1. Resuscitation. 2018 Jun 30. pii: S0300-9572(18)30327-7. doi: 10.1016/j.resuscitation.2018.06.037. [Epub ahead of print]
Can chest compression release rate or recoil velocity identify rescuer leaning in out-of-hospital cardiopulmonary resuscitation?
Russell JK1, González-Otero DM2, de Gauna SR3, Daya M4, Ruiz J3.
Abstract
BACKGROUND: Measurement of chest velocity has been proposed as an alternative method to identify responder leaning during cardiopulmonary resuscitation (CPR). Leaning is defined in terms of force, but no study has tested the utility of chest velocity in the presence of force measurements that directly measure leaning.
MATERIALS AND METHODS: We analyzed 1004 out-of-hospital cardiac arrest (OHCA) files collected with Q-CPR monitors in the Portland, Oregon, USA metro region from 2006 to 2017. Records contained accelerometry and force signals. For each chest compression, the following metrics were computed: minimum force at the end of the compression (Frelease), compression depth, compression rate, maximum chest velocity during recoil (vrecoil) and maximum rate of change in force during chest release (ʋrelease). A compression was classified as having leaning if Frelease was greater than 2.5 kg-f. The ability of vrecoil and ʋrelease to predict Frelease was estimated with generalized linear models, and their ability to identify leaning with logistic regression.
RESULTS: The data set contained over 1.5 million chest compressions, 21% compliant with 2015 rate and depth guidelines for CPR (the G2015 population). Leaning was uncommon generally (12%), and less common in G2015 compliant compressions (5%). Leaning and Frelease decreased with both vrecoil and ʋrelease but with extensive overlap. Neither vrecoil nor ʋrelease, alone or in combination with chest compression rate and depth, reliably predicted leaning or Frelease.
CONCLUSION: Leaning cannot be reliably identified from vrecoil or ʋrelease, alone or in combination with currently recommended chest compression metrics in out-of-hospital CPR.

2. Acute Med Surg. 2018 Mar 1;5(3):236-240. doi: 10.1002/ams2.336. eCollection 2018 Jul.
The mechanism of blood flow during chest compressions for cardiac arrest is probably influenced by the patient's chest configuration.
Ewy GA1.
Abstract
Aim: Mechanical assist devices are sometimes needed during resuscitation efforts of patients with prolonged cardiac arrest. Two such devices, the AutoPulse and the LUCAS, have different mechanisms of action. We propose that the effectiveness of mechanical assist devices is somewhat dependent on the configuration and compliance of the patient's chest wall.
Methods: A previous study of patients with out-of-hospital cardiac arrest in Arizona reported that survivors were younger and many were observed to have narrow anterior-posterior chest diameters. These observations suggest that the predominant mechanism of blood flow during cardiopulmonary resuscitation of individuals with primary cardiac arrest is influenced by the patient's anterior-posterior chest diameter and compliance. It is proposed that in older individuals with an increased anterior-posterior chest diameter and decreased chest compliance that the AutoPulse, which works by increasing intrathoracic pressures, may be more effective. In contrast, the LUCAS device, which works predominately by compression of the sternum, is probably more effective in patients with narrower anterior-posterior diameters and a more compliant chest.
Results: These hypotheses need to be confirmed by researchers who not only have access to the lateral chest roentgenograms of patients with cardiac arrest, to determine their anterior-posterior chest diameter, but also to the type of mechanical device that was used during resuscitation efforts and their patient's survival. If the observations herein proposed are confirmed, hospitals and paramedics may ideally need to have one of each type of mechanical chest compression unit and select the one to use depending on the patient's age and anterior-posterior chest diameter.
Conclusions: The mechanism of blood flow in patients with cardiac arrest is predominantly secondary to cardiac compression in younger patients with narrow anterior chest diameters and predominately secondary to the thoracic pump mechanism in older patients with emphysema.
Free Article

3. Resuscitation. 2018 Jul 10;130:92-98. doi: 10.1016/j.resuscitation.2018.07.011. [Epub ahead of print]
Assessing the efficacy of the new protocol for chest compressions before definitive cardiac arrest in emergency medical service-witnessed adult out-of-hospital cardiac arrests.
Kurosaki H1, Ohta K2, Wato Y3, Yamashita A4, Inaba H5.
Abstract
AIMS: Japanese emergency medical services (EMS) personnel providing advance life support confirm the absence of a carotid pulse before initiating chest compressions (CCs) in adult out-of-hospital cardiac arrest (OHCA). This

study aims to investigate the efficacy of a new protocol facilitating early CCs before definitive cardiac arrest in enhancing the outcomes of OHCA.
METHODS: The 2011 new protocol facilitated EMS to initiate CCs when the carotid pulse was weak and/or <50/min in comatose adult patients with respiratory arrest (apnoea or agonal breathing) and loss of the radial pulse. During 2008-2015, we compared the neurologically favourable 1-year survival rate of EMS-witnessed OHCA and EMS-confirmed out-of-hospital respiratory arrest (OHRA) in adults before (N = 257 and 34, respectively) and after (N = 255 and 54, respectively) the implementation of the new protocol.
RESULTS: After the new protocol, EMS initiated CCs >1.5 min before definitive cardiac arrest in 31% (80/255) and 33% (18/54) of EMS-witnessed OHCA and EMS-confirmed OHRA, respectively. While the new protocol was not significantly associated with survival of EMS-confirmed OHRA, it was significantly associated with survival of EMS-witnessed OHCA: 9.0% and 14.9%, before and after, P by univariate analysis <0.03; adjusted OR (95% CI) by multivariable logistic regression analysis, 2.01 (1.04-3.90). Neither early start of CCs nor the new protocol was associated with the progression to cardiac arrest in 212 cases with impending cardiac arrest.
CONCLUSIONS: A new EMS protocol facilitating early CCs before definitive cardiac arrest was associated with higher survival of EMS-witnessed OHCA.

