

This week's PubMed 10<sup>th</sup> – 16<sup>th</sup> October 2021: articles of interest n = 43

### **CPR AND COVID-19**

1. Circ Cardiovasc Qual Outcomes. 2021 Oct 13:CIRCOUTCOMES121008396. doi: 10.1161/CIRCOUTCOMES.121.008396. Online ahead of print.

#### **2021 Interim Guidance to Health Care Providers for Basic and Advanced Cardiac Life Support in Adults, Children, and Neonates With Suspected or Confirmed COVID-19.**

Hsu A(1), Sasson C(2), Kudenchuk PJ(3), Atkins DL(4), Aziz K(5), Becker LB(6), Berg RA(7), Bhanji F(8), Bradley SM(9), Brooks SC(10), Chan M(11), Chan PS(12), Cheng A(13), Clemency BM(14), de Caen A(15), Duff JP(15), Edelson DP(16), Flores GE(17), Fuchs S(18), Girotra S(19), Hinkson C(20), Joyner BL Jr(21), Kamath-Rayne BD(22), Kleinman M(23), Lasa JJ(24), Lavonas EJ(25), Lee HC(26), Lehotzky RE(2), Levy A(27), Mancini ME(28), McBride ME(29), Meckler G(11), Merchant RM(7)(30), Moitra VK(31), Morgan RW, Nadkarni V(7), Panchal AR(32), Peberdy MA(33), Raymond T(34), Roberts K(35), Sayre MR(36), Schexnayder SM(37), Sutton RM(7), Terry M(38), Walsh B(39), Wang DS(31)(40), Zelop CM(41), Topjian A(7); Emergency Cardiovascular Care Committee and Get With the Guidelines-Resuscitation Adult and Pediatric Task Forces of the American Heart Association in Collaboration With the American Academy of Pediatrics, American Association for Respiratory Care, American College of Emergency Physicians, American Society of Anesthesiologists, and the Society of Critical Care Anesthesiologists.

**NO ABSTRACT AVAILABLE**

### **CPR/MECHANICAL CHEST COMPRESSION**

1. Lancet. 2021 Oct 2;398(10307):1257-1268. doi: 10.1016/S0140-6736(21)01257-5. Epub 2021 Aug 26.

#### **Cardiopulmonary resuscitation in special circumstances.**

Soar J(1), Becker LB(2), Berg KM(3), Einav S(4), Ma Q(5), Olasveengen TM(6), Paal P(7), Parr MJA(8).

#### **ABSTRACT**

Cardiopulmonary resuscitation prioritises treatment for cardiac arrests from a primary cardiac cause, which make up the majority of treated cardiac arrests. Early chest compressions and, when indicated, a defibrillation shock from a bystander give the best chance of survival with a good neurological status. Cardiac arrest can also be caused by special circumstances, such as asphyxia, trauma, pulmonary embolism, accidental hypothermia, anaphylaxis, or COVID-19, and during pregnancy or perioperatively. Cardiac arrests in these circumstances represent an increasing proportion of all treated cardiac arrests, often have a preventable cause, and require additional interventions to correct a reversible cause during resuscitation. The evidence for treating these conditions is mostly of low or very low certainty and further studies are needed. Irrespective of the cause, treatments for cardiac arrest are time sensitive and most effective when given early-every minute counts.

2. Am Surg. 2021 Oct 13:31348211047507. doi: 10.1177/00031348211047507. Online ahead of print.

#### **Iatrogenic Injuries in Manual and Mechanical Cardiopulmonary Resuscitation.**

Chun MJ(1), Zhang Y(1), Toraih EA(1), McGrew PR(1).

#### **ABSTRACT**

**PURPOSE:** Mechanical chest compression has been shown to be equivalent to manual chest compression in providing survival benefits to patients experiencing cardiac arrest. There has been a growing need for a contemporary review of iatrogenic injuries caused by mechanical in comparison with manual chest compression. Our study aims to analyze the studies that document significant life-threatening iatrogenic injuries caused by mechanical and manual chest compression. **METHODS:** A systematic review of PubMed and Embase was performed according to Preferred Reporting Items for Systematic Review and Meta-Analyses guidelines. All studies published after January 1st, 2000 were reviewed using inclusion/exclusion criteria and completed by May 2020. A total of 7202 patients enrolled in 15 studies were included in our meta-analysis. **RESULTS:** Significant life-threatening iatrogenic injuries had higher odds of occurring when mechanical chest compression was used compared to manual chest compression, especially for hemothorax and liver lacerations. Mechanical chest compression involves consistently deeper compression depths compared to manual chest compression, potentially resulting in more injuries. In the mechanical chest compression cohort, chest wall fractures had the highest incidence rate (55.7%), followed by sternal fracture (28.3%), lung injuries (3.7%), liver (1.0%), and diaphragm (.2%) lacerations. **CONCLUSIONS:** Mechanical chest compression was associated with more iatrogenic injuries as compared to manual chest compression. Further research is needed to define the appropriate application of mechanical in comparison with manual chest compression in different scenarios. Levels of provider training, different mechanical chest compression device types, patient demographics, and compression duration/depth may all play roles in influencing outcomes.

## **REGISTRIES, REVIEWS AND EDITORIALS**

1. Resuscitation. 2021 Oct 11:S0300-9572(21)00401-9. doi: 10.1016/j.resuscitation.2021.10.005. Online ahead of print.

### **Neurocognitive Function Following Out-of-Hospital Cardiac Arrest: A systematic review.**

Zook N(1), Voss S(1), Blennow Nordström E(2), Brett SJ(3), Jenkinson E(1), Shaw P(1), White P(1), Bengler J(4).

#### **ABSTRACT**

**OBJECTIVES:** The primary aim of this review was to investigate neurocognitive outcomes following out-of-hospital cardiac arrest (OHCA). Specifically, the focus was on identifying the different neurocognitive domains that are assessed, the measures used, and the level of, and criteria for, impairment. **Design and review methods:** A systematic review of the literature from 2006 to 2021 was completed using Medline, Cinahl and Psychinfo. Criteria for inclusion were studies with participants over the age of 18, OHCA and at least one neurocognitive function measure. Qualitative and case studies were excluded. Reviewers assessed criteria and risk of bias using a modified version of Downs and Black. **RESULTS:** Forty-three studies were identified. Most studies had a low risk of bias (n=31) or moderate risk of bias (n=11) and one had a high risk; however, only six reported effect sizes or power analyses. Multiple measures of neurocognitive outcomes were used (>50) and level of impairment criteria varied considerably. Memory impairments were frequently found and were also more likely to be impaired followed by executive function and processing speed. **DISCUSSION:** This review highlights the heterogeneity of measures and approaches used to assess neurocognitive outcomes following OHCA as well as the need to improve risk of bias concerning generalizability. Improved understanding of the approaches used for assessment and the subsequent findings will facilitate a standardized evaluation of neurocognitive outcomes following OHCA.

2. Eur Heart J Acute Cardiovasc Care. 2021 Oct 14:zuab084. doi: 10.1093/ehjacc/zuab084. Online ahead of print.

**Temporal trends in patient characteristics, presumed causes, and outcomes following cardiogenic shock between 2005 and 2017: a Danish registry-based cohort study.**

Petersen LT(1), Riddersholm S(2), Andersen DC(1), Polcwiartek C(1), Lee CJ(3)(4), Lauridsen MD(5), Fosbøl E(5), Christiansen CF(6), Pareek M(7)(8)(9), Søggaard P(1), Torp-Pedersen C(1)(4)(10), Rasmussen BS(11)(12), Kragholm KH(1)(13).

**ABSTRACT**

AIMS: Most cardiogenic shock (CS) studies focus on acute coronary syndrome (ACS). Contemporary data on temporal trends in patient characteristics, presumed causes, treatments, and outcomes of ACS- and in particular non-ACS-related CS patients are sparse. METHODS AND RESULTS: Using nationwide medical registries, we identified patients with first-time CS between 2005 and 2017. Cochrane-Armitage trend tests were used to examine temporal changes in presumed causes of CS, treatments, and outcomes. Among 14 363 CS patients, characteristics remained largely stable over time. As presumed causes of CS, ACS (37.1% in 2005 to 21.4% in 2017), heart failure (16.3% in 2005 to 12.0% in 2017), and arrhythmias (13.0% in 2005 to 10.9% in 2017) decreased significantly over time; cardiac arrest increased significantly (11.3% in 2005 to 24.5% in 2017); and changes in valvular heart disease were insignificant (11.5% in 2005 and 11.6% in 2017). Temporary left ventricular assist device, non-invasive ventilation, and extracorporeal membrane oxygenation use increased significantly over time; intra-aortic balloon pump and mechanical ventilation use decreased significantly. Over time, 30-day and 1-year mortality were relatively stable. Significant decreases in 30-day and 1-year mortality for patients presenting with ACS and arrhythmias and a significant increase in 1-year mortality in patients presenting with heart failure were seen. CONCLUSION: Between 2005 and 2017, we observed significant temporal decreases in ACS, heart failure, and arrhythmias as presumed causes of first-time CS, whereas cardiac arrest significantly increased. Although overall 30-day and 1-year mortality were stable, significant decreases in mortality for ACS and arrhythmias as presumed causes of CS were seen.

3. *Kardiol Pol.* 2021 Oct 13. doi: 10.33963/KP.a2021.0133. Online ahead of print.

**Risk of perioperative death and sudden cardiac arrest: a study of 113 456 cases from the National Registry of Invasive Cardiology Procedures (ORPKI) for estimation of the perioperative prognosis.**

Sielski J(1), Kaziród-Wolski K(2), Siudak Z(1).

