This week's PubMed 4th – 10th December 2022: articles of interest n = 41

CPR AND COVID-19

1. BMC Emerg Med. 2022 Dec 5;22(1):193. doi: 10.1186/s12873-022-00754-x.
Evaluation of cardiopulmonary resuscitation quality during the pandemic of COVID-19.
Yu Y(1), Liu X(2), Wang L(1), Gao Y(1), Ding Y(1), Ao H(3).

ABSTRACT
BACKGROUND: Cardiopulmonary resuscitation (CPR) is an important technique of first aid. It is necessary to be popularized. Large-scale offline training has been affected after the outbreak of Coronavirus disease 2019 (COVID-19). Online training will be the future trend, but the quality of online assessment is unclear. This study aims to compare online and offline evaluations of CPR quality using digital simulator and specialist scoring methods. METHODS: Forty-eight out of 108 contestants who participated in the second Chinese National CPR Skill Competition held in 2020 were included in this study. The competition comprised two stages. In the preliminary online competition, the contestants practiced on the digital simulator while the specialist teams scored live videos. The final competition was held offline, and consisted of live simulator scoring and specialist scoring. The grades of the simulator and specialists in different stages were compared. RESULTS: There was no statistical significance for simulator grades between online and offline competition(37.7 ± 2.0 vs. 36.4 ± 3.4, p = 0.169). For specialists' grades, the video scores were lower than live scores (55.0 ± 1.4 vs. 57.2 ± 1.7, p < 0.001). CONCLUSION: Simulator scoring provided better reliability than specialist scoring in the online evaluation of CPR quality. However, the simulator could only collect quantified data. Specialist scoring is necessary in conjunction with online tests to provide a comprehensive evaluation. A complete and standardized CPR quality evaluation system can be established by combining simulator and specialist contributions.

CPR/MECHANICAL CHEST COMPRESSION

1. Air Med J. 2022 Nov-Dec;41(6):556-559. doi: 10.1016/j.amj.2022.07.003. Epub 2022 Aug 16.
Mechanical Cardiopulmonary Resuscitation's Role in Helicopter Air Ambulances: A Narrative Review.
Shekhar AC(1), Blumen IJ(2), Lyon RM(3).

ABSTRACT
Helicopter emergency medical services (HEMS) frequently respond to out-of-hospital cardiac arrest (OHCA) situations. Some have speculated mechanical cardiopulmonary resuscitation (mCPR) may be able to rectify the inadequacy of human performance of cardiopulmonary resuscitation (CPR) during transport. A number of studies have examined the performance of mCPR devices in the air medical setting specifically. Many aspects of the HEMS environment seem uniquely conducive to mCPR, and a growing body of research seems to suggest mCPR holds promise for the treatment of cardiac arrest by HEMS clinicians. Simulation studies show that mCPR leads to improved CPR performance compared with manual CPR in HEMS. Case reports and the experience of several HEMS programs suggest that mCPR can be effectively integrated into HEMS care. However, further research regarding the effectiveness of mCPR in the HEMS environment and in general cardiac arrest care is needed.

REGISTRIES, REVIEWS AND EDITORIALS

1. Z Gerontol Geriatr. 2022 Dec 8. doi: 10.1007/s00391-022-02131-6. Online ahead of print.
Impact of age on the prognosis of patients with ventricular tachyarrhythmias and aborted cardiac arrest.
Weidner K(1)(2), Schupp T(1)(2), Rusnak J(1)(2), El-Battrawy I(1)(2), Ansari U(1)(2), Hoppner J(3), Mueller J(1)(2), Kittel M(4), Taton G(1)(2), Reiser L(1)(2), Bollow A(1)(2), Reichelt T(1)(2), Ellguth D(1)(2), Engelke N(1)(2), Große Meininghaus D(5), Akin M(6), Bertsch T(7), Akin I(1)(2), Behnes M(1)(2).
ABSTRACT
BACKGROUND: This study evaluated the prognostic impact of age on patients presenting with ventricular tachyarrhythmias (VTA) and aborted cardiac arrest. MATERIAL AND METHODS: The present registry-based, monocentric cohort study included all consecutive patients presenting at the University Medical Center Mannheim (UMM) between 2002 and 2016 with ventricular tachycardia (VT), ventricular fibrillation (VF) and aborted cardiac arrest. Middle-aged (40-60 years old) were compared to older patients (> 60 years old). Furthermore, age was analyzed as a continuous variable. The primary endpoint was all-cause mortality at 2.5 years. The secondary endpoints were cardiac death at 24 h, all-cause mortality at index hospitalization, all-cause mortality after index hospitalization and the composite endpoint at 2.5 years of cardiac death at 24 h, recurrent VTA, and appropriate implantable cardioverter defibrillator (ICD) treatment. RESULTS: A total of 2259 consecutive patients were included (28% middle-aged, 72% older). Older patients were more often associated with all-cause mortality at 2.5 years (27% vs. 50%; hazard ratio, HR = 2.137; 95% confidence interval, CI 1.809-2.523, p = 0.001) and the secondary endpoints. Even patient age as a continuous variable was independently associated with mortality at 2.5 years in all types of VTA. Adverse prognosis in older patients was demonstrated by multivariate Cox regression analyses and propensity score matching. Chronic kidney disease (CKD), systolic left ventricular dysfunction (LVEF) < 35%, cardiopulmonary resuscitation (CPR) and cardiogenic shock worsened the prognosis for both age groups, whereas acute myocardial infarction (STEMI/NSTEMI) and the presence of an ICD improved prognosis. CONCLUSION: The results of this study suggest that increasing age is associated with increased mortality in VTA patients. Compared to the middle-aged, older patients were associated with higher all-cause mortality at 2.5 years and the secondary endpoints.

2. Resusc Plus. 2022 Nov 28;12:100335. doi: 10.1016/j.resplu.2022.100335. eCollection 2022 Dec.
Pre-hospital guidelines for CPR-Induced Consciousness (CPRIC): A scoping review.
Howard J(1)(2), Lipscombe C(1), Beovich B(1), Shepherd M(1)(2), Grusd E(3), Nudell NG(4)(5), Rice D(6), Olaussen A(1)(7)(8).
ABSTRACT
BACKGROUND: CPR-Induced Consciousness is an emerging phenomenon with a paucity of consensus guidelines from peak resuscitative bodies. Local prehospital services have had to implement their own CPR-Induced Consciousness guidelines. This scoping review aims to identify prehospital CPR-Induced Consciousness guidelines and compare or contrast their management options. OBJECTIVE: The purpose of this scoping review is to identify and compare as many prehospital CPR-Induced Consciousness guidelines as feasible, highlight common management trends, and discuss the factors that might impact CPR-Induced Consciousness guidelines and the management trends identified. DESIGN: To search for prehospital CPR-Induced Consciousness guidelines, a bibliographical search of five databases was undertaken (MEDLINE, EMBASE, Cochrane, Scopus, and CINAHL plus). Also included was a grey literature search arm, comprised of four search strategies: 1. Customised Google search, 2. Hand searching of targeted websites, 3. Grey literature databases, 4. Consultation with subject experts. RESULTS: Our search extracted 23 prehospital CPR-Induced Consciousness

guidelines and one good practise statement from the International Liaison Committee on Resuscitation. Of the 23 prehospital guidelines available, we identified 20 different ways of treating CPR-Induced Consciousness. Midazolam was the most frequently used drug to treat CPR-Induced Consciousness (14/23, 61%), followed by Ketamine (11/23, 48%) and Fentanyl (9/23, 39%). CONCLUSION: Prehospital CPR-Induced Consciousness guidelines are both exceptionally uncommon and vary substantially from each other. This has a flow-on effect towards data collection and only serves to continue CPR-Induced Consciousness's relatively unknown status surrounding both knowledge of, and the effect CPR-Induced Consciousness treatment has on cardiac arrest outcomes.

IN-HOSPITAL CARDIAC ARREST

1. Crit Care. 2022 Dec 6;26(1):376. doi: 10.1186/s13054-022-04247-y.
In-hospital cardiac arrest: the state of the art.
Penketh J(1), Nolan JP(2)(3).
ABSTRACT
In-hospital cardiac arrest (IHCA) is associated with a high risk of death, but mortality rates are decreasing. The latest epidemiological and outcome data from several cardiac arrest registries are helping to shape our understanding of IHCA. The introduction of rapid response teams has been associated with a downward trend in hospital mortality. Technology and access to defibrillators continues to progress. The optimal method of airway management during IHCA remains uncertain, but there is a trend for decreasing use of tracheal intubation and increased use of supraglottic airway devices. The first randomised clinical trial of airway management during IHCA is ongoing in the UK. Retrospective and observational studies have shown that several pre-arrest factors are strongly associated with outcome after IHCA, but the risk of bias in such studies makes prognostication of individual cases potentially unreliable. Shared decision making and advanced care planning will increase application of appropriate DNACPR decisions and decrease rates of resuscitation attempts following IHCA.