REGISTRES, REVISIONS I EDITORIALS

1. J Am Heart Assoc. 2018 Jun 30;7(13). pii: e008571. doi: 10.1161/JAHA.118.008571.
Delphi Analysis of Science Gaps in the 2015 American Heart Association Cardiac Arrest Guidelines.
Panchal AR1,2, Cash RE2, Crowe RP2, Coute R3, Way D4, Aufderheide T5, Merchant RM6.
Abstract
BACKGROUND: Current cardiac arrest guidelines have limited high-quality scientific evidence to support recommendations for care. The quality of scientific evidence on which guidelines are based may correlate with improved patient outcomes and meaningful survival. We sought to develop a prioritized list of knowledge gaps in resuscitation to assist researchers, policy makers, and funding agencies in their decision-making process.
METHODS AND RESULTS: A 4-stage modified Delphi method was used with a panel of cardiac arrest experts. Experts addressed the prompt: "What are the top 3 gaps in knowledge involving cardiac arrest care that should be research priorities for National Institutes of Health/American Heart Association funding to have the greatest impact on public health?" Knowledge gaps were identified in the initial round, rated in a second round, and rank ordered in the third round, and they underwent final review and consensus (final round). The outcome was 10 knowledge gaps, with prioritization of the top 3 gaps. A total of 61 gaps, with 19 distinct themes, were identified by participants. The 10 knowledge gaps most likely to affect public health identified by the expert panel included, in order, the following: telecommunicator cardiopulmonary resuscitation, hemodynamic monitoring for goal-directed resuscitation, reasons why bystanders fail to respond, optimization of postarrest care, out-of-hospital cardiac arrest identification and response, individualizing resuscitation strategies, predicting patients at risk, tools for neuroprognostication, optimal airway management, and optimizing educational strategies.
CONCLUSIONS: Ten priorities for cardiac arrest research were identified, but consensus was not reached on the prioritized top 3. Future research should address these gaps to potentially improve resuscitation guideline evidence quality.
Free Article

2. Resuscitation. 2018 Jun 27;130:21-27. doi: 10.1016/j.resuscitation.2018.06.021. [Epub ahead of print]
Out-of-hospital cardiac arrest termination of resuscitation with ongoing CPR: An observational study.
Yates EJ1, Schmidbauer S2, Smyth AM3, Ward M4, Dorrian S5, Siriwardena AN6, Friberg H2, Perkins GD7.
Abstract
INTRODUCTION: Termination of resuscitation guidelines for out-of-hospital cardiac arrest can identify patients in whom continuing resuscitation has little chance of success. This study examined the outcomes of patients transferred to hospital with ongoing CPR. It assessed outcomes for those who would have met the universal prehospital termination of resuscitation criteria (no shocks administered, unwitnessed by emergency medical services, no return of spontaneous circulation).
METHODS: A retrospective cohort study of consecutive adult patients who were transported to hospital with ongoing CPR was conducted at three hospitals in the West Midlands, UK between September 2016 and November 2017. Patient characteristics, interventions and response to treatment (ROSC, survival to discharge) were identified.
RESULTS: 227 (median age 69 years, 67.8% male) patients were identified. 89 (39.2%) met the universal prehospital termination of resuscitation criteria. Seven (3.1%) were identified with a potentially reversible cause of cardiac arrest. After hospital arrival, patients received few specialist interventions that were not available in the prehospital setting. Most (n = 210, 92.5%) died in the emergency department. 17 were admitted (14 to intensive care), of which 3 (1.3%) survived to hospital discharge. There were no survivors (0%) in those who met the criteria for universal prehospital termination of resuscitation.

CONCLUSION: Overall survival amongst patients transported to hospital with ongoing CPR was very poor. Application of the universal prehospital termination of resuscitation rule, in patients without obvious reversible causes of cardiac arrest, would have allowed resuscitation to have been discontinued at the scene for 39.2% of patients who did not survive.

3. Scand J Trauma Resusc Emerg Med. 2018 Jul 4;26(1):54. doi: 10.1186/s13049-018-0520-3. Identification of the technical and medical requirements for HEMS avalanche rescue missions through a 15-year retrospective analysis in a HEMS in Switzerland: a necessary step for quality improvement. Kottmann A1,2, Carron PN3, Theiler L4,5, Albrecht R4, Tissi M4, Pasquier M3. Abstract

BACKGROUND: Avalanche rescues mostly rely on helicopter emergency medical services (HEMS) and include technical rescue and complex medical situations under difficult conditions. The adequacy of avalanche victim management has been shown to be unexpectedly low, suggesting the need for quality improvement. We analyse the technical rescue and medical competency requirements of HEMS crewmembers for avalanche rescue missions, as well as their clinical exposure. The study aims to identify areas that should be the focus of future quality improvement efforts.

METHODS: This 15-year retrospective study of avalanche rescue by the Swiss HEMS Rega includes all missions where at least one patient had been caught by an avalanche, found within 24 h of the alarm being raised, and transported.

