

This week's PubMed 22nd – 28th May 2022: articles of interest n = 43

CPR AND COVID-19

No articles identified.

CPR/MECHANICAL CHEST COMPRESSION

1. Health Sci Rep. 2022 May 24;5(3):e644. doi: 10.1002/hsr2.644. eCollection 2022 May.

Efficacy of heads-up CPR compared to supine CPR positions: Systematic review and meta-analysis.

Varney J(1), Motawea KR(2), Mostafa MR(3), AbdelQadir YH(2), Aboelenein M(2), Kandil OA(2), Ibrahim N(2), Hashim HT(4), Murry K(5), Jackson G(1), Shah J(6)(7), Boury M(1), Awad AK(8), Patel P(1), Awad DM(2), Rozan SS(2), Talat NE(2).

ABSTRACT

BACKGROUND AND AIM: Cardiopulmonary resuscitation (CPR) in full-coded patients requires effective chest compressions with minimal interruptions to maintain adequate perfusion to the brain and other vital organs. Many novel approaches have been proposed to attain better organ perfusion compared to traditional CPR techniques. The purpose of this review is to investigate the safety and efficacy of heads-up CPR versus supine CPR. METHODS: We searched PubMed Central, SCOPUS, Web of Science, and Cochrane databases from 1990 to February 2021. After the full-text screening of 40 eligible studies, only seven studies were eligible for our meta-analysis. We used the RevMan software (5.4) to perform the meta-analysis. RESULTS: In survival outcome, the pooled analysis between heads-up and supine CPR was (risk ratio = 0.98, 95% confidence interval [CI] = 0.17-5.68, $p = 0.98$). The pooled analyses between heads-up CPR and supine CPR in cerebral flow, cerebral perfusion pressure and coronary perfusion pressure outcomes, were (mean difference [MD] = 0.10, 95% CI = 0.03-0.17, $p = 0.003$), (MD = 12.28, 95% CI = 5.92-18.64], $p = 0.0002$), and (MD = 8.43, 95% CI = 2.71-14.14, $p = 0.004$), respectively. After doing a subgroup analysis, cerebral perfusion was found to increase during heads-up CPR compared with supine CPR at 6 min CPR duration and 18 to 20 min CPR duration as well. CONCLUSION: Our study suggests that heads-up CPR is associated with better cerebral and coronary perfusion compared to the conventional supine technique in pigs' models. However, more research is warranted to investigate the safety and efficacy of the heads-up technique on human beings and to determine the best angle for optimization of the technique results.

REGISTRIES, REVIEWS AND EDITORIALS

1. Am J Emerg Med. 2022 May 19;58:27-32. doi: 10.1016/j.ajem.2022.05.017. Online ahead of print.

Mid-term (30- to 90-day) neurological changes in out-of-hospital cardiac arrest patients: A nationwide retrospective study (the JAAM-OHCA registry).

Naito H(1), Nojima T(2), Yorifuji T(3), Fujisaki N(2), Nakao A(2).

ABSTRACT

OBJECTIVE: Few studies have focused on mid/long-term neurological changes in out-of-hospital cardiac arrest (OHCA) survivors. Some studies suggest that there is still a slow, small, progressive improvement in cognitive function and quality of life for this population, even in the mid/long term. However, clinical data focused on mid/long-term outcomes for OHCA patients are still lacking. This study aimed to assess mid-term neurological changes in OHCA patients. We summarized patients'

improved or worsened neurological changes between 30 and 90 days. Then we identified the relationship between clinical variables and 30- to 90-day neurological improvement. **METHODS:** A retrospective review of data (Jun 2014 - Dec 2017) from a Japanese nationwide OHCA registry was conducted. Inclusion criteria were OHCA patients ≥ 18 years old. Exclusion criteria were death within 30 days and missing Cerebral Performance Category (CPC) score at 30 and 90 days. We described the distributions of 30-day and 90-day CPC scores as well as the number and portion of patients whose CPC scores improved and worsened between 30 and 90 days. Additionally, factors affecting improved neurological changes over the time period were examined using multivariable logistic regression. **RESULTS:** Of the registry's 34,745 patients, 1868 were analyzed. Favorable neurological outcomes (CPC scores of 1 and 2) were seen in 1020/1868 patients at 90 days. CPC scores at 90 days were: CPC 1: 866 (46%), CPC 2: 154 (8.2%), CPC 3: 224 (12%), and CPC 4: 392 (20%), respectively. A total of 232 patients (CPC 5: 12%) died between 30 and 90 days. In 133 patients (7%), 90-day CPC scores improved compared to their 30-day scores. In 260 patients (14%), 90-day CPC scores worsened compared with their 30-day scores. Application of target temperature management was an independent factor for 30- to 90-day neurological improvement (adjusted odds ratio: 1.69, 95% confidence interval: 1.07-2.68). **CONCLUSIONS:** In our nationwide registry, 7% of resuscitated patients had improved neurological changes in the 30- to 90-day period; most of the improvements were CPC scores improving from 2 to 1. Target temperature management was an independent factor associated with CPC improvement over the 30- to 90-day period.

2. Resusc Plus. 2022 May 18;10:100249. doi: 10.1016/j.resplu.2022.100249. eCollection 2022 Jun. **Thrombolysis for pulmonary embolism cardiac arrest after large hemispheric stroke: The lesser of two evils?**

Esmaeeli S(1), Kashani S(2), Nozari A(1).

NO ABSTRACT AVAILABLE

IN-HOSPITAL CARDIAC ARREST

1. Resuscitation. 2022 May 23:S0300-9572(22)00165-4. doi: 10.1016/j.resuscitation.2022.05.014. Online ahead of print.

Socioeconomic status and risk of in-hospital cardiac arrest.

Stankovic N(1), Holmberg MJ(2), Granfeldt A(3), Andersen LW(4).

ABSTRACT

AIM: To investigate how socioeconomic status was associated with the risk of in-hospital cardiac arrest in Denmark. **METHODS:** We conducted a matched case-control study based on data from nationwide registries in Denmark. A total of 3,449 cases with in-hospital cardiac arrest in 2017 and 2018 were matched at the index time based on age and sex with up to 10 controls from the total Danish population and a hospitalized patient population, respectively. Household income, household assets, and education were used as measures of socioeconomic status. Conditional logistic regression was used to assess the association between socioeconomic status and the risk of in-hospital cardiac arrest. **RESULTS:** Across all analyses of cases and controls, high household income, high household assets, and higher education were associated with decreased odds of in-hospital cardiac arrest. In the analyses of cases and background controls, high household income was associated with 0.45 (95% CI: 0.40, 0.52) times the odds of in-hospital cardiac arrest compared to low household income, which was similar for household assets. Compared to basic education, higher education was associated with 0.50 (95% CI: 0.43, 0.58) times the odds of in-hospital cardiac arrest. The results attenuated marginally after adjustment for comorbidities. Similar albeit attenuated findings were observed in the analyses of cases and hospitalized controls. **CONCLUSIONS:** In this matched case-control study, high socioeconomic status was associated with lower odds of in-

hospital cardiac arrest compared to low socioeconomic status. The findings were consistent across household income, household assets, and education and persisted after adjustment for comorbidities. Strategies are needed to address the socioeconomic inequalities observed in the risk of in-hospital cardiac arrest.

2. Sci Rep. 2022 May 24;12(1):8779. doi: 10.1038/s41598-022-12781-6.

External validation of a triage tool for predicting cardiac arrest in the emergency department.

Sun JT(1)(2), Chang CC(3)(4), Lu TC(5)(6), Lin JC(1)(2), Wang CH(5)(6), Fang CC(5)(6), Huang CH(5)(6), Chen WJ(5)(6), Tsai CL(7)(8).

ABSTRACT

Early recognition and prevention comprise the first ring of the Chain of Survival for in-hospital cardiac arrest (IHCA). We previously developed and internally validated an emergency department (ED) triage tool, Emergency Department In-hospital Cardiac Arrest Score (EDICAS), for predicting ED-based IHCA. We aimed to externally validate this novel tool in another ED population. This retrospective cohort study used electronic clinical warehouse data from a tertiary medical center with approximately 130,000 ED visits per year. We retrieved data from 268,208 ED visits over a 2-year period. We selected one ED visit per person and excluded out-of-hospital cardiac arrest or children. Patient demographics and computerized triage information were retrieved, and the EDICAS was calculated to predict the ED-based IHCA. A total of 145,557 adult ED patients were included. Of them, 240 (0.16%) developed IHCA. The EDICAS showed excellent discrimination with an area under the receiver operating characteristic (AUROC) of 0.88. The AUROC of the EDICAS outperformed those of other early warning scores (0.80 for Modified Early Warning Score [MEWS] and 0.83 for Rapid Emergency Medicine Score [REMS]) in the same ED population. An EDICAS of 6 or above (i.e., high-risk patients) corresponded to a sensitivity of 33%, a specificity of 97%, and a positive likelihood ratio of 12.2. In conclusion, we externally validated a tool for predicting imminent IHCA in the ED and demonstrated its superior performance over other early warning scores. The real-world impact of the EDICAS warning system with appropriate interventions would require a future prospective study.