**ABSTRACT**

BACKGROUND: Despite optimizing treatment of ST-segment elevation myocardial infarction (STEMI) a lot of patients die during the invasive procedure or experience sudden cardiac arrest (SCA) that complicates further hospitalization. AIMS: The aim of the study was to identify the most important risk factors leading to SCA and death in the cath lab among STEMI patients. METHODS: We used the National Registry of Invasive Cardiology Procedures (ORPKI) between 2014 and 2019. The study population consisted of 113 465 patients. Descriptive statistics univariate and multiple logistic regression analysis of factors affecting perioperative mortality (PM) and SCA in the cath lab were performed. RESULTS: Death and SCA occurred in 1549 (1.4%) and 945 (0.8%) patients, respectively. Diabetes (odds ratio [OR] 1.76; P <0.0001), previous brain stroke (OR 2.26; P <0.0001), prior myocardial infarction (OR 1.81; P <0.0001), psoriasis (OR 1.79; P = 0.04) and chronic renal failure (OR 2.79; P <0.0001) were the strongest predictors of PM. The occurrence of SCA was dependent mainly on diabetes (OR 1.37; P = 0.0001), previous brain stroke (OR 2.23; P <0.0001), prior myocardial infarction (OR 1.73; P <0.0001), psoriasis (OR 2.03; P = 0.04), chronic renal failure (OR 2.79; P <0.0001). Of the pre-hospital factors, the Killip-Kimball class showed the strongest relationship with the two endpoints (OR 3.53; P <0.0001 and OR 2.65; P <0.0001). CONCLUSIONS: Diabetes, previous brain stroke and myocardial infarction, psoriasis, chronic renal failure and the Killip-Kimball class were the strongest predictors of PM and SCA in the cath lab.

4. Curr Opin Crit Care. 2021 Oct 8. doi: 10.1097/MCC.0000000000000896. Online ahead of print.

**Epidemiology and risk factors of sudden cardiac arrest.**

Zimmerman DS(1), Tan HL.

**ABSTRACT**

**PURPOSE OF REVIEW:** Sudden cardiac arrest (SCA) remains a major health burden around the globe, most often occurring in the community (out-of-hospital cardiac arrest [OHCA]). SCA accounts for 15-20% of all natural deaths in adults in the USA and Western Europe, and up to 50% of all cardiovascular deaths. To reduce this burden, more knowledge is needed about its key facets such as its incidence in various geographies, its risk factors, and the populations that may be at risk. **RECENT FINDINGS:** SCA results from a complex interaction of inherited and acquired causes, specific to each individual. Resolving this complexity, and designing personalized prevention and treatment, requires an integrated approach in which big datasets that contain all relevant factors are collected, and a multimodal analysis. Such datasets derive from multiple data sources, including all players in the chain-of-care for OHCA. This recognition has led to recently started large-scale collaborative efforts in Europe. **SUMMARY:** Our insights into the causes of SCA are steadily increasing thanks to the creation of big datasets dedicated to SCA research. These insights may be used to earlier recognize of individuals at risk, the design of personalized methods for prevention, and more effective resuscitation strategies for OHCA.

5. Curr Opin Crit Care. 2021 Oct 8. doi: 10.1097/MCC.0000000000000897. Online ahead of print.

**Basic life support and systems saving lives.**

Olasveengen TM(1), Semeraro F.

**ABSTRACT**

**PURPOSE OF REVIEW:** To describe recent science in basic life support (BLS) after cardiac arrest and how evolving knowledge in resuscitation is changing current guidelines and practices. **RECENT FINDINGS:** The core elements of BLS have remained mostly unchanged since 2005 when Cardio-pulmonary Resuscitation recommendations were changed from 2 ventilations to 15 compressions and up to three stacked shocks for shockable rhythms, to 30 compressions to 2 ventilations and single shocks. Since 2010, basic life support has largely focused on the importance of providing high-quality CPR for professional and lay rescuers alike. The most recent resuscitation updates has seen an increased focus on the systems perspective. The 'Systems Saving Lives' concept emphasizes the interconnection between community and Emergency Medical Services (EMS). The main changes in current resuscitation practice are within three important basic life support domains: recognition of cardiac arrest, interaction between rescuers and EMS and improving resuscitation quality. **SUMMARY:** This review highlights the importance of strengthening both community and emergency medical services efforts to improve outcomes in cardiac arrest. Strategies that enhance the communication and collaboration between lay rescuers and professional resuscitation systems are important new avenues to pursue in developing systems that save more lives.

**IN-HOSPITAL CARDIAC ARREST**

1. Resuscitation. 2021 Oct 7:S0300-9572(21)00394-4. doi: 10.1016/j.resuscitation.2021.08.054.

Online ahead of print.

**Intraosseous Versus Intravenous Resuscitation During In-Hospital Cardiac Arrest.**

Shaw M(1), Patel J(2), Berezowski I(3), Taylor D(4), Pourmand A(5).

**NO ABSTRACT AVAILABLE**

## **INJURIES AND CPR**

1. J Trauma Acute Care Surg. 2021 Oct 8. doi: 10.1097/TA.0000000000003426. Online ahead of print.

### **Surgical Stabilization of Severe Chest Wall Injury Following Cardiopulmonary Resuscitation.**

DeVoe WB(1), Abourezk M, Goslin BJ, Kiel B, Bach JA, Suh KI, Eriksson EA.

#### **ABSTRACT**

**BACKGROUND:** Cardiopulmonary resuscitation (CPR) contributes to significant chest wall injury (CWI) similar to blunt trauma. With benefits realized for surgical stabilization of rib fractures (SSRF) for flail injuries and severely displaced fractures following trauma, SSRF for CWI following CPR could be advantageous, provided good functional and neurologic outlook. Experience is limited. We present a review of patients treated with SSRF at our institution following CPR. **METHODS:** A retrospective analysis of patients undergoing SSRF following CPR was performed between 2019-2020. Perioperative inpatient data were collected with outpatient follow-up as able. **RESULTS:** Five patients underwent SSRF over the course of the 2-year interval. All patients required invasive ventilation preoperatively or had impending respiratory. Mean age was  $59 \pm 12$  years, with all patients being male. Inciting events for cardiac arrest included respiratory, ventricular tachycardia, ventricular fibrillation, pulseless electrical activity, and anaphylaxis. Time to operation was  $6.6 \pm 3$  days. Four patients demonstrated anterior flail injury pattern with or without sternal fracture, with 1 patient having multiple severely displaced fractures. SSRF was performed appropriately to restore chest wall stability. Mean ICU LOS was  $9.8 \pm 6.4$  days and overall hospital LOS  $24.6 \pm 13.2$  days. Median postoperative ventilation was 2 days (range 1-15) with 2 patients developing pneumonia and 1 requiring tracheostomy. There were no mortalities at 30 days. One patient expired in hospice after a prolonged hospitalization. Disposition destination was variable. No hardware complications were noted on outpatient follow-up and all surviving patients were home. **CONCLUSIONS:** Chest wall injuries are incurred frequently following cardiopulmonary resuscitation. Surgical stabilization of these injuries can be considered to promote ventilator liberation and rehabilitation. Careful patient selection is paramount, with surgery offered to those with reversible causes of arrest and good functional and neurologic outcome. Experience is early, with further investigation needed. **LEVEL OF EVIDENCE:** V, therapeutic.

## **CAUSE OF THE ARREST**

No articles identified.

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

No articles identified.

## **ORGAN DONATION**

No articles identified.

## **FEEDBACK**

No articles identified.

## **DRUGS**

No articles identified.

## **TRAUMA**

1. Int J Environ Res Public Health. 2021 Sep 29;18(19):10234. doi: 10.3390/ijerph181910234.

### **On-Site Medical Management of Avalanche Victims-A Narrative Review.**

Rauch S(1)(2), Strapazzon G(1), Brugger H(1).

#### **ABSTRACT**

Avalanche accidents are common in mountain regions and approximately 100 fatalities are counted in Europe each year. The average mortality rate is about 25% and survival chances are mainly determined by the degree and duration of avalanche burial, the patency of the airway, the presence of an air pocket, snow characteristics, and the severity of traumatic injuries. The most common cause of death in completely buried avalanche victims is asphyxia followed by trauma. Hypothermia accounts for a minority of deaths; however, hypothermic cardiac arrest has a favorable prognosis and prolonged resuscitation and extracorporeal rewarming are indicated. In this article, we give an overview on the pathophysiology and on-site management of avalanche victims.

2. Trauma Surg Acute Care Open. 2021 Sep 21;6(1):e000814. doi: 10.1136/tsaco-2021-000814. eCollection 2021.

### **Challenge in acute care surgery: sudden cardiac arrest in the surgical intensive care unit.**

Henry R(1), Getrajdman J(1), Franklin B(1), Marx M(2), Mehra A(3), Matsushima K(1).

**NO ABSTRACT AVAILABLE**

## **VENTILATION**

No articles identified.

## **CEREBRAL MONITORING**

1. Med Klin Intensivmed Notfmed. 2021 Oct 14. doi: 10.1007/s00063-021-00869-2. Online ahead of print.

### **Sex-specific differences and outcome in elderly patients after survived out-of-hospital cardiac arrest.**

Pätz T(1), Stelzig K(2), Pfeifer R(3), Thiele H(4), Busch HJ(5), Stiermaier T(6), Eitel I(6), Wolfrum S(2).

#### **ABSTRACT**

**BACKGROUND:** Little is known about sex differences in elderly patients after out-of-hospital cardiac arrest (OHCA) with return of spontaneous circulation (ROSC) and subsequent target temperature management (TTM). Therefore, this study was designed to evaluate sex-specific differences in survival and neurological outcome in elderly patients at 28-day and 180-day follow-up. **METHODS:** A total of 468 nontraumatic OHCA survivors with preclinical ROSC and an age of  $\geq 65$  years were included in this study. Sex-specific differences in survival and a favorable neurological outcome according to the cerebral performance category (CPC) score were evaluated as clinical endpoints. **RESULTS:** Of all participants included, 70.7% were men and 29.3% women. Women were significantly older ( $p = 0.011$ ) and were more likely to have a nonshockable rhythm ( $p = 0.001$ ) than men.

