.001$ ). Regression indicated that the protocol change was independently associated with an improved chance of ROSC (OR 1.81; 95% CI 1.23-2.64). CONCLUSIONS: A protocol change mandating a 30-min STI in OHCA correlated with increased STI and increased ROSC. While increased ROSC may not always equate with positive neurologic outcome, logistic regression

indicated that the protocol change was independently associated with improved ROSC at emergency department arrival.

3. N C Med J. 2019 Jul-Aug;80(4):204-212. doi: 10.18043/ncm.80.4.204.

### **The Case for Drone-assisted Emergency Response to Cardiac Arrest: An Optimized Statewide Deployment Approach.**

Bogle BM(1), Rosamond WD(2), Snyder KT(3), Zègre-Hemsey JK(4).

#### **Abstract**

**BACKGROUND** Despite evidence linking rapid defibrillation to out-of-hospital cardiac arrest (OHCA) survival, bystander use of automatic external defibrillators (AEDs) remains low, due in part to AED placement and accessibility. AED-equipped drones may improve time-to-defibrillation, yet the benefits and costs are unknown. **METHODS** We designed drone deployment networks for the state of North Carolina using mathematical optimization models to select drone stations from existing infrastructure by specifying the number of stations and the targeted AED arrival time. Expected outcomes were evaluated over the drone's lifespan (4 years). We estimated the following parameters: proportion of OHCA within a targeted AED delivery time, bystander utilization of AEDs, survival/neurological status, and incremental cost per quality-adjusted life year (QALY). **RESULTS** Statewide, 16,503 adults aged 18 or older were expected to experience OHCA with an attempted resuscitation over 4 years. Compared to no drone network, all proposed drone networks were expected to improve survival outcomes. For example, assuming 46% of OHCA have bystanders willing to use an AED, a 500-drone network decreased the median time of defibrillator arrival from 7.7 to 2.7 minutes compared to no drone network. Expected survival rates doubled (24.5% versus 12.3%), resulting in an additional 30,267 QALYs (\$858/incremental QALY). If just 4.5% of OHCA had willing bystanders, 13.8% of victims would have survived. Sensitivity analysis demonstrated that an AED drone network remained cost-effective over a wide range of assumptions. **CONCLUSIONS** With proper integration into existing systems, large-scale networks for drone AED delivery have the potential to substantially improve OHCA survival rates while remaining cost-effective. Public health researchers should consider advocating for feasibility studies and policy development surrounding drones.

#### **FREE FULL TEXT**

4. Simul Healthc. 2019 Sep 5. doi: 10.1097/SIH.0000000000000386. [Epub ahead of print]

### **Certified Basic Life Support Instructors Identify Improper Cardiopulmonary Resuscitation Skills Poorly: Instructor Assessments Versus Resuscitation Manikin Data.**

Hansen C(1), Bang C, Stærk M, Krogh K, Løfgren B.

#### **Abstract**

**INTRODUCTION:** During basic life support (BLS) training, instructors assess learners' cardiopulmonary resuscitation (CPR) skills and correct errors to ensure high-quality performance. This study aimed to investigate certified BLS instructors' assessments of CPR skills. **METHODS:** Data were collected at BLS courses for medical students at Aarhus University, Aarhus, Denmark. Two certified BLS instructors evaluated each learner with a cardiac arrest test scenario, where learners demonstrated CPR on a resuscitation manikin for 3.5 minutes. Instructors' assessments were compared with manikin data as reference for correct performance. The first 3 CPR cycles were analyzed. Correct chest compressions were defined as 2 or more of 3 CPR cycles with  $30 \pm 2$  chest compressions, 50 to 60 mm depth, and 100 to 120 min rate. Correct rescue breaths were defined as 50% or more efficient breaths with visible, but not excessive manikin chest inflation (for instructors) or 500 to 600mL air (manikin data). **RESULTS:** Overall, 90 CPR assessments were performed by 16 instructor pairs. Instructors

passed 81 (90%) learners, whereas manikin pass rate was 2%. Instructors identified correct chest compressions with a sensitivity of 0.96 [95% confidence interval (CI) = 0.79-1] and a specificity of 0.05 (95% CI = 0.01-0.14), as well as correct rescue breaths with a sensitivity of 1 (95% CI = 0.40-1) and a specificity of 0.07 (95% CI = 0.03-0.15). Instructors mistakenly failed 1 learner with adequate chest compression depth, while passing 53 (59%) learners with improper depth. Moreover, 80 (89%) improper rescue breath performances were not identified. CONCLUSIONS: Certified BLS instructors assess CPR skills poorly. Particularly, improper chest compression depth and rescue breaths are not identified.

6. Data Brief. 2019 Jul 9;25:104236. doi: 10.1016/j.dib.2019.104236. eCollection 2019 Aug.

**Cardiopulmonary resuscitation (CPR) psychomotor skills of laypeople, as affected by training interventions, number of times trained and retention testing intervals: A dataset derived from a systematic review.**

Riggs M(1), Franklin R(2), Saylany L(1).

**Abstract**

This article is a companion to a systematic review, entitled, *Associations between cardiopulmonary resuscitation (CPR) knowledge, self-efficacy, training history and willingness to perform CPR and CPR psychomotor skills: a systematic review* (Riggs et al., 2019). The data tables described in this article summarise the impact that specific training interventions, number of times trained, and retention testing intervals have on laypeople's CPR psychomotor skills, as reported by peer-reviewed journal articles. The psychomotor skills included are: compression rate, compression depth, duration of interruptions to compressions, chest recoil, hand placement, proportion of adequate or 'correct' compressions, ventilation volume, compression-to-ventilation ratio, duty cycle and overall skills. The data tables described in this article are available as a supplementary file to this article.

**FREE FULL TEXT**

7. Int Emerg Nurs. 2019 Sep 4:100788. doi: 10.1016/j.ienj.2019.100788. [Epub ahead of print]

**Willingness and obstacles of healthcare professionals to perform bystander cardiopulmonary resuscitation in China.**

Zhou G(1), Lu G(2), Shi O(3), Li X(4), Wang Z(4), Wang Y(4), Luo Q(5).

**Abstract**

**BACKGROUND:** Bystander CPR (B-CPR) is crucial to increase survival of out-of-hospital cardiac arrest (OHCA), and this study is performed to assess the willingness and obstacles of Chinese healthcare professionals (HCPs) to perform B-CPR on strangers, as well as the factors associated with the willingness. **METHODS:** An internet-based questionnaire surveying demographic information, CPR training, CPR knowledge, willingness, and obstacles to perform B-CPR among 10,393 HCPs. A multivariate logistic regression analysis was used to evaluate the factors associated with the willingness. **RESULTS:** Here, 73.9% of HCPs were willing to perform B-CPR on strangers in China. The factors associated with the willingness were as follows: female, senior, working in Third-class hospitals, working in Pre-hospital emergency and Cardiology or Cardiac surgery, receiving current training, having adequate CPR knowledge. The main obstacles were fear of infection via mouth-to-mouth ventilations (MMV), fear of being blackmailed and fear of legal liability. **CONCLUSION:** About three quarters of HCPs are willing to perform B-CPR. Female HCPs, those who have more CPR experience, adequate knowledge, and recent

training are more likely to perform B-CPR. Reform of the legal and credit system are needed, and recommendation of hands-only CPR is a possibility to encourage HCPs to perform B-CPR on strangers.