RESULTS: Our analyses included 422 missions (596 patients). Crews were frequently confronted with technical rescue aspects, including winching (29%) and patient location and extrication (48%), as well as multiple casualty accidents (32%). Forty-seven percent of the patients suffered potential or overt vital threat; 29% were in cardiac arrest. The on-site medical management of the victims required a large array of basic and advanced medical skills. Clinical exposure was low, as 56% of the physicians were involved in only one avalanche rescue mission over the study period.

CONCLUSIONS: Our data provide a solid baseline measure and valuable starting point for improving our understanding of the challenges encountered during avalanche rescue missions. We further suggest QI interventions, that might be immediately useful for HEMS operating under similar settings. A coordinated approach using a consensus process to determine quality indicators and a minimal dataset for the specific setting of avalanche rescue would be the logical next step.

4. Resuscitation. 2018 Jun 28. pii: S0300-9572(18)30317-4. doi: 10.1016/j.resuscitation.2018.06.031. [Epub ahead of print]
Approaches to Community Consultation in Exception from Informed Consent: Analysis of Scope, Efficiency, and Cost at Two Centers.
Eubank L1, Lee KS2, Seder DB1, Strout T1, Darrow M2, McDonald C2, May T1, Riker RR1, Kern KB3. Abstract

OBJECTIVES: Community consultation (CC) is fundamental to the Exception from Informed Consent (EFIC) process for emergency research, designed to inform and receive feedback from the target study population about potential risks and benefits. To better understand the effectiveness of different techniques for CC, we evaluated EFIC processes at two centers participating in a trial of early cardiac catheterization following out-of-hospital cardiac arrest.

METHODS: We studied the Institutional Review Board-approved CC activities at Maine Medical Center (MMC) and University of Arizona (AZ) in support of NCT02387398. In Maine, the public was consulted by survey at a professional basketball game and in the emergency department waiting room (in-person group), by multimedia direction to an online website (online group), and by mail (mailing group). Arizona respondents were either approached at a county fair (in-person group) or were directed to an online survey (online group) via social media advertising.

RESULTS: Among 2185 survey respondents, approval rates were high for community involvement and personal participation without individual consent. Community consultation using in-person, online, and mailed surveys offered slightly different approval rates, and the rate of responses by modality differed by age and education level but not ethnicity. Print advertising was the least cost effective at $442 per completed survey.

CONCLUSIONS: Canvassing at public events was the most efficient mode of performing CC, with approval rates similar to mailings, online surveys, and canvassing in other locations. Print advertisements in local papers had a low yield and cost more than other approaches.

5. Resuscitation. 2018 Jun 27. pii: S0300-9572(18)30305-8. doi: 10.1016/j.resuscitation.2018.06.028. [Epub ahead of print]
Outcomes and healthcare-associated costs one year after intensive care-treated cardiac arrest.
Efendijev I1, Folger D2, Raj R3, Reinikainen M 4, Pekkarinen PT2, Litonius E2, Skrifvars MB5. Abstract

BACKGROUND: Despite the significant socioeconomic burden associated with cardiac arrest (CA), data on CA patients' long-term outcome and healthcare-associated costs are limited. The aim of this study was to determine one-year survival, neurological outcome and healthcare-associated costs for ICU-treated CA patients.
METHODS: This is a single-centre retrospective study on adult CA patients treated in Finnish tertiary hospital's ICUs between 2005 and 2013. Patients' personal identification number was used to crosslink data between several nationwide databases in order to obtain data on one-year survival, neurological outcome, and healthcare-associated costs. Healthcare-associated costs were calculated for every patient stratified by cardiac arrest location (OHCA = out-of-hospital cardiac arrest, IHCA = all in-hospital cardiac arrest, ICU-CA = in-ICU cardiac arrest) and initial cardiac rhythm. Cost-effectiveness was estimated by dividing total healthcare-associated costs for all patients from the respective group by the number of survivors and survivors with favourable neurological outcome.
RESULTS: The study population included 1,024 ICU-treated CA patients. The sum of costs for all patients was €50,847,540. At one-year after CA, 58% of OHCAs, 44% of IHCAs, and 39% of ICU-CAs were alive. Of one-year survivors 97% of OHCAs, 88% of IHCAs, and 93% of ICU-CAs had favourable neurological outcome. Effective cost per one-year survivor was €76,212 for OHCAs, €144,168 for IHCAs, and €239,468 for ICU-CAs. Effective cost per one-year survivor with favourable neurological outcome was €81,196 for OHCAs, €164,442 for IHCAs, and €257,207 for ICU-CAs.
CONCLUSIONS: In-ICU CA patients had the lowest one-year survival with the effective cost per survivor three times higher than for OHCAs.

6. S D Med. 2018 Feb;71(2):72-79.
Using Data Science to Provide Preliminary Estimates of Out-of-Hospital Cardiac Arrest in Rural South Dakota.
Samra HA1, Sudhagoni RG2, Kupershmidt S3, Seiber MJ4, Fuller MD5, Pickthorn ST5, Lowmiller K1.
Abstract
BACKGROUND: Out-of-hospital cardiac arrest (OHCA) is the cessation of electric or mechanical activity of the heart, confirmed by absence of circulation. Survival to hospital dismissal rates have remained low nationwide despite considerable effort to improve treatment. Current initiatives seek systems approaches that optimize care at each point along the "chain of survival." Systems approaches rely on the availability of robust data sets to understand and control variables that can be highly interdependent. The current report seeks to provide a source of reliable data of OHCA for South Dakota.
METHODS:
Using the "Utstein" guidelines for reviewing and reporting OHCA resuscitations issued by the American Heart Association in 2014, we analyzed the EMS data that were captured by ePCR between January 1, 2013 and December 31, 2015. Inclusion criteria were 911 calls in 2013-2015, where first impression of the call was cardiac arrest. Exclusion criteria were inconsistent and missing data.
RESULTS:
There were 1,781 OHCA in the ePCR, and 1,280 cases had survival information, with 378 victims surviving to ED. Overall, SD OHCA rates were lower than those reported nationally. Survival was the highest in patients with a shockable rhythm and when victim received bystander CPR. The odds for survival were greater if the arrest took place in an urban setting compared to a rural setting and if the victim received care from an EMS unit that did not have a "hardship" designation.
DISCUSSION:
Recommendations for future efforts include: (1) Develop and employ quality improvement methodologies for data collection and utilization to minimize the impact of poor or missing data, (2) Assess the educational and training needs of the EMS staff to properly collect, analyze, and develop actionable outputs, (3) Provide public training to include hands-only CPR and PulsePoint.