INJURIES AND CPR

1. Am J Emerg Med. 2022 May 18:S0735-6757(22)00320-5. doi: 10.1016/j.ajem.2022.05.020. Online ahead of print.

Surgical stabilization of iatrogenic rib fractures following cardiopulmonary resuscitation.

Spardy J(1), Kornblith L(2), Elkbuli A(3).

NO ABSTRACT AVAILABLE

CAUSE OF THE ARREST

1. Resuscitation. 2022 Jun;175:171-172. doi: 10.1016/j.resuscitation.2022.03.031.

A debate on the relationship between out-of-hospital cardiac arrest attributed to poisoning and good neurological outcome.

Zhou C(1), Ye L(2), Luo C(3), Wang G(4), Xu P(5).

NO ABSTRACT AVAILABLE

2. JAMA Netw Open. 2022 May 2;5(5):e2214351. doi: 10.1001/jamanetworkopen.2022.14351.

Identification and Treatment of Opioid-Associated Out-of-Hospital Cardiac Arrest in Emergency Medical Service Protocols.

Dillon DG(1), Porto GD(2), Eswaran V(1)(3), Shay C(1), Montoy JCC(1).

NO ABSTRACT AVAILABLE

3. Curr Opin Cardiol. 2022 May 1;37(3):212-218. doi: 10.1097/HCO.0000000000000946.

Genetics of sudden cardiac death.

Ben-Haim Y(1), Behr ER.

ABSTRACT

PURPOSE OF REVIEW: Numerous cardiac diseases may cause sudden cardiac death (SCD), and a genetic basis for SCD has been established in the inherited cardiac conditions (ICCs). Previously, ICCs were thought to have a Mendelian inheritance pattern, wherein a rare pathogenic/likely pathogenic variant in a known diseasecausing gene conferred risk. This inheritance model, however, could not explain a large proportion of cases. **RECENT FINDINGS:** Advancements in genomic technology have facilitated application of genome-wide association studies (GWAS), allowing appreciation of the full spectrum of genetic variation in large populations. It has become clear that common variants may contribute to disease phenotype in ICCs as well, albeit with a smaller effect size and the need for additional factors. This has caused a shift in the understanding of inheritance patterns in ICCs, now thought to have a more complex, polygenic nature. **SUMMARY:** Implementing this knowledge into genetic testing of SCD decedents will improve its diagnostic yield by identifying a subset of patients who do not carry a variant in one of the acknowledged disease-causing genes. It will also assist our understanding of modification of phenotype and potentially outcomes.

END-TIDAL CO₂

No articles identified.

ORGAN DONATION

No articles identified.

FEEDBACK

No articles identified.

DRUGS

1. Hosp Pharm. 2022 Jun;57(3):329-335. doi: 10.1177/00185787211032359. Epub 2021 Jul 11.

Effects of Propofol on Hemodynamic Profile in Adults Receiving Targeted Temperature Management.

Hawkins WA(1)(2), Kim JY(3), Smith SE(4), Sikora Newsome A(5)(6), Hall RG(7)(8).

ABSTRACT

Background: Propofol is a key component for the management of sedation and shivering during targeted temperature management (TTM) following cardiac arrest. The cardiac depressant effects of propofol have not been described during TTM and may be especially relevant given the stress to the myocardium following cardiac arrest. The purpose of this study is to describe hemodynamic changes associated with propofol administration during TTM. **Methods:** This single center, retrospective cohort study evaluated adult patients who received a propofol infusion for at least 30 minutes during TTM. The primary outcome was the change in cardiovascular Sequential Organ Failure

Assessment (cvSOFA) score 30 minutes after propofol initiation. Secondary outcomes included change in systolic blood pressure (SBP), mean arterial pressure (MAP), heart rate (HR), and vasopressor requirements (VR) expressed as norepinephrine equivalents at 30, 60, 120, 180, and 240 minutes after propofol initiation. A multivariate regression was performed to assess the influence of propofol and body temperature on MAP, while controlling for vasopressor dose and cardiac arrest hospital prognosis (CAHP) score. Results: The cohort included 40 patients with a median CAHP score of 197. The goal temperature of 33°C was achieved for all patients. The median cvSOFA score was 1 at baseline and 0.5 at 30 minutes, with a non-significant change after propofol initiation (P = .96). SBP and MAP reductions were the greatest at 60 minutes (17 and 8 mmHg; P < .05 for both). The median change in HR at 120 minutes was -9 beats/minute from baseline. This reduction was sustained through 240 minutes (P < .05). No change in VR were seen at any time point. In multivariate regression, body temperature was the only characteristic independently associated with changes in MAP (coefficient 4.95, 95% CI 1.6-8.3). Conclusion: Administration of propofol during TTM did not affect cvSOFA score. The reductions in SBP, MAP, and HR did not have a corresponding change in vasopressor requirements and are likely not clinically meaningful. Propofol appears to be a safe choice for sedation in patients receiving targeted temperature management after cardiac arrest.

TRAUMA

1. Anesth Analg. 2022 Jun 1;134(6):1338-1339. doi: 10.1213/ANE.0000000000005883. Epub 2022 May 10.

EDCB ET AA: A Mnemonic for Resuscitating Hypothermic Patients Under Extreme Conditions.

Venetz P(1), Luedi MM(2).

NO ABSTRACT AVAILABLE

VENTILATION

1. Healthcare (Basel). 2022 May 23;10(5):961. doi: 10.3390/healthcare10050961.

The Importance of Acknowledging an Intermediate Category of Airway Management Devices in the Prehospital Setting.

Suppan L(1), Fehlmann CA(1), Stuby L(2), Suppan M(3).

ABSTRACT

Prehospital airway devices are often classified as either basic or advanced, with this latter category including both supraglottic airway (SGA) devices and instruments designed to perform endotracheal intubation (ETI). Therefore, many authors analyze the impact of SGA and ETI devices jointly. There are however fundamental differences between these instruments. Indeed, adequate airway protection can only be achieved through ETI, and SGA devices all have relatively low leak pressures which might compromise both oxygenation and ventilation when lung compliance is decreased. In addition, there is increasing evidence that SGA devices reduce carotid blood flow in case of cardiac arrest. Nevertheless, SGA devices might be particularly useful in the prehospital setting where many providers are not experienced enough to safely perform ETI. Compared to basic airway management (bag-valve-mask) devices, SGA devices enable better oxygenation, decrease the odds of aspiration, and allow for more reliable capnometric measurement by virtue of their enhanced airtightness. For all these reasons, we strongly believe that SGA devices should be categorized as "intermediate airway management devices" and be systematically analyzed separately from devices designed to perform ETI.

CEREBRAL MONITORING

No articles identified.

ULTRASOUND AND CPR

No articles identified.

ORGANISATION AND TRAINING

1. Med Glas (Zenica). 2022 Aug 1;19(2). doi: 10.17392/1472-22. Online ahead of print.

Bystanders' cardiopulmonary resuscitation involvement in the treatment of out-of-hospital cardiac arrest events and educational status regarding basic life support measures and automated external defibrillator usage among residents in Canton Sarajevo, Bosnia and Herzegovina.

Zalihić A(1), Šljivo A(1), Ribić E(1), Gavranović A(1), Brigić L(2).

ABSTRACT

Aim To investigate bystanders' CPR involvement in out-of-hospital cardiac arrest (OHCA) events, their current knowledge regarding OHCA and BLS measures, their willingness to learn BLS measures with the usage of AEDs, as well as current practices. **Methods** This cross-sectional study included: data regarding all OHCA events treated at the Emergency Medical Service of Canton Sarajevo between January 2015 and December 2019, and an online anonymous questionnaire that examined knowledge, attitudes and practices regarding basic life support (BLS) and automated external defibrillators (AEDs). **Results** A total of 328 (24.0 %) of 1362 OHCA events achieved the return of spontaneous circulation (ROSC). OHCA incidence was 62/100.000 inhabitants per year. Male gender ($p=0.043$) and younger age ($p<0.001$) were significantly associated with obtaining ROSC. Only 44 (3.2%) OHCA events were assisted by bystanders, who were mostly medical professionals 38 (86.4%), followed by close family members 6 (13.6%). There was no report of AED usage. BLS and AED knowledge test score was in the range 12.0-89.8% with generally poor knowledge. Our residents agreed that BLS measurements are essential, 1604 (86.7 %) and that BLS should be a part of their curriculum, 1678 (90.7 %). **Conclusion** The prevalence of OHCA events in Bosnia and Herzegovina is similar to the region; ROSC among OHCA events was lower than European average, but among highest in the region. There was an extremely low rate of bystander engagement and no AEDs usage. Governmental institutions and health agencies should intervene to increase population knowledge thus increasing OHCA survival rate.