INJURIES AND CPR

No articles identified.

CAUSE OF THE ARREST

1. Am J Med. 2022 Dec 7:S0002-9343(22)00884-1. doi: 10.1016/j.amjmed.2022.11.014. Online ahead of print.
Risks of the Athletic Field Revisited: Report of Unusual Occurrences of Cardiac Arrest and Sudden Death in Professional Soccer Players.
Bonaventura J(1), Rowin EJ(2), Maron MS(2), Maron BJ(3).
ABSTRACT
BACKGROUND: Sudden deaths in competitive athletes are highly visible but potentially preventable events that generate great interest amongst the cardiovascular community and general public. METHODS: Internet searches was performed using a combination of keywords and operators to produce search results for sudden death or cardiac arrest on the field in professional soccer players. RESULTS: We identified 35 male professional soccer players (mean age 26 ± 5 years) who experienced collapse and cardiac arrest on the field (most during matches) in Europe from December 2002 to February 2022 with 63 % in the last 6 years. Twenty-five have died on the field or later in a hospital despite cardiopulmonary resuscitation. Of the 10 survivors, eight were implanted

with cardioverter-defibrillators for secondary (n=6) or primary (n=2) prevention and returned to full competition; five of the 8 required successful device therapy during matches or training. CONCLUSIONS: Cardiac arrest and sudden death can occur not uncommonly in professional athletes highly trained over decades and participating at an elite sports level. Our observations also underscore the importance of targeted preparticipation cardiovascular screening, and availability of external defibrillators on the playing field.

2. Mayo Clin Proc. 2022 Dec;97(12):2333-2354. doi: 10.1016/j.mayocp.2022.06.027.
Contemporary Management of Concomitant Cardiac Arrest and Cardiogenic Shock Complicating Myocardial Infarction.
Vallabhajosyula S(1), Verghese D(2), Henry TD(3), Katz JN(4), Nicholson WJ(5), Jaber WA(5), Jentzer JC(6).
ABSTRACT
Cardiogenic shock (CS) and cardiac arrest (CA) are the most life-threatening complications of acute myocardial infarction. Although there is a significant overlap in the pathophysiology with approximately half the patients with CS experiencing a CA and approximately two-thirds of patients with CA developing CS, comprehensive guideline recommendations for management of CA + CS are lacking. This paper summarizes the current evidence on the incidence, pathophysiology, and short- and long-term outcomes of patients with acute myocardial infarction complicated by concomitant CA + CS. We discuss the hemodynamic factors and unique challenges that need to be accounted for while developing treatment strategies for these patients. A summary of expert-based step-by-step recommendations to the approach and treatment of these patients, both in the field before admission and in-hospital management, are presented.

END-TIDAL CO_2

No articles identified.

ORGAN DONATION

No articles identified.

FEEDBACK

No articles identified.

DRUGS

1. EuroIntervention. 2022 Dec 6:EIJ-D-22-00675. doi: 10.4244/EIJ-D-22-00675. Online ahead of print.
Cangrelor for comatose survivors of out-of-hospital cardiac arrest undergoing percutaneous coronary intervention: the CANGRELOR-OHCA study.
Kordis P(1)(2), Bozic Mijovski M(3), Berden J(1)(2), Steblovnik K(2)(4), Blinc A(2)(3), Noc M(1)(2).
NO ABSTRACT AVAILABLE

2. Crit Care. 2022 Dec 7;26(1):378. doi: 10.1186/s13054-022-04248-x.

Augmented-Medication CardioPulmonary Resuscitation Trials in out-of-hospital cardiac arrest: a pilot randomized controlled trial.

Kim JS(1), Ryoo SM(1), Kim YJ(1), Sohn CH(1), Ahn S(1), Seo DW(1), Hong SI(1), Kim SM(1), Chae B(1), Kim WY(2).

ABSTRACT

BACKGROUND: Previously conducted physician-centered trials on the usefulness of vasopressin have yielded negative results; thus, patient-oriented trials have been warranted. We hypothesize that Augmented-Medication CardioPulmonary Resuscitation could be helpful for selected patients with out-of-hospital cardiac arrest (OHCA). METHODS: This is a double-blind, single-center, randomized, placebo-controlled trial conducted in the emergency department in a tertiary, university-affiliated hospital in Seoul, Korea. A total of 148 adults with non-traumatic OHCA who had initial diastolic blood pressure (DBP) < 20 mm Hg via invasive arterial monitoring during the early cardiac compression period were randomly assigned to two groups. Patients received a dose of 40 IU of vasopressin or placebo with initial epinephrine. The primary endpoint was a sustained return of spontaneous circulation. Secondary endpoints were survival discharge, and neurologic outcomes at discharge. RESULTS: Of the 180 included patients, 32 were excluded, and 148 were enrolled in the trial. A sustained return of spontaneous circulation was achieved by 27 patients (36.5%) in the vasopressin group and 24 patients (32.4%) in the control group (risk difference, 4.1%; P = .60). Survival discharge and good neurologic outcomes did not differ between groups. The trial group had significantly higher median DBPs during resuscitation than the control group (16.0 vs. 14.5 mm Hg, P < 0.01). There was no difference in end-tidal carbon dioxide, acidosis, and lactate levels at baseline, 10 min, and end-time. CONCLUSION: Among patients with refractory vasodilatory shock in OHCA, administration of vasopressin, compared with placebo, did not significantly increase the likelihood of return of spontaneous circulation.

TRAUMA

No articles identified.

VENTILATION

1. Resuscitation. 2022 Dec 5:S0300-9572(22)00734-1. doi: 10.1016/j.resuscitation.2022.11.028. Online ahead of print.

Ventilation Rates Measured by Capnography during Out-of-Hospital Cardiac Arrest Resuscitations and their Association with Return of Spontaneous Circulation.

Benoit JL(1), Lakshmanan S(2), Farmer SJ(3), Sun Q(4), Jordan Gray J(5), Sams W(6), Tadesse DG(7), McMullan JT(8).

ABSTRACT

BACKGROUND: Clinical guidelines for adult out-of-hospital cardiac arrest (OHCA) recommend a ventilation rate of 8-10 per minute yet acknowledge that few data exist to guide recommendations. The goal of this study was to evaluate the utility of continuous capnography to measure ventilation rates and the association with return of spontaneous circulation (ROSC). METHODS: This was a retrospective observational cohort study. We included all OHCA during a two-year period and excluded traumatic and pediatric patients. Ventilations were recorded using non-invasive continuous capnography. Blinded medically trained team members manually annotated all ventilations. Four techniques were used to analyze ventilation rate. The primary outcome was sustained prehospital ROSC. Secondary outcomes were vital status at the end of prehospital care and survival to hospital admission. Univariable and multivariable logistic regression models were constructed. RESULTS: A

total of 790 OHCA were analyzed. Only 386 (49%) had useable capnography data. After applying inclusion and exclusion criteria, the final study cohort was 314 patients. The median ventilation rate per minute was 7 (IQR 5.4-8.5). Only 70 (22%) received a guideline-compliant ventilation rate of 8-10 per minute. Sixty-two (20%) achieved the primary outcome. No statistically significant associations were observed between any of the ventilation parameters and patient outcomes in both univariable and multivariable logistic regression models. CONCLUSIONS: We failed to detect an association between intra-arrest ventilation rates measured by continuous capnography and proximal patient outcomes after OHCA. Capnography has poor reliability as a measure of ventilation rate. Achieving guideline-compliant ventilation rates remains challenging.

2. Data Brief. 2022 Nov 25;46:108767. doi: 10.1016/j.dib.2022.108767. eCollection 2023 Feb.
Data for: Reliability of mechanical ventilation during continuous chest compressions: A crossover study of transport ventilators in a human cadaver model of CPR.
Orlob S(1), Hobisch C(2), Wittig J(3)(4)(5), Auinger D(2), Touzil O(6), Honnef G(2), Schindler O(7), Metnitz P(2), Feigl G(8)(9), Prause G(2).
ABSTRACT
The data presented in this article relate to the research article, "Reliability of mechanical ventilation during continuous chest compressions: a crossover study of transport ventilators in a human cadaver model of CPR" [1]. This article contains raw data of continuous recordings of airflow, airway and esophageal pressure during the whole experiment. Data of mechanical ventilation was obtained under ongoing chest compressions and from repetitive measurements of pressure-volume curves. All signals are presented as raw time series data with a sample rate of 200Hz for flow and 500 Hz for pressure. Additionally, we hereby publish extracted time series recordings of force and compression depth from the used automated chest compression device. Concomitantly, we report tables with time stamps from our laboratory book by which the data can be sequenced into different phases of the study protocol. We also present a dataset of derived volumes which was used for statistical analysis in our research article together with the used exclusion list. The reported dataset can help to understand mechanical properties of Thiel-embalmed cadavers better and compare different models of cardiopulmonary resuscitation (CPR). Future research may use this data to translate our findings from bench to bedside. Our recordings may become useful in developing respiratory monitors for CPR, especially in prototyping and testing algorithms of such devices.