7. Am J Emerg Med. 2018 Jul 9. pii: S0735-6757(18)30495-9. doi: 10.1016/j.ajem.2018.06.031. [Epub ahead of print]
Prehospital advanced cardiac life support by EMT with a smartphone-based direct medical control for nursing home cardiac arrest.
Kim C1, Choi HJ2, Moon H3, Kim G 4, Lee C5, Cho JS6, Kim S7, Lee K8, Choi H9, Jeong W10.
Abstract
OBJECTIVE: To compare the survival to discharge between nursing home (NH) cardiac arrest patients receiving smartphone-based advanced cardiac life support (SALS) and basic life support (BLS).
METHODS: The SALS registry includes data on cardiac arrest from 7 urban and suburban areas in Korea between July 2015 and December 2016. We include adult patients (>18) with out-of-hospital cardiac arrest (OHCA) of medical causes and EMS attended and dispatched in. SALS is an advanced field resuscitation including drug administration by paramedics with video communication-based direct medical direction. Prehospital resuscitation method was key exposure (SALS, BLS). The primary outcome was survival to discharge.
RESULTS: A total of 616 consecutive out-of-hospital cardiopulmonary resuscitation cases in NHs were recorded,

and 199 (32.3%) underwent SALS. Among the NH arrest patients, the survival discharge rate was a little higher in the SALS group than the BLS group (4.0% vs 1.7%), but the difference was not significant (P = 0.078). Survival discharge with good neurologic outcome rates was 0.5% in the SALS group and 1.0% in the BLS group (P = 0.119). On the other hand, in the non-NH group, all outcome measures significantly improved when SALS was performed compared to BLS alone (survival discharge rate: 10.0% vs 7.3%, P = 0.001; good neurologic outcome: 6.8% vs 3.3%, P < 0.001).
CONCLUSIONS: As a result of providing prehospital ACLS with direct medical intervention through remote video calls to paramedics, the survival to discharge rate and that with good neurologic outcome (CPC 1, 2) of non-NH patients significantly improved, however those of NH patients were not significantly increased.

8. Acute Med Surg. 2018 Apr 25;5(3):249-258. doi: 10.1002/ams2.340. eCollection 2018 Jul.
The profile of Japanese Association for Acute Medicine - out-of-hospital cardiac arrest registry in 2014-2015.
Kitamura T1, Iwami T2, Atsumi T3, Endo T4, Kanna T5, Kuroda Y6, Sakurai A7, Tasaki O8, Tahara Y9, Tsuruta R10, Tomio J11, Nakata K12, Nachi S13, Hase M14, Hayakawa M15, Hiruma T16, Hiasa K17, Muguruma T18, Yano T19, Shimazu T20, Morimura N16; special committee that aims to improve survival after out-of-hospital cardiac arrest (OHCA) by providing evidence-based therapeutic strategy and emergency medical system from the Japanese Association for Acute Medicine (JAAM).
Abstract
Aim: To describe the registry design of the Japanese Association for Acute Medicine - out-of-hospital cardiac arrest (JAAM-OHCA) Registry as well as its profile on hospital information, patient and emergency medical service characteristics, and in-hospital procedures and outcomes among patients with OHCA who were transported to the participating institutions.
Methods: The special committee aiming to improve the survival after OHCA by providing evidence-based therapeutic strategies and emergency medical systems from the JAAM has launched a multicenter, prospective registry that enrolled OHCA patients who were transported to critical care medical centers or hospitals with an emergency care department. The primary outcome was a favorable neurological status 1 month after OHCA.
Results: Between June 2014 and December 2015, a total of 12,024 eligible patients with OHCA were registered in 73 participating institutions. The mean age of the patients was 69.2 years, and 61.0% of them were male. The first documented shockable rhythm on arrival of emergency medical services was 9.0%. After hospital arrival, 9.4% underwent defibrillation, 68.9% tracheal intubation, 3.7% extracorporeal cardiopulmonary resuscitation, 3.0% intra-aortic balloon pumping, 6.4% coronary angiography, 3.0% percutaneous coronary intervention, 6.4% targeted temperature management, and 81.1% adrenaline administration. The proportion of cerebral performance category 1 or 2 at 1 month after OHCA was 3.9% among adult patients and 5.5% among pediatric patients.
Conclusions: The special committee of the JAAM launched the JAAM-OHCA Registry in June 2014 and continuously gathers data on OHCA patients. This registry can provide valuable information to establish appropriate therapeutic strategies for OHCA patients in the near future.
Free Article