8. Resuscitation. 2019 Sep 7. pii: S0300-9572(19)30605-7. doi:

10.1016/j.resuscitation.2019.08.040. [Epub ahead of print]

**Basic life support training using shared mental models improves team performance of first responders on normal wards: a randomised controlled simulation trial.**

Beck S(1), Doehn C(2), Funk H(1), Kosan J(1), Issleib M(1), Daubmann A(3),

Zöllner C(1), Kubitz JC(1).

**Abstract**

**INTRODUCTION:** Survival of in-hospital cardiac arrest (IHCA) depends on fast and effective action of the first responding team. Not only technical skills, but professional teamwork is required. Observational studies and theoretical models suggest that shared mental models of members improve teamwork. This study investigated if a training on shared mental models, improves team performance in simulated in-hospital cardiac arrest. **METHODS:** On the background of an introduction of mandatory Basic Life Support (BLS) training for clinical staff a randomized controlled trial was performed to compare two training methods. Staff from clinical departments was randomised to receive either a conventional instructor led training (control group) or an interventional training (intervention group). The interventional training was based on self-directed learning of the group in order to develop shared mental models. Primary outcome were mean scores of the team assessment scale (TAS) and the hands-off time. Secondary outcome were mean scores for quality of BLS. **RESULTS:** Performance of 75 teams of the interventional and 66 of the control group was analysed. The hands-off time was significantly lower in the interventional group (5.42% vs. 8.85%,  $p = 0.029$ ). Scores of the TAS and the overall BLS score were high and not significantly different between the groups. Hands-off time correlated significantly negative with all TAS items. **CONCLUSION:** BLS training for clinical staff which creates shared mental models reduces hands-off time in a simulated cardiac arrest scenario. Training methods establishing shared mental models of team members can be considered for effective team trainings without adding additional training time.

9. Resuscitation. 2019 Sep 6. pii: S0300-9572(19)30593-3. doi:

10.1016/j.resuscitation.2019.08.032. [Epub ahead of print]

**Effect of bystander CPR initiated by a dispatch centre following out-of-hospital cardiac arrest on 30-day survival: Adjusted results from the French National Cardiac Arrest Registry.**

Noel L(1), Jaeger D(2), Baert V(3), Debaty G(4), Genin M(3), Sadoune S(1), Bassand A(1), Tazarourte K(5), Gueugniaud PY(6), Elkhoury C(7), Hubert H(3), Chouihed T(8); GR-RéAC.

**Abstract**

**AIM:** Cardiac arrest (CA) was considered irreversible until 1960, when basic cardiopulmonary resuscitation (CPR) was defined. CPR guidelines include early recognition of CA, rapid and effective CPR, effective defibrillation strategies and organized post-resuscitation to ensure a strengthening of the survival chain. Bystanders are the key to extremely early management, which is associated with the early medical care provided by EMS. This study aims to assess the prognosis of a bystander's cardiac CPR when it is initiated by the Dispatch Centre (DC). **METHODS:** We included patients in 3 groups according to who initiated the CPR. The groups were matched according to multiple propensity partition methods. We presented our results in terms of 30-day survival and

neurological prognosis. RESULTS: 85634 patients were included. Statistical study focused on 18185 patients once the exclusion criteria were applied. 12743 (70.1%) are men and the average age is 70.1 years. Survival at D30 was 5.11% in the absence of CPR, 8.86% with bystander initiation and 7.35% with DC initiation ( $p < 0.001$ ). Survival at D30 with favourable neurologic prognosis (CPC 1-2) was 76.30%, 83.69% and 82.82%, respectively. Our results show a 3.75% increase in the chance of survival at D30 if CPR was initiated by bystanders compared to patients for whom CPR was not initiated, a 2.25% increase in survival in the group that received from CPR initiated by the DC compared to the group that did not receive CPR. CONCLUSIONS: Bystander CPR initiated by the DC represents a suitable option following out-of-hospital cardiac arrest.

10. Resuscitation. 2019 Sep 6. pii: S0300-9572(19)30592-1. doi:

10.1016/j.resuscitation.2019.08.031. [Epub ahead of print]

### **Effects of dispatcher-initiated telephone cardiopulmonary resuscitation after out-of-hospital cardiac arrest: A nationwide, population-based, cohort study.**

Shibahashi K(1), Ishida T(2), Kuwahara Y(2), Sugiyama K(2), Hamabe Y(2).

#### **Abstract**

AIM: This study aimed to investigate the effects of dispatcher-initiated telephone cardiopulmonary resuscitation (TCPR) in Japan using a nationwide population-based registry. METHODS: Adult Japanese patients with out-of-hospital cardiac arrest (OHCA;  $n = 582,483$ , age  $\geq 18$  years) were selected from a nationwide Utstein-style database (2010-2016) and divided into 3 groups: no bystander CPR (NCPR) before emergency medical service arrival ( $n = 448,606$ ), bystander-initiated CPR (BCPR) performed without assistance ( $n = 46,964$ ), and TCPR ( $n = 86,913$ ). The primary outcome was a favourable neurological outcome 1 month after OHCA. RESULTS: After adjusting for potential confounders, and relative to the NCPR group, significantly better 1-month neurological outcomes were observed in the BCPR group (odds ratio: 2.25, 95% confidence interval: 2.15-2.36;  $P < 0.001$ ) and in the TCPR group (odds ratio: 1.30, 95% confidence interval: 1.24-1.36;  $P < 0.001$ ). The collapse-to-CPR time was independently associated with the 1-month outcomes, with a rate of  $< 1\%$  for 1-month favourable neurological outcomes if CPR was initiated  $> 5$  min after the collapse. CONCLUSION: Patients who received TCPR had significantly better outcomes than those who did not receive CPR. However, the TCPR outcomes were less favourable than those in the BCPR group. Better protocol development and enhanced education are needed to improve dispatcher instructions in Japan, which may help lessen the gap between the BCPR and TCPR outcomes and further improve the outcomes after OHCA.

12. J Clin Med. 2019 Aug 29;8(9). pii: E1336. doi: 10.3390/jcm8091336.

### **Predicting Cardiac Arrest and Respiratory Failure Using Feasible Artificial Intelligence with Simple Trajectories of Patient Data.**

Kim J(1), Chae M(2), Chang HJ(3), Kim YA(4), Park E(5).

#### **Abstract**

We introduce a Feasible Artificial Intelligence with Simple Trajectories for Predicting Adverse Catastrophic Events (FAST-PACE) solution for preparing immediate intervention in emergency situations. FAST-PACE utilizes a concise set of collected features to construct an artificial intelligence model that predicts the onset of cardiac arrest or acute respiratory failure from 1 h to 6 h prior to its occurrence. Data from the trajectory of 29,181 patients in intensive care units of two hospitals includes periodic vital signs, a history of treatment, current health status, and recent surgery. It excludes the results of laboratory data to construct a feasible application in wards, out-hospital emergency care, emergency transport, or other clinical situations where instant medical decisions are required with restricted patient data. These results are superior to previous warning scores including the



Modified Early Warning Score (MEWS) and the National Early Warning Score (NEWS). The primary outcome was the feasibility of an artificial intelligence (AI) model predicting adverse events 1 h to 6 h prior to occurrence without lab data; the area under the receiver operating characteristic curve of this model was 0.886 for cardiac arrest and 0.869 for respiratory failure 6 h before occurrence. The secondary outcome was the superior prediction performance to MEWS (net reclassification improvement of 0.507 for predicting cardiac arrest and 0.341 for predicting respiratory failure) and NEWS (net reclassification improvement of 0.412 for predicting cardiac arrest and 0.215 for predicting respiratory failure) 6 h before occurrence. This study suggests that AI consisting of simple vital signs and a brief interview could predict a cardiac arrest or acute respiratory failure 6 h earlier.