3. Cureus. 2022 Nov 1;14(11):e30987. doi: 10.7759/cureus.30987. eCollection 2022 Nov.
Comparing the First-Pass Success Rate of the King LTS-D and the i-gel Airway Devices in Out-of-Hospital Cardiac Arrest.
Price P(1), Laurie A(2), Plant E(1), Chandra K(3), Pishe T(4), Brunt K(1).
ABSTRACT
OBJECTIVES: Significant heterogeneity exists internationally in the airway devices used in the pre-hospital setting during cardiac arrest. This study evaluated the first-pass success (FPS) rate of two supraglottic airways (SGAs) used by paramedics during out-of-hospital cardiac arrest: the King LTS-D and the i-gel. METHODS: By examining 2,680 patient care records compiled by Ambulance New Brunswick between 2015 and 2020, we evaluated the FPS rate of the two SGAs using a 2x2 Pearson chi-square test for association, and a Mann-Whitney U test, to determine whether there were significant differences in FPS rates. RESULTS: Our study demonstrated a statistically significant association between airway devices and FPS favoring the i-gel with an FPS of 90.6% compared to a 76.6% FPS with the King LTS-D; $X 2(1) = 96.01$, $p < 0.001$. The odds of successfully inserting the airway on the first attempt were 2.94 times higher if paramedics used the i-gel than if they used the King LTS-D with a 95% CI [2.32, 3.60]. Mann-Whitney's U test for SGA differences favored the i-gel in fewer attempts for successful insertion ($z = -4.357$, $p < 0.001$, $d = 0.15$). CONCLUSIONS: Among patients in New Brunswick with out-of-hospital cardiac arrest, paramedics had a higher FPS rate with the i-gel compared to the King LTS-D. Our study also found a statistically significant difference

between the King LTS-D and i-gel, favoring the i-gel in fewer attempts. Our findings suggest that the i-gel provides a more consistent FPS rate compared to the King LTS-D within our study populations; however, further research is necessary to determine the clinical implications of this. While multiple attempts at tracheal intubation are associated with negative clinical outcomes, no such evidence exists for SGAs.

CERERBRAL MONITORING

1. BMC Emerg Med. 2022 Dec 10;22(1):197. doi: 10.1186/s12873-022-00743-0.
Correspondence: is there an association between centre volume and survival or neurological outcomes among out-of-hospital cardiac arrest patients?
Goh AXC(1), Ho AFW(2)(3).
ABSTRACT
This commentary discusses the findings of a study by Tsuchida et al. on the effect of annual hospital admissions of out-of-hospital cardiac arrest patients on survival and neurological outcomes in OHCA patients in the context of existing literature on the topic, and the implications on future studies investigating the volume-outcome relationship in cardiac arrest.

2. BMC Emerg Med. 2022 Dec 11;22(1):198. doi: 10.1186/s12873-022-00744-z.
Author Response Letter: "Correspondence: Is there an association between centre volume and survival or neurological outcomes among out-of-hospital cardiac arrest patients?".
Tsuchida T(1), Hayakawa M(2).
NO ABSTRACT AVAILABLE

3. Resusc Plus. 2022 Nov 29;12:100337. doi: 10.1016/j.resplu.2022.100337. eCollection 2022 Dec.
Prediction of intracerebral hemorrhage in patients with out-of-hospital cardiac arrest using post-resuscitation electrocardiogram: An observational cohort study.
Kaichi R(1), Ishii M(2), Marume K(2)(3), Takae M(1), Mori T(1), Komaki S(1), Toida R(1), Kurogi K(1), Nagamine Y(1), Nishikawa S(1), Matsuyama M(1), Yamaguchi T(1), Yano T(1), Tsujita K(2), Yamamoto N(1).
ABSTRACT
AIM: We evaluated the characteristics of patients with intracerebral hemorrhage in nontraumatic out-of-hospital cardiac arrests (OHCA) after return of spontaneous circulation (ROSC) to identify patients who required brain computed tomography as the next diagnostic workup. METHODS: We conducted a retrospective cohort study on 1303 consecutive patients with nontraumatic OHCA who were admitted to Miyazaki Prefectural Nobeoka Hospital between 2008 and 2020. Among these, 454 patients achieved sustained ROSC. We excluded 126 patients with obvious extracardiac causes. Clinical and demographic characteristics of patients and post-resuscitation 12-lead electrocardiogram were compared. Patients were categorized into the intracerebral hemorrhage (n = 32, 10%) and no intracerebral hemorrhage group (n = 296). All causes of intracerebral hemorrhage were diagnosed based on brain computed tomography images by board-certified radiologists. RESULTS: We included 328 patients (mean age, 74 years; women, 36%) who achieved ROSC. Logistic regression analyses showed that female sex, younger age (<75 years), no shockable rhythm changes, tachycardia (≥100 bpm), lateral ST-segment elevation, and inferior ST-segment depression on post-resuscitation electrocardiogram were independently associated with intracerebral hemorrhage. We developed a new predictive model for intracerebral hemorrhage by considering 1 point for each of the six factors. The odds ratio for intracerebral hemorrhage increased 2.36 for each 1-point increase (P < 0.001). A score ≥ 4 had 43.7% sensitivity, 90.8% specificity, 34.1%

positive predictive value, and 93.7% negative predictive value. CONCLUSION: Our new predictive model might be useful for risk stratification of intracerebral hemorrhage in patients with OHCA who achieved ROSC.

ULTRASOUND AND CPR

1. Clin Exp Emerg Med. 2022 Dec 7. doi: 10.15441/ceem.22.399. Online ahead of print.
Intra-arrest transesophageal echocardiography during cardiopulmonary resuscitation.
Hwang SO(1), Jung WJ(1), Roh YI(1), Cha KC(1).

ABSTRACT
Determining the cause of cardiac arrest (CA) and the heart status during CA is crucial for its treatment. Transesophageal echocardiography (TEE) is an imaging method that facilitates close observation of the heart without interfering with cardiopulmonary resuscitation (CPR). Intra-arrest TEE is a point-of-care ultrasound technique that is used during CPR. Intra-arrest TEE is performed to diagnose the cause of CA, determine the presence of cardiac contraction, evaluate the quality of CPR, assist with catheter insertion, and explore the mechanism of blood flow during CPR. The common causes of CA diagnosed using intra-arrest TEE include cardiac tamponade, aortic dissection, pulmonary embolism, and intracardiac thrombus, which can be observed on a few simple image planes at the mid-esophageal and upper esophageal positions. To operate an intra-arrest TEE program, it is necessary to secure a physician who is capable of performing TEE, provide appropriate training, establish implementation protocols, and prepare a plan in collaboration with the CPR team.

ORGANISATION AND TRAINING

1. Resuscitation. 2022 Dec 7:S0300-9572(22)00727-4. doi: 10.1016/j.resuscitation.2022.11.021. Online ahead of print.
The incidence and outcomes of out-of-hospital cardiac arrest in metropolitan versus rural locations: A systematic review and meta-analysis.
Smith A(1), Masters S(2), Ball S(3), Finn J(4).

ABSTRACT
BACKGROUND/AIMS: Rurality poses a unique challenge to the management of out-of-hospital cardiac arrest (OHCA) when compared to metropolitan (metro) locations. We conducted a systematic review of published literature to understand how OHCA incidence, management and survival outcomes vary between metro and rural areas. METHODS: We included studies comparing the incidence or survival of ambulance attended OHCA in metropolitan and rural areas, from a search of five databases from inception until 9th March 2022. The primary outcomes of interest were cumulative incidence and survival (return of spontaneous circulation, survival to hospital discharge (or survival to 30 days)). Meta-analyses of OHCA survival were undertaken. RESULTS: We identified 28 studies (30 papers- total of 823,253 patients) across 13 countries of origin. The definition of rurality varied markedly. There was no clear difference in OHCA incidence between metro and rural locations. Whilst there was considerable statistical heterogeneity between studies, the likelihood of return of spontaneous circulation on arrival at hospital was lower in rural than metro locations (OR=0.53, 95% CI 0.40, 0.70; I2=89%; 5 studies; 90,934 participants), as was survival to hospital discharge/survival to 30 days (OR= 0.52, 95% CI 0.38, 0.71; I2=95%; 15 studies; 18,837 participants). CONCLUSIONS: Overall, while incidence did not vary, the odds of OHCA survival to hospital discharge were approximately 50% lower in rural areas compared to metro areas. This suggests an opportunity for improvement in the prehospital management of OHCA within rural

locations. This review also highlighted major challenges in standardising the definition of rurality in the context of cardiac arrest research.