2. J Sports Med Phys Fitness. 2022 May 27. doi: 10.23736/S0022-4707.22.13719-9. Online ahead of print.

Health characteristics, knowledge, and attitude towards basic life support among marathon runners in Thailand: a population-based survey.

Wongtanasarasin W(1), Sutham K(1), Laosuksri W(1), Wittayachamnankul B(2).

ABSTRACT

BACKGROUND: Out-of-hospital cardiac arrest (OHCA) is not common but associated with a low survival rate. There is no evidence investigating the effects of previous Basic Life Support (BLS) training among long-distance runners. The goal of this study is to demonstrate the health characteristics, knowledge, and attitudes towards BLS among marathon runners. **METHODS:** An online cross-sectional survey was asked to all 2019 Chiang Mai University marathon participants as a part of the running registration. Details of health characteristic, running history, and BLS training

details were requested. The primary outcomes were knowledge and attitude towards BLS among marathon runners. RESULTS: Of all 10,507 questionnaires sent, the response rate was 92.9%. One-ninth of participants were 50 years of age or above. The mean age was 36.8±9.9 years. Most were male (56.1%) and Thai (99.4%). Only a quarter (2,454 out of 9,761 runners) of study population had previous BLS training. Family history of sudden cardiac death or cardiac death with unknown causes was more in participants with previous BLS training than those without (1.1% vs 0.6%, $p = 0.01$). Previous BLS training group answered the national emergency call number correctly more than those without (90.4% vs 73.0%, $p < 0.001$) and previous BLS training group were more likely to initiate CPR than those without (median self-confidence 8 vs 5, respectively, $p < 0.001$). CONCLUSIONS: Only a quarter of running participants have participated in BLS training before entering a marathon running. Having previous BLS training is associated with higher self-confidence to attempt CPR. Organized planning including trained medical staff, adequate equipment, and qualified bystanders is recommended.

3. Stud Health Technol Inform. 2022 May 25;294:445-449. doi: 10.3233/SHTI220498.

Out-of-Hospital Cardiac Arrest Detection by Machine Learning Based on the Phonetic Characteristics of the Caller's Voice.

Rafi S(1), Gangloff C(1), Paulhet E(2), Grimault O(3)(4), Soulat L(2), Bouzillé G(1), Cuggia M(1).

ABSTRACT

INTRODUCTION: Out-of-hospital cardiac arrest (OHCA) is a major public health issue. The prognosis is closely related to the time from collapse to return of spontaneous circulation. Resuscitation efforts are frequently initiated at the request of emergency call center professionals who are specifically trained to identify critical conditions over the phone. However, 25% of OHCA are not recognized during the first call. Therefore, it would be interesting to develop automated computer systems to recognize OHCA on the phone. The aim of this study was to build and evaluate machine learning models for OHCA recognition based on the phonetic characteristics of the caller's voice. METHODS: All patients for whom a call was done to the emergency call center of Rennes, France, between 01/01/2017 and 01/01/2019 were eligible. The predicted variable was OHCA presence. Predicting variables were collected by computer-automatized phonetic analysis of the call. They were based on the following voice parameters: fundamental frequency, formants, intensity, jitter, shimmer, harmonic to noise ratio, number of voice breaks, and number of periods. Three models were generated using binary logistic regression, random forest, and neural network. The area under the curve (AUC) was the primary outcome used to evaluate each model performance. RESULTS: 820 patients were included in the study. The best model to predict OHCA was random forest (AUC=74.9, 95% CI=67.4-82.4). CONCLUSION: Machine learning models based on the acoustic characteristics of the caller's voice can recognize OHCA. The integration of the acoustic parameters identified in this study will help to design decision-making support systems to improve OHCA detection over the phone.

4. Resusc Plus. 2022 May 18;10:100248. doi: 10.1016/j.resplu.2022.100248. eCollection 2022 Jun.

Characterization of teamwork and guideline compliance in prehospital neonatal resuscitation simulations.

Bahr N(1), Huynh TK(2), Lambert W(3), Guise JM(1).

ABSTRACT

AIM: Neonatal cardiopulmonary arrests are rare but serious events. There is limited information on compliance to best-practice guidelines due to rarity, but deviations can have dire consequences. This research aimed to characterize compliance with and deviations from Neonatal Resuscitation Program (NRP) guidelines and their association with teamwork. METHODS: We observed Emergency

Medical Service (EMS) teams responding to standardized neonatal resuscitation simulations following a precipitous home delivery. A Clinical expert evaluated teamwork during simulations using the Clinical Teamwork Scale (CTS™). A neonatologist evaluated technical performance in blinded video review according to NRP guidelines. We report the types, counts, and severity of observed deviations. Logistic regression tested the association of CTS™ factors with the occurrence of deviations. RESULTS: Forty-five (45) teams of 265 EMS personnel from fire and transport agencies participated in the simulations. Eighty-seven percent (39/45) of teams were rated as having good teamwork according to CTS™. Nearly all teams (44 of 45) delayed or did not perform one or more of the initial steps of dry, warm, or stimulate; delayed bag-valve mask ventilation (BVM); or performed continuous compressions instead of the recommended 3:1 compression-to-ventilation ratio. Logistic regression revealed an 82% ($p < 0.04$) decrease in the odds of airway errors for each level of improvement in teams' decision-making. CONCLUSION: Drying, warming, and stimulating, and ventilation tailored to the physiologic needs of infants continue to be top priorities in neonatal care for out-of-hospital settings. EMS teamwork is good and higher quality of decision-making appears to decrease the odds of ventilation errors.

5. J Am Coll Cardiol. 2022 May 31;79(21):2140-2143. doi: 10.1016/j.jacc.2022.03.359.

Impact of State Laws: CPR Education in High Schools.

Vetter VL(1), Griffis H(2), Dalldorf KF(3), Naim MY(4), Rossano J(4), Vellano K(5), McNally B(6), Glatz AC(7); CARES Surveillance Group.

NO ABSTRACT AVAILABLE

6. Simul Healthc. 2022 May 25. doi: 10.1097/SIH.0000000000000670. Online ahead of print.

Video Review of Simulated Pediatric Cardiac Arrest to Identify Errors/Latent Safety Threats: A Mixed Methods Study.

Garcia-Jorda D(1), Nikitovic D, Gilfoyle E.

ABSTRACT

INTRODUCTION: Outcomes from pediatric in-hospital cardiac arrest depend on the treatment provided as well as resuscitation team performance. Our study aimed to identify errors occurring in this clinical context and develop an analytical framework to classify them. This analytical framework provided a better understanding of team performance, leading to improved patient outcomes. METHODS: We analyzed 25 video recordings of pediatric cardiac arrest simulations from the pediatric intensive care unit at the Alberta Children's Hospital. We conducted a qualitative-dominant crossover mixed method analysis to produce a broad understanding of the etiology of errors. Using qualitative framework analysis, we identified and qualitatively described errors and transformed the data coded into quantitative data to determine the frequency of errors. RESULTS: We identified 546 errors/error-related actions and behaviors and 25 near misses. The errors were coded into 21 codes that were organized into 5 main themes. Clinical task-related errors accounted for most errors (41.9%), followed by planning, and executing task-related errors (22.3%), distraction-related errors (18.7%), communication-related errors (10.1%), and knowledge/training-related errors (7%). CONCLUSIONS: This novel analytical framework can robustly identify, classify, and describe the root causes of errors within this complex clinical context. Future validation of this classification of errors and error-related actions and behaviors on larger samples of resuscitations from various contexts will allow for a better understanding of how errors can be mitigated to improve patient outcomes.

7. Resusc Plus. 2022 May 18;10:100246. doi: 10.1016/j.resplu.2022.100246. eCollection 2022 Jun.

Smartphone activated community first responders' experiences of out-of-hospital cardiac arrests alerts, a qualitative study.

Källestedt MS(1), Lindén H(2), Bjurling-Sjöberg P(3).