**FREE FULL TEXT**

## CURES POST-RCE

1. Crit Care Med. 2018 Apr;46(4):e279-e285. doi: 10.1097/CCM.0000000000002935.

**The Cumulative Partial Pressure of Arterial Oxygen Is Associated With Neurological Outcomes After Cardiac Arrest Treated With Targeted Temperature Management.**

Youn CS(1), Park KN(1), Kim SH(1), Lee BK(2), Oh SH(1), Jeung KW(2), Choi SP(3).

### **Abstract**

**OBJECTIVE:** Hyperoxia could lead to a worse outcome after cardiac arrest. The aim of this study was to investigate the relationship between the cumulative partial pressure of arterial oxygen (PaO<sub>2</sub>) and neurological outcomes after cardiac arrest treated with targeted temperature management. **DESIGN:** Retrospective analysis of a prospective cohort. **SETTING:** An academic tertiary care hospital. **PATIENTS:** A total of 187 consecutive patients treated with targeted temperature management after cardiac arrest. **INTERVENTIONS:** None. **MEASUREMENTS AND MAIN RESULTS:** The area under the curve of PaO<sub>2</sub> for different cutoff values of hyperoxia ( $\geq 100$ ,  $\geq 150$ ,  $\geq 200$ ,  $\geq 250$ , and  $\geq 300$  mm Hg) with different time intervals (0-24, 0-6, and 6-24 hr after return of spontaneous circulation) was calculated for each patient using the trapezoidal method. The primary outcome was the neurologic outcome, as defined by the cerebral performance category, at 6 months after cardiac arrest. Of 187 subjects, 77 (41%) had a good neurologic outcome at 6 months after cardiac arrest. The median age was 54 (43-69) years, and 128 (68%) were male. The area under the curve of PaO<sub>2</sub> with cutoff values of greater than or equal to 200, greater than or equal to 250, and greater than or equal to 300 was higher in the poor outcome group at 0-6 and 0-24 hours. The adjusted odds ratios of area under the curve of PaO<sub>2</sub> greater than or equal to 200 mm Hg were 1.659 (95% CI, 1.194-2.305) for 0-24 hours after return of spontaneous circulation and 1.548 (95% CI, 1.086-2.208) for 0-6 hours after return of spontaneous circulation. With a higher cumulative exposure to oxygen tension, we found significant increasing trends in the adjusted odds ratio for poor neurologic outcomes. **CONCLUSION:** In a new method for PaO<sub>2</sub> analysis, cumulative exposure to hyperoxia was associated with

neurologic outcomes in a dose-dependent manner. Greater attention to oxygen supply during the first 6 hours appears to be important for outcome after cardiac arrest.

2. *J Clin Med*. 2019 Sep 1;8(9). pii: E1360. doi: 10.3390/jcm8091360.

**Prognostic Factors for Re-Arrest with Shockable Rhythm during Target Temperature Management in Out-Of-Hospital Shockable Cardiac Arrest Patients.**

Ryoo SM(1), Lee DH(2), Lee BK(2), Youn CS(3), Kim YJ(1), Kim SJ(4), Kim YH(5), Kim WY(6).

**Abstract**

Re-arrest during post-cardiac arrest care after the return of spontaneous circulation is not uncommon. However, little is known about the risk factors associated with re-arrest. A previous study failed to show a benefit of prophylactic antiarrhythmic drug infusion in all kinds of out-of-hospital cardiac arrest (OHCA) survivors. This study evaluated high-risk OHCA survivors who may have re-arrest with shockable rhythm during targeted temperature management (TTM). Medical records of consecutive OHCA survivors treated with TTM at four tertiary referral university hospitals in the Republic of Korea between January 2010 and December 2016 were retrospectively reviewed. Patients who did not have any shockable rhythm during cardiopulmonary resuscitation (CPR) or unknown initial rhythm were excluded. The primary outcome of interest was the recurrence of shockable cardiac arrest during TTM. There were 289 cases of initial shockable arrest rhythm and 132 cases of shockable rhythm during CPR. Of the 421 included patients, 11.4% of patients had a shockable re-arrest during TTM. Survival to discharge and good neurologic outcomes did not differ between non-shockable and shockable re-arrest patients (78.3% vs. 72.9%,  $p = 0.401$ ; 53.1% vs. 54.2%  $p = 0.887$ ). Initial serum magnesium level, ST segment depression or ventricular premature complex (VPC) in initial electrocardiography (ECG), prophylactic amiodarone infusion, and dopamine and norepinephrine infusion during TTM were significantly higher and more frequent in the shockable re-arrest group (all  $p$  values  $< 0.05$ ). Normal ST and T wave in initial ECG was common in the non-shockable re-arrest group ( $p = 0.038$ ). However, in multivariate logistic regression analysis, only VPC was an independent prognostic factor for shockable re-arrest (OR 2.806 (95% CI 1.276-6.171),  $p = 0.010$ ). Initial VPC may be a prognostic risk factor for shockable re-arrest in OHCA survivors with shockable rhythm.

**FREE FULL TEXT**

3. *Medicine (Baltimore)*. 2019 Aug;98(34):e16930. doi: 10.1097/MD.0000000000016930.

**Predictive performance of plasma neutrophil gelatinase-associated lipocalin for neurologic outcomes in out-of-hospital cardiac arrest patients treated with targeted temperature management: A prospective observational study.**

Lee JH(1)(2), Park I(1), You JS(1), Kim MJ(1), Lee HS(3), Park YS(1), Park HC(4), Chung SP(1).

**Abstract**

Few studies have demonstrated the prognostic potential of neutrophil gelatinase-associated lipocalin (NGAL) in post-cardiac arrest patients. This study evaluated the usefulness of plasma NGAL in predicting neurologic outcome and mortality in out-of-hospital cardiac arrest (OHCA) patients treated with targeted temperature management (TTM). A prospective observational study was conducted between October 2013 and April 2016 at a single tertiary hospital. We enrolled 75 patients treated with TTM and collected their demographic data, cardiopulmonary resuscitation-related information, data on plasma NGAL concentration, and prognostic test results. Plasma NGAL was measured at 4 hours after return of spontaneous circulation (ROSC). The primary endpoint was the neurologic outcome at discharge and the secondary outcome was 28-day mortality. Neurologic outcomes were analyzed using a stepwise multivariate logistic regression while 28-day mortality was analyzed using a stepwise Cox regression. The predictive performance of plasma NGAL for neurologic outcome was

measured by the area under the receiver operating characteristic curve and the predictability of 28-day mortality was measured using Harrell C-index. We also compared the predictive performance of plasma NGAL to that of other traditional prognostic modalities for outcome variables. Thirty patients (40%) had good neurologic outcomes and 53 (70.7%) survived for more than 28 days. Plasma NGAL in patients with good neurologic outcomes was  $122.7 \pm 146.7$  ng/ml, which was significantly lower than that in the poor neurologic outcome group ( $307.5 \pm 269.6$  ng/ml;  $P < .001$ ). The probability of a poor neurologic outcome was more than 3.3-fold in the NGAL  $>124.3$  ng/ml group (odds ratio, 3.321; 95% confidence interval [CI], 1.265-8.721). Plasma NGAL in the survived group was significantly lower than that in the non-survived group ( $172.7 \pm 191.6$  vs  $379.9 \pm 297.8$  ng/ml;  $P = .005$ ). Plasma NGAL was significantly correlated with 28-day mortality (hazard ratio 1.003, 95% CI 1.001-1.004;  $P < .001$ ). The predictive performance of plasma NGAL was not inferior to that of other prognostic modalities except electroencephalography. Plasma NGAL is valuable for predicting the neurologic outcome and 28-day mortality of patients with OHCA at an early stage after ROSC. This study was registered at ClinicalTrials.gov on November 19, 2013 (Identifier: [NCT01987466](https://clinicaltrials.gov/ct2/show/study/NCT01987466)).