2. Int J Cardiol. 2022 Dec 7:S0167-5273(22)01875-7. doi: 10.1016/j.ijcard.2022.12.004. Online ahead of print.

Registered prodromal symptoms of out-of-hospital cardiac arrest among patients calling the medical helpline services.

Zylyftari N(1), Lee CJ(2), Gnesin F(3), Møller AL(3), Mills EHA(4), Møller SG(5), Jensen B(6), Ringgren KB(7), Kragholm K(8), Christensen HC(9), Blomberg SNF(9), Tan HL(10), Folke F(11), Køber L(12), Gislason G(13), Torp-Pedersen C(14).

ABSTRACT

Background Early identification of warning symptoms among out-of-hospital cardiac arrest (OHCA) patients remains challenging. Thus, we examined the registered prodromal symptoms of patients who called medical helpline services within 30-days before OHCA. Methods Patients unwitnessed by emergency medical services (EMS) aged ≥18 years during their OHCA were identified from the Danish Cardiac Arrest Registry (2014-2018) and linked to phone records from the 24-h emergency helpline (1-1-2) and out-of-hours medical helpline (1813-Medical Helpline) in Copenhagen before the arrest. The registered symptoms were categorized into chest pain; breathing problems; central nervous system (CNS)-related/unconsciousness; abdominal/back/urinary; psychiatric/addiction; infection/fever; trauma/exposure; and unspecified (diverse from the beforementioned categories). Analyses were divided by the time-period of calls (0-7 days/8-30 days preceding OHCA) and call type (1-1-2/1813-Medical Helpline). Results Of all OHCA patients, 18% (974/5442) called helpline services (males 56%, median age 76 years[Q1-Q3:65-84]). Among these, 816 had 1145 calls with registered symptoms. The most common symptom categories (except for unspecified, 33%) were breathing problems (17%), trauma/exposure (17%), CNS/unconsciousness (15%), abdominal/back/urinary (12%), and chest pain (9%). Most patients (61%) called 1813-Medical Helpline, especially for abdominal/back/urinary (17%). Patients calling 1-1-2 had breathing problems (24%) and CNS/unconsciousness (23%). Nearly half of the patients called within 7 days before their OHCA, and CNS/unconsciousness (19%) was the most registered. The unspecified category remained the most common during both time periods (32%;33%) and call type (24%;39%). Conclusions Among patients who called medical helplines services up to 30-days before their OHCA, besides symptoms being highly varied (unspecified (33%)), breathing problems (17%) were the most registered symptom-specific category.

3. Cureus. 2022 Nov 30;14(11):e32050. doi: 10.7759/cureus.32050. eCollection 2022 Nov.

The Effect of Resuscitation Residents on the Duration of Pre-induction of Targeted Temperature Management in Out-of-Hospital Cardiac Arrest.

Wloszczynski P(1), Berger DA(1), Lee DM(2), Chen NW(3), Burla MJ(4)(1).

ABSTRACT

Background The Resuscitation Rotation is a novel second-year emergency medicine rotation focusing on the highest acuity patients, including out-of-hospital cardiac arrest (OHCA). The resuscitation resident (RR) functions as an extra physician during resuscitation and post return of spontaneous circulation (ROSC). The objective of this study is to examine if the presence of a RR decreases the pre-induction interval of targeted temperature management (TTM) for patients following OHCA. Methods A retrospective study was conducted at a tertiary care level 1 trauma center with an annual ED census of 127,323 visits in 2019. We retrospectively reviewed consecutive OHCA patients from September 1, 2014, to July 20, 2020, who underwent TTM. Patients were identified as cases with or without a RR. Clinical characteristics were summarized by the status of RR involvement and

compared by using t-test and χ2 test for continuous and categorical variables, respectively. All tests with $p < 0.05$ were considered to indicate statistical significance. Results Our study population identified 198 adult OHCA patients that underwent TTM from 2014-2020. There were exclusions for missing TTM start time and for missing patient characteristics leaving 176 for final analysis, of which 55 (33.3%) had RR involvement. The mean time (hours) to TTM initiation (ie, the pre-induction phase) for patients involving the RR versus those without was not statistically significant (3.11 vs 3.34, p=0.39). Linear regression analysis indicates that the adjusted effect of RR involvement was not associated with the mean hours of pre-induction (p=0.47). Conclusion There is no statistically significant association of a RR on the duration of the pre-induction phase. Limitations include that both arms had prolonged pre-induction phases. This may represent a non-optimized TTM protocol. Future work will aim to use the RR to improve our pre-induction phase.

4. Korean J Med Educ. 2022 Dec;34(4):319-325. doi: 10.3946/kjme.2022.240. Epub 2022 Nov 29.
A simulation-based continuing professional development course for the first 5 minutes of cardiac arrest in the resource-limited local clinics.
Cho CH(1), Kim YM(1)(2), Oh YM(1), Kim JH(1), Kim HJ(1), Kim JE(2), Lee SA(1).
ABSTRACT
PURPOSE: Using simulation in continuing professional development (CPD) courses for local practitioners is uncommon in Korea. The aim of our study was to evaluate the responses of the local practitioners for a simulation-based short CPD course. METHODS: Following the targeted needs assessment of local practitioners, we developed and implemented a 3-hour simulation-based CPD course for the first 5 minutes of cardiac arrest in the resource-limited local clinics. We evaluated the participant's responses to the course using a questionnaire. RESULTS: During the 3-year implementation period, 115 practitioners participated in 10 courses, and 113 (98%) responded to the questionnaire. The overall course satisfaction (10-point scale) was very positive (10 in 93 [82.3%], 9 in 19 [16.8%], and 8 in 1 [0.8%]). The level (5-point scale) of recommendation to the others was also high (5 in 103 [91.2%] and 4 in 10 [8.8%]). Many participants positively commented on the authentic practical experience of the uncommon crisis in their contexts. CONCLUSION: A simulation-based short CPD course for in-hospital cardiac arrest could provide an authentic practical experience for local practitioners working in resource-limited clinics.

5. Open Access Emerg Med. 2022 Nov 29;14:639-648. doi: 10.2147/OAEM.S382744. eCollection 2022.
High School Student CPR Training in Kuwait: A Cross-Sectional Study of Teacher Perspectives, Willingness, and Perceived Barriers.
Alhasan D(1), Fakhraldeen M(2), Alqabandi S(3), Alajmi M(3).
ABSTRACT
BACKGROUND: School cardiopulmonary resuscitation (CPR) training has not been previously implemented nor studied in the Arabian Peninsula, and this is due to the challenges that this training imposes. This study aims to determine high school teacher perspectives, willingness, and barriers as related to CPR student training in high schools. METHODS: An anonymous, voluntary, cross-sectional electronic questionnaire, primarily based on the theory of planned behavior (TPB) was distributed to high school principals and teachers from 20 local (public and private) high schools between October and December 2021. The questionnaire was a 4-part (demographics, willingness, barriers, implementation approach), 23-variable tool. RESULTS: Eighty-four out of 88 participants were included in the analysis from 20 high schools. The overall willingness to teach CPR to students was 4.2 ± 0.9, and this willingness was significantly associated with being a female ($p = 0.019$), being a teacher ($p = 0.036$), having a family history of cardiovascular disease ($p = 0.007$), previous school CPR

campaigns (p = 0.02), and all TPB factors: attitude (p = 0.001), subjective norms (p = 0.011), and perceived behaviour control (p = 0.007). As for perceived barriers, there was moderate concern regarding the absence of the Good Samaritan law (3.8 ± 1.1) and CoVID-19 transmission (3.5 ± 1.3). High school teaching staff recommended formal legislation of CPR training from the Ministry of Education (MoE) and favoured CPR training delivery by healthcare professionals. However, they were willing to conduct CPR training themselves with regular training, material integration into the curriculum, and online teaching material access. CONCLUSION: High school teachers are willing to teach students CPR. They need MoE legislation, appropriate training, online material, and a standardized database. Teaching staff also recommend specific training session settings. CoVID-19 and Good Samaritan law are moderate barriers. A number of factors influence teaching staff willingness to conduct CPR training. From this analysis, we recommend piloting CPR training in Kuwait high schools with consideration to the identified influential factors and barriers.