Evaluation of survival rate and favorable neurological outcome by sex category showed no significant differences at 28-day and 180-day follow-up. In multiple stepwise logistic regression analysis, age (odds ratio 0.932 [95% confidence interval 0.891-0.951],  $p = 0.002$ ) and time of hypoxia (0.899 [0.850-0.951],  $p < 0.001$ ) proved to be independent predictors of survival only in male patients, whereas an initial shockable rhythm (4.325 [1.309-14.291],  $p = 0.016$ ) was associated with 180-day survival in female patients. The majority of patients (93.7%) remained in the same CPC category when comparing 28-day and 180-day follow-up. **CONCLUSION:** Our results show no significant sex-specific differences in survival or favorable neurological outcome in elderly patients after having survived OHCA, but sex-specific predictors for 180-day survival. Moreover, the neurological assessment 28 days after the index event also seems to provide a valid indication for the further prognosis in elderly patients.

2. PLoS One. 2021 Oct 14;16(10):e0258480. doi: 10.1371/journal.pone.0258480. eCollection 2021.

**Differences in the gray-to-white matter ratio according to different computed tomography scanners for outcome prediction in post-cardiac arrest patients receiving target temperature management.**

Oh JH(1), Choi SP(1), Zhu JH(1), Kim SH(1), Park KN(2), Youn CS(2), Oh SH(2), Kim HJ(2), Park SH(3).

**ABSTRACT**

The gray-to-white matter ratio (GWR) has been used to identify brain damage in comatose patients after cardiac arrest. However, Hounsfield units (HUs), the measurement of brain density on computed tomography (CT) images, may vary depending on the machine type or parameter. Therefore, differences in CT scanners may affect the GWR in post-cardiac arrest patients. We performed a retrospective study on comatose post-cardiac arrest patients who visited the hospital from 2007 to 2017. Two CT, Lightspeed and SOMATOM, scanners were used. Two observers independently measured the HUs of the caudate nucleus, putamen, posterior internal capsule, and corpus callosum using regions of interest. We compared the GWR calculated from the HUs measured at different CT scanners. The analysis of different scanners showed statistically significant differences in the measured HUs and GWR. The HUs and GWR of Lightspeed were measured lower than SOMATOM. The difference between the two CT scanners was also evident in groups divided by neurological prognosis. The area under the curve of the receiver operating characteristic curve to predict poor outcomes of Lightspeed was 0.798, and the cut-off value for 100% specificity was 1.172. The SOMATOM was 0.855, and the cut-off value was 1.269. The difference in scanners affects measurements and performance characteristics of the GWR in post-cardiac arrest patients. Therefore, when applying the results of the GWR study to clinical practice, reference values for each device should be presented, and an integrated plan should be prepared.

3. Resuscitation. 2021 Oct 8:S0300-9572(21)00396-8. doi: 10.1016/j.resuscitation.2021.10.001.

Online ahead of print.

**Incidence of hyperoxia and factors associated with cerebral oxygenation during cardiopulmonary resuscitation.**

Nelskylä A(1), Skrifvars MB(1), Ångerman S(2), Nurmi J(3).

**ABSTRACT**

**BACKGROUND:** High oxygen levels may worsen cardiac arrest reperfusion injury. We determined the incidence of hyperoxia during and immediately after successful cardiopulmonary resuscitation and identified factors associated with intra-arrest cerebral oxygenation measured with near-infrared spectroscopy (NIRS). **METHODS:** A prospective observational study of out-of-hospital cardiac arrest patients treated by a physician-staffed helicopter unit. Collected data included intra-arrest brain regional oxygen saturation (rSO<sub>2</sub>) with NIRS, invasive blood pressures, end-tidal CO<sub>2</sub> (etCO<sub>2</sub>) and

arterial blood gas samples. Moderate and severe hyperoxia were defined as arterial oxygen partial pressure (paO<sub>2</sub>) 20.0-39.9 and ≥40 kPa, respectively. Intra-arrest factors correlated with the NIRS value, rSO<sub>2</sub>, were assessed with the Spearman's correlation test. RESULTS: Of 80 recruited patients, 73 (91%) patients had rSO<sub>2</sub> recorded during CPR, and 46 had an intra-arrest paO<sub>2</sub> analysed. ROSC was achieved in 28 patients, of whom 20 had paO<sub>2</sub> analysed. Moderate hyperoxia was seen in one patient during CPR and in four patients (20%, 95% CI 7-42%) after ROSC. None had severe hyperoxia during CPR, and one patient (5%, 95% 0-25%) immediately after ROSC. The rSO<sub>2</sub> during CPR was correlated with intra-arrest systolic (r = 0.28, p < 0.001) and diastolic blood pressure (p = 0.32, p < 0.001) but not with paO<sub>2</sub> (r = 0.13, p = 0.41), paCO<sub>2</sub> (r = 0.18, p = 0.22) or etCO<sub>2</sub> (r = 0.008, p = 0.9). CONCLUSION: Hyperoxia during or immediately after CPR is rare in patients treated by physician-staffed helicopter units. Cerebral oxygenation during CPR appears more dependent, albeit weakly, on hemodynamics than arterial oxygen concentration.

4. Clin Cardiol. 2021 Sep;44(9):1256-1262. doi: 10.1002/clc.23680. Epub 2021 Jul 27.

**General health condition of patients hospitalized after an incident of in-hospital or out-of hospital sudden cardiac arrest with return of spontaneous circulation.**

Stasiowski M(1)(2), Głowacki Ł(1), Gąsiorek J(3), Majer D(1), Niewiadomska E(4), Król S(1)(2), Żak J(1)(2), Missir A(1)(2), Prof LK(1)(2), Prof PJ(2), Grabarek BO(5).

**ABSTRACT**

BACKGROUND: Sudden cardiac arrest (SCA) is one of the main reasons for admission to the intensive care unit (ICU), which influences discharge in a good neurological state. HYPOTHESIS: To analyze patients who had recovery of spontaneous circulation (ROSC) during hospitalization in the ICU using the Glasgow Outcome Scale (GOS). METHODS: The study group comprised 78 patients after SCA (35 after out-of-hospital cardiac arrest [OHCA] and 43 after in-hospital cardiac arrest [IHCA]) with ROSC who were admitted to the ICU of Regional Hospital No. 5 in Sosnowiec from January 1, 2016 to December 31, 2016. GOS was used to assess neurological status. Basic anthropological data, with, arterial blood pH, lactate concentration (LAC), and catecholamine treatment were also collected. RESULTS: In the study group, 32.1% (n = 25/78) of patients survived until ICU discharge and 30.8% (n = 24/78) until discharge from the hospital. SCA in cardiac mechanism was more common in OHCA than in the IHCA group (OHCA vs. IHCA: 85.7% vs. 62.8%, p = .02). There was no statistically significant difference between the two groups for neurological status assessed using GOS. There was no statistically significant difference between LAC or arterial blood pH and survival to ICU discharge, survival to hospital discharge, or mortality. The need for using catecholamines increased the mortality rate (GOS 1) (p < .001). CONCLUSIONS: Most patients after ROSC were assigned to a group other than GOS 1, and 25% of all subjects belonged to GOS 4-5. Treatment with catecholamines was more common in patients who do not survive hospital or ICU discharge.

**ULTRASOUND AND CPR**

No articles identified.

**ORGANISATION AND TRAINING**

1. Prehosp Disaster Med. 2021 Oct 14:1-6. doi: 10.1017/S1049023X21001084. Online ahead of print.  
**Effectiveness of a Dispatcher-Assisted Cardiopulmonary Resuscitation Program Developed by the Thailand National Institute of Emergency Medicine (NIEMS).**



Angkoontassaneeyarat C(1), Yuksen C(1), Jenpanitpong C(1), Rukthai P(1), Seanpan M(1), Pongprajak D(1), Laksanamapune T(1).

#### **ABSTRACT**

**BACKGROUND:** Out-of-hospital cardiac arrest (OHCA) is a life-threatening condition with an overall survival rate that generally does not exceed 10%. Several factors play essential roles in increasing survival among patients experiencing cardiac arrest outside the hospital. Previous studies have reported that implementing a dispatcher-assisted cardiopulmonary resuscitation (DA-CPR) program increases bystander CPR, quality of chest compressions, and patient survival. This study aimed to assess the effectiveness of a DA-CPR program developed by the Thailand National Institute for Emergency Medicine (NIEMS). **METHODS:** This was an experimental study using a manikin model. The participants comprised both health care providers and non-health care providers aged 18 to 60 years. They were randomly assigned to either the DA-CPR group or the uninstructed CPR (U-CPR) group and performed chest compressions on a manikin model for two minutes. The sequentially numbered, opaque, sealed envelope method was used for randomization in blocks of four with a ratio of 1:1. **RESULTS:** There were 100 participants in this study (49 in the DA-CPR group and 51 in the U-CPR group). Time to initiate chest compressions was statistically significantly longer in the DA-CPR group than in the U-CPR group (85.82 [SD = 32.54] seconds versus 23.94 [SD = 16.70] seconds;  $P < .001$ ). However, the CPR instruction did not translate into better performance or quality of chest compressions for the overall sample or for health care or non-health care providers. **CONCLUSION:** Those in the CPR-trained group applied chest compressions (initiated CPR) more quickly than those who initiated CPR based upon dispatch-based CPR instructions.

2. BMC Emerg Med. 2021 Oct 13;21(1):120. doi: 10.1186/s12873-021-00514-3.

#### **Barriers and facilitators to cardiopulmonary resuscitation within pre-hospital emergency medical services: a qualitative study.**

Dehghan-Nayeri N(1), Nouri-Sari H(2), Bahramnezhad F(1), Hajibabae F(1), Senmar M(3).