4. Shock. 2019 Sep 3. doi: 10.1097/SHK.0000000000001441. [Epub ahead of print]

#### **Association of Vitamin D Deficiency with Profound Cardiogenic Shock In Patients Resuscitated from Sudden Cardiac Arrest.**

Cha JJ(1), Wi J(1)(2).

#### **Abstract**

**BACKGROUND:** Vitamin D deficiency is associated with various cardiovascular diseases, including sudden cardiac arrest (SCA). Profound cardiogenic shock is associated with morbidity and mortality in patients with SCA. This study investigated the association of vitamin D deficiency with profound cardiogenic shock in patients resuscitated from SCA. **MATERIALS AND METHODS:** We enrolled patients who were successfully resuscitated from out-of-hospital cardiac arrests of a presumed cardiac cause. Profound cardiogenic shock was defined as refractory hypotension requiring high-dose vasopressor infusion (norepinephrine  $>0.5$  mcg/kg/min) despite adequate intravascular volume replacement. Vitamin D levels were measured as plasma 25(OH)D concentrations and severe vitamin D deficiency was defined as 25(OH)D  $<10$  ng/mL. **RESULTS:** A total of 237 subjects (179 men (76%), mean age  $56.5 \pm 16.5$  years) were included in this study. The first monitored rhythm was shockable in 160 subjects (68%). Mean arrest time and CPR times were  $25.6 \pm 15.7$  and  $22.8 \pm 15.0$  minutes, respectively. Profound cardiogenic shock was observed in 100 subjects (42%). The mean vitamin D level was  $12.3 \pm 6.7$  ng/mL, and vitamin D deficiency was diagnosed in 109 subjects (46%). In profound cardiogenic shock subjects, vitamin D levels were significantly lower ( $10.7 \pm 7.0$  vs.  $13.4 \pm 6.2$  ng/mL,  $p = 0.002$ ) and severe vitamin D deficiency was observed more frequently (63% vs. 34%,  $p < 0.001$ ). Subjects with profound cardiogenic shock were likely to have longer arrest times ( $29.5 \pm 17.0$  vs.  $22.7 \pm 14.0$  minutes,  $p = 0.001$ ), left ventricular systolic dysfunction (LVEF  $<40\%$ , 73% vs. 38%,  $p < 0.001$ ), and baseline renal dysfunction (65% vs. 37%,  $p < 0.001$ ). Multivariate logistic analysis indicated that vitamin D deficiency was significantly associated with profound cardiogenic shock after SCA (OR 2.71, 95% CI 1.42-5.18,  $p = 0.003$ ) after adjusting for confounding variables. **CONCLUSIONS:** Severe vitamin D deficiency was strongly associated with profound cardiogenic shock and mortality in patients resuscitated from SCA.

# ECMO

1. Catheter Cardiovasc Interv. 2019 Sep 5. doi: 10.1002/ccd.28492. [Epub ahead of print]

### **Outcomes of extracorporeal membrane oxygenation support in the cardiac catheterization laboratory.**

Parr CJ(1)(2), Sharma R(3), Arora RC(2)(4), Singal R(2)(4), Hiebert B(2), Minhas K(1)(2).

#### **Abstract**

**OBJECTIVES:** The aims of this single-center retrospective study were to characterize and determine predictors of 30-day survival in a cohort of patients requiring venoarterial extracorporeal membrane oxygenation (VA-ECMO) supported cardiopulmonary resuscitation (E-CPR) in the cardiac catheterization laboratory (CCL) for cardiac arrest (CA) or refractory cardiogenic shock (CS). **BACKGROUND:** While safety in the CCL has improved, periprocedural mortality from CA remains high. The application of VA-ECMO is an emerging form of resuscitation with a paucity of data evaluating its use in the CCL for CA or CS. **METHODS:** All consecutive patients aged 18 years or older presenting to a single CCL from October 2010 to May 2018 who required E-CPR for CA or refractory CS were included. The primary outcome of our study was overall survival 30 days from VA-ECMO initiation. Secondary outcomes included 1-year survival, hospital length of stay, and ECMO related complications. **RESULTS:** Sixty-two patients with a mean age of  $60 \pm 9$  years, 63% male, were included. VA-ECMO was initiated for CA in 39 patients (63%) and for CS in 23 patients (37%). The median ECMO duration was 48 hr. Overall 30-day survival was 47% (CA group 44% vs. CS group 52%;  $p = .414$ ). One-year survival was 44%. Initial serum creatinine (OR 1.18 per 10  $\mu\text{mol/L}$  increase;  $p = .016$ ; AUC = 0.65) was the only multivariate predictor of 30-day mortality. **CONCLUSIONS:** The use of VA-ECMO in the CCL is feasible, demonstrating 47% 30-day survival, largely persistent to 1 year, in a cohort that otherwise has extremely high mortality.

2. Resuscitation. 2019 Aug 29. pii: S0300-9572(19)30585-4. doi:10.1016/j.resuscitation.2019.08.024. [Epub ahead of print]

### **Cost-effectiveness of Extracorporeal Cardiopulmonary Resuscitation after in-hospital cardiac arrest: a Markov decision model.**

Gravesteyn BY(1), Schlupe M(2), Voormolen DC(3), van der Burgh AC(4), Dos Reis Miranda D(5), Hoeks SE(2), Endeman H(5).

#### **Abstract**

**BACKGROUND:** This study aimed to estimate the cost-effectiveness of extracorporeal cardiopulmonary resuscitation (ECPR) for in-hospital cardiac arrest treatment. **METHODS:** A decision tree and Markov model were constructed based on current literature. The model was conditional on age, Charlson Comorbidity Index (CCI) and sex. Three treatment strategies were considered: ECPR for patients with an Age-Combined Charlson Comorbidity Index (ACCI) below different thresholds (2-4), ECPR for everyone (EALL), and ECPR for no one (NE). Cost-effectiveness was assessed with costs per quality-of-life adjusted life years (QALY). **MEASUREMENTS AND MAIN RESULTS:** Treating eligible patients with an ACCI below 2 points costs 8394 (95% CI: 4922-14,911) euro per extra QALY per IHCA patient; treating eligible patients with an ACCI below 3 costs 8825 (95% CI: 5192-15,777) euro per extra QALY per IHCA patient; treating eligible patients with an ACCI below 4 costs 9311 (95% CI: 5478-16,690) euro per extra QALY per IHCA patient; treating every eligible patient with ECPR costs 10,818 (95% CI: 6357-19,400) euro per extra QALY per IHCA patient. For WTP thresholds of 0-9500 euro, NE has the highest probability of being the most cost-effective strategy. For WTP thresholds between 9500 and 12,500, treating eligible patients with an ACCI below 4 has the highest probability of being the most cost-effective strategy. For WTP thresholds of 12,500 or higher, EALL was found to have the highest probability of being the most cost-effective strategy. **CONCLUSIONS:** Given that conventional WTP thresholds in Europe and North-America lie between 50,000-100,000 euro or U.S. dollars, ECPR can be considered a cost-effective treatment after in-hospital cardiac arrest

from a healthcare perspective. More research is necessary to validate the effectiveness of ECPR, with a focus on the long-term effects of complications of ECPR.