POST-CARDIAC ARREST TREATMENTS

1. Am J Cardiol. 2022 Dec 1;188:41-43. doi: 10.1016/j.amjcard.2022.11.012. Online ahead of print.
Meta-Analysis on Early Versus Delayed Coronary Angiography for Patients With Out-of-Hospital Cardiac Arrest Without ST-Elevation Myocardial Infarction.
Hamed M(1), Neupane G(1), Abdelsalam M(2), Elkhawas I(3), Morsy M(4), Khalili H(5), Elgendy IY(6), Elbadawi A(7).
NO ABSTRACT AVAILABLE

TARGETED TEMPERATURE MANAGEMENT

1. J Formos Med Assoc. 2022 Dec 6:S0929-6646(22)00429-6. doi: 10.1016/j.jfma.2022.11.007. Online ahead of print.
Comparison of outcomes between cardiogenic and non-cardiogenic cardiac arrest patients receiving targeted temperature management: The nationwide TIMECARD multicenter registry.
Wang MT(1), Tsai MS(2), Huang CH(2), Kuo LK(3), Hsu H(4), Lai CH(5), Chang Lin K(6), Huang WC(7).
ABSTRACT
BACKGROUND AND PURPOSE: Targeted temperature management (TTM) has been recommended for post-resuscitation care of cardiac arrest (CA) patients who remain comatose. However, the differences between cardiogenic and non-cardiogenic causes need further investigation. Thus, this study aimed to investigate the difference in outcomes between cardiogenic and non-cardiogenic CA patients receiving TTM. METHODS: The TIMECARD registry established the study cohort and database for patients receiving TTM between January 2013 and September 2019. A total of 543 patients were enrolled, with 305 and 238 patients in the cardiogenic and non-cardiogenic groups, respectively. RESULTS: Compared with the non-cardiogenic group, the cardiogenic group had higher proportion of initial shockable rhythm, better survival (cardiogenic: 45.9%; non-cardiogenic: 30.7%, P = 0.0017), and better neurologic performance at discharge. In the cardiogenic group, witnessed collapse (OR = 0.31, 95% CI: 0.13-0.72), and coronary intervention (OR = 0.45, 95% CI: 0.24-0.84) were positive predictors for overall outcome. Mean arterial pressure <65 mmHg led to poor outcome regardless in the cardiogenic (OR = 3.31, 95% CI: 1.46-7.52) or non-cardiogenic group (OR = 2.39, 95% CI: 1.06-5.39). CONCLUSIONS: Patients with cardiogenic CA post TTM had better survival and neurologic performance at discharge than those without cardiogenic CA. Cardiogenic etiology was a potential predictor of better cardiac arrest survival, but it was not an independent risk factor for overall outcome after adjusting for potential covariates. In the cardiogenic group, better

outcomes were reported in patients with witnessed collapse, bystander cardiopulmonary resuscitation, as well as those receiving coronary intervention.

2. Crit Care. 2022 Dec 8;26(1):380. doi: 10.1186/s13054-022-04256-x.
The impact of different targeted temperatures on out-of-hospital cardiac arrest outcomes in patients receiving extracorporeal membrane oxygenation: a nationwide cohort study.
Watanabe M(#)(1), Matsuyama T(#)(2), Miyamoto Y(1), Kitamura T(3), Komukai S(4), Ohta B(1).
ABSTRACT
BACKGROUND: Targeted temperature management (TTM) is recommended in the management of out-of-hospital cardiac arrest (OHCA) when coma persists after the return of spontaneous circulation. In the setting of extracorporeal membrane oxygenation (ECMO) for OHCA patients, TTM is associated with good neurological outcomes and is recommended in the Extracorporeal Life Support Organization guidelines. However, the optimal targeted temperature for these patients has not yet been adequately investigated. This study aimed to compare the impact of different targeted temperatures on the outcomes in OHCA patients receiving ECMO. METHODS: This was a retrospective analysis of data from the Japanese Association for Acute Medicine (JAAM)-OHCA Registry, a multicentre nationwide prospective database in Japan in which 103 institutions providing emergency care participated. OHCA patients aged ≥ 18 years who required ECMO with TTM between June 2014 and December 2019 were included in our analysis. The primary outcome was 30-day survival with favourable neurological outcomes, defined as a Glasgow-Pittsburgh cerebral performance category score of 1 or 2. Patients were divided into two groups according to their targeted temperature: normothermic TTM (n-TTM) (35-36 °C) and hypothermic TTM (h-TTM) (32-34 °C). We compared the outcomes between the two targeted temperature groups using multivariable logistic regression and inverse probability weighting (IPW). RESULTS: A total of 890 adult OHCA patients who received ECMO and TTM were eligible for our analysis. Of these patients, 249 (28%) and 641 (72%) were treated with n-TTM and h-TTM, respectively. The proportions of patients with 30-day favourable neurological outcomes were 16.5% (41/249) and 15.9% (102/641), in the n-TTM and h-TTM groups, respectively. No difference in neurological outcomes was observed in the multiple regression analysis [adjusted odds ratio 0.91, 95% confidence interval (CI) 0.58-1.43], and the result was constant in the IPW (odds ratio 1.01, 95% CI 0.67-1.54). CONCLUSION: No difference was observed between n-TTM and h-TTM in OHCA patients receiving TTM with ECMO. The current understanding that changes to the targeted temperature have little impact on the outcome of patients may remain true regardless of ECMO use.

3. Ther Hypothermia Temp Manag. 2022 Dec 6. doi: 10.1089/ther.2022.0037. Online ahead of print.
Fibrinolysis in Cardiac Arrest Patients Treated with Hypothermia.
Jeppesen AN(1), Duez C(2)(3), Kirkegaard H(2)(4), Grejs AM(4)(5), Hvas AM(6).
ABSTRACT
Hypothermia affects coagulation, but the effect of hypothermia on fibrinolysis is not clarified. Imbalance in the fibrinolytic system may lead to increased risk of bleeding or thrombosis. Our aim was to investigate if resuscitated cardiac arrest patients treated with hypothermia had an unbalanced fibrinolysis. A prospective cohort study, including 82 patients were treated with hypothermia at 33°C ± 1°C after out-of-hospital cardiac arrest. Blood samples were collected at 24 hours (hypothermia) and at 72 hours (normothermia). Samples were analyzed for fibrin D-dimer, tissue plasminogen activator (tPA), plasminogen, plasminogen activator Inhibitor-1 (PAI-1), thrombin-activatable fibrinolysis inhibitor (TAFI), and an in-house dynamic fibrin clot formation and lysis assay. Compared with normothermia, hypothermia significantly increased plasminogen activity

(mean difference = 10.4%, 95% confidence interval [CI] 7.9-12.9), p < 0.001), PAI-1 levels (mean difference = 275 ng/mL, 95% CI 203-348, p < 0.001), and tPA levels (mean difference = 1.0 ng/mL, 95% CI 0.2-1.7, p = 0.01). No differences between hypothermia and normothermia were found in TAFI activity (p = 0.59) or in the fibrin D-dimer levels (p = 0.08). The fibrin clot lysis curves showed three different patterns: normal-, flat-, or resistant clot lysis curve. At hypothermia 45 (55%) patients had a resistant clot lysis curve and 33 (44%) patients had a resistant clot lysis curve at normothermia (p = 0.047). Comatose, resuscitated, cardiac arrest patients treated with hypothermia express an inhibited fibrinolysis even after rewarming. This could potentially increase the thromboembolic risk.

4. J Formos Med Assoc. 2022 Dec 2:S0929-6646(22)00433-8. doi: 10.1016/j.jfma.2022.11.012. Online ahead of print.

TIMECARD score: An easily operated prediction model of unfavorable neurological outcomes in out-of-hospital cardiac arrest patients with targeted temperature management.

Lin JJ(1), Huang CH(1), Chien YS(2), Hsu CH(3), Chiu WT(4), Wu CH(5), Wang CH(6), Tsai MS(7).

ABSTRACT

BACKGROUND: Targeted temperature management (TTM) is recommended for comatose out-of-hospital cardiac arrest (OHCA) survivors. Several prediction models have been proposed; however, most of these tools require data conversion and complex calculations. Early and easy predictive model of neurological prognosis in OHCA survivors with TTM warrant investigation. MATERIALS AND METHODS: This multicenter retrospective cohort study enrolled 408 non-traumatic adult OHCA survivors with TTM from the TaIwan network of targeted temperature ManagEment for CARDiac arrest (TIMECARD) registry during January 2014 to June 2019. The primary outcome was unfavorable neurological outcome at discharge. The clinical variables associated with unfavorable neurological outcomes were identified and a risk prediction score-TIMECARD score was developed. The model was validated with data from National Taiwan University Hospital. RESULTS: There were 319 (78.2%) patients presented unfavorable neurological outcomes at hospital discharge. Eight independent variables, including malignancy, no bystander cardiopulmonary resuscitation (CPR), non-shockable rhythm, call-to-start CPR duration >5 min, CPR duration >20 min, sodium bicarbonate use during resuscitation, Glasgow Coma Scale motor score of 1 at return of spontaneous circulation, and no emergent coronary angiography, revealed a significant correlation with unfavorable neurological prognosis in TTM-treated OHCA survivors. The TIMECARD score was established and demonstrated good discriminatory performance in the development cohort (area under the receiver operating characteristic curve [AUC] = 0.855) and validation cohorts (AUC = 0.918 and 0.877, respectively). CONCLUSION: In emergency settings, the TIMECARD score is a practical and simple-to-calculate tool for predicting neurological prognosis in OHCA survivors, and may help determine whether to initiate TTM in indicated patients.