#### **ABSTRACT**

**BACKGROUND:** Out-of-hospital cardiopulmonary arrest is a common and fatal problem. Rescuing patients with this problem by pre-hospital emergency medical services is associated with various barriers and facilitators. Identifying these barriers as well as the facilitators in a qualitative and an information-rich way will help to improve the quality of performing the maneuver and to increase the patients' survival. Therefore, the current study was qualitatively conducted with the aim of identifying the factors affecting the cardiopulmonary resuscitation within the pre-hospital emergency medical services. **METHODS:** This qualitative study was conducted using a content analysis approach in Iran in 2021. The participants were 16 Iranian emergency medical technicians who were selected through a purposive sampling method. For data collection, in-depth and semi-structured interviews were conducted. For data analysis, the Elo and Kyngäs method was applied. **RESULTS:** The mean participants' age was  $33.06 \pm 7.85$  years, and their mean work experience was  $10.62 \pm 6.63$  years. The collected information was categorized into one main category called "complex context of the cardiopulmonary resuscitation" and 5 general categories with 17 subcategories. These categories and subcategories include patient condition (patient's underlying diseases, age, high weight, number of children, and place of living), dominant atmosphere in companions at home (companions' feeling of agitation, companions doing harm, and companions helping), policy (educational policy, human resource policy, up-to-date equipment and technology, and do-not-resuscitate policy), performance of the out-of-organizational system (disorganization in the patient handover process, and cooperation of the support organizations), and conditions related to the treatment team (conscience, cultural dominance, and shift burden). **CONCLUSIONS:** The results showed that the conditions related to the patient and his/her companions, as well as the

organizational factors such as the policies and the out-of-organizational factors act as the barriers and the facilitators to the cardiopulmonary resuscitation within pre-hospital emergency medical services. Therefore, the barriers can be modified and the facilitators can be enhanced by taking various measures such as educating, human resource policy-making, upgrading the equipment, and considering appropriate management policies.

3. Resuscitation. 2021 Oct 8:S0300-9572(21)00397-X. doi: 10.1016/j.resuscitation.2021.10.002.

Online ahead of print.

**Prognostication of patients in coma after cardiac arrest: public perspectives.**

van Til J(1), Bouwers-Beens E(2), Mertens M(3), Boenink M(4), Groothuis-Oudshoorn C(2), Hofmeijer J(5).

**ABSTRACT**

AIM: To elicit preferences for prognostic information, attitudes towards withdrawal of life-sustaining treatment (WLST) and perspectives on acceptable quality of life after post-anoxic coma within the adult general population of Germany, Italy, the Netherlands and the United States of America.

METHODS: A web-based survey, consisting of questions on respondent characteristics, perspectives on quality of life, communication of prognostic information, and withdrawal of life-sustaining treatment, was taken by adult respondents recruited from four countries. Statistical analysis included descriptive analysis and chi2 tests for differences between countries. RESULTS: In total, 2012 respondents completed the survey. In each country, at least 84% indicated they would prefer to receive early prognostic information. If a poor outcome was predicted with some uncertainty, 37-54% of the respondents indicated that WLST was not to be allowed. A conscious state with severe physical and cognitive impairments was perceived as acceptable quality of life by 17-44% of the respondents. Clear differences between countries exist, including respondents from the U.S. being more likely to allow WLST than respondents from Germany (OR=1.99, p<0.001) or the Netherlands (OR=1.74, p<0.001) and preferring to stay alive in a conscious state with severe physical and cognitive impairments more than respondents from Italy (OR=3.76, p<0.001), Germany (OR=2.21, p<0.001), or the Netherlands (OR=2.39, p<0.001). CONCLUSIONS: Over one-third of the respondents considered WLST unacceptable when there is any remaining prognostic uncertainty. Respondents had a more positive perspective on acceptable quality of life after coma than what is currently considered acceptable in medical literature. This indicates a need for a closer look at the practice of WLST based on prognostic information, to ensure responsible use of novel prognostic tests.

4. Resuscitation. 2021 Oct 7:S0300-9572(21)00390-7. doi: 10.1016/j.resuscitation.2021.09.034.

Online ahead of print.

**Criteria for the Certification of Cardiac Arrest Centers in Germany.**

Rott N(1), Scholz KH(2), Busch HJ(3), Frey N(4), Kelm M(5), Thiele H(6), Böttiger BW(1).

**NO ABSTRACT AVAILABLE**

5. J Am Med Dir Assoc. 2021 Oct 8:S1525-8610(21)00824-0. doi: 10.1016/j.jamda.2021.09.009.

Online ahead of print.

**Nursing Home Versus Community Resuscitation After Cardiac Arrest: Comparative Outcomes and Risk Factors.**

Shibahashi K(1), Sakurai S(2), Sugiyama K(3), Ishida T(3), Hamabe Y(3).

**ABSTRACT**

OBJECTIVE: To investigate the characteristics and outcomes of patients who experienced cardiac arrest in nursing homes compared with those in private residences and determine prognostic factors for survival. DESIGN: This was a retrospective study that analyzed data from an Utstein-style registry

of the Tokyo Fire Department. **SETTING AND PARTICIPANTS:** We identified patients aged  $\geq 65$  years who experienced cardiac arrest in a nursing home or private residence from the population-based registry of out-of-hospital cardiac arrests in Tokyo, Japan, from 2014 to 2018. **METHODS:** Patients were grouped into the nursing home or the private residence groups according to their cardiac arrest location. We compared the characteristics and outcomes between the 2 groups and determined prognostic factors for survival in the nursing home group. The primary outcome was 1-month survival after cardiac arrest. **RESULTS:** In total, 37,550 patient records (nursing home group = 6271; private residence group = 31,279) were analyzed. Patients in the nursing home group were significantly older and more often had witnessed arrest, bystander cardiopulmonary resuscitation (CPR), and shock delivery using an automated external defibrillator. The 1-month survival rate was significantly higher in the nursing home group (2.6% vs 1.8%,  $P < .001$ ). In the best scenario (daytime emergency call, witnessed cardiac arrest, bystander CPR provided), the 1-month survival rate after cardiac arrest in the nursing home group was 8.0% (95% confidence interval 6.4-9.9%), while none survived if they had neither witness nor bystander CPR. **CONCLUSIONS AND IMPLICATIONS:** Survival outcome was significantly better in the nursing home group than in the private residence group and was well stratified by 3 prognostic factors: emergency call timing, witnessed status, and bystander CPR provision. Our results suggest that a decision to withhold vigorous treatment solely based on nursing home residential status is not justified, while termination of resuscitation may be determined by considering significant prognostic factors.

6. BMC Emerg Med. 2021 Oct 9;21(1):114. doi: 10.1186/s12873-021-00513-4.

**Assessment of breathing in cardiac arrest: a randomised controlled trial of three teaching methods among laypersons.**

Breindahl N(1), Granholm A(2)(3), Jensen TW(2)(4), Ersbøll AK(5), Myklebust H(6), Lippert F(4)(7), Lippert A(2).

**ABSTRACT**

**BACKGROUND:** The aim of this trial was to compare a video- and a simulation-based teaching method to the conventional lecture-based method, hypothesizing that the video- and simulation-based teaching methods would lead to improved recognition of breathing patterns during cardiac arrest. **METHODS:** In this Danish, investigator-initiated, stratified, randomised controlled trial, adult laypersons (university students, military conscripts and elderly retirees) participating in European Resuscitation Council Basic Life Support courses were randomised to receive teaching on how to recognise breathing patterns using a lecture- (usual practice), a video-, or a simulation-based teaching method. The primary outcome was recognition of breathing patterns in nine videos of actors simulating normal breathing, no breathing, and agonal breathing (three of each). We analysed outcomes using logistic regression models and present results as odds ratios (ORs) with 95% confidence intervals (CIs) and P-values from likelihood ratio tests. **RESULTS:** One hundred fifty-three participants were included in the analyses from February 2, 2018 through May 21, 2019 and recognition of breathing patterns was statistically significantly different between the teaching methods ( $P = 0.013$ ). Compared to lecture-based teaching (83% correct answers), both video- (90% correct answers; OR 1.77, 95% CI: 1.19-2.64) and simulation-based teaching (88% correct answers; OR 1.48; 95% CI: 1.01-2.17) led to significantly more correct answers. Video-based teaching was not statistically significantly different compared to simulation-based teaching (OR 1.20; 95% CI: 0.78-1.83). **CONCLUSION:** Video- and simulation-based teaching methods led to improved recognition of breathing patterns among laypersons participating in adult Basic Life Support courses compared to the conventional lecture-based teaching method.

7. Simul Healthc. 2021 Oct 13. doi: 10.1097/SIH.0000000000000608. Online ahead of print.

### **Cardiopulmonary Resuscitation Training for Healthcare Professionals: A Scoping Review.**

Lauridsen KG(1), Løfgren B, Brogaard L, Paltved C, Hvidman L, Krogh K.

#### **ABSTRACT**

The optimal strategy for training cardiopulmonary resuscitation (CPR) for healthcare professionals remains to be determined. This scoping review aimed to describe the emerging evidence for CPR training for healthcare professionals. We screened 7605 abstracts and included 110 studies in this scoping review on CPR training for healthcare professionals. We assessed the included articles for evidence for the following topics: training duration, retraining intervals, e-learning, virtual reality/augmented reality/gamified learning, instructor-learner ratio, equipment and manikins, other aspects of contextual learning content, feedback devices, and feedback/debriefing. We found emerging evidence supporting the use of low-dose, high-frequency training with e-learning to achieve knowledge, feedback devices to perform high-quality chest compressions, and in situ team simulations with debriefings to improve the performance of provider teams.

8. Am J Emerg Med. 2021 Oct 5;51:22-25. doi: 10.1016/j.ajem.2021.09.060. Online ahead of print.

### **Efficacy of cardiopulmonary resuscitation performance while wearing a powered air-purifying respirator.**

Chong JY(1), Kang C(1), Jeong W(1), Park JS(2), You Y(1), Ahn HJ(2), Min JH(2), Hwang T(3), Kwon O(4), Kim SW(5).