3. Resuscitation. 2019 Sep 9. pii: S0300-9572(19)30606-9. doi:10.1016/j.resuscitation.2019.08.041. [Epub ahead of print]

**Extracorporeal membrane oxygenation improves outcomes of accidental hypothermia without vital signs: a nationwide observational study.**

Ohbe H(1), Isogai S(2), Jo T(3), Matsui H(2), Fushimi K(4), Yasunaga H(2).

**Abstract**

AIM: Patients with accidental hypothermia without vital signs increasingly receive venoarterial extracorporeal membrane oxygenation (VA-ECMO). However, there is limited knowledge regarding the efficacy of this advanced rewarming method. We aimed to determine whether VA-ECMO improved outcomes in patients with accidental hypothermia without vital signs, using a large nationwide inpatient database in Japan. METHODS: Using the Japanese Diagnosis Procedure Combination inpatient database from July 2010 to March 2017, we identified patients diagnosed with accidental hypothermia who received closed-chest cardiac massage in-hospital on the day of admission. Patients who received VA-ECMO on the day of admission were allocated to the VA-ECMO group, and those who received cardiopulmonary resuscitation (CPR) only were allocated to the conventional CPR group. The primary outcome was in-hospital mortality, and the secondary outcome was a Japan Coma Scale status of "alert consciousness" at discharge. Propensity score-matching analyses were performed to compare the outcomes. RESULTS: We identified 1661 eligible patients during the 81-month study period, and 318 (19%) received VA-ECMO on the day of admission. Crude in-hospital mortality was 65% in the VA-ECMO group and 84% in the conventional CPR group. Propensity score-matching analyses demonstrated significantly lower in-hospital mortality (risk difference: -13%; 95% confidence interval: -21% to -5.1%) and a higher proportion of "alert consciousness" at discharge (risk difference: 8.3%; 95% confidence interval: 1.9%-15%) in the VA-ECMO group compared with the conventional CPR group. CONCLUSION: VA-ECMO was associated with higher survival and favourable neurological outcomes compared with conventional CPR alone in patients with accidental hypothermia without vital signs.

## PEDIATRIA

1. Pak J Med Sci. 2019 Sep-Oct;35(5):1434-1440. doi: 10.12669/pjms.35.5.487.

**Pediatric cardiac arrest in the emergency department: Outcome is related to the time of admission.**

Yurtseven A(1), Turan C(2), Akarca FK(3), Saz EU(4).

**Abstract**

OBJECTIVES: Nights and weekends represent a potentially high-risk time for pediatric cardiac arrest (CA) patients in emergency departments. Data regarding night or weekend arrest and its impact on outcomes is controversial. The purpose of this study was to determine the relationship between cardiopulmonary resuscitation during the various emergency department shifts and survival to discharge. METHODS: We conducted a retrospective, observational study of patients who had visited our Emergency Department for CAs from January 2014 to December 2016. Medical records and patient characteristics of 67 children with CA were retrieved from patient admission files. RESULTS: The mean age was 54.7±7.3 months and 59% were male. Rates of survival to discharge

35% (11/31) within working hours' vs. out of working hours 3% (1/36). Among the CAs presenting to the emergency department, the survival rates were higher for working hours than for non-working hours (OR: 37.6 (2.62-539.7),  $p: 0.008$ ). The rate of return of spontaneous circulation within working hours was higher than that of non-working hours (71% vs.19%) ( $p < 0.001$ ). Patients who received chest compression for more than 10 minutes had the lowest survival rate (2%) ( $p < 0.001$ ), whereas better outcome was associated with in-hospital CA, younger age (less than 12 months) and respiratory failure. CONCLUSION: Survival rates from pediatric CAs were significantly lower during non-working hours. Poor outcome was associated with prolonged cardiopulmonary resuscitation, out of hospital CA and older age.

2. *Cardiol Young*. 2019 Sep 9:1-9. doi: 10.1017/S1047951119002002. [Epub ahead of print]

### **Early identification of impending cardiac arrest in neonates and infants in the cardiovascular ICU: a statistical modelling approach using physiologic monitoring data.**

Bose SN(1)(2), Verigan A(3), Hanson J(3)(4), Ahumada LM(5), Ghazarian SR(5), Goldenberg N(3)(4)(6), Stock A(7), Jacobs JP(1)(2)(3)(4)(5)(6)(7).

#### **Abstract**

**OBJECTIVE:** To develop a physiological data-driven model for early identification of impending cardiac arrest in neonates and infants with cardiac disease hospitalised in the cardiovascular ICU. **METHODS:** We performed a single-institution retrospective cohort study (11 January 2013-16 September 2015) of patients  $\leq 1$  year old with cardiac disease who were hospitalised in the cardiovascular ICU at a tertiary care children's hospital. Demographics and diagnostic codes of cardiac arrest were obtained via the electronic health record. Diagnosis of cardiac arrest was validated by expert clinician review. Minute-to-minute physiological monitoring data were recorded via bedside monitors. A generalized linear model was used to compute a minute by minute risk score. Training and test data sets both included data from patients who did and did not develop cardiac arrest. An optimal risk-score threshold was derived based on the model's discriminatory capacity for impending arrest versus non-arrest. Model performance measures included sensitivity, specificity, accuracy, likelihood ratios, and post-test probability of arrest. **RESULTS:** The final model consisting of multiple clinical parameters was able to identify impending cardiac arrest at least 2 hours prior to the event with an overall accuracy of 75% (sensitivity = 61%, specificity = 80%) and observed an increase in probability of detection of cardiac arrest from a pre-test probability of 9.6% to a post-test probability of 21.2%. **CONCLUSIONS:** Our findings demonstrate that a predictive model using physiologic monitoring data in neonates and infants with cardiac disease hospitalised in the paediatric cardiovascular ICU can identify impending cardiac arrest on average 17 hours prior to arrest.

## **RECERCA EXPERIMENTAL**

1. *Br J Anaesth*. 2019 Aug 27. pii: S0007-0912(19)30572-0. doi: 10.1016/j.bja.2019.07.010. [Epub ahead of print]

### **Noble gas neuroprotection: xenon and argon protect against hypoxic-ischaemic injury in rat hippocampus in vitro via distinct mechanisms.**

Koziakova M(1), Harris K(1), Edge CJ(2), Franks NP(3), White IL(4), Dickinson R(5).

#### **Abstract**

**BACKGROUND:** Noble gases may provide novel treatments for neurological injuries such as ischaemic and traumatic brain injury. Few studies have evaluated the complete series of noble gases under identical conditions

in the same model. **METHODS:** We used an in vitro model of hypoxia-ischaemia to evaluate the neuroprotective properties of the series of noble gases, helium, neon, argon, krypton, and xenon. Organotypic hippocampal brain slices from mice were subjected to oxygen-glucose deprivation, and injury was quantified using propidium iodide fluorescence. **RESULTS:** Both xenon and argon were equally effective neuroprotectants, with 0.5 atm of xenon or argon reducing injury by 96% ( $P < 0.0001$ ), whereas helium, neon, and krypton were devoid of any protective effect. Neuroprotection by xenon, but not argon, was reversed by elevated glycine. **CONCLUSIONS:** Xenon and argon are equally effective as neuroprotectants against hypoxia-ischaemia in vitro, with both gases preventing injury development. Although xenon's neuroprotective effect may be mediated by inhibition of the N-methyl-D-aspartate receptor at the glycine site, argon acts via a different mechanism. These findings may have important implications for their clinical use as neuroprotectants.