ABSTRACT

AIM: The aim was to illustrate how community first responders perceive out-of-hospital cardiac arrest alerts delivered via smartphone, what support they have and how they cope with potentially distressing experiences. **METHOD:** A qualitative interview study was conducted with a volunteer sample of 14 community first responders in two regions of Sweden. The interviews were transcribed and analysed using thematic analysis with a data-driven inductive approach supported by NVivo 1.3. **RESULTS:** The responders' experiences were illustrated in three main themes, each including several subthemes: 1) Profound wish to help, including the sense of importance and sense of emergency; 2) Facing the situation, including essential actions performed in collaboration, confidence from training and experience, challenges posed by unforeseen situations and ethical dilemmas, and coping with emotional reactions; and 3) Potential for improvements, including technical and communication development, feedback and debriefing, training and social marketing. **CONCLUSION:** The community first responders were motivated and eager to help but simultaneously feared the mission and were not always prepared for their own reactions in the emergency when dispatched. Although cardiopulmonary resuscitation training and experience gave them skills that enabled them to act constructively, they faced situations that might be facilitated by improvements in the community first responder system and further training. The responders were proud of their efforts and were good ambassadors for the system. Appreciation of their commitment, better preparation and providing support in the aftermath of an emergency appears to be a good investment in societies' efforts to bring quick help to distressed persons.

8. J Community Health Nurs. 2022 Apr-Jun;39(2):121-126. doi: 10.1080/07370016.2022.2058203.

Increasing Self-Efficacy and Bystander CPR Rates:A Train-the-Trainer Program.

Constantino AA(1).

ABSTRACT

PURPOSE: Increase the number of community members within underserved areas trained in bystander cardiopulmonary resuscitation (BCPR), increase their self-efficacy levels to perform BCPR, and implement a train-the-trainer program for community leaders. **DESIGN:** Quantitative, before-and-after design. **METHODS:** Participants completed BCPR training with automatic feedback device mannequins and completed pre and post-training surveys to measure self-efficacy levels. **FINDINGS:** All survey questions showed statistically significant increases from pre to post using both a paired t-test ($p < 0.001$) and Wilcoxon Signed-Rank test ($p < 0.01$). **CONCLUSIONS:** Targeting BCPR training to underserved areas by community leaders, combined with the use of automatic feedback mannequins, is a unique way to increase self-efficacy levels and the number of community members trained to perform BCPR during an out-of-hospital cardiac arrest (OHCA). **CLINICAL EVIDENCE:** Free BCPR trainings led by community leaders increases BCPR training rates and participants' self-efficacy levels to deliver BCPR to a victim during an OHCA.

POST-CARDIAC ARREST TREATMENTS

1. Acta Anaesthesiol Scand. 2022 May 26. doi: 10.1111/aas.14090. Online ahead of print.

Protocol for an individual patient data meta-analysis on blood pressure targets after cardiac arrest.

Skrifvars MB(1), Ameloot K(2)(3)(4), Grand J(5), Reinikainen M(6), Hästbacka J(7), Niemelä V(7), Hassager C(5), Kjaergard J(5), Åneman A(8), Tiainen M(9), Nielsen N(10), Ullen S(11), Dankiewicz J(12), Olsen MH(13)(14), Jørgensen CK(13), Saxena M(15)(16), Jakobsen JC(13)(17).

ABSTRACT

BACKGROUND: Hypotension is common after cardiac arrest (CA), and current guidelines recommend using vasopressors to target a mean arterial blood pressure (MAP) higher than 65 mmHg. Pilot trials have compared higher and lower MAP targets. We will review the evidence whether higher MAP improves outcome after cardiac arrest. **METHODS:** This systematic review and meta-analysis will be conducted based on a systematic search of relevant major medical databases from their inception onwards, including MEDLINE, Embase and the Cochrane Central Register of Controlled Trials (CENTRAL), as well as clinical trial registries. We will identify randomised controlled trials published in the English language that compare targeting a MAP higher than 65-70 mmHg in CA patients using vasopressors, inotropes and intravenous fluids. The data extraction will be performed separately by two authors (a third author will be involved in case of disagreement), followed by a bias assessment with the Cochrane Risk of Bias tool using an eight-step procedure for assessing if thresholds for clinical significance are crossed. The outcomes will be all-cause mortality, functional long-term outcomes and serious adverse events. We will contact the authors of the identified trials to request individual anonymised patient data to enable individual patient data meta-analysis, aggregate data meta-analyses, trial sequential analyses and multivariable regression, controlling for baseline characteristics. The certainty of the evidence will be assessed by the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) system. We will register this systematic review with Prospero and aim to redo it when larger trials are published in the near future. **CONCLUSIONS:** This protocol defines the performance of a systematic review on whether a higher MAP after cardiac arrest improves patient outcome. Repeating this systematic review including more data likely will allow for more certainty regarding the effect of the intervention and possible sub-groups differences.

2. Am J Cardiol. 2022 May 22:S0002-9149(22)00421-0. doi: 10.1016/j.amjcard.2022.04.015. Online ahead of print.

Meta-Analysis of Early Versus Delayed or Selective Coronary Angiography in Patients With Out-of-Hospital Cardiac Arrest Without ST-Elevation Myocardial Infarction.

Bavishi C(1), Trivedi V(1), Bhatt DL(2).

NO ABSTRACT AVAILABLE

TARGETED TEMPERATURE MANAGEMENT

1. Crit Care Med. 2022 Jun 1;50(6):999-1009. doi: 10.1097/CCM.0000000000005463. Epub 2022 Jan 31.

Intravascular Versus Surface Cooling in Patients Resuscitated From Cardiac Arrest: A Systematic Review and Network Meta-Analysis With Focus on Temperature Feedback.

Ramadanov N(1)(2), Arrich J(1)(3), Klein R(4), Herkner H(3), Behringer W(3).

ABSTRACT

OBJECTIVE: The aim of the study was to compare the effect of intravascular cooling (IC), surface cooling with temperature feedback (SCF), and surface cooling without temperature feedback (SCnoF) on neurologic outcome and survival in patients successfully resuscitated from cardiac arrest (CA) and treated with targeted temperature management (TTM) at 32-34°C. **DATA SOURCES:** We performed a systematic review on Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, MEDLINE, SCOPUS, CINAHL, Web of Science, and Clinical Trials up to June 30, 2021. **STUDY SELECTION:** We included randomized and nonrandomized studies on IC, SCF, and SCnoF in adult humans resuscitated from CA undergoing TTM, reporting neurologic outcome or survival. **DATA EXTRACTION:** We performed a network meta-analysis to assess the comparative effects of IC, SCF, and SCnoF. The overall effect between two cooling methods included the effect of direct and indirect comparisons. Results are given as odds ratios (OR) and 95% CIs. Rankograms estimated the probability of TTM methods being ranked first, second, and third best interventions. **DATA**

SYNTHESIS: A total of 14 studies involving 4,062 patients met the inclusion criteria. Four studies were randomized controlled studies, and 10 studies were nonrandomized observational studies. IC compared with SCnoF was significantly associated with better neurologic outcome (OR, 0.6; 95% CI, 0.49-0.74) and survival (OR, 0.8; 95% CI, 0.66-0.96). IC compared with SCF, and SCF compared with SCnoF did not show significant differences in neurologic outcome and survival. The rankogram showed that IC had the highest probability to be the most beneficial cooling method, followed by SCF and SCnoF. CONCLUSIONS: Our results suggest that in patients resuscitated from CA and treated with TTM at 32-34°C, IC has the highest probability of being the most beneficial cooling method for survival and neurologic outcome.

2. *Diagnostics* (Basel). 2022 May 10;12(5):1190. doi: 10.3390/diagnostics12051190.

Brain Death and Its Prediction in Out-of-Hospital Cardiac Arrest Patients Treated with Targeted Temperature Management.

Song H(1), Oh SH(2), Woo HR(3), On Behalf Of Crown Investigators.

ABSTRACT

Evolution toward brain death (BD) in out-of-hospital cardiac arrest patients with targeted temperature management (TTM) provides opportunities for organ donation. However, knowledge regarding BD in these patients is limited. We retrospectively analyzed the TTM registry of one hospital where life-sustaining therapy was not withdrawn. In-hospital death patients were categorized into BD and non-BD groups. We explored the process of evolution toward BD and its predictors by comparing the serial measurements of clinical variables and the results of various prognostic tests between the two groups. Of the 121 patients who died before hospital discharge, 19 patients (15.7%) developed BD at a median of 6 (interquartile range, 5.0-7.0) days after cardiac arrest. Four patients with pupillary light reflexes at 48 h eventually developed BD. The area under the curves of the gray-to-white matter ratio (GWR) on early brain computed tomography images and the level of S100 calcium-binding protein B (S100B) at 72 h were 0.67 (95% CI, 0.55-0.77) and 0.70 (95% CI, 0.55-0.83), respectively. In conclusion, approximately one-sixth of all in-hospital deaths were diagnosed with BD at a median of 6 days after cardiac arrest. The use of GWR and serial S100B measurements may help to screen potential BD.

ELECTROPHYSIOLOGY AND DEFIBRILLATION

1. *Resusc Plus*. 2022 May 11;10:100232. doi: 10.1016/j.resplu.2022.100232. eCollection 2022 Jun.

Effectiveness of alternative shock strategies for out-of-hospital cardiac arrest: A systematic review.