#### **ABSTRACT**

**BACKGROUND:** The use of personal protective equipment for respiratory infection control during cardiopulmonary resuscitation (CPR) is a physical burden to healthcare providers. The duration for which CPR quality according to recommended guidelines can be maintained under these circumstances is important. We investigated whether a 2-min shift was appropriate for chest compression and determined the duration for which chest compression was maintained in accordance with the recommended guidelines while wearing personal protective equipment. **METHODS:** This prospective crossover simulation study was performed at a single center from September 2020 to October 2020. Five indicators of CPR quality were measured during the first and second sessions of the study period. All participants wore a Level D powered air-purifying respirator (PAPR), and the experiment was conducted using a Resusci Anne manikin, which can measure the quality of chest compressions. Each participant conducted two sessions. In Session 1, the sequence of 2 min of chest compressions, followed by a 2-min rest, was repeated twice; in Session 2, the sequence of 1-min chest compressions followed by a 1-min rest was repeated four times. **RESULTS:** All 34 participants completed the study. The sufficiently deep compression rate was  $65.9 \pm 31.1\%$  in the 1-min shift group and  $61.5 \pm 30.5\%$  in the 2-min shift group. The mean compression depth was  $52.8 \pm 4.3$  mm in the 1-min shift group and  $51.0 \pm 6.1$  mm in the 2-min shift group. These two parameters were significantly different between the two groups. There was no significant difference in the other values related to CPR quality. **CONCLUSIONS:** Our findings indicated that 1 min of chest compressions with a 1-min rest maintained a better quality of CPR while wearing a PAPR.

9. BMC Emerg Med. 2021 Oct 15;21(1):121. doi: 10.1186/s12873-021-00509-0.

### **Adherence to the ABCDE approach in relation to the method of instruction: a randomized controlled simulation study.**

Linders M(#)(1), Binkhorst M(#)(2), Draaisma JMT(1), van Heijst AFJ(3), Hogeveen M(3).

#### **ABSTRACT**

**BACKGROUND:** The Airway, Breathing, Circulation, Disability, and Exposure (ABCDE) approach is widely recommended and taught in many resuscitation courses. This study assessed the adherence to the ABCDE algorithm and whether this was affected by the instruction method used to teach this

approach. **METHODS:** Randomized controlled trial in which simulation was used as investigational method. Between June 2017 and January 2018, neonatal healthcare providers routinely participated in simulated neonatal advanced life support (NALS) scenarios, using a high-fidelity manikin. They were randomly assigned to a video-based instruction (intervention group) or a conventional lecture (control group) as the method of instruction. One blinded researcher evaluated the adherence to the ABCDE approach on video with an assessment tool specifically designed and tested for this study. The primary outcomes were: 1) the overall adherence and 2) the between-group difference in individual adherence to the ABCDE approach, both expressed as a percentage score. Secondary outcomes were: 1) the scores of each profession category (nurses, neonatal ward clinicians, fellows/neonatologists) and 2) the scores for the separate domains (A, B, C, D, and E) of the algorithm. **RESULTS:** Seventy-two participants were assessed. Overall mean (SD) percentage score (i.e. overall adherence) was 31.5% (19.0). The video-based instruction group (28 participants) adhered better to the ABCDE approach than the lecture group (44 participants), with mean (SD) scores of 38.8% (18.7) and 27.8% (18.2), respectively ( $p = 0.026$ ). The difference in adherence between both groups could mainly be attributed to differences in the adherence to domain B ( $p = 0.023$ ) and C ( $p = 0.007$ ). Neonatal ward clinicians (39.9% (18.2)) showed better adherence than nurses (25.0% (15.2)), independent of the study group ( $p = 0.010$ ). **CONCLUSIONS:** Overall adherence to the ABCDE algorithm was rather low. Video-based instruction resulted in better adherence to the ABCDE approach during NALS training than lecturing. **TRIAL REGISTRATION:** ISRCTN registry, trial ID ISRCTN95998973, retrospectively registered on October 13th, 2020.

## **POST-CARDIAC ARREST TREATMENTS**

1. Crit Care Explor. 2021 Oct 8;3(10):e543. doi: 10.1097/CCE.0000000000000543. eCollection 2021 Oct.

### **Safety of Prolonged Inhalation of Hydrogen Gas in Air in Healthy Adults.**

Cole AR(1), Sperotto F(1)(2)(3), DiNardo JA(4)(5), Carlisle S(6), Rivkin MJ(7)(8)(9)(10), Sleeper LA(1)(2), Kheir JN(1)(2).

#### **ABSTRACT**

Ischemia-reperfusion injury is common in critically ill patients, and directed therapies are lacking. Inhaled hydrogen gas diminishes ischemia-reperfusion injury in models of shock, stroke, and cardiac arrest. The purpose of this study was to investigate the safety of inhaled hydrogen gas at doses required for a clinical efficacy study. **DESIGN:** Prospective, single-arm study. **SETTING:** Tertiary care hospital. **PATIENTS/SUBJECTS:** Eight healthy adult participants. **INTERVENTIONS:** Subjects underwent hospitalized exposure to 2.4% hydrogen gas in medical air via high-flow nasal cannula (15 L/min) for 24 ( $n = 2$ ), 48 ( $n = 2$ ), or 72 ( $n = 4$ ) hours. **MEASUREMENTS AND MAIN RESULTS:** Endpoints included vital signs, patient- and nurse-reported signs and symptoms (stratified according to clinical significance), pulmonary function testing, 12-lead electrocardiogram, mini-mental state examinations, neurologic examination, and serologic testing prior to and following exposure. All adverse events were verified by two clinicians external to the study team and an external Data and Safety Monitoring Board. All eight participants (18-30 yr; 50% female; 62% non-Caucasian) completed the study without early termination. No clinically significant adverse events occurred in any patient. Compared with baseline measures, there were no clinically significant changes over time in vital signs, pulmonary function testing results, Mini-Mental State Examination scores, neurologic examination findings, electrocardiogram measurements, or serologic tests for hematologic (except for clinically insignificant increases in hematocrit and platelet counts), renal, hepatic, pancreatic, or cardiac injury associated with hydrogen gas inhalation. **CONCLUSIONS:** Inhalation of 2.4% hydrogen gas does not appear to cause clinically significant adverse effects in

healthy adults. Although these data suggest that inhaled hydrogen gas may be well tolerated, future studies need to be powered to further evaluate safety. These data will be foundational to future interventional studies of inhaled hydrogen gas in injury states, including following cardiac arrest.

### **TARGETED TEMPERATURE MANAGEMENT**

1. Resuscitation. 2021 Oct 12:S0300-9572(21)00395-6. doi: 10.1016/j.resuscitation.2021.09.038. Online ahead of print.

**"Cold War": why does the debate continue?**

Yip YY(1), Chun-Hei Cheung J(2).

**NO ABSTRACT AVAILABLE**

2. Crit Care Med. 2021 Sep 22. doi: 10.1097/CCM.0000000000005271. Online ahead of print.

**Targeted Temperature Management in Out-of-Hospital Cardiac Arrest With Shockable Rhythm: A Post Hoc Analysis of the Coronary Angiography After Cardiac Arrest Trial.**

Spoormans EM(1), Lemkes JS, Janssens GN, van der Hoeven NW, Jewbali LSD, Dubois EA, Meuwissen M, Rijpstra TA, Bosker HA, Blans MJ, Bleeker GB, Baak R, Vlachoianis GJ, Eikemans BJW, Girbes ARJ, van der Harst P, van der Horst ICC, Voskuil M, van der Heijden JJ, Beishuizen A, Stoel M, Camaro C, van der Hoeven H, Henriques JP, Vlaar APJ, Vink MA, van den Bogaard B, Heestermans TACM, de Ruijter W, Delnoij TSR, Crijs HJGM, Jessurun GAJ, Oemrawsingh PV, Gosselink MTM, Plomp K, Magro M, van de Ven PM, van Royen N, Elbers PWG.

#### **ABSTRACT**

**OBJECTIVES:** The optimal targeted temperature in patients with shockable rhythm is unclear, and current guidelines recommend targeted temperature management with a correspondingly wide range between 32°C and 36°C. Our aim was to study survival and neurologic outcome associated with targeted temperature management strategy in postarrest patients with initial shockable rhythm. **DESIGN:** Observational substudy of the Coronary Angiography after Cardiac Arrest without ST-segment Elevation trial. **SETTING:** Nineteen hospitals in The Netherlands. **PATIENTS:** The Coronary Angiography after Cardiac Arrest trial randomized successfully resuscitated patients with shockable rhythm and absence of ST-segment elevation to a strategy of immediate or delayed coronary angiography. In this substudy, 459 patients treated with mild therapeutic hypothermia (32.0-34.0°C) or targeted normothermia (36.0-37.0°C) were included. Allocation to targeted temperature management strategy was at the discretion of the physician. **INTERVENTIONS:** None.

**MEASUREMENTS AND MAIN RESULTS:** After 90 days, 171 patients (63.6%) in the mild therapeutic hypothermia group and 129 (67.9%) in the targeted normothermia group were alive (hazard ratio, 0.86 [95% CI, 0.62-1.18]; log-rank  $p = 0.35$ ; adjusted odds ratio, 0.89; 95% CI, 0.45-1.72). Patients in the mild therapeutic hypothermia group had longer ICU stay (4 d [3-7 d] vs 3 d [2-5 d]; ratio of geometric means, 1.32; 95% CI, 1.15-1.51), lower blood pressures, higher lactate levels, and increased need for inotropic support. Cerebral Performance Category scores at ICU discharge and 90-day follow-up and patient-reported Mental and Physical Health Scores at 1 year were similar in the two groups. **CONCLUSIONS:** In the context of out-of-hospital cardiac arrest with shockable rhythm and no ST-elevation, treatment with mild therapeutic hypothermia was not associated with improved 90-day survival compared with targeted normothermia. Neurologic outcomes at 90 days as well as patient-reported Mental and Physical Health Scores at 1 year did not differ between the groups.