#### **FREE FULL TEXT**

2. J Am Heart Assoc. 2019 Sep 3;8(17):e012809. doi: 10.1161/JAHA.119.012809. Epub 2019 Aug 31.

#### **Tissue-Specific Metabolic Profiles After Prolonged Cardiac Arrest Reveal Brain Metabolome Dysfunction Predominantly After Resuscitation.**

Choi J(1), Shoaib M(2)(3), Yin T(2), Nayyar G(4), Shinozaki K(2), Stevens JF(1)(5), Becker LB(2)(3)(6), Kim J(2)(3)(6).

#### **Abstract**

**Background** Cardiac arrest (CA) has been a leading cause of death for many decades. Despite years of research, we still do not understand how each organ responds to the reintroduction of blood flow after prolonged CA. Following changes in metabolites of individual organs after CA and resuscitation gives context to the efficiency and limitations of current resuscitation protocols. **Methods and Results** Adult male Sprague-Dawley rats were arbitrarily assigned into 3 groups: control, 20 minutes of CA, or 20 minutes of CA followed by 30 minutes of cardiopulmonary bypass resuscitation. The rats were euthanized by decapitation to harvest brain, heart, kidney, and liver tissues. The obtained tissue samples were analyzed by ultra-high-performance liquid chromatography-high-accuracy mass spectrometry for comprehensive metabolomics evaluation. After resuscitation, the brain showed decreased glycolysis metabolites and fatty acids and increased amino acids compared with control. Similarly, the heart displayed alterations mostly in amino acids. The kidney showed decreased amino acid and fatty acid pools with severely increased tricarboxylic acid cycle metabolites following resuscitation, while the liver showed minimal alterations with slight changes in the lipid pool. Each tissue has a distinct pattern of metabolite changes after ischemia/reperfusion. Furthermore, resuscitation worsens the metabolic dysregulation in the brain and kidney, while it normalizes metabolism in the heart. **Conclusions** Developing metabolic profiles using a global metabolome analysis identifies the variable nature of metabolites in individual organs after CA and

reperfusion, establishing a stark contrast between the normalized heart and liver and the exacerbated brain and kidney, only after the reestablishment of blood circulation.

#### FREE FULL TEXT

3. Life Sci. 2019 Aug 30;116821. doi: 10.1016/j.lfs.2019.116821. [Epub ahead of print]

#### **Electroacupuncture pretreatment attenuates brain injury in a mouse model of cardiac arrest and cardiopulmonary resuscitation via the AKT/eNOS pathway.**

Yong Y(1), Guo J(1), Zheng D(2), Li Y(2), Chen W(2), Wang J(1), Chen W(1), Wang K(3), Wang Y(4).

#### **Abstract**

**AIMS:** This study aims to examine the effects of electroacupuncture (EA) pretreatment on brain injury after cardiac arrest and cardiopulmonary resuscitation (CA/CPR) and its underlying mechanisms. **MATERIALS AND METHODS:** Adult male C57BL/6 mice were subjected to 6 min of cardiac arrest induced with a potassium chloride infusion and resuscitated by chest compressions and an epinephrine infusion. During the 3 days prior to CA/CRP, mice received EA pretreatment (1 mA, 2 Hz; daily session of 30 min) at the Baihui acupoint (GV20) once daily. Stimulation at a nonacupoint served as a control. In mechanistic studies, mice received the AKT inhibitor LY294002 or endothelial nitric oxide synthase (eNOS) inhibitor L-NIO 30 min before EA pretreatment. A neurological assessment was conducted 24 h after CA/CRP, followed by animal sacrifice and evaluation of physiological brain damage. **KEY FINDINGS:** CA/CPR resulted in severe brain injury as evidenced by neurological deficits and increased neuronal apoptosis, oxidative stress and the proinflammatory cytokines TNF- $\alpha$  and IL-6. EA pretreatment at the GV20 acupoint but not at a nonacupoint attenuated the neurological deficits and the pathological changes induced by CA/CPR. LY294002 or L-NIO eliminated the neuroprotective effects of the EA pretreatment. **SIGNIFICANCE:** This study showed that EA pretreatment at the GV20 acupoint can protect the brain from damage Associated with globalized ischemia followed by reperfusion and that these protective effects occur via the AKT/eNOS signaling pathway.

4. Nat Commun. 2019 Sep 4;10(1):3983. doi: 10.1038/s41467-019-11870-x.

#### **RBM3 promotes neurogenesis in a niche-dependent manner via IMP2-IGF2 signaling pathway after hypoxic-ischemic brain injury.**

Zhu X(1), Yan J(2), Bregere C(3)(4), Zelmer A(2), Goerne T(2), Kapfhammer JP(3), Guzman R(3)(4), Wellmann S(5)(6).

#### **Abstract**

Hypoxic ischemia (HI) is an acute brain threat across all age groups. Therapeutic hypothermia ameliorates resulting injury in neonates but its side effects prevent routine use in adults. Hypothermia up-regulates a small protein subset that includes RNA-binding motif protein 3 (RBM3), which is neuroprotective under stressful conditions. Here we show how RBM3 stimulates neuronal differentiation and inhibits HI-induced apoptosis in the two areas of persistent adult neurogenesis, the subventricular zone (SVZ) and the subgranular zone (SGZ), while promoting neural stem/progenitor cell (NSPC) proliferation after HI injury only in the SGZ. RBM3 interacts with IGF2 mRNA binding protein 2 (IMP2), elevates its expression and thereby stimulates IGF2 release in SGZ but



not SVZ-NSPCs. In summary, we describe niche-dependent regulation of neurogenesis after adult HI injury via the novel RBM3-IMP2-IGF2 signaling pathway.

#### **FREE FULL TEXT**

5. *Drug Des Devel Ther.* 2019 Aug 7;13:2759-2768. doi: 10.2147/DDDT.S215358. eCollection 2019.

#### **Cerebral protection of epigallocatechin gallate (EGCG) via preservation of mitochondrial function and ERK inhibition in a rat resuscitation model.**

Qin S(#)(1), Chen MH(#)(1), Fang W(1), Tan XF(1), Xie L(1), Yang YG(1), Qin T(1), Li N(1).

#### **Abstract**

Background: Various and opposite roles of epigallocatechin gallate (EGCG) have been reported in different studies. We aimed to investigate how EGCG affects the cerebral injury in a cardiac arrest/cardiopulmonary resuscitation (CA/CPR) model of rat. Methods: The rats which were subjected to CA/CPR randomly received low dose of EGCG (3 mg/kg, Low-EGCG group, n=16), high dose of EGCG (9 mg/kg, High-EGCG group, n=16) and equal volume of 0.9% saline solution (NS group, n=16) at the first minute after return of spontaneous circulation (ROSC). The rats underwent anesthesia and intubation were defined as Sham group (n=16). Twenty-four hours after ROSC, neural defect score (NDS), ROS fluorescence intensity, degree of mitochondrial permeability transition pore (mPTP) opening, ATP contents and mitochondrial ATP synthase expression were evaluated in the four groups. The expression of extracellular signal-regulated kinase (ERK) activity and cleaved-caspase 3 were also detected by Western blot. Results: CA/CPR induced severe ischemia-reperfusion injury (IRI), resulted in mitochondrial dysfunction and upregulated phosphorylation of ERK. EGCG dose-dependently alleviated the IRI after CA/CPR, inhibited ERK activity and restored mitochondrial function and, as indicated by improved NDS, reduced ROS level, decreased mPTP opening, elevated ATP content, increased ATPase expression and downregulated cleaved-caspase 3 level. Conclusion: EGCG alleviated global cerebral IRI by restoring mitochondrial dysfunction and ERK modulation in a rat CA/CPR model, which might make it a potential candidate agent against IRI after CA/CPR in the future. Further study is needed to determine whether higher dosage of EGCG might aggravate cerebral IRI post-CA/CPR.