Pocock H(1)(2), Deakin CD(2)(3), Lall R(1), Smith CM(1), Perkins GD(1)(4).

ABSTRACT

AIM: To determine the optimal first-shock energy level for biphasic defibrillation and whether fixed or escalating protocols for subsequent shocks are most effective. METHODS: We searched Medline, Embase, Cochrane CENTRAL, CINAHL, the Web of Science and national and international trial registry databases for papers published from database inception to January 2022. We reviewed reference lists of key papers to identify additional references. The population included adults sustaining non-traumatic out-of-hospital cardiac arrest subject to attempted defibrillation. Studies of internal or monophasic defibrillation and studies other than randomised controlled trials or prospective cohorts were excluded. Two reviewers assessed study relevance. Data extraction and risk of bias assessment, using the ROBINS-I tool, were conducted by one reviewer and checked by a second reviewer. Data underwent intention-to-treat analysis. RESULTS: We identified no studies evaluating first shock energy. Only one study (n = 738) comparing fixed versus escalating energy met eligibility criteria: a

prospective cohort analysis of a randomised controlled trial of manual versus mechanical CPR. High fixed (360 J) energy was compared with an escalating (200-200/300-360 J) strategy. Researchers found 27.5% (70/255) of patients in the escalating energy group and 27.61% (132/478) in the fixed high energy group survived to hospital discharge (unadjusted risk ratio 0.99, 95% CI 0.73, 1.23). Results were of very low certainty as the study was at serious risk of bias. **CONCLUSION:** This systematic review did not identify an optimal first-shock energy for biphasic defibrillation. We identified no survival advantage at 30 days when comparing 360 J fixed with 200 J escalating strategy.

2. Resuscitation. 2022 Jun;175:167-168. doi: 10.1016/j.resuscitation.2022.03.021.

Defibrillator pad placement for shockable rhythms in OHCA.

Hodkinson M(1).

NO ABSTRACT AVAILABLE

3. Resuscitation. 2022 May 23:S0300-9572(22)00163-0. doi: 10.1016/j.resuscitation.2022.05.013.

Online ahead of print.

Functionality of Registered Automated External Defibrillators.

Seit Jespersen S(1), Samsøe Kjoelbye J(2), Collatz Christensen H(3), Andelius L(4), Christian Tofte Gregers M(2), Torp-Pedersen C(5), Malta Hansen C(6), Folke F(7).

ABSTRACT

AIMS: Little is known about automated external defibrillator (AED) functionality in real-life settings. We aimed to assess the functionality of all registered AEDs in a geographically selected area and calculate the proportion of historical out-of-hospital cardiac arrests (OHCAs) covered by non-functioning AEDs. **METHODS:** In this cross-sectional study we inspected all registered and available AEDs on the island of Bornholm in Denmark. We collected information on battery status (determined by AED self-test) and electrode status, as well as AED availability. We identified all historical OHCAs registered with the Danish Cardiac Arrest Registry on Bornholm during 2016-2019 and calculated the proportion of OHCAs covered by an AED (regardless of functionality status) within ≤ 100 , ≤ 750 , and ≤ 1800 meters and the proportion of OHCAs covered by non-functioning AEDs. **RESULTS:** Of 211 registered AEDs, 181 (81.9%) were publicly accessible and functional. The remaining 40 (18.1%) were not functional, primarily due to expired electrodes (42.5%, n=17), obstacles to AED retrieval (20.0%, n=8) or failed self-tests (17.5%, n=7). Of 197 historical OHCAs, non-functional AEDs resulted in an OHCA coverage loss of 5.6%, 4.1% and 1.0 % for ≤ 100 m, ≤ 750 m and ≤ 1800 m, respectively. **CONCLUSION:** Almost one-fifth of all registered and publicly available AEDs were not functional, primarily due to expired electrodes, failed self-tests or obstacles to retrieving AEDs. One in twenty historical OHCA was covered by a non-functional AED. Although general AED functionality was high, this finding underlines the importance of regular AED maintenance.

PEDIATRICS AND CHILDREN

1. Children (Basel). 2022 May 17;9(5):733. doi: 10.3390/children9050733.

Laryngeal Masks in Neonatal Resuscitation-A Narrative Review of Updates 2022.

Mani S(1), Pinheiro JMB(2), Rawat M(3).

ABSTRACT

Positive pressure ventilation (PPV) is crucial to neonatal cardiopulmonary resuscitation because respiratory failure precedes cardiac failure in newborns affected by perinatal asphyxia. Prolonged

ineffective PPV could lead to a need for advanced resuscitation such as intubation, chest compression, and epinephrine. Every 30 s delay in initiation of PPV increased the risk of death or morbidity by 16%. The most effective interface for providing PPV in the early phases of resuscitation is still unclear. Laryngeal masks (LMs) are supraglottic airway devices that provide less invasive and relatively stable airway access without the need for laryngoscopy which have been studied as an alternative to face masks and endotracheal tubes in the initial stages of neonatal resuscitation. A meta-analysis found that LM is a safe and more effective alternative to face mask ventilation in neonatal resuscitation. LM is recommended as an alternative secondary airway device for the resuscitation of infants > 34 weeks by the International Liaison Committee on Resuscitation. It is adopted by various national neonatal resuscitation guidelines across the globe. Recent good-quality randomized trials have enhanced our understanding of the utility of laryngeal masks in low-resource settings. Nevertheless, LM is underutilized due to its variable availability in delivery rooms, providers' limited experience, insufficient training, preference for endotracheal tube, and lack of awareness.

2. BMJ Open. 2022 May 24;12(5):e055599. doi: 10.1136/bmjopen-2021-055599.

Parents' and healthcare professionals' experiences and perceptions of parental readiness for resuscitation in Iranian paediatric hospitals: a qualitative study.

Ghavi A(1), Hassankhani H(2), Powers K(3), Arshadi-Bostanabad M(4), Namdar Areshtanab H(5), Heidarzadeh M(4)(6).

ABSTRACT

OBJECTIVE: The aim of this study was to examine parents' and healthcare professionals' experiences and perceptions of parental readiness for resuscitation of their child in a paediatric hospital. **DESIGN:** This exploratory descriptive qualitative study used content analysis. Participants shared their experiences and perceptions about parental readiness for cardiopulmonary resuscitation through semi-structured and in-depth interviews. MAXQDA 2020 software was also used for data analysis. **SETTING:** The setting was two large teaching paediatric hospitals in Iran (Este Azerbaijan and Mashhad). **PARTICIPANTS:** Participants were 10 parents and 13 paediatric healthcare professionals (8 nurses and 5 physicians). Selection criteria were: (a) parents who experienced their child's resuscitation crisis at least 3 months prior and (b) nurses and physicians who were working in emergency rooms or intensive care wards with at least 2 years of experience on the resuscitation team. **RESULTS:** Participants shared their experiences about parental readiness for resuscitation of their child in four categories: awareness (acceptance of resuscitation and its consequences; providing information about the child's current condition and prognosis), chaos in providing information (defect of responsibility in informing; provide selective protection of information; hardness in obtaining information), providing situational information (honest information on the border of hope and hopeless; providing information with apathy; providing information as individual; dualism in blaming; assurance to parents; presence of parents to better understand the child's situation) and psychological and spiritual requirements (reliance on supernatural power; need for access to a psychologist; sharing emotions; collecting mementos). **CONCLUSION:** The results of this study provide insight on the needs of parents and strategies to use to prepare them for their child's resuscitation crisis, which can be used to enhance family centred care practices in paediatric acute care settings.

3. J Pediatr Surg. 2022 May 4:S0022-3468(22)00328-1. doi: 10.1016/j.jpedsurg.2022.04.020. Online ahead of print.

Characteristics of pediatric non-cardiac eCPR programs in United States and Canadian hospitals: A cross-sectional survey.

Rice-Townsend SE(1), Brogan TV(2), DiGeronimo RJ(3), Riehle KJ(1), Stark RA(1), Yalon L(2), Rothstein DH(4).