3. Intensive Care Med. 2021 Oct;47(10):1078-1088. doi: 10.1007/s00134-021-06505-z. Epub 2021 Aug 13.

### **Targeted temperature management following out-of-hospital cardiac arrest: a systematic review and network meta-analysis of temperature targets.**

Fernando SM(1)(2), Di Santo P(3)(4), Sadeghirad B(5)(6), Lascarrou JB(7), Rochweg B(6)(8), Mathew R(9)(3), Sekhon MS(10), Munshi L(11)(12)(13), Fan E(11)(12)(13)(14), Brodie D(15)(16), Rowan KM(17), Hough CL(18), McLeod SL(6)(19)(20), Vaillancourt C(21)(4)(22), Cheskes S(20)(23), Ferguson ND(11)(12)(13)(14), Scales DC(11)(12)(23)(24), Sandroni C(25)(26), Nolan JP(#)(27)(28), Hibbert B(#)(3)(4).

#### **ABSTRACT**

**PURPOSE:** Targeted temperature management (TTM) may improve survival and functional outcome in comatose survivors of out-of-hospital cardiac arrest (OHCA), though the optimal target temperature remains unknown. We conducted a systematic review and network meta-analysis to investigate the efficacy and safety of deep hypothermia (31-32 °C), moderate hypothermia (33-34 °C), mild hypothermia (35-36 °C), and normothermia (37-37.8 °C) during TTM. **METHODS:** We searched six databases from inception to June 2021 for randomized controlled trials (RCTs) evaluating TTM in comatose OHCA survivors. Two reviewers performed screening, full text review, and extraction independently. The primary outcome of interest was survival with good functional outcome. We used GRADE to rate our certainty in estimates. **RESULTS:** We included 10 RCTs (4218 patients). Compared with normothermia, deep hypothermia (odds ratio [OR] 1.30, 95% confidence interval [CI] 0.73-2.30), moderate hypothermia (OR 1.34, 95% CI 0.92-1.94) and mild hypothermia (OR 1.44, 95% CI 0.74-2.80) may have no effect on survival with good functional outcome (all low certainty). Deep hypothermia may not improve survival with good functional outcome, as compared to moderate hypothermia (OR 0.97, 95% CI 0.61-1.54, low certainty). Moderate hypothermia (OR 1.23, 95% CI 0.86-1.77) and deep hypothermia (OR 1.27, 95% CI 0.70-2.32) may have no effect on survival, as compared to normothermia. Finally, incidence of arrhythmia was higher with moderate hypothermia (OR 1.45, 95% CI 1.08-1.94) and deep hypothermia (OR 3.58, 95% CI 1.77-7.26), compared to normothermia (both high certainty). **CONCLUSIONS:** Mild, moderate, or deep hypothermia may not improve survival or functional outcome after OHCA, as compared to normothermia. Moderate and deep hypothermia were associated with higher incidence of arrhythmia. Routine use of moderate or deep hypothermia in comatose survivors of OHCA may potentially be associated with more harm than benefit.

### **ELECTROPHYSIOLOGY AND DEFIBRILLATION**

1. Resuscitation. 2021 Oct 7:S0300-9572(21)00393-2. doi: 10.1016/j.resuscitation.2021.09.037. Online ahead of print.

#### **Pre-charging the defibrillator before rhythm analysis reduces hands-off time in patients with out-of-hospital cardiac arrest with shockable rhythm.**

Nees Iversen B(1), Meilandt C(2), Væggemose U(3), Juhl Terkelsen C(4), Kirkegaard H(5), Fjølner J(6).

**NO ABSTRACT AVAILABLE**

### **PEDIATRICS AND CHILDREN**

1. Resuscitation. 2021 Oct 11:S0300-9572(21)00400-7. doi: 10.1016/j.resuscitation.2021.10.004. Online ahead of print.

#### **Post-cardiac arrest physiology and management in the neonatal intensive care unit.**

Coggins SA(1), Haggerty M(2), Herrick HM(3).

**ABSTRACT**

AIM: The importance of high-quality post-cardiac arrest care is well-described in adult and paediatric populations, but data are lacking to inform post-cardiac arrest care in the neonatal intensive care unit (NICU). The objective of this study was to describe post-cardiac arrest physiology and management in a quaternary NICU. METHODS: Retrospective descriptive study of post-cardiac arrest physiology and management. Data were abstracted from electronic medical records and an institutional resuscitation database. A cardiac arrest was defined as  $\geq 1$  minute of chest compressions. Only index arrests were analysed. Descriptive statistics were used to report patient, intra-arrest, and post-arrest characteristics. RESULTS: There were 110 index cardiac arrests during the 5-year study period from 1/2017-2/2021. The majority (69%) were acute respiratory compromise leading to cardiopulmonary arrest (ARC-CPA) and 26% were primary cardiopulmonary arrests (CPA). Vital sign monitoring within 24 hours post-arrest was variable, especially non-invasive blood pressure frequency (median 5, range 1-44 measurements). There was a high prevalence of hypothermia (73% of arrest survivors). There was substantial variability in laboratory frequency within 24 hours post-arrest. Patients with primary CPA received significantly more lab testing and had a higher prevalence of acidosis (pH <7.2) than those with ARC-CPA. CONCLUSIONS: We identified significant variation in post-arrest management and a high prevalence of hypothermia. These data highlight the need for post-arrest management guidelines specific to neonatal physiology, as well as opportunities for quality improvement initiatives. Further research is needed to ascertain the impact of neonatal post-arrest management on long-term outcomes and survival.

2. Resuscitation. 2021 Oct 11:S0300-9572(21)00399-3. doi: 10.1016/j.resuscitation.2021.10.003. Online ahead of print.

**Dispatcher-assisted conventional cardiopulmonary resuscitation and outcomes for paediatric out-of-hospital cardiac arrests.**

Goto Y(1), Funada A(2), Maeda T(3), Goto Y(4).

**ABSTRACT**

AIM: As asphyxial cardiac arrest is more common than cardiac arrest from a primary cardiac event in paediatric cardiac arrest, effective ventilation is important during paediatric cardiopulmonary resuscitation (CPR). We aimed to determine optimal dispatcher-assisted CPR instructions for bystanders after paediatric out-of-hospital cardiac arrest (OHCA). METHODS: We analysed the records of 8172 children who received bystander dispatcher-assisted CPR. Data were obtained from an All-Japan Utstein-style registry from 2005 to 2017. Patients were divided into conventional CPR and compression-only CPR groups. The primary study endpoint was 1-month neurologically intact survival, defined as a Cerebral Performance Category score of 1 or 2 (CPC 1-2). RESULTS: The 1-month CPC 1-2 rate was significantly higher in the dispatcher-assisted conventional CPR group than in the dispatcher-assisted compression-only CPR group (before propensity score matching, 5.7% [175/3077] vs. 3.1% [160/5095],  $p < 0.0001$ , adjusted odds ratio 2.48, 95% confidence interval 1.19-3.22; after propensity score matching, 6.0% [156/2618] vs. 2.6% [69/2618],  $p < 0.0001$ , adjusted odds ratio 2.42, 95% confidence interval 1.76-3.32). In most subgroup analyses after matching, dispatcher-assisted conventional CPR had a higher CPC 1-2 rate than dispatcher-assisted compression-only CPR; however, CPC 1-2 rates were similar between the two groups for patients with an initial shockable rhythm, those with total prehospital CPR time  $\geq 20$  min, those receiving public access defibrillation, advanced airway management, or adrenaline administration. CONCLUSION: Within the limitations of this retrospective observational study, dispatcher-assisted conventional CPR was preferable to dispatcher-assisted compression-only CPR as optimal CPR instructions for coaching callers to perform bystander CPR.

3. ASAIO J. 2021 Oct 12. doi: 10.1097/MAT.0000000000001601. Online ahead of print.



**Acute Kidney Injury and Fluid Overload in Pediatric Extracorporeal Cardio-Pulmonary Resuscitation: A Multicenter Retrospective Cohort Study.**

Gist KM(1), Misfeldt A, Sahay RD, Gorga SM, Askenazi DJ, Bridges BC, Paden ML, Zappitelli M, Gien J, Basu RK, Jetton JG, Murphy HJ, King E, Fleming GM, Selewski DT, Cooper DS.

**ABSTRACT**

Acute kidney injury (AKI) and fluid overload (FO) are common complications of extracorporeal membrane oxygenation (ECMO). The purpose of this study was to characterize AKI and FO in children receiving extracorporeal cardiopulmonary resuscitation (eCPR). We performed a multicenter retrospective study of children who received eCPR. AKI was assessed during ECMO and FO defined as <10% [FO-] vs. ≥10% [FO+] evaluated at ECMO initiation and discontinuation. A composite exposure, defined by a four-group discrete phenotypic classification [FO-/AKI-, FO-/AKI+, FO+/AKI-, FO+/AKI+] was also evaluated. Primary outcome was mortality and hospital length of stay (LOS) among survivors. 131 patients (median age 29 days (IQR:9, 242 days); 51% men and 82% with underlying cardiac disease) were included. 45.8% survived hospital discharge. FO+ at ECMO discontinuation, but not AKI was associated with mortality [aOR=2.3; 95% CI: 1.07-4.91]. LOS for FO+ patients was twice as long as FO- patients, irrespective of AKI status [(FO+/AKI+ (60 days; IQR: 49-83) vs. FO-/AKI+ (30 days, IQR: 19-48 days); P = 0.01]. FO+ at ECMO initiation and discontinuation was associated with an adjusted 66% and 50% longer length of stay respectively. Prospective studies that target timing and strategy of fluid management, including its removal in children receiving ECPR are greatly needed.