9. Circulation. 2018 Jul 9. pii: CIRCULATIONAHA.117.033211. doi: 10.1161/CIRCULATIONAHA.117.033211. [Epub ahead of print]
Racial Differences in Long-Term Outcomes Among Older Survivors of In-Hospital Cardiac Arrest.
Chen LM1, Nallamothu BK2, Spertus JA3, Tang Y 4, Chan PS3; GWTG-R Investigators.
Abstract
Background -Black patients have worse in-hospital survival than white patients after in-hospital cardiac arrest (IHCA), but less is known about longterm outcomes. We sought to assess among IHCA survivors whether there are additional racial differences in survival after hospital discharge and to explore potential reasons for differences.
Methods -This was a longitudinal study of patients ≥65 years of age who had an IHCA and survived until hospital discharge between 2000 and 2011 from the national Get With The Guidelines-Resuscitation registry whose data could be linked to Medicare claims data. Sequential hierarchical modified Poisson regression models evaluated the proportion of racial differences explained by patient, hospital, and unmeasured factors. Our exposure was black or white race. Our outcome was survival at 1, 3, and 5 years. Results -Among 8764 patients who survived to discharge, 7652 (87.3%) were white and 1112 (12.7%) were black. Black patients with IHCA were younger, more frequently female, sicker with more comorbidities, less likely to have a shockable initial cardiac arrest rhythm, and less likely to be evaluated with coronary angiography after initial resuscitation. At discharge, black patients were also more likely to have at least moderate neurological disability and less likely to be discharged home. Compared with white patients and after adjustment only for hospital site, black patients had lower 1-year (43.6% versus 60.2%; relative risk [RR], 0.72), 3-year (31.6% versus 45.3%; RR, 0.71), and 5-year (23.5% versus 35.4%; RR, 0.67; all P<0.001) survival. Adjustment for patient factors explained 29% of racial differences in 1-year survival (RR, 0.80; 95% confidence interval, 0.75-0.86), and further adjustment for hospital treatment factors explained an additional 17% of racial differences (RR, 0.85; 95% confidence interval, 0.80-0.92). Approximately half of the racial difference

in 1-year survival remained unexplained, and the degree to which patient and hospital factors explained racial differences in 3-year and 5-year survival was similar. Conclusions -Black survivors of IHCA have lower long-term survival compared with white patients, and about half of this difference is not explained by patient factors or treatments after IHCA. Further investigation is warranted to better understand to what degree unmeasured but modifiable factors such as postdischarge care account for unexplained disparities.

10. Resuscitation. 2018 Jul 7. pii: S0300-9572(18)30337-X. doi: 10.1016/j.resuscitation.2018.07.006. [Epub ahead of print]
Associations between Body Size and Outcomes of Adult In-hospital Cardiac Arrest: A Retrospective Cohort Study.
Wang CH1, Huang CH1, Chang WT1, Fu CM 2, Wang HC2, Tsai MS1, Yu PH3, Wu YW4, Ma MH5, Chen WJ6.
Abstract
AIM: Animal studies have demonstrated that hemodynamic-directed cardiopulmonary resuscitation (CPR) improves outcomes following cardiac arrest compared with the "one-size-fits-all" algorithm. We investigated whether body size of patients is correlated with outcomes of in-hospital cardiac arrest (IHCA).
METHODS: A retrospective study in a single centre was conducted. Adult patients experiencing IHCA between 2006 and 2015 were screened. Body mass index (BMI) was calculated using body weight and height measured at hospital admission. Thoracic anteroposterior diameter (APD) was measured by analysing computed tomography images. Multivariate logistic regression analysis was used to study the associations between independent variables and outcomes. Generalised additive models were used to identify cut-off points for continuous variables.
RESULTS: A total of 766 patients were included, and 60.4% were male. Their mean age was 62.8 years. Mean BMI was 22.9 kg/m2, and the mean thoracic APD was 21.4 cm. BMI > 23.2 kg/m2 was inversely associated with a favourable neurological outcome (odds ratio [OR]: 0.30, 95% confidence interval [CI]: 0.13-0.68; p-value = 0.004), while thoracic APD was not. When the interaction term was analysed, BMI > 23.2 (kg/m2) ×thoracic APD > 18.5 (cm) was inversely associated with both a favourable neurological outcome (OR: 0.33, 95% CI: 0.16-0.69; p-value = 0.003) and survival to hospital discharge (OR: 0.46, 95% CI: 0.26-0.81; p-value = 0.007).
CONCLUSION: Higher BMI and thoracic APD was correlated with worse outcomes following IHCA. For those patients, it might be better to perform CPR under guidance of physiological parameters rather than a "one-size-fits-all" resuscitation algorithm to improve outcomes.