ABSTRACT

OBJECTIVE: To characterize practices surrounding pediatric eCPR in the U.S. and Canada. **METHODS:** Cross-sectional survey of U.S. and Canadian hospitals with non-cardiac eCPR programs. Variables included hospital and surgical group demographics, eCPR inclusion/exclusion criteria, cannulation approaches, and outcomes (survival to decannulation and survival to discharge). **RESULTS:** Surveys were completed by 40 hospitals in the United States (37) and Canada (3) among an estimated 49 programs (82% response rate). Respondents tended to work in >200 bed free-standing children's hospitals (27, 68%). Pediatric general surgeons respond to activations in 32 (80%) cases, with a median group size of 7 (IQR 5,9.5); 8 (20%) responding institutions take in-house call and 63% have a formal back-up system for eCPR. Dedicated simulation programs were reported by 22 (55%) respondents. Annual eCPR activations average approximately 6/year; approximately 39% of patients survived to decannulation, with 35% surviving to discharge. Cannulations occurred in a variety of settings and were mostly done through the neck at the purview of cannulating surgeon/proceduralist. Exclusion criteria used by hospitals included pre-hospital arrest (21, 53%), COVID+ (5, 13%), prolonged CPR (18, 45%), lethal chromosomal anomalies (15, 38%) and terminal underlying disease (14, 35%). **CONCLUSIONS:** While there are some similarities regarding inclusion/exclusion criteria, cannulation location and modality and follow-up in pediatric eCPR, these are not standard across multiple institutions. Survival to discharge after eCPR is modest but data on cost and long-term neurologic sequela are lacking. Codification of indications and surgical approaches may help clarify the utility and success of eCPR.

EXTRACORPOREAL LIFE SUPPORT

1. Artif Organs. 2022 May 26. doi: 10.1111/aor.14321. Online ahead of print.

Risk Factors and Outcomes for Patients with Bleeding Complications Receiving Extracorporeal Membrane Oxygenation: An Analysis of the Chinese Extracorporeal Life Support Registry.

Li C(#)(1), Cai T(#)(1), Xie H(1), Wang L(1), Yang F(1), Du Z(1), Hong X(2), Zhou C(3), Li Y(4), Qiu H(5), Tong Z(6), Zeng H(7), Peng Z(8), Li X(9), Hou X(1).

ABSTRACT

OBJECTIVE: Bleeding is a severe complication of patients supported with extracorporeal membrane oxygenation (ECMO). This study aimed to analyze the occurrence, risk factors, and clinical outcomes of patients on ECMO with bleeding complications. **METHODS:** ECMO cases reported to the multicenter ECMO registry database of the Chinese Society of Extracorporeal Life Support (CSECLS) from January 2017 to December 2020 were enrolled. General information, ECMO indications, application, complications, and patient outcomes were collected and analyzed. **RESULTS:** A total of 6541 ECMO patients from 112 centers were enrolled. Overall, 1185 patients (18.1%) presented with one of the following bleeding complications, including 82 cases (1.3%) with severe bleeding during ECMO catheterization, 462 cases (7.1%) with bleeding at the ECMO cannulation site, 200 cases (3.5%) with bleeding at the surgical site, 180 cases (2.8%) with cerebral hemorrhage, 99 cases (1.5%) with pulmonary hemorrhage, 200 cases (3.5%) with gastrointestinal hemorrhage, 82 cases (1.3%) with ECMO withdrawal, and 118 (1.8%) deaths due to severe bleeding. Extracorporeal cardio-pulmonary resuscitation (ECPR) patients had the highest incidence of bleeding complications (22.4%), followed by those on circulatory support (18.7%) and respiratory support (15.4%) ($p<0.001$). Multivariate analysis showed that pediatric patients (odds ratio [OR] 1.509, $p<0.001$), patients receiving renal replacement therapy (OR 1.932, $p<0.001$), and patients receiving central ECMO

cannulation (OR 3.023, $p < 0.001$) were independent risk factors for all bleeding complications, while peripheral cannulation (OR 0.712, $p < 0.001$) was an independent protective factor. Patients with any bleeding complication had significantly higher in-hospital mortality than patients without (61.9% vs. 46.3%, $p < 0.001$). **CONCLUSION:** Up to 18.1% of ECMO patients in the CSECLS registry experienced bleeding complications, which was associated with higher in-hospital mortality, especially in patients who received ECPR, patients on circulatory support, and pediatric patients, which should arouse the attention of clinicians.

2. Front Med (Lausanne). 2022 May 9;9:867602. doi: 10.3389/fmed.2022.867602. eCollection 2022. **Hyperoxia Is Not Associated With 30-day Survival in Out-of-Hospital Cardiac Arrest Patients Who Undergo Extracorporeal Cardiopulmonary Resuscitation.**

Kobayashi M(1), Kashiura M(2), Yasuda H(2), Sugiyama K(1), Hamabe Y(1), Moriya T(2).

ABSTRACT

INTRODUCTION: The appropriate arterial partial pressure of oxygen (PaO₂) in patients undergoing extracorporeal cardiopulmonary resuscitation (ECPR) for out-of-hospital cardiac arrest (OHCA) remains unclear. The present study aimed to investigate the relationship between hyperoxia and 30-day survival in patients who underwent ECPR. **MATERIALS AND METHODS:** This single-center retrospective cohort study was conducted between January 2010 and December 2018. OHCA patients who underwent ECPR were included in the study. Exclusion criteria were (1) age <18 years, (2) death within 24 h after admission, (3) return of spontaneous circulation at hospital arrival, and (4) hypoxia (PaO₂ < 60 mmHg) 24 h after admission. Based on PaO₂ at 24 h after admission, patients were classified into normoxia (60 mmHg ≤ PaO₂ ≤ 100 mmHg), mild hyperoxia (100 mmHg < PaO₂ ≤ 200 mmHg), and severe hyperoxia (PaO₂ > 200 mmHg) groups. The primary outcome was 30-day survival after cardiac arrest, while the secondary outcome was 30-day favorable neurological outcome. Multivariate logistic regression analysis for 30-day survival or 30-day favorable neurological outcome was performed using multiple propensity scores as explanatory variables. To estimate the multiple propensity score, we fitted a multinomial logistic regression model using the patients' demographic, pre-hospital, and in-hospital characteristics. **RESULTS:** Of the patients who underwent ECPR in the study center, 110 were eligible for the study. The normoxia group included 29 cases, mild hyperoxia group included 46 cases, and severe hyperoxia group included 35 cases. Mild hyperoxia was not significantly associated with survival, compared with normoxia as the reference (adjusted odds ratio, 1.06; 95% confidence interval: 0.30-3.68; $p = 0.93$). Severe hyperoxia was also not significantly associated with survival compared to normoxia (adjusted odds ratio, 1.05; 95% confidence interval: 0.27-4.12; $p = 0.94$). Furthermore, no association was observed between oxygenation and 30-day favorable neurological outcomes. **CONCLUSIONS:** There was no significant association between hyperoxia at 24 h after admission and 30-day survival in OHCA patients who underwent ECPR.

3. Resusc Plus. 2022 May 20;10:100244. doi: 10.1016/j.resplu.2022.100244. eCollection 2022 Jun. **Impact of extracorporeal CPR with transcatheter heart pump support (ECPELLA) on improvement of short-term survival and neurological outcome in patients with refractory cardiac arrest - A single-site retrospective cohort study.**

Unoki T(1), Kamentani M(1), Nakayama T(1), Tamura Y(1), Konami Y(1), Suzuyama H(1), Inoue M(1), Yamamuro M(1), Taguchi E(1), Sawamura T(1), Nakao K(1), Sakamoto T(1).

ABSTRACT

AIM: Extracorporeal cardiopulmonary resuscitation (E-CPR) using veno-arterial extracorporeal membrane oxygenation (VA-ECMO) is a novel lifesaving method for refractory cardiac arrest. Although VA-ECMO preserves end-organ perfusion, it may affect left ventricular (LV) recovery due to increased LV load. An emerging treatment modality, ECPELLA, which combines VA-ECMO and a transcatheter heart pump, Impella, can simultaneously provide circulatory support and LV unloading. In this single-site cohort study, we assessed impact of ECPELLA support on clinical

outcomes of refractory cardiac arrest patients. **METHOD:** We retrospectively reviewed 165 consecutive cardiac arrest patients, who underwent E-CPR by VA-ECMO with or without intra-aortic balloon pump (IABP) or ECPELLA from January 2012 to September 2021. We assessed 30-day survival rate, neurological outcome, hemodynamic data, and safety profiles including hemolysis, acute kidney injury, blood transfusion and embolic cerebral infarction. **RESULTS:** Among 165 E-CPR patients, 35 patients were supported by ECPELLA, and 130 patients were supported by conventional VA-ECMO with or without IABP. Following propensity score matching of 30 ECPELLA and 30 VA-ECMO patients, the 30-day survival (ECPELLA: 53%, VA-ECMO: 20%, $p < 0.01$) and favorable neurological outcome determined by the Cerebral Performance Category score 1 or 2 (ECPELLA: 33%, VA-ECMO: 7%, $p < 0.01$) were significantly higher with ECPELLA. Patients receiving ECPELLA also showed significantly higher total mechanical circulatory support flow and lower arterial pulse pressure for the first 3 days ($p < 0.01$) of treatment. There were no statistical differences in safety profiles between treatment groups. **CONCLUSION:** ECPELLA may be associated with improved 30-day survival and neurological outcome in patients with refractory cardiac arrest.