**EXTRACORPOREAL LIFE SUPPORT**

1. Resuscitation. 2021 Oct 12:S0300-9572(21)00403-2. doi: 10.1016/j.resuscitation.2021.10.007. Online ahead of print.

**Clinical Use and Outcome of Extracorporeal Membrane Oxygenation in Patients with Pulmonary Embolism.**

Hobohm L(1), Sagoschen I(2), Habertheuer A(3), Barco S(4), Valerio L(5), Wild J(2), Schmidt FP(6), Gori T(2), Münzel T(2), Konstantinides S(5), Keller K(7).

**ABSTRACT**

AIM: of the study: Extracorporeal membrane oxygenation (ECMO) is considered a life-saving treatment option for patients in cardiogenic shock or cardiac arrest undergoing cardiopulmonary resuscitation (CPR) due to acute pulmonary embolism (PE). We sought to analyze use and outcome of ECMO with or without adjunctive treatment strategies in patients with acute PE. METHODS: We retrospectively analyzed data on patient characteristics, treatments, and in-hospital outcomes for all PE patients (ICD-code I26) undergoing ECMO in Germany between 2005 and 2018. RESULTS: At total of 1,172,354 patients were hospitalized with PE; of those, 2,197 (0.2%) were treated with ECMO support. Cardiac arrest requiring cardiopulmonary resuscitation was present in 77,196 (6.5%) patients. While more than one fourth of those patients were treated with systemic thrombolysis alone (n=20,839 patients; 27.0%), a minority of patients received thrombolysis and VA-ECMO (n=165; 0.2%), embolectomy and VA-ECMO (n=385; 0.5%) or VA-ECMO alone (n=588; 0.8%). A multivariable logistic regression analysis indicated the lowest risk for in-hospital death in patients who received embolectomy in combination with VA-ECMO (OR, 0.50 [95%CI, 0.41-0.61], P<0.001), thrombolysis and VA-ECMO (0.60 [0.43-0.85], P=0.003) or VA-ECMO alone (0.68 [0.57-0.82], P<0.001) compared to thrombolysis alone (1.04 [0.99-1.01], P=0.116). CONCLUSION: Our findings suggest that the use of VA-ECMO alone or as part of a multi-pronged reperfusion approach including embolectomy or thrombolysis might offer survival advantages compared to thrombolysis alone in patients with PE deteriorating to cardiac arrest.

2. Shock. 2021 Nov 1;56(5):701-708. doi: 10.1097/SHK.0000000000001727.

**Association Between Converting Asystole From Initial Shockable ECG Rhythm Before Extracorporeal Cardiopulmonary Resuscitation and Outcome.**

Maeda K(1)(2), Inoue A(1)(3), Kuroda Y(3), Inoue F(1)(2), Suga M(1), Ijuin S(1), Kai S(1), Koga T(1), Igarashi N(1), Matsuyama S(1), Kawase T(1), Ishihara S(1), Naitou H(2), Nakayama S(1).

**ABSTRACT**

**BACKGROUND:** Initial electrocardiogram (ECG) rhythm is a predictor of outcomes in out-of-hospital cardiac arrest (OHCA) in patients receiving extracorporeal cardiopulmonary resuscitation (ECPR). However, ECG rhythm often changes before ECPR, and the consequence of this change remains unclear. This study aimed to assess the relationship between the conversion of ECG rhythm from initial shockable rhythm before ECPR and mortality. **PATIENTS AND METHODS:** This was a retrospective cohort study of OHCA patients with initial shockable rhythm who underwent ECPR between January 2010 and September 2020. Patients were classified into two groups: asystole (patients whose ECG rhythm converted to asystole at any time before initiating ECPR) and non-asystole (patients whose ECG rhythm did not convert to asystole at any time before initiating ECPR) groups. The primary outcome was in-hospital mortality. **RESULTS:** A total of 102 patients were included in the study; in-hospital mortality rate was 46.1% (n = 47) and 76 (74.5%) patients had unfavorable neurological outcomes (Cerebral Performance Category: 3-5). There were 33 and 69 patients in the asystole and non-asystole groups, respectively. The mortality rates in the asystole and non-asystole groups were 69.7% and 34.8%, respectively (P = 0.001). On multivariable analysis, the asystole group showed a significant association with mortality (odds ratio, 5.42; 95% confidence interval, 2.11-15.36; P < 0.001). **CONCLUSION:** Conversion to asystole before ECPR at any time in patients with OHCA is associated with mortality in patients with an initial shockable ECG rhythm.

3. J Am Heart Assoc. 2021 Oct 11:e021406. doi: 10.1161/JAHA.121.021406. Online ahead of print.

**Outcomes of Venoarterial Extracorporeal Membrane Oxygenation for Cardiac Arrest in Adult Patients in the United States.**

Gill G(1), Patel JK(2), Casali D(1), Rowe G(1), Meng H(3), Megna D(1), Chikwe J(1), Parikh PB(4).

**ABSTRACT**

**Background** Factors associated with poor prognosis following receipt of extracorporeal membrane oxygenation (ECMO) in adults with cardiac arrest remain unclear. We aimed to identify predictors of mortality in adults with cardiac arrest receiving ECMO in a nationally representative sample. **Methods and Results** The US Healthcare Cost and Utilization Project's National Inpatient Sample was used to identify 782 adults hospitalized with cardiac arrest who received ECMO between 2006 and 2014. The primary outcome of interest was all-cause in-hospital mortality. Factors associated with mortality were analyzed using multivariable logistic regression. The overall in-hospital mortality rate was 60.4% (n=472). Patients who died were older and more often men, of non-White race, and with lower household income than those surviving to discharge. In the risk-adjusted analysis, independent predictors of mortality included older age, male sex, lower annual income, absence of ventricular arrhythmia, absence of percutaneous coronary intervention, and presence of therapeutic hypothermia. **Conclusions** Demographic and therapeutic factors are independently associated with mortality in patients with cardiac arrest receiving ECMO. Identification of which patients with cardiac arrest may receive the utmost benefit from ECMO may aid with decision-making regarding its implementation. Larger-scale studies are warranted to assess the appropriate candidates for ECMO in cardiac arrest.

4. Scand J Trauma Resusc Emerg Med. 2021 Oct 9;29(1):147. doi: 10.1186/s13049-021-00961-8.

**Reliability of prognostic biomarkers after prehospital extracorporeal cardiopulmonary resuscitation with target temperature management.**

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**ABSTRACT**

**BACKGROUND:** Extracorporeal cardiopulmonary resuscitation (ECPR) performed at the emergency scene in out-of-hospital cardiac arrest (OHCA) can minimize low-flow time. Target temperature management (TTM) after cardiac arrest can improve neurological outcome. A combination of ECPR and TTM, both implemented as soon as possible on scene, appears to have promising results in OHCA. To date, it is still unknown whether the implementation of TTM and ECPR on scene affects the time course and value of neurological biomarkers. **METHODS:** 69 ECPR patients were examined in this study. Blood samples were collected between 1 and 72 h after ECPR and analyzed for S100, neuron-specific enolase (NSE), lactate, D-dimers and interleukin 6 (IL6). Cerebral performance category (CPC) scores were used to assess neurological outcome after ECPR upon hospital discharge. Resuscitation data were extracted from the Regensburg extracorporeal membrane oxygenation database and all data were analyzed by a statistician. The data were analyzed using non-parametric methods. Diagnostic accuracy of biomarkers was determined by area under the curve (AUC) analysis. Results were compared to the relevant literature. **RESULTS:** Non-hypoxic origin of cardiac arrest, manual chest compression until ECPR, a short low-flow time until ECPR initiation, low body mass index (BMI) and only a minimal need of extra-corporeal membrane oxygenation support were associated with a good neurological outcome after ECPR. Survivors with good neurological outcome had significantly lower lactate, IL6, D-dimer, and NSE values and demonstrated a rapid decrease in the initial S100 value compared to non-survivors. **CONCLUSIONS:** A short low-flow time until ECPR initiation is important for a good neurological outcome. Hypoxia-induced cardiac arrest has a high mortality rate even when ECPR and TTM are performed at the emergency scene. ECPR patients with a higher BMI had a worse neurological outcome than patients with a normal BMI. The prognostic biomarkers S100, NSE, lactate, D-dimers and IL6 were reliable indicators of neurological outcome when ECPR and TTM were performed at the emergency scene.

5. J Cardiothorac Surg. 2021 Oct 9;16(1):290. doi: 10.1186/s13019-021-01674-w.

**Short-term and intermediate outcomes of cardiogenic shock and cardiac arrest patients supported by venoarterial extracorporeal membrane oxygenation.**

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**ABSTRACT**

**BACKGROUND:** Cardiogenic shock and cardiac arrest are life-threatening emergencies with high mortality rates. Veno-arterial extracorporeal membrane oxygenation (VA ECMO) and extracorporeal cardiopulmonary resuscitation (e-CPR) provide viable options for life sustaining measures when medical therapy fails. The purpose of this study is to determine the utilization and outcomes of VA ECMO and eCPR in patients that require emergent cardiac support at a single academic center. **METHODS:** A retrospective chart review of prospectively collected data was performed at an academic institution from January 1st, 2018 to June 30th, 2020. All consecutive patients who required VA ECMO were evaluated based on whether they underwent traditional VA ECMO or eCPR. The study variables include demographic data, duration on ECMO, length of stay, complications, and survival to discharge. **RESULTS:** A total of 90 patients were placed on VA ECMO for cardiac support with 44.4% (40) of these patients undergoing eCPR secondary to cardiac arrest and emergent placement on ECMO. A majority of the patients were male (n = 64, 71.1%) and the mean age was 58.8 ± 15.8 years. 44.4% of patients were transferred from outside hospitals for a higher level of care and 37.8% of patients required another primary therapy such as an Impella or IABP. The most common complication experienced by patients was bleeding (n = 41, 45.6%), which occurred less often in eCPR (n = 29, 58% vs. n = 12, 30%). Other complications included infections (n = 11, 12.2%), limb ischemia (n = 13, 14.4%), acute kidney injury (n = 17, 18.9%), and cerebral vascular accident (n = 4, 4.4%). The length of stay was longer for patients on VA ECMO (32.1 ± 40.7 days vs. 17.7 ± 18.2 days). Mean time on ECMO was 8.1 ± 8.3 days. Survival to discharge was higher in VA ECMO patients (n = 23, 46% vs. n = 8, 20%). **CONCLUSION:** VA ECMO provided an effective rescue

therapy in patients in acute cardiogenic shock with a survival greater than the expected ELSO guidelines of 40%. While the survival of eCPR was lower than expected, this may reflect the severity of patient's condition and emphasizes the importance of careful patient selection and planning.