5. Ther Hypothermia Temp Manag. 2022 Nov;12(4):235-239. doi: 10.1089/ther.2022.0033. Epub 2022 Oct 26.

Targeted Temperature Management Using Esophageal Cooling.

Anderson CM(1), Joseph C(2), Fisher R(1), Berry D(1), Diestelhorst JB(1), Kulstad C(2), Wayne M(1)(3).

ABSTRACT

Although specific temperature targets are debated, targeted temperature management (TTM) is a common treatment for postcardiac arrest patients. However, consistently implementing a TTM protocol is challenging, especially in a community hospital. Often, the protocols described in the literature include labor- and cost-intensive methods that are not feasible or sustainable in many

health care settings. Esophageal temperature management (ETM) is a TTM method that can be easily utilized alone or combined with surface methods. We sought to evaluate ETM in a cohort of patients treated with TTM after cardiac arrest. Chart reviews were conducted of all patients treated with ETM after cardiac arrest at our community medical center. Initial patient temperature, time to target, supplemental methods (water blankets, chest wraps, or head wraps), and patient survival were extracted for analysis. A total of 54 patients were treated from August 2016 to November 2018; 30 received ETM only, 22 received supplemental cooling, and 2 had treatment discontinued before reaching target due to recovery. Target temperatures ranged from 32°C to 36°C, depending on provider preference. The median time to target temperature for the entire cohort was 219 minutes (interquartile range [IQR] 81-415). For the cohorts without, and with, supplemental cooling modalities, the median time to attain target temperature was 128 minutes (IQR 71-334), and 285 minutes (IQR 204-660), respectively. Survival to intensive care unit discharge was 51.9% for the entire cohort. Survivors exhibited longer times to achieve goal temperature (median 180 minutes in nonsurvivors vs. 255 minutes in survivors). ETM attains target temperature at a rate consistent with current guidelines and with similar performance to alternative modalities. As in other studies, surviving patients required longer times to reach target temperature.

6. Ther Hypothermia Temp Manag. 2022 Nov;12(4):210-214. doi: 10.1089/ther.2021.0038. Epub 2022 Apr 22.

The Association of Serum Magnesium Levels and QT Interval with Neurological Outcomes After Targeted Temperature Management.

Kumar M(1), Perucki W(1)(2), Hiendlmayr B(2), Mazigh S(1), O'Sullivan DM(3), Fernandez AB(2).

ABSTRACT

Targeted temperature management (TTM) is associated with corrected QT (QTc) prolongation and decrease in serum magnesium (Mg) levels that may lead to recurrent ventricular arrhythmia and poor neurological outcomes. We aimed to evaluate the association between QTc interval and Mg levels during TTM with neurological outcomes. We reviewed the electrocardiograms of 366 patients who underwent TTM during the induction, maintenance, and rewarming phase after cardiac arrest. We reviewed the association of change in QTc interval, and Mg levels with neurological outcomes. In total, 71.3% of the patients had a significant increase in QTc interval defined as >60 ms or any QTc >500 ms during TTM. Poor neurological outcome was associated with persistent prolongation of QTc after rewarming (507 vs. 483 ms, p = 0.046) and higher Mg levels at presentation (2.08 ± 0.41 mg/dL, p = 0.014). Supplemental Mg did not have any significant change in their QTc. Patients with prolonged QTc during TTM should be promptly evaluated for QTc-prolonging factors given its association with worse neurological outcomes. The inverse correlation between Mg levels and poor neurological outcomes deserves further investigation.

ELECTROPHYSIOLOGY AND DEFIBRILLATION

1. Ann Intensive Care. 2022 Dec 8;12(1):111. doi: 10.1186/s13613-022-01083-9.

Prognostication after cardiac arrest: how EEG and evoked potentials may improve the challenge.

Benghanem S(1)(2)(3)(4), Pruvost-Robieux E(5)(6)(7), Bouchereau E(8)(7), Gavaret M(5)(6)(7), Cariou A(9)(5)(10)(11).

ABSTRACT

About 80% of patients resuscitated from CA are comatose at ICU admission and nearly 50% of survivors are still unawake at 72 h. Predicting neurological outcome of these patients is important to provide correct information to patient's relatives, avoid disproportionate care in patients with irreversible hypoxic-ischemic brain injury (HIBI) and inappropriate withdrawal of care in patients

with a possible favorable neurological recovery. ERC/ESICM 2021 algorithm allows a classification as "poor outcome likely" in 32%, the outcome remaining "indeterminate" in 68%. The crucial question is to know how we could improve the assessment of both unfavorable but also favorable outcome prediction. Neurophysiological tests, i.e., electroencephalography (EEG) and evoked-potentials (EPs) are a non-invasive bedside investigations. The EEG is the record of brain electrical fields, characterized by a high temporal resolution but a low spatial resolution. EEG is largely available, and represented the most widely tool use in recent survey examining current neuro-prognostication practices. The severity of HIBI is correlated with the predominant frequency and background continuity of EEG leading to "highly malignant" patterns as suppression or burst suppression in the most severe HIBI. EPs differ from EEG signals as they are stimulus induced and represent the summated activities of large populations of neurons firing in synchrony, requiring the average of numerous stimulations. Different EPs (i.e., somato sensory EPs (SSEPs), brainstem auditory EPs (BAEPs), middle latency auditory EPs (MLAEPs) and long latency event-related potentials (ERPs) with mismatch negativity (MMN) and P300 responses) can be assessed in ICU, with different brain generators and prognostic values. In the present review, we summarize EEG and EPs signal generators, recording modalities, interpretation and prognostic values of these different neurophysiological tools. Finally, we assess the perspective for futures neurophysiological investigations, aiming to reduce prognostic uncertainty in comatose and disorders of consciousness (DoC) patients after CA.

PEDIATRICS AND CHILDREN

1. Front Pediatr. 2022 Nov 17;10:1065585. doi: 10.3389/fped.2022.1065585. eCollection 2022.
Pediatric cardiopulmonary resuscitation in infant and children with chronic diseases: A simple approach?
Uzun DD(1), Lang K(2)(3), Saur P(4), Weigand MA(1), Schmitt FCF(1).

ABSTRACT
Infants and children with complex chronic diseases have lifelong, life-threatening conditions and for many, early death is an unavoidable outcome of their disease process. But not all chronic diseases in children are fatal when treated well. Cardiopulmonary resuscitation is more common in children with chronic diseases than in healthy children. Resuscitation of infants and children presents significant challenges to physicians and healthcare providers. Primarily, these situations occur only rarely and are therefore not only medically demanding but also associated with emotional stress. In case of resuscitation in infants and children with chronic diseases these challenges become much more complex. The worldwide valid Pediatric Advanced Life Support Guidelines do not give clear recommendations how to deal with periarrest situations in chronically ill infants and children. For relevant life-limiting illnesses, a "do not resuscitate" order should be discussed early, taking into account medical, ethical, and emotional considerations. The decision to terminate resuscitative efforts in cardiopulmonary arrest in infants and children with chronic illnesses such as severe lung disease, heart disease, or even incurable cancer is complex and controversial among physicians and parents. Judging the "outcome" of resuscitation as a "good" outcome becomes complex because for some, life extension itself and for others, quality of life is a goal. Physicians often decide that a healthy child is more likely to have a reversible condition and thereby have a better outcome than a child with multiple comorbidities and chronic health care needs. Major challenges in resuscitation infants and children are that clinicians need to individualize resuscitation strategies in light of each chronic disease, anatomy and physiology. This review aims to highlight terms of resuscitation infants and children with complex chronic diseases, considering resuscitation-related factors, parent-related factors, patient-related factors, and physician-related factors.

EXTRACORPOREAL LIFE SUPPORT

1. ASAIO J. 2022 Dec 12. doi: 10.1097/MAT.0000000000001871. Online ahead of print.
Anti-thrombotic Therapy with Cangrelor and Bivalirudin in Venoarterial Extracorporeal Membrane Oxygenation Patients Undergoing Percutaneous Coronary Intervention: A Single-Center Experience.
Baldetti L(1), Nardelli P(2), Ajello S(2), Melisurgo G(2), Calabrò MG(2), Pieri M(2), Scandroglio AM(2).
ABSTRACT
VA-ECMO is commonly used for patients in cardiogenic shock (CS) or refractory cardiac arrest (CA) undergoing PCI for ACS. In this setting at high risk of both thrombotic and hemorrhagic complications, optimal anti-thrombotic therapy remains ill-defined. We hypothesized that an anti-thrombotic therapy comprising a parenteral anticoagulant (bivalirudin) and a parenteral anti-platelet agent (cangrelor) may prove safe and effective in this scenario. From November 2019 to December 2021, 14 patients received at least one dose of cangrelor (starting dose: 0.125 µg/kg/min) plus bivalirudin, without background aspirin, in the context of PCI and VA-ECMO for ACS-related CS/CA, and were included in this study. Efficacy endpoint was occurrence of thrombotic events and safety endpoint was major bleeding occurrence. Median age was 58 years. The majority (64%) presented with refractory CA. A thrombotic event occurred in 14%, while major bleeding occurred in 21% patients. One patient experienced arterial thrombosis after VA-ECMO arterial cannula removal, another experienced ischemic cerebellar stroke without functional sequelae. Bleeding events were: 29% BARC 3a, 14% BARC 3b, and 7% BARC 5b. Overall in-hospital mortality was 50%. Cangrelor was continued for 5 (4-10) days; temporary discontinuation was necessary in 36%, either for VA-ECMO cannula removal or for bleeding events. A low dose of cangrelor, associated with standard-intensity anticoagulation with bivalirudin was a feasible anti-thrombotic strategy in patients undergoing PCI during VA-ECMO support for ACS-related CS/CA. Bleeding events rates outweighed thrombotic events rates in this critically-ill population, although the observed rates were lowest among available studies.