4. Crit Care Med. 2022 Jun 1;50(6):e569-e580. doi: 10.1097/CCM.0000000000005466. Epub 2022 Feb 3.

Longitudinal Trends in Bleeding Complications on Extracorporeal Life Support Over the Past Two Decades-Extracorporeal Life Support Organization Registry Analysis.

Willers A(1), Swol J(2), Buscher H(3)(4), McQuilten Z(5), van Kuijk SMJ(6), Ten Cate H(7)(8), Rycus PT(9), McKellar S(10)(11), Lorusso R(1)(8), Tonna JE(10)(11).

ABSTRACT

OBJECTIVES: Data about inhospital outcomes in bleeding complications during extracorporeal life support (ECLS) have been poorly investigated. **DESIGN:** Retrospective observational study. **SETTING:** Patients reported in Extracorporeal Life Support Organization Registry. **PATIENTS:** Data of 53,644 adult patients (greater than or equal to 18 yr old) mean age 51.4 ± 15.9 years, 33,859 (64.5%) male supported with single ECLS run between 01.01.2000 and 31.03.2020, and 19,748 cannulated for venovenous (V-V) ECLS and 30,696 for venoarterial (V-A) ECLS. **INTERVENTIONS:** Trends in bleeding complications, bleeding risk factors, and mortality. **MEASUREMENT AND MAIN RESULTS:** Bleeding complications were reported in 14,786 patients (27.6%), more often in V-A ECLS compared with V-V (30.0% vs 21.9%; $p < 0.001$). Hospital survival in those who developed bleeding complications was lower in both V-V ECLS (49.6% vs 66.6%; $p < 0.001$) and V-A ECLS (33.9 vs 44.9%; $p < 0.001$). Steady decrease in bleeding complications in V-V and V-A ECLS was observed over the past 20 years (coef., -1.124; $p < 0.001$ and -1.661; $p < 0.001$). No change in mortality rates was reported over time in V-V or V-A ECLS (coef., -0.147; $p = 0.442$ and coef., -0.195; $p = 0.139$). Multivariate regression revealed advanced age, ecls duration, surgical cannulation, renal replacement therapy, prone positioning as independent bleeding predictors in v-v ecls and female gender, ecls duration, pre-ecls arrest or bridge to transplant, therapeutic hypothermia, and surgical cannulation in v-a ecls. **CONCLUSIONS:** A steady decrease in bleeding over the last 20 years, mostly attributable to surgical and cannula-site-related bleeding has been found in this large cohort of patients receiving ECLS support. However, there is not enough data to attribute the decreasing trends in bleeding to technological refinements alone. Especially reduction in cannulation site bleeding is also due to changes in timing, patient selection, and ultrasound guided percutaneous cannulation. Other types of bleeding, such as CNS, have remained stable, and overall bleeding remains associated with a persistent increase in mortality.

5. Emerg Med Australas. 2022 Jun;34(3):471-472. doi: 10.1111/1742-6723.13963. Epub 2022 Mar 16.

Survival with extracorporeal membrane oxygenation during cardiopulmonary resuscitation following cardiac arrest due to nortriptyline overdose.

Humphreys M(1)(2)(3), Pincus J(3)(4), Harburg G(1)(3), Isoardi KZ(1)(2)(3).

NO ABSTRACT AVAILABLE

EXPERIMENTAL RESEARCH

1. J Am Heart Assoc. 2022 May 27:e025400. doi: 10.1161/JAHA.122.025400. Online ahead of print.
Effects of Sodium Nitroprusside Administered Via a Subdural Intracranial Catheter on the Microcirculation, Oxygenation, and Electrocortical Activity of the Cerebral Cortex in a Pig Cardiac Arrest Model.

Lee HY(1), Jung YH(2)(3), Mamadjonov N(4), Jeung KW(2)(3), Kim MC(5), Lim KS(6), Jeon CY(7), Lee Y(7), Kim HJ(8).

ABSTRACT

Background Postischemic cerebral hypoperfusion has been indicated as an important contributing factor to secondary cerebral injury after cardiac arrest. We evaluated the effects of sodium nitroprusside administered via a subdural intracranial catheter on the microcirculation, oxygenation, and electrocortical activity of the cerebral cortex in the early postresuscitation period using a pig model of cardiac arrest. Methods and Results Twenty-nine pigs were resuscitated with closed cardiopulmonary resuscitation after 14 minutes of untreated ventricular fibrillation. Thirty minutes after restoration of spontaneous circulation, 24 pigs randomly received either 4 mg of sodium nitroprusside (IT-SNP group) or saline placebo (IT-saline group) via subdural intracranial catheters and were observed for 5 hours. The same dose of sodium nitroprusside was administered intravenously in another 5 pigs. Compared with the IT-saline group, the IT-SNP group had larger areas under the curve for tissue oxygen tension and percent changes of arteriole diameter and number of perfused microvessels from baseline (all $P < 0.05$) monitored on the cerebral cortex during the 5-hour period, without severe hemodynamic instability. This group also showed faster recovery of electrocortical activity measured using amplitude-integrated electroencephalography. Repeated-measures analysis of variance revealed significant group-time interactions for these parameters. Intravenously administered sodium nitroprusside caused profound hypotension but did not appear to increase the cerebral parameters. Conclusions Sodium nitroprusside administered via a subdural intracranial catheter increased post-restoration of spontaneous circulation cerebral cortical microcirculation and oxygenation and hastened electrocortical activity recovery in a pig model of cardiac arrest. Further studies are required to determine its impact on the long-term neurologic outcomes.

2. Physiol Res. 2022 May 26. Online ahead of print.

Inhibition of extracellular signal-regulated kinase downregulates endoplasmic reticulum stress-induced apoptosis and decreases brain injury in a cardiac arrest rat model.

Yuan ZL(1), Zhang ZX, Mo YZ, Li DL, Xie L, Chen MH.

ABSTRACT

Cerebral ischemia-reperfusion injury (CIRI) is the predominant cause of neurological disability after cardiac arrest/cardiopulmonary resuscitation (CA/CPR). The endoplasmic reticulum stress (ERs)-induced apoptosis plays an important role in neuronal survival/death in CIRI. Our previous studies reported that the extracellular signal-regulated kinase (ERK) inhibitor, PD98059, alleviates CIRI after CA/CPR. Whether ERs-induced apoptosis is involved in the neuroprotection of PD98059 remains unknown. This study aims to investigate the effects of ERK inhibition by PD98059 on ERs-induced apoptosis after CIRI in the CA/CPR rat model. The baseline characteristics of male adult Sprague-Dawley (SD) rats in all groups were evaluated before CA/CPR. The SD rats that survived from CA/CPR were randomly divided into 3 groups ($n=12$ /group): normal saline group (1 ml/kg), dimethylsulfoxide (DMSO, the solvent of PD98059, 1 ml/kg) group, PD98059 group (0.3 mg/kg). Another 12 SD rats

were randomly selected as the Sham group. Twenty-four hours after resuscitation, neural injury was assessed by survival rate, neurological deficit scores (NDS) and Nissl staining; apoptosis of brain cells was detected using terminal deoxynucleotidyl transferase dUTP nick end labeling (TUNEL) staining; mRNA expression and protein levels of ERs-related protein BIP, PERK, ATF4 and CHOP were checked with RT-PCR and Western Blot. The results showed that there were no significant differences in baseline characteristics before CA/CPR among all groups. PD98059 significantly improved survival rate and NDS, increased the Nissl bodies in neurons, reduced apoptosis, downregulated the mRNA transcription and expression levels of BIP, PERK, ATF4 and CHOP at 24 h after CA/CPR. Our results demonstrate that inhibition of ERK by PD98059 alleviates ERs-induced apoptosis via BIP-PERK-ATF4-CHOP signaling pathway and mitigates CIRC in the CA/CPR rat model.

3. J Transl Med. 2022 May 23;20(1):238. doi: 10.1186/s12967-022-03441-4.

Serum proteome alterations during conventional and extracorporeal resuscitation in pigs.

Bernhard P(1)(2)(3), Bretthauer BA(4), Brixius SJ(4), Bügener H(4), Groh JE(4), Scherer C(4), Damjanovic D(4), Haberstroh J(5), Trummer G(4), Benk C(4), Beyersdorf F(4), Schilling O(1), Pooth JS(6).