11. West J Emerg Med. 2018 Jul;19(4):654-659. doi: 10.5811/westjem.2018.3.37051. Epub 2018 May 15.
Paramedic Out-of-hospital Cardiac Arrest Case Volume Is a Predictor of Return of Spontaneous Circulation.
Tuttle JE1, Hubble MW1.
Abstract
Introduction: Many factors contribute to the survival of out-of-hospital cardiac arrest (OHCA). One such factor is the quality of resuscitation efforts, which in turn may be a function of OHCA case volume. However, few studies have investigated the OHCA case volume-survival relationship. Consequently, we sought to develop a model describing the likelihood of return of spontaneous circulation (ROSC) as a function of paramedic cumulative OHCA experience.
Methods: We conducted a statewide retrospective study of cardiac arrest using the North Carolina Prehospital Care Reporting System. Adult patients suffering a witnessed, non-traumatic cardiac arrest between January 2012 and June 2014 were included. Using logistic regression, we calculated an adjusted odds ratio (OR) for the influence of the preceding five-year paramedic OHCA case volume on ROSC while controlling for the potentially confounding variables identified a priori as patient age, gender, and non-Caucasian race; shockable presenting rhythm; layperson/first responder cardiopulmonary resuscitation (CPR); and emergency medical services (EMS) response time.
Results: Of the 6,405 patients meeting inclusion criteria, 3,155 (49.3%) experienced ROSC. ROSC was more likely among patients treated by paramedics with ≥ 15 OHCA experiences during the preceding five years (OR [1.21], p<0.01). ROSC was also more likely among patients with shockable initial rhythms (OR [2.35], p<0.01) and who received layperson/first responder CPR (OR [1.77], p<0.01). Increasing patient age (OR [0.996], p=0.02), male gender (OR [0.742], p<0.01), and increasing EMS response time (OR [0.954], p<0.01) were associated with a decreased likelihood of ROSC. Non-Caucasian race was not an independent predictor of ROSC.
Conclusion: We found that a paramedic five-year OHCA case volume of ≥ 15 is significantly associated with ROSC. Further study is needed to determine the specific actions of these more experienced paramedics who are responsible for the increased likelihood of ROSC, as well as the influence of case volume on the longer-term outcome measures of hospital discharge and neurological function.
Free Article

12. Resuscitation. 2018 Jul 20;130:124-132. doi: 10.1016/j.resuscitation.2018.07.019. [Epub ahead of print]
Implementation of a bundle of Utstein cardiopulmonary resuscitation programs to improve survival outcomes after out-of-hospital cardiac arrest in a metropolis: A before and after study.
Abstract

INTRODUCTION: The study aimed to determine the effect of community implementation of a bundles of cardiopulmonary resuscitation (CPR) programs on outcomes in out-of-hospital cardiac arrest (OHCA). METHODS: A before- and after-intervention study was performed in a metropolis. Emergency medical services (EMS)-treated adults and cardiac OHCAs were included. Three new CPR programs was implemented in January 2015: 1) a high-quality dispatcher-assisted CPR program (DACPR), 2) a multi-tier response (MTR) program using fire engines or basic life support vehicles, and 3) a feedback CPR (FCPR) program with professional recording and feedback of CPR process. The outcomes (cerebral performance category 1 or 2, good CPC) and survival to discharge) were compared between study period (2015-2016) and control period (2013-2014). RESULTS: Overall, 6201 and 6469 patients were included in the control period and the study period, respectively. During the post-intervention period, the proportion of OHCA patients who underwent three types of cardiopulmonary resuscitation programs increased significantly compared to those in the pre-intervention period. DACPR increased from 38.3% to 44.3%, MTR increased from 0.0% to 37.5%, and FCPR increased from 25.3% to 61.5%. (All p values <0.001). Good neurological recovery and survival to discharge were significantly increased from 5.4% to 6.8%, and from 9.6% to 10.9%. The adjusted odds ratio (95% confidence intervals) of the study period was 1.45 (1.12-1.87) for good CPC, and 1.31 (1.09-1.58) for survival to discharge. CONCLUSIONS: The citywide implementation of a bundle of UTIS CPR programs was associated with significantly better OHCA outcomes.

13. Resuscitation. 2018 Jul 24. pii: S0300-9572(18)30366-6. doi: 10.1016/j.resuscitation.2018.07.023. [Epub ahead of print]
Survival and variability over time from out of hospital cardiac arrest across large geographically diverse communities participating in the Resuscitation Outcomes Consortium.
Zive DM1, Schmicker R2, Daya M2, Kudenchuk P2, Nichol G2, Rittenberger JC2, Aufderheide T2, Vilke GM2, Christenson J2, Buick JE2, Kaila K2, May S2, Rea T2, Morrison LJ2; ROC Investigators2.
Abstract
BACKGROUND: The Resuscitation Outcomes Consortium (ROC)epidemiological registry (Epistry) provides opportunities to assess trends in out-of-hospital cardiac arrest treatment and outcomes. METHODS: Patient, event, system, treatment, and outcome data from adult (>18 years) out-of-hospital cardiac arrest (OHCA) from 10 geographically diverse North American ROC sites over four 12-month epochs, from July 1, 2011 to June 30, 2015, were assessed. Descriptive statistics were used to characterize the sample and logistic regression assessed the association of study epoch and key covariates on survival. RESULTS: Overall, 85,553 patients were assessed by Emergency Medical Services (EMS) and 45,516 (53.2%, site range 30.4% to 69.9%) had resuscitation attempted by EMS. Patient and event characteristics were consistent except for increases in bystander CPR (41.3% to 44.9%) and bystander AED application (3.9% to 5.2%). EMS CPR depth and compression fraction increased while pre-shock pause interval decreased. Targeted temperature management was performed in 51.1% of admitted patients and early coronary angiography in 30.2%. Survival to hospital discharge improved (from 10.9% to 11.3% across epochs) with epoch significantly associated with survival ($p < 0.001$) showing an increasing trend in survival over time. ($p = 0.02$). Marked site variation in survival persisted within and across epochs (overall site range: 4.2% to 19.8%). Patients with an initially shockable rhythm (VT/VF) had an overall survival of 32.2% (site range: 11.9%-47.1%) while survival in bystander witnessed VT/VF was 35.8% (site range: 12.9%-53.1%).
CONCLUSIONS: Survival from adult OHCA in multiple large geographically-separate sites improved over the study period. Marked site differences in survival persist and addressing this variation is essential to improve outcomes from OHCA across North America.