2. Resuscitation. 2022 Dec 5:S0300-9572(22)00732-8. doi: 10.1016/j.resuscitation.2022.11.026. Online ahead of print.
Intra-aortic Balloon Pump Use in Out-of-hospital Cardiac Arrest Patients Who Underwent Extracorporeal Cardiopulmonary Resuscitation.
Kashiura M(1), Kishihara Y(2), Ozawa H(2), Amagasa S(3), Yasuda H(2), Moriya T(2).
ABSTRACT
AIM: To investigate the effect of intra-aortic balloon pump (IABP) use after extracorporeal membrane oxygenation-assisted cardiopulmonary resuscitation (ECPR) on short-term neurological outcomes and survival in patients with out-of-hospital cardiac arrest (OHCA). METHODS: We retrospectively analysed data collected between June 2014 and December 2019 from the Japanese OHCA registry. Adult patients (aged ≥18 years) who underwent ECPR were included. We divided the patients into those who received IABP and those who did not receive IABP. The primary outcome was the 30-day favourable neurological outcomes in survived patients. The secondary outcome was the 30-day survival. We performed propensity score matching (PSM) to adjust for confounding factors after multiple imputations of missing data. Adjusted odds ratios (aORs) and 95% confidence intervals (CIs) were estimated using logistic regression analysis after PSM to adjust for confounding factors after IABP initiation. RESULTS: Among 2,135 adult patients who underwent ECPR, 1,173 received IABP. In 842 matched patients, IABP use was associated with survival (aOR, 1.98; 95% CI, 1.39-2.83; $p < 0.001$). However, IABP use was not significantly associated with the 30-day neurologically favourable outcome in 190 survived patients (aOR, 1.22; 95% CI, 0.79-1.89; $p = 0.36$).

CONCLUSION: The use of IABP in patients with OHCA who underwent ECPR was associated with 30-day survival. Among survived patients, there was no significant association between IABP use and 30-day neurological outcome. A further well-designed prospective study is needed.

3. Front Med (Lausanne). 2022 Nov 21;9:935424. doi: 10.3389/fmed.2022.935424. eCollection 2022.
Extracorporeal cardiopulmonary resuscitation in adults and children: A review of literature, published guidelines and pediatric single-center program building experience.
Olson T(1), Anders M(2)(3), Burgman C(4), Stephens A(5)(6), Bastero P(2)(3).
ABSTRACT
Extracorporeal cardiopulmonary resuscitation (ECPR) is an adjunct supportive therapy to conventional cardiopulmonary resuscitation (CCPR) employing veno-arterial extracorporeal membrane oxygenation (VA-ECMO) in the setting of refractory cardiac arrest. Its use has seen a significant increase in the past decade, providing hope for good functional recovery to patients with cardiac arrest refractory to conventional resuscitation maneuvers. This review paper aims to summarize key findings from the ECPR literature available to date as well as the recommendations for ECPR set forth by leading national and international resuscitation societies. Additionally, we describe the successful pediatric ECPR program at Texas Children's Hospital, highlighting the logistical, technical and educational features of the program.

EXPERIMENTAL RESEARCH

1. Resuscitation. 2022 Dec 2:S0300-9572(22)00729-8. doi: 10.1016/j.resuscitation.2022.11.022. Online ahead of print.
The use of 100% compared to 50% oxygen during ineffective experimental cardiopulmonary resuscitation improves brain oxygenation.
Nelskylä A(1), Humaloja J(1), Litonius E(2), Pekkarinen P(2), Babini G(3), Mäki-Aho TP(1), Heinonen JA(2), Skrifvars MB(4).
ABSTRACT
INTRODUCTION: Perfusion pressure and chest compression quality are generally considered key determinants of brain oxygenation during cardiopulmonary resuscitation (CPR) and the impact of oxygen administration is less clear. We compared ventilation with 100% and 50% oxygen during ineffective manual chest compressions and hypothesized that 100% oxygen would improve brain oxygenation. METHODS: Ventricular fibrillation (VF) was induced electrically in anaesthetized pigs and left untreated for 5 minutes, followed by randomization to ineffective manual CPR with ventilation of 50% or 100% oxygen. The first defibrillation was performed 10 minutes after induction of VF, and CPR continued with mechanical chest compressions (LUCAS2™) and defibrillation every 2 minutes until 36 minutes or return of spontaneous circulation (ROSC). Brain oxygenation was measured with near-infrared spectroscopy (rSO2) and invasive brain tissue oxygen (PbtO2) with a probe (NEUROVENT-PTO, RAUMEDIC) inserted into frontal brain tissue. Cerebral oxygenation was compared between groups with Mann-Whitney U tests and linear mixed models. RESULTS: Twenty-eight pigs were included in the study: 14 subjects in each group. During ineffective chest compressions relative PbtO2 was higher in the group ventilated with 100% compared to 50% oxygen (5.2mmHg [1.4-20.5] vs 2.2 [0.8-6.8], p=0.001), but there was no difference in rSO2 (22% [16-28] vs 18 [15-25], p=0.090). The use of 50% or 100% oxygen showed no difference in relative PbtO2 (p=1.00) and rSO2 (p=0.206) during mechanical CPR. CONCLUSIONS: The use of 100% compared to

50% oxygen during ineffective manual CPR improved brain oxygenation measured invasively in brain tissue, but there was no difference in rSO2.

2. Eur J Pharmacol. 2022 Dec 1;938:175431. doi: 10.1016/j.ejphar.2022.175431. Online ahead of print.

Ginsenoside-Rg1 mitigates cardiac arrest-induced cognitive damage by modulating neuroinflammation and hippocampal plasticity.

Wu Z(1), Huang J(1), Bai X(1), Wang Q(2), Wang F(3), Xu J(1), Tang H(4), Yin C(5), Wang Y(1), Yu F(6), Zhang H(7).

ABSTRACT

Ginsenoside-Rg1 can effectively ameliorate mental disorders, but whether ginsenoside-Rg1 plays a neuroprotective role in cardiac arrest and cardiopulmonary resuscitation (CA/CPR)-induced cognitive impairment remains unclear. In this study, a 5-min asphyxia-based CA/CPR rat model was established to explore the mechanisms underlying the effects of ginsenoside-Rg1 (40 mg·kg-1·d-1, ip, 14 days) on its cognitive alterations. These CA/CPR rats displayed spatial learning and memory impairment in the Morris water maze, as reflected in the compromised basal synaptic transmission and long-term potentiation (LTP) at the Schaffer collateral of hippocampal CA1 area in vivo electrophysiology, whereas the ginsenoside-Rg1 remarkably mitigated these alterations. Next, we found that ginsenoside-Rg1 inhibited hippocampal neuroinflammation by alleviating the CA/CPR-induced hippocampal activation of microglia and astrocytes and the overexpression of related proinflammatory cytokines interleukin-1β (IL-1β) and tumour necrosis factor-α (TNF-α). In addition, ginsenoside-Rg1 improved CA/CPR-induced hippocampal neuronal apoptosis, dendritic spines and synaptic ultrastructure defects as associated with the upregulation of the key synaptic regulatory proteins. Furthermore, ginsenoside-Rg1 could ameliorate CA/CPR-induced aberrant expression of the key regulators of hippocampal glutamate signaling pathways, excitatory amino acid transporter 2 (EAAT2), excitatory amino acid transporter 1 (EAAT1), Glutamine Synthetase (GS), GluN2B, and glutamate. In conclusion, ginsenoside-Rg1 exerts its neuroprotective effects by ameliorating hippocampus-dependent neuroglia activation-mediated neuroinflammation and neuroplasticity deficits, shedding new light on the therapeutic intervention of CA/CPR-related cognitive disorders.

3. J Cardiovasc Transl Res. 2022 Dec 8. doi: 10.1007/s12265-022-10343-9. Online ahead of print.

Intra-aortic and Intra-caval Balloon Pump Devices in Experimental Non-traumatic Cardiac Arrest and Cardiopulmonary Resuscitation.