#### **FREE FULL TEXT**

6. *PLoS One.* 2019 Sep 10;14(9):e0221039. doi: 10.1371/journal.pone.0221039. eCollection 2019.

#### **Novel application of amino-acid buffered solution for neuroprotection against ischemia/reperfusion injury.**

Hsu J(1), Wang CH(2), Huang SC(2), Chen YW(1), Yu S(1), Hwang JJ(3), Lin JW(3), Ma MC(4), Chen YS(2).

#### **Abstract**

Ischemic neuron loss contributes to brain dysfunction in patients with cardiac arrest (CA). Histidine-tryptophan-ketoglutarate (HTK) solution is a preservative used during organ transplantation. We tested the potential of HTK to protect neurons from severe hypoxia (SH) following CA. We isolated rat primary cortical neurons and induced SH with or without HTK. Changes in caspase-3, hypoxia-inducible factor 1-alpha (HIF-1 $\alpha$ ), and nicotinamide adenine dinucleotide phosphate oxidase-4 (NOX4) expression were evaluated at different time points up to 72 h. Using a rat asphyxia model, we induced CA-mediated brain damage and then completed resuscitation. HTK or sterile saline was administered into the left carotid artery. Neurological deficit scoring and mortality were evaluated for 3 days. Then the rats were sacrificed for evaluation of NOX4 and H<sub>2</sub>O<sub>2</sub> levels in blood and brain. In the in vitro study, HTK attenuated SH- and H<sub>2</sub>O<sub>2</sub>-mediated cytotoxicity in a volume- and time-dependent manner, associated with persistent HIF-1 $\alpha$  expression and reductions in procaspase-3 activation and NOX4 expression. The inhibition of HIF-1 $\alpha$  abrogated HTK's effect on NOX4. In the in vivo study, neurological scores were

significantly improved by HTK. H<sub>2</sub>O<sub>2</sub> level, NOX4 activity, and NOX4 gene expression were all decreased in the brain specimens of HTK-treated rats. Our results suggest that HTK acts as an effective neuroprotective solution by maintaining elevated HIF-1 $\alpha$  level, which was associated with inhibited procaspase-3 activation and decreased NOX4 expression.

#### FREE FULL TEXT

7. *Am J Physiol Renal Physiol*. 2019 Sep 4. doi: 10.1152/ajprenal.00241.2019. [Epub ahead of print]

#### **Extracorporeal Resuscitation with Carbon Monoxide Improves Renal Function by Targeting Inflammatory Pathways in Cardiac Arrest in Pigs.**

Wollborn J(1), Schlueter B(2), Steiger C(3), Hermann C(4), Wunder C(5), Schmidt J(6), Diel P(7), Meinel L(8), Buerkle H(9), Goebel U(1), Schick MA(9).

#### **Abstract**

**BACKGROUND:** Deleterious consequences like acute kidney injury frequently occur upon successful resuscitation from cardiac arrest. Extracorporeal life support is increasingly used to overcome high cardiac arrest mortality. Carbon monoxide (CO) is an endogenous gasotransmitter, capable of reducing renal injury. In our study, we hypothesize that addition of CO to extracorporeal resuscitation hampers severity of renal injury in a porcine model of cardiac arrest. **METHODS:** Hypoxic cardiac arrest was induced in pigs. Animals were resuscitated using a conventional (CPR), an extracorporeal (E-CPR) or a CO-assisted extracorporeal (CO-E-CPR) protocol. CO was applied using a membrane-controlled releasing system. Markers of renal injury were measured and histopathological analyses were carried out. We investigated renal pathways involving inflammation as well as apoptotic cell death. **RESULTS:** No differences in serum neutrophil gelatinase-associated lipocalin (NGAL) were detected after CO treatment compared to Sham animals (Sham 71 $\pm$ 7 and CO-E-CPR 95 $\pm$ 6 ng/ml), while NGAL was increased in CPR and E-CPR groups (CPR 135 $\pm$ 11 and E-CPR 124 $\pm$ 5 ng/ml;  $p$ <0.05). Evidence for histopathological damage was abrogated after CO application. CO increased renal heat-shock protein 70 expression and reduced inducible cyclooxygenase 2 (CPR 60 $\pm$ 8; E-CPR 56 $\pm$ 8; CO-E-CPR 31 $\pm$ 3  $\mu$ g/ml;  $p$ <0.05). Caspase 3 activity was decreased (CPR 1469 $\pm$ 276; E-CPR 1670 $\pm$ 225; CO-E-CPR 755 $\pm$ 83 pg/ml;  $p$ <0.05). Furthermore, we found a reduction in renal inflammatory signaling upon CO treatment. **CONCLUSION:** Our data demonstrates improved renal function by extracorporeal CO treatment in a porcine model of cardiac arrest. CO reduced pro-inflammatory and pro-apoptotic signaling, characterizing beneficial aspects of a novel treatment option to overcome high mortality.

8. *Circ Arrhythm Electrophysiol*. 2018 Aug;11(8):e006452. doi:10.1161/CIRCEP.118.006452.

#### **Ventricular Arrhythmias Underlie Sudden Death in Rats With Heart Failure and Preserved Ejection Fraction.**

Cho JH(1), Zhang R(1), Aynaszyan S(1), Holm K(1), Goldhaber JI(1), Marbán E(1), Cingolani E(2).

#### **Abstract**

**BACKGROUND:** Heart failure (HF) with preserved ejection fraction (HFpEF) is increasingly common clinically, now rivaling or exceeding HF with reduced ejection fraction. Sudden death is the leading mode of exodus in patients with HFpEF, but the underlying causes are largely unknown. Using ambulatory recordings in a rat model, we test the hypothesis that ventricular arrhythmias (VA) underlie sudden death in HFpEF. **METHODS:** Dahl salt-sensitive rats (7 weeks of age) were fed a high-salt diet to induce HFpEF (n=13) or a normal-salt diet (controls, n=9). Transthoracic echocardiography was performed to check systolic and diastolic function at 14 to 18 weeks of age. Telemetric electrocardiographic recordings were analyzed for QT interval duration, burden of premature ventricular contractions, spontaneous VA, and heart rate variability. Survival was monitored twice daily. **RESULTS:** High-salt-fed rats with clear diastolic dysfunction, preserved ejection fraction, and HF signs were

diagnosed with HFpEF at 14 to 15 weeks of age. QT and QTc intervals were prolonged in HFpEF rats compared with controls. Heart rate variability was reduced in HFpEF rats compared with controls. Spontaneous VA were more prevalent in HFpEF rats (6/13=46.1% versus 0/9=0% in controls;  $P<0.05$ ), and sudden death was observed in 4 of 13 HFpEF rats. Three of the 4 sudden deaths were associated with VA as the terminal rhythm. **CONCLUSIONS:** In this rat model with phenotypically verified HFpEF, sudden death was common and generally associated with VA. Further clinical studies are warranted to determine whether these insights translate to sudden death in HFpEF patients.