14. Medicine (Baltimore). 2018 Jul;97(30):e11607. doi: 10.1097/MD.0000000000011607.
An analysis of the relationship between the applied medical rescue actions and the return of spontaneous circulation in adults with out-of-hospital sudden cardiac arrest.
Nadolny K1, Szarpak L2, Gotlib J3, Panczyk M3, Sterlinski M4, Ladny JR1, Smereka J5, Galazkowski R6.
Abstract
Sudden cardiac arrest (SCA) is a significant medical and social issue, the main cause of death in Europe and the United States.The aim of the research was to evaluate the effectiveness of emergency medical procedures applied by emergency medical teams in prehospital care in the context of return of spontaneous circulation (ROSC).The case-control study was based on the medical documentation of the Rescue Service in Katowice (responsible for monitoring 2.7 million inhabitants of the region) referring to 2016. The research involved exclusively adults (ie, individuals older than 18 years) with out-of-hospital cardiac arrest (OHCA). After considering the above inclusion criteria, there were 1603 dispatch order forms (0.64% of all dispatch orders) involved in further research.On the basis of the emergency medical procedure forms, the actions of emergency medical teams were verified as medical procedures (endotracheal intubation, the use of suction pumps, defibrillation, the use of alternatives providing airway patency and ROSC was determined.The analysis covered 1603 cases of OHCA. SCA turned out more frequent in men than in women (P = .000). Most often, SCA occurred in domestic conditions during the day and

was witnessed by a third person. In 59.9% of the cases, actions were taken by witnesses, which increased the probability of ROSC. Patients were usually intubated (51.4%). Respirators were used less frequently (20.2%). Ventricular fibrillation (VF) was reported only in 22.0% of the cases. The ROSC rate was higher in the group of patients with diagnosed VF than in those with nonshockable rhythms (VF, 55.43% vs asystole, 24.05%; P = .000).Successful resuscitation depends on the quality of emergency medical procedures performed at the place of incident. The highest probability of ROSC is related with defibrillation (in the cases of VF or ventricular tachycardia with no pulse), intubation, the application of a respirator, and performing mechanical ventilation, as well as with a shorter time from dispatch to arrival.
Free Article

CAUSES DE L'ACR

1. J Clin Anesth. 2018 Jul 10;50:78-90. doi: 10.1016/j.jclinane.2018.06.005. [Epub ahead of print]
Perioperative cardiac arrests - A subanalysis of the anesthesia -related cardiac arrests and associated mortality.
Sobreira-Fernandes D1, Teixeira L2, Lemos TS3, Costa L3, Pereira M3, Costa AC3, Couto PS3.
Abstract
STUDY OBJECTIVE: To determine the incidence, risk factors, and predictors of survival of perioperative cardiac arrests (PCAs) occurring in patients who underwent non-cardiac and non-obstetric surgery from January 2008 to May 2015 at a tertiary hospital; determine the incidence and risk factors of anesthesia-related PCA.
DESIGN: Retrospective observational study.
SETTING: Operating room and postoperative recovery area.
PATIENTS: Sixty-two PCA cases from an anesthesia database of 122,289 anesthetics.
INTERVENTIONS: Each PCA was classified as anesthesia-related, partially anesthesia-related, or anesthesia unrelated. The main outcome variables were occurrence of PCA, survival at least 1 h after initial resuscitation and survival to hospital discharge. To determine the risk factors for PCA, for each patient who suffered a PCA, two other patients that underwent anesthesia on the same day and in the same operating suite were selected.
MEASUREMENTS: Three sets of variables were collected; patient-related, surgical procedure-related, and PCA-related.
MAIN RESULTS: The incidence of PCAs of all causes was 5.07 per 10,000 anesthetics, and the associated mortality was 2.9 per 10,000 anesthetics. The independent risk factors for occurrence were: ASA PS score higher than 3, diagnosed cardiac disease, and the use of vasopressors. Decreased survival was associated with: higher ASA PS score, urgent surgical procedures of a higher complexity, use of vasopressors, documented hypotension prior to PCA, and arrests due to bleeding. The incidence of anesthesia-related PCAs was 0.74 per 10,000 anesthetics, and the associated mortality was 0.08 per 10,000 anesthetics. The main causes of anesthesia-related PCAs were associated with medication and airway/ventilation, and the independent risk factors for occurrence were: ASA PS score higher than 3 and diagnosed cardiac disease.
CONCLUSIONS: Most PCAs were not due to anesthesia-related causes, and anesthesia-related PCAs were associated with improved survival. Improvements in the management of high-risk patients, medication administration, and airway/ventilation management may result in better outcomes.