Dogan EM(1), Axelsson B(2), Jauring O(3), Hörer TM(2), Nilsson KF(2), Edström M(3).

ABSTRACT

Intra-aortic balloon pump (IABP) use during CPR has been scarcely studied. Intra-caval balloon pump (ICBP) may decrease backward venous flow during CPR. Mechanical chest compressions (MCC) were initiated after 10 min of cardiac arrest in anesthetized pigs. After 5 min of MCC, IABP (n = 6) or ICBP (n = 6) was initiated. The MCC device and the IABP/ICBP had slightly different frequencies, inducing a progressive peak pressure phase shift. IABP inflation 0.15 s before MCC significantly increased mean arterial pressure (MAP) and carotid blood flow (CBF) compared to inflation 0.10 s after MCC and to MCC only. Coronary perfusion pressure significantly increased with IABP inflation 0.25 s before MCC compared to inflation at MCC. ICBP inflation before MCC significantly increased MAP and CBF compared to inflation after MCC but not compared to MCC only. This shows the potential of IABP in

CPR when optimally synchronized with MCC. The effect of timing of intra-aortic balloon pump (IABP) inflation during mechanical chest compressions (MCC) on hemodynamics. Data from12 anesthetized pigs.

CASE REPORTS

1. J Cardiothorac Surg. 2022 Dec 9;17(1):301. doi: 10.1186/s13019-022-02060-w.
Hybrid surgery for blunt aortic injury with rupture: a case report.
Maruhashi T(1), Maruki H(2), Mishima T(3), Kitamura T(3), Kurihara Y(2), Oi M(2), Kataoka Y(2), Miyaji K(3), Asari Y(2).
ABSTRACT
BACKGROUND: Blunt thoracic aortic injury is one of the most lethal traumatic injuries. Ruptured cases often result in cardiac arrest before arrival at the hospital, and survival is rare. CASE PRESENTATION: A female patient in her 30 s was struck by an automobile while she was walking across an intersection. She was in a state of shock when emergency services arrived and was in cardiac arrest shortly after arriving at the hospital. A left anterolateral thoracotomy revealed a massive hemothorax secondary to thoracic aortic rupture. In addition, the patient had multiple traumas, including maxillary, pelvic, and lumbar burst fractures. We attempted to directly suture the aortic lesion; however, the increasing blood pressure caused the suture to break. We used a thoracic stent graft while ensuring permissive hypotension. Her postoperative prognosis was positive, and she was transferred to another hospital 85 days later. CONCLUSIONS: We successfully performed a hybrid surgery combining thoracotomy and endovascular repair for this emergency case of blunt thoracic aortic injury with rupture.

2. Front Med (Lausanne). 2022 Nov 21;9:980847. doi: 10.3389/fmed.2022.980847. eCollection 2022.
Seizure as the clinical presentation of massive pulmonary embolism: Case report and literature review.
Leong W(1), Zhang Y(2), Huang X(1), Luo Z(3), Wang Y(1), Rainer TH(4), Wai AKC(1)(4), Huang Y(1).
ABSTRACT
Massive pulmonary embolism (MPE) is a high-risk medical emergency. Seizure as the clinical presentation of MPE is extremely rare, and to our knowledge, there have been no reports on successful percutaneous, catheter-based treatment of MPE presenting with new-onset seizures and cardiac arrest. In this report, we discuss the case of a 64-year-old woman who presented with an episode of seizure that lasted 5 h. Seizure occurred four times within 12 h after arrival at the hospital, and in the end, she sustained a cardiac arrest. The patient had no past history of seizure or cardiopulmonary disease. Bilateral MPE was detected by a computed tomography pulmonary angiogram, and she was successfully treated with percutaneous, catheter-directed anticoagulant therapy. Pulmonary embolism-related seizures are more difficult to diagnose and have higher mortality rates than seizures. MPE should be suspected in patients presenting with new-onset seizures and hemodynamic instability.

3. Turk Kardiyol Dern Ars. 2022 Dec;50(8):610-612. doi: 10.5543/tkda.2022.22439.
Intra-aortic Balloon Occlusion for Refractory Cardiac Arrest in a Patient with Anterior Myocardial Infarction.
Aslanger E(1), Akaslan D(1), Yıldırım Ç(1), Uysaler E(1), Nizam AC(1), Jafarov E(1), Ataş H(1), Tigen MK(1), Mutlu B(1).
ABSTRACT

Despite recent advances in its management, the outcome of cardiac arrest is often poor despite appropriate cardiopulmonary resuscitation. The arteriovenous perfusion gradient achieved dur ing cardiopulmonary resuscitation is associated with the successful return of spontaneous cir culation. Continuous balloon occlusion of the descending aorta is an experimental method that can occlude the "unnecessary" part of the circulation, thus diverting generated pressure and blood flow to the heart and brain. In this study, we present a case report of a patient unre sponsive to standard cardiopulmonary resuscitation, in whom constant intra-aortic balloon occlusion achieved a return of spontaneous circulation and successful survival.

4. J Cardiothorac Surg. 2022 Dec 5;17(1):296. doi: 10.1186/s13019-022-02044-w.
Successful management of hemodynamic instability secondary to saddle pulmonary embolism-induced cardiac arrest using VA-ECMO in advanced malignancy with brain metastases.
Pan J(1), Zhou X(1), Xu Z(1), Chen B(2).
ABSTRACT
BACKGROUND: Saddle pulmonary embolism (SPE) represents a rare type of venous thrombo-embolism that frequently causes circulation collapse and sudden death. While venoarterial extracorporeal membrane oxygenation (VA-ECMO) has been well established as a salvage treatment for SPE-induced circulatory shock, it is infrequently administered in patients with advanced malignancy, especially those with brain metastases, given the potential bleeding complications and an uncertain prognosis. As far, there are rare case reports regarding the successful management of hemodynamic instability secondary to SPE-induced cardiac arrest using VA-ECMO in advanced malignancy patients with brain metastases. CASE PRESENTATION: A 65-year-old woman presenting with cough and waist discomfort who had a history of lung cancer with brain metastases was admitted to the hospital to receive chemoradiotherapy. She suffered sudden cardiac arrest during hospitalization and returned to spontaneous circulation after receiving a 10-min high-quality cardiopulmonary resuscitation. Pulmonary embolism was suspected due to the collapsed hemodynamics and a distended right ventricle identified by echocardiography. Subsequent computed tomographic pulmonary angiography revealed a massive saddle thrombus straddling the bifurcation of the pulmonary trunk. VA-ECMO with adjusted-dose systemic heparinization was initiated to rescue the unstable hemodynamics despite receiving thrombolytic therapy with alteplase. Immediately afterward, the hemodynamic status of the patient stabilized rapidly. VA-ECMO was successfully discontinued within 72 h of initiation without any clotting or bleeding complications. She was weaned off invasive mechanical ventilation on the 6th day of intensive care unit (ICU) admission and discharged from the ICU 3 days later with good neurological function. CONCLUSION: VA-ECMO may be a 'bridging' therapy to circulation recovery during reperfusion therapy for SPE-induced hemodynamic collapse in malignancy patients with brain metastases.

5. SAGE Open Med Case Rep. 2022 Nov 28;10:2050313X221140241. doi: 10.1177/2050313X221140241. eCollection 2022.
An unusual presentation of acute diaphragmatic hernia complicated by tension gastrothorax an under-recognized cause of cardiac arrest due to a fall from a height: A case report and literature review.
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ABSTRACT

A diaphragmatic hernia is a protrusion of the abdominal contents into the negative pressure thoracic cavity through a congenital or acquired diaphragmatic defect. Generally, acquired diaphragmatic hernia is a rare, life-threatening condition that usually follows blunt/penetrating trauma or an iatrogenic cause, resulting in the diaphragmatic rupture, accompanied by the herniation of abdominal visceral organs. We report a 47-year-old male construction worker who sustained a fall from a height of about 30 feet height. He presented with hypoxia initially and, after a primary survey, was found to have a traumatic rupture of the diaphragm with herniation of the stomach and abdominal contents, causing signs of obstructive shock. After adequate resuscitation in the Emergency Department, he was rushed to operating room. There, he suffered two very short pulseless electrical activity cardiac arrests. Therefore, an emergency anterolateral thoracotomy was done, and it was extended into laparotomy to reduce the abdominal contents through the diaphragmatic tear of 12 cm, which restored the spontaneous circulation. He recovered eventually, despite chest infections and pulmonary atelectasis, and was discharged on the 28th day and remained in good condition during the outpatient visit. Tension gastrothorax or viscerothorax is rare, but an under-recognized cause of cardiac arrest in the trauma setting necessitates a vigilant evaluation and early suspicion to prevent a catastrophic outcome. This case report emphasizes the inclusion of tension viscero or abdominal thorax as one of the recognizable causes of a pulseless electrical activity cardiac arrest.