## CASE REPORTS

1. *Ann Cardiol Angeiol (Paris)*. 2019 Aug 27. pii: S0003-3928(19)30057-5. doi: 10.1016/j.ancard.2019.07.013. [Epub ahead of print]

**Coronary artery spasm revealed by an out-of-hospital cardiac arrest associated with a moyamoya disease. A case report of multimodality imaging.**

Cherif G(1), Georges JL(2), Convers R(1), De Malherbe M(3), Ajlani B(1), Dagher Hayeck Y(4), Larnier L(4), Blicq E(1), Charbonnel C(1), Legriel S(5), Hervé D(6), Livarek B(1).

### Abstract

Moyamoya disease is a rare angiopathy characterized by a progressive distal occlusion of the internal carotid arteries and their branches. Extracerebral involvement, including coronary arteries, has been described. We report the case of a patient with moyamoya disease who suffered an out-of-hospital cardiac arrest associated with coronary spasm. We discussed the possible links between coronary spasm and moyamoya, as well as the contribution of multimodal cardiac imaging, combining conventional and intracoronary imaging, cardiac MRI, provocative tests for spasm, in the exploration of out-of-hospital cardiac arrest without obvious electrocardiographic and angiographic cause.

### ARTICLE IN FRENCH

2. *Medicine (Baltimore)*. 2019 Aug;98(31):e16651. doi: 10.1097/MD.000000000016651.

**Survival after cardiac arrest secondary to high-risk pulmonary embolism without reperfusion therapies: A case report.**

Xu CY(1), Song JF(2), Yao LH(3), Xu HL(1), Liu KX(1).

### Abstract

**INTRODUCTION:** High-risk pulmonary embolism (PE) needs reperfusion therapies. However, it is difficult to make medical decisions when thrombolysis is contraindicated, though pulmonary embolectomy and percutaneous catheter-directed treatment (CTD) are recommended for these patients. **PATIENT CONCERNS:** We reported here a case of high-risk PE patient with cardiac arrest (CA), vertebral compression fracture, as well as scalp and frontal hematoma. **DIAGNOSIS:** The diagnosis of PE was based on computed tomography pulmonary angiography (CTPA) which demonstrated filling defects in the right and left pulmonary arteries. **INTERVENTIONS:** Cardiopulmonary resuscitation was performed until the patient returned to idioventricular rhythm 3 minutes

after admitted. She suffered another half-hour of hemodynamic disturbance after her shock improved 3 days later. The diagnosis of PE was confirmed by CTPA at that time. The patient did not receive any reperfusion therapies because hemoglobin decreased significantly. Moreover, anticoagulation was postponed for 2 weeks when bleeding appeared to be stopped. She received overlapping treatment with low molecular weight heparin and warfarin for 5 days then warfarin alone and discharged. **OUTCOMES:** She was discharged with normal vital signs and neurologically intact. She received anticoagulant therapy with warfarin and international normalized ratio regularly monitored after she was discharged, moreover, the pulmonary artery pressure turned normal, as determined by transthoracic echocardiography 1 month later. The warfarin treatment was discontinued after 12 months and no evidence of recurrence was seen until recently. **CONCLUSIONS:** This is the first case report of PE combined with CA that did not receive reperfusion therapy. We hypothesized that there was a spontaneous resolution in pulmonary emboli.

#### **FREE FULL TEXT**

3. Rev Port Cir Cardiorac Vasc. 2019 Apr-Jun;26(2):143-145.

#### **Acute Prosthetic Aortic Valve Obstruction Leading to Free Aortic Insufficiency Veno-Arterial Extracorporeal Membrane Oxygenation as a bridge to surgery.**

Passos Silva M(1), Caeiro D(1), Neves F(2), Braga P(1).

#### **Abstract**

**INTRODUCTION:** Mechanical prosthetic valve thrombosis (PVT) and obstruction is a lifethreatening event. The significant morbidity and mortality associated with this condition warrants rapid diagnostic evaluation and treatment. **CASE REPORT:** A 66-year-old female patient with a history of aortic valve replacement 13 years before, was admitted to our intensive cardiac care unit with symptoms and signs of prosthetic aortic valve dysfunction. During cardiac angiography, she collapsed and fluoroscopy showed an immobile disc, stopped in an open position and causing free aortic regurgitation. Cardio-pulmonary resuscitation (CPR) was initiated and a VA-ECMO was inserted as a bridge to emergent cardiac surgery. Surgery was then performed and the patient was successfully discharged with no neurological impairment. **DISCUSSION:** We present a case where Veno-Arterial Extracorporeal Membrane Oxygenation (VA-ECMO) was successfully used as a bridge to emergent surgery in a cardiac arrest patient due to prosthetic valve thrombosis. **CONCLUSIONS:** This case illustrates how a relative contraindication (severe aortic insufficiency) to VA-ECMO may, in the end, be an indication in a very particular scenario.

4. Turk Kardiyol Dern Ars. 2019 Sep;47(6):512-515. doi: 10.5543/tkda.2018.65708.

#### **Concomitant usage of thrombolytic therapy and therapeutic hypothermia in a case of sudden cardiac arrest due to massive pulmonary embolism.**

Çoner A(1), Birtay T(2).

#### **Abstract**

Massive pulmonary embolism is a well-known cause of sudden cardiac arrest in the adult population. Systemic fibrinolysis can be a life-saving option. Therapeutic hypothermia is highly recommended for nontraumatic sudden cardiac arrest victims to minimize neurological complications. However, there are limited data about the use of therapeutic hypothermia for sudden cardiac arrest victims also treated with systemic fibrinolysis. Concerns about hypothermia-related coagulopathy and a possible tendency to bleeding have limited the use of cooling therapy in such cases. Presently described is a case of sudden cardiac arrest due to a massive pulmonary embolism that was successfully treated with the concomitant usage of systemic fibrinolysis and therapeutic hypothermia.

5. Prehosp Disaster Med. 2019 Sep 9:1-3. doi: 10.1017/S1049023X19004795. [Epub ahead of print]

**Resuscitative Endovascular Balloon Occlusion of the Aorta for Refractory Out-of-Hospital Non-Traumatic Cardiac Arrest - A Case Report.**

Coniglio C(1), Gamberini L(1), Lupi C(1), Cavallo P(1), Tartaglione M(1), Chiarini V(1), Gordini G(1)

**Abstract**

Resuscitative endovascular balloon occlusion of the aorta (REBOA) is a percutaneous transfemoral balloon technique used in select centers for resuscitation and temporary hemostasis of bleeding patients. Several animal studies demonstrated that its application in non-traumatic cardiac arrest could enhance cerebral and coronary perfusion during cardiopulmonary resuscitation (CPR); despite this, there are few reports of its application in humans. This is a case report of REBOA application during a refractory out-of-hospital cardiac arrest in a 50-year-old man where Advanced Cardiac Life Support (ACLS) alone was unable to maintain a stable return of spontaneous circulation (ROSC) and Extracorporeal Cardiac Life Support (ECLS) was not available.

6. Ann Noninvasive Electrocardiol. 2019 Sep 9:e12686. doi: 10.1111/anec.12686. [Epub ahead of print]

**"Nonsignificant" early repolarization pattern on postresuscitation ECG as a harbinger of impending electrical storm.**

Takasugi N(1), Kubota T(2), Okura H(1).

**Abstract**

We report a 55-year-old man who was resuscitated from out-of-hospital cardiac arrest and subsequently developed three episodes of ventricular fibrillation (VF) on the same day. Early repolarization (ER) pattern was not significant ( $<0.1$  mV) on postresuscitation ECG. However, ER pattern became evident (0.25 mV) before the onset of VF and then completely disappeared. The unusual dynamics of ER pattern observed in the present case could be called "masked" ER syndrome.