6. Perfusion. 2021 Oct 9:2676591211049767. doi: 10.1177/02676591211049767. Online ahead of print.

**Predictors of acute kidney injury in patients after extracorporeal cardiopulmonary resuscitation.**

Gaisendrees C(1), Ivanov B(1), Gerfer S(1), Sabashnikov A(1), Eghbalzadeh K(1), Schlachtenberger G(1), Avgeridou S(1), Rustenbach C(1), Merkle J(1), Adler C(2), Kuhn E(1), Mader N(1), Kuhn-Régnier F(1), Djordjevic I(1), Wahlers T(1).

**ABSTRACT**

**OBJECTIVES:** Extracorporeal cardiopulmonary resuscitation (eCPR) is increasingly used due to its beneficial outcomes and results compared with conventional CPR. Data after eCPR for acute kidney injury (AKI) are lacking. We sought to investigate factors predicting AKI in patients who underwent eCPR. **METHODS:** From January 2016 until December 2020, patients who underwent eCPR at our institution were retrospectively analyzed and divided into two groups: patients who developed AKI (n = 60) and patients who did not develop AKI (n = 35) and analyzed for outcome parameters. **RESULTS:** Overall, 63% of patients suffered AKI after eCPR and 45% of patients who developed AKI needed subsequent dialysis. Patients who developed AKI showed higher values of creatinine (1.1 mg/dL vs 1.5 mg/dL,  $p \leq 0.01$ ), urea (34 mg/dL vs 42 mg/dL,  $p = 0.04$ ), CK (creatin kinase) (923 U/L vs 1707 U/L,  $p = 0.07$ ) on admission, and CK after 24 hours of ECMO support (1705 U/L vs 4430 U/L,  $p = 0.01$ ). ECMO explantation was significantly more often performed in patients who suffered AKI (24% vs 48%,  $p = 0.01$ ). In-hospital mortality (86% vs 70%;  $p = 0.07$ ) did not differ significantly. **CONCLUSION:** Patients after eCPR are at high risk for AKI, comparable to those after conventional CPR. Baseline urea levels predict the development of AKI during the hospital stay.

**EXPERIMENTAL RESEARCH**

1. Crit Care Med. 2021 Sep 22. doi: 10.1097/CCM.0000000000005268. Online ahead of print.

**Exogenous Nicotinamide Adenine Dinucleotide Attenuates Postresuscitation Myocardial and Neurologic Dysfunction in a Rat Model of Cardiac Arrest.**

Su C(1), Xiao Y, Zhang G, Liang L, Li H, Cheng C, Jin T, Bradley J, Peberdy MA, Ornato JP, Mangino MJ, Tang W.

**ABSTRACT**

**OBJECTIVES:** To investigate the therapeutic potential and underlying mechanisms of exogenous nicotinamide adenine dinucleotide+ on postresuscitation myocardial and neurologic dysfunction in a rat model of cardiac arrest. **DESIGN:** Thirty-eight rats were randomized into three groups: 1) Sham, 2) Control, and 3) NAD. Except for the sham group, untreated ventricular fibrillation for 6 minutes followed by cardiopulmonary resuscitation was performed in the control and NAD groups. Nicotinamide adenine dinucleotide+ (20 mg/kg) was IV administered at the onset of return of spontaneous circulation. **SETTING:** University-affiliated research laboratory. **SUBJECTS:** Sprague-Dawley rats. **INTERVENTIONS:** Nicotinamide adenine dinucleotide+. **MEASUREMENTS AND MAIN RESULTS:** Hemodynamic and myocardial function were measured at baseline and within 4 hours following return of spontaneous circulation. Survival analysis and Neurologic Deficit Score were performed up to 72 hours after return of spontaneous circulation. Adenosine triphosphate (adenosine triphosphate) level was measured in both brain and heart tissue. Mitochondrial respiratory chain function, acetylation level, and expression of Sirtuin3 and NADH dehydrogenase (ubiquinone) 1 alpha subcomplex, 9 (NDUFA9) in isolated mitochondrial protein from both brain and

heart tissue were evaluated at 4 hours following return of spontaneous circulation. The results demonstrated that nicotinamide adenine dinucleotide+ treatment improved mean arterial pressure (at 1 hr following return of spontaneous circulation,  $94.69 \pm 4.25$  mm Hg vs  $89.57 \pm 7.71$  mm Hg;  $p < 0.05$ ), ejection fraction (at 1 hr following return of spontaneous circulation,  $62.67\% \pm 6.71\%$  vs  $52.96\% \pm 9.37\%$ ;  $p < 0.05$ ), Neurologic Deficit Score (at 24 hr following return of spontaneous circulation,  $449.50 \pm 82.58$  vs  $339.50 \pm 90.66$ ;  $p < 0.05$ ), and survival rate compared with that of the control group. The adenosine triphosphate level and complex I respiratory were significantly restored in the NAD group compared with those of the control group. In addition, nicotinamide adenine dinucleotide+ treatment activated the Sirtuin3 pathway, down-regulating acetylated-NDUFA9 in the isolated mitochondria protein. **CONCLUSIONS:** Exogenous nicotinamide adenine dinucleotide+ treatment attenuated postresuscitation myocardial and neurologic dysfunction. The responsible mechanisms may involve the preservation of mitochondrial complex I respiratory capacity and adenosine triphosphate production, which involves the Sirtuin3-NDUFA9 deacetylation.

### **CASE REPORTS**

1. Aorta (Stamford). 2021 Oct 12. doi: 10.1055/s-0041-1729912. Online ahead of print.

#### **A High-Echoic Layer Surrounding the Heart Suggesting Cardiac Tamponade by Clotting.**

Takeuchi I(1), Shitara J(1), Yanagawa Y(1).

#### **ABSTRACT**

A 16-year-old boy experienced a sudden loss of consciousness. On arrival, he was in cardiac arrest. An ultrasound study revealed a high-echoic layer surrounding the heart. He received a diagnosis of clotting cardiac tamponade. Urgent thoracotomy with pericardiotomy was performed, but he failed to obtain return of spontaneous circulation. Physicians should focus on not only low-echoic but also high-echoic areas to accurately diagnose clotting, which can result in a critical condition if not managed properly.

2. Pathol Int. 2021 Oct 12. doi: 10.1111/pin.13179. Online ahead of print.

#### **Autopsy case with concurrent transthyretin and immunoglobulin amyloidosis.**

Shintani-Domoto Y(1), Ishino K(2), Naiki H(3), Sakatani T(1), Ohashi R(1)(2).

#### **ABSTRACT**

An 85-year-old man with a history of aortic dissection suddenly fainted, underwent cardiac heart arrest, and died. An autopsy was performed, but the cause of death was not grossly identified. Congo red staining detected amyloid deposits in systemic organs, including the heart, lungs, liver, and kidneys. Immunohistochemical (IHC) analysis revealed immunoglobulin (Ig)  $\lambda$  light chain ( $-\lambda$ ) in systemic blood vessels and transthyretin (TTR) in the heart and lungs. Ig- $\lambda$  was predominantly positive in the blood vessels of the lungs, while TTR was detected in the alveolar septum. In the heart, Ig- $\lambda$  was positive in the endocardium and blood vessels, and TTR was positive in nodular deposits between cardiomyocytes. The concurrent deposition of Ig- $\lambda$  and TTR in the heart was further substantiated by laser microdissection (LMD)-liquid chromatography-tandem mass spectrometry (LC-MS/MS) at each deposition site. Despite systemic deposition of Ig- $\lambda$ , bone marrow biopsy findings were not diagnostic for multiple myeloma. In summary, we present an autopsy case of concurrent Ig- $\lambda$  and TTR deposition as revealed by IHC and LC-MS/MS. When Congo red staining and IHC results are indeterminate due to the deposition of multiple amyloid proteins, LMD-LC-MS/MS is useful for determining the precursor protein.

3. Wilderness Environ Med. 2021 Oct 7:S1080-6032(21)00114-9. doi: 10.1016/j.wem.2021.05.006. Online ahead of print.

## **Successful Non-Extracorporeal Rewarming from Hypothermic Cardiac Arrest: 2 Cases.**

Cools E(1), Latscher H(2), Ströhle M(3), Paal P(4).

### **ABSTRACT**

Accidental hypothermia (core temperature  $<35^{\circ}\text{C}$ ) is a complication in persons who have fallen into crevasses; hypothermic cardiac arrest is the most serious complication. Extracorporeal life support (ECLS) is the optimal method for rewarming hypothermic cardiac arrest patients, but it may not be readily available and non-ECLS rewarming may be required. We report the medical course of 2 patients with hypothermic cardiac arrest, each of whom had fallen into a crevasse. They were treated successfully with non-ECLS rewarming using peritoneal and thoracic lavage. We discuss non-ECLS treatment options for hypothermic cardiac arrest and describe successful non-ECLS rewarming in an outlying hospital without ECLS rewarming capability in the Grossglockner region of Austria in 1990 and 2003. Both patients survived neurologically intact. Non-ECLS rewarming in a trauma center without ECLS capabilities is feasible and can result in a good outcome when ECLS is not available. The best non-ECLS rewarming method for hypothermic cardiac arrest patients has not yet been established. Non-ECLS rewarming should be adapted to local capabilities. To obtain more robust evidence, it seems reasonable to pool data on the treatment and outcome of non-ECLS rewarming in hypothermic cardiac arrest patients.