ABSTRACT

BACKGROUND: Only a small number of patients survive an out-of-hospital cardiac arrest (CA) and can be discharged from hospital alive with a large percentage of these patients retaining neurological impairments. In recent years, extracorporeal cardiopulmonary resuscitation (ECPR) has emerged as a beneficial strategy to optimize cardiac arrest treatment. However, ECPR is still associated with various complications. To reduce these problems, a profound understanding of the underlying mechanisms is required. This study aims to investigate the effects of CA, conventional cardiopulmonary resuscitation (CPR) and ECPR using a whole-body reperfusion protocol (controlled and automated reperfusion of the whole body-CARL) on the serum proteome profiles in a pig model of refractory CA. **METHODS:** N = 7 pigs underwent 5 min of untreated CA followed by 30 min CPR and 120 min perfusion with CARL. Blood samples for proteomic analysis were drawn at baseline, after CPR and at the end of the CARL period. Following albumin-depletion, proteomic analysis was performed using liquid chromatography-tandem mass spectrometry. **RESULTS:** N = 21 serum samples were measured resulting in the identification and quantification of 308-360 proteins per sample and 388 unique proteins in total. The three serum proteome profiles at the investigated time points clustered individually and segregated almost completely when considering a 90% confidence interval. Differential expression analysis showed significant abundance changes in 27 proteins between baseline and after CPR and in 9 proteins after CARL compared to CPR. Significant findings were further validated through a co-abundance cluster analysis corroborating the observed abundance changes. **CONCLUSIONS:** The presented data highlight the impact of systemic ischemia and reperfusion on the entire serum proteome during resuscitation with a special focus on changes regarding haemolysis, coagulation, inflammation, and cell-death processes. Generally, the observed changes contribute to post-ischemic complications. Better understanding of the underlying mechanisms during CA and resuscitation may.

4. Eur J Pharmacol. 2022 May 19:175038. doi: 10.1016/j.ejphar.2022.175038. Online ahead of print.

Carbon monoxide-releasing molecule-2 ameliorates postresuscitation myocardial dysfunction in rat via mitochondrial-mediated apoptosis pathway and the regulation of mitochondrial dynamics.

Liu M(1), Du F(2), Liu F(3), Wang XH(4).

ABSTRACT

Mitochondrial dysfunction plays a significant role in the development of postresuscitation myocardial dysfunction (PRMD). Endogenous carbon monoxide (CO) has obvious protective effects

on cardiomyocytes and that mitochondria are considered to be the main targets of CO action. This study aimed to investigate whether exogenous CO (carbon monoxide releasing molecule 2, CORM-2) could protect against PRMD, and improve cardiac function in rats via the mitochondria pathway. Forty male Sprague-Dawley rats were randomly divided into five groups: sham group, model cardiopulmonary resuscitation (CPR) group, CORM-2 treatment group, inactivated CORM-2 group, and DMSO (Dimethyl sulfoxide, CORM-2 vehicle) group. Excluding the sham group, all groups underwent CPR 4 min after cardiac arrest (CA), animals in every group underwent surgery for catheter insertion before the CA-CPR. In the treatment groups, CORM-2 and inactivated CORM-2 (both 4 mg/kg, dissolved in 2% dimethyl sulfoxide and diluted in normal saline) were intraperitoneally injected 12 h before CPR was started. In the sham, model CPR, and vehicle groups, animals were administered normal saline or vehicle as appropriate. The results demonstrated that the mitochondrial ultrastructure abnormalities in CORM-2 group was less severe than CPR rats. CORM-2 alleviated myocardial contractile and diastolic dysfunction after CPR, decreased caspase-3 and caspase-9 expression in myocardial tissues, and meanwhile suppressed cytochrome c release from mitochondria. Furthermore, CORM-2 lessened the production of reactive oxygen species (ROS) and increased myocardial mitochondrial respiratory complex IV enzyme activity after CPR. Dynamin-related protein 1 (Drp1) was significantly less expressed in CORM-2 group with high expression of mitofusion-2 (Mfn2), suggesting that CORM-2 can promote mitochondrial fusion and reduce mitochondrial fission. Collectively, we provide the evidence that CORM-2 effectively relieved myocardial injury after CPR in rats, protected myocardial mitochondria, and preserved cardiac function after resuscitation. The proposed mechanisms of action were improved mitochondrial respiratory function, maintained mitochondrial dynamics balance, and suppressed the mitochondrial-mediated apoptosis.

5. Exp Ther Med. 2022 Jun;23(6):422. doi: 10.3892/etm.2022.11349. Epub 2022 May 3.

Anisodamine hydrobromide ameliorates cardiac damage after resuscitation.

Dong GJ(1), Yang J(1), Zhao X(1), Guo SB(1).

ABSTRACT

The microcirculation is correlated with the prognosis of patients with cardiac arrest and changes after resuscitation. In the present study, the effects of anisodamine hydrobromide (AH) on microcirculation were investigated and its potential mechanisms were explored. A total of 24 pigs were randomly grouped into three groups (n=8): Sham, Saline and AH group. After pigs were anesthetized, intubated and mechanically ventilated, ventricular fibrillation was induced by electrical stimulation. After 8 min, cardiopulmonary resuscitation was given to the restoration of spontaneous circulation (ROSC). Arteriovenous blood was collected at baseline and 0, 1, 2, 4 and 6 h after ROSC to measure blood gas and cytokines. Perfused vessel density (PVD) and microvascular flow index (MFI) were measured to reflect the microcirculation. Continuous cardiac output and global ejection fraction were measured to indicate hemodynamics. Compared with Sham group, PVD and MFI in the intestines and the sublingual regions decreased significantly after resuscitation. The microcirculation recovered faster in the AH group than the SA group. The decrease of intestinal microcirculatory blood flow was closely related to the decrease of sublingual microcirculatory blood flow. The cardiac function was impaired after resuscitation, and a decrease of IFN- γ as well as IL-2 and an increase of IL-4 as well as IL-10 suggested the immune imbalance. The microcirculation changes in sublingual

regions were closely related to the changes in intestines. AH could improve the immune imbalance after resuscitation and was beneficial to the recovery of cardiac function.

CASE REPORTS

1. J Cardiovasc Dev Dis. 2022 Apr 27;9(5):135. doi: 10.3390/jcdd9050135.

A Rare Case of Polysplenia Syndrome Associated with Severe Cardiac Malformations and Congenital Alveolar Dysplasia in a One-Month-Old Infant: A Complete Macroscopic and Histopathologic Study.

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ABSTRACT

Polysplenia syndrome represents a type of left atrial isomerism characterized by multiple small spleens, often associated with cardiac malformations and with situs ambiguus of the abdominal organs. The case presented is of a one-month-old male infant, weighing approximately 3000 g, born at the County Clinical Emergency Hospital of Sibiu, who was hospitalized from birth until death. The patient suffered cardio-respiratory arrest due to severe hypoxia and septicemia on the background of a series of complex cardiac malformations associated with congenital abdominal organ anomalies. Examination of the body revealed a common atrium with complete atrioventricular canal defect, left ventricular hypertrophy, right ventricle hypoplasia, truncus arteriosus, superior vena cava duplication, bilobation of the lungs, situs ambiguous of the abdominal organs with right-sided stomach, a midline liver, gall bladder agenesis, multiple right-sided spleens and complete inversion of the intestines and pancreas. Histopathology concluded that the patient suffered cardiac lesions consistent with infantile lactic acidosis, as well as pulmonary modifications suggesting congenital alveolar dysplasia and altered hepatic architecture compatible with fibrosis.

2. JACC Case Rep. 2022 May 18;4(10):576-580. doi: 10.1016/j.jaccas.2022.03.028. eCollection 2022 May 18.

Pulmonary Embolism Complicated With Cardiopulmonary Arrest Treated With Combination of Thrombolytics and Aspiration Thrombectomy.

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ABSTRACT

Systemic thrombolytic therapy is frequently used in the treatment of massive pulmonary embolism. We describe a case of pulseless electrical activity arrest, refractory obstructive shock in the setting of massive pulmonary embolism despite tissue plasminogen activator that was successfully treated with catheter-directed aspiration thrombectomy.

3. J Surg Case Rep. 2022 May 18;2022(5):rjac219. doi: 10.1093/jscr/rjac219. eCollection 2022 May.

Non-operative management of pneumoperitoneum following cardiopulmonary resuscitation.

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ABSTRACT

Spontaneous pneumoperitoneum in a patient with a tracheostomy tube following cardiopulmonary resuscitation is exceedingly rare, with little experimental nor observational data to guide evidence-based management. We present the case of a 75-year-old woman with a tracheostomy tube who developed pneumoperitoneum following CPR. The patient experienced pulseless electrical activity arrest requiring nine rounds of chest compressions to return to spontaneous circulation. Computerized tomography demonstrated pneumothoraces, subcutaneous emphysema and extensive intraperitoneal, extraperitoneal and retroperitoneal free air without evidence of visceral

perforation. The patient's abdomen was distended without tenderness, guarding or rebound. She had a white blood cell count mildly elevated from her baseline levels. The management plan of serial abdominal exams without operative intervention was chosen given the absence of clinical and laboratory signs of peritonitis. This case highlights the importance of developing a standardized management algorithm for patients with pneumoperitoneum in the setting of tracheostomy tubes without evidence of perforation.