2. Resuscitation. 2018 Jul 5. pii: S0300-9572(18)30334-4. doi: 10.1016/j.resuscitation.2018.07.004. [Epub ahead of print]
Usefulness of early plasma S-100B Protein and Neuron-Specific Enolase measurements to identify cerebrovascular etiology of out-of-hospital cardiac arrest.
Mongardon N1, Arnaout M2, Geri G3, Chenevier-Gobeaux C4, Deye N5, Legriel S6, Daviaud F2, Merceron S7, Marin N8, Pene F2, Mira JP2, Cariou A3.
Abstract
BACKGROUND: While S-100B protein and Neuron-Specific Enolase (NSE) dosages have been extensively investigated for neurological prognostication after cardiac arrest (CA), there is no data about their ability to detect a cerebrovascular cause of CA. We assessed the utility of plasma S-100B protein and NSE measurements for early diagnosis of primary neurological cause in resuscitated CA patients.
PATIENTS AND METHODS: Case control study based on two prospectively acquired CA databases. Patients with a primary cerebrovascular etiology were compared with randomly selected CA of non-neurological cause. S-100B protein and NSE were measured at ICU admission in all patients.
RESULTS: CA was due to a cerebrovascular etiology in 18 patients (subarachnoid hemorrhage, n = 15; ischemic stroke, n = 3), with an ICU mortality of 100%. Comparative group was constituted with 66 patients (cardiac etiology n = 45, respiratory etiology n = 21), with an ICU mortality of 71%. Admission S-100B protein concentration was 2.0 [0.63-7.15] µg/L in the cerebrovascular group and 0.45 [0.24-1.95] in the non-cerebrovascular group ($p < 0.001$). In contrast, NSE concentration was similar in cerebrovascular and non-cerebrovascular etiologies (35 [25-103] µg/L vs. 27 [19-47] respectively, $p = 0.16$). Area under ROC curves for S-100B protein and NSE to predict cerebrovascular cause of CA was 0.75 [95%CI: 0.64-0.87] and 0.61 [95%CI: 0.45-0.76], respectively.

CONCLUSIONS: Even if S-100B protein dosage performs slightly better than NSE, early dosages of these biomarkers are poorly predictive of a cerebrovascular etiology of CA. Our results suggest that early measurement of brain biomarkers should not be recommended to tailor the imaging strategy employed to investigate the CA cause.

3. J Am Heart Assoc. 2018 Jul 6;7(14). pii: e009163. doi: 10.1161/JAHA.118.009163.
Grand Sumo Tournaments and Out-of-Hospital Cardiac Arrests in Tokyo.
Hagihara A1, Onozuka D2, Hasegawa M3, Miyazaki S4, Nagata T5.
Abstract
BACKGROUND: Sumo wrestling is a demanding sport. Although watching sumo wrestling may have cardiovascular effects, no studies of this relationship have been performed. Thus, we aimed to evaluate the association between sumo wrestling tournaments and the rate of out-of-hospital cardiac arrests.
METHODS AND RESULTS: We counted the daily number of patients aged 18 to 110 years who had an out-of-hospital cardiac arrest of presumed-cardiac origin in the Tokyo metropolis between 2005 and 2014. A Poisson regression was used to model out-of-hospital cardiac arrests of presumed-cardiac origin per day. Exposure days were the days on which a sumo tournament was held and broadcast, whereas control days were all other days. Events that occurred on exposure days were compared with those that occurred on control days. Risk ratios for out-of-hospital cardiac arrests on Grand Sumo tournaments days compared with control days were estimated. In total, 71 882 out-of-hospital cardiac arrests met the inclusion criteria. We recorded a 9% increase in the occurrence of out-of-hospital cardiac arrests on the day of a sumo tournament compared with control days. In patients aged 75 to 110 years, we found a 13% increase in the occurrence of out-of-hospital cardiac arrests on the day of a sumo tournament compared with control days.
CONCLUSIONS: We found a significant increase in the occurrence of out-of-hospital cardiac arrests on the days of sumo tournaments compared with control days in the Tokyo metropolis between 2005 and 2014. Further studies are needed to verify these initial findings on sumo tournaments and cardiovascular events.

4. Resuscitation. 2018 Jul 19. pii: S0300-9572(18)30361-7. doi: 10.1016/j.resuscitation.2018.07.018. [Epub ahead of print]
Severity of ischemic heart disease and presenting rhythm in patients with out-of-hospital cardiac arrest.
Granfeldt A1, Adelborg K2, Wissenberg M3, Møller Hansen S4, Torp-Pedersen C4, Christensen EF5, Andersen LW6, Christiansen CF7.
Abstract
INTRODUCTION: Ischemic heart disease (IHD) is associated with a shockable rhythm in out-of-hospital cardiac arrest (OHCA). However, the impact of IHD severity on first recorded rhythm is unknown. We hypothesized that the strength of the association between IHD and shockable rhythm increases with increasing IHD severity.
METHODS: OHCA patients were identified in the Danish Cardiac Arrest Registry (20012014). Population-based registries were used to identify chronic diseases, cardiac procedures such as coronary angiography (CAG), percutaneous coronary intervention (PCI), coronary artery bypass grafting (CABG) and drug prescriptions. Severity of IHD was categorized as 1) No diagnosis of IHD, 2) IHD without previous CAG, PCI or CABG, 3) IHD with CAG, 4) IHD with PCI, and 5) IHD with CABG. Adjusted odds ratios (ORs) for a shockable rhythm was computed using multivariable logistic regression.
RESULTS: Of 34,749 patients with OHCA, 6,325 (18.2%) patients had a diagnosis of IHD. The prevalence of a shockable rhythm was higher for patients with a previous diagnosis of IHD (25.6%) and for those with previous CAG (33.3%), PCI (36.4%) or CABG (34.0%) when compared to patients without IHD (21.2%). IHD was associated with shockable rhythm (OR = 1.69, 95%CI 1.55-1.85) when compared to patients without IHD. The association with shockable rhythm was higher for patients with a history of CAG (OR = 1.92, 95%CI 1.67-2.20) and PCI (OR = 1.93, 95%CI 1.67-2.23), but similar in patients with CABG (OR = 1.69, 95%CI 1.37-2.10).
CONCLUSION: IHD was associated with a shockable rhythm, with a moderate increase in the association in patients with a CAG or PCI procedure.

ETCO2

1. Resuscitation. 2018 Jan;122:19-24. doi: 10.1016/j.resuscitation.2017.11.040. Epub 2017 Nov 13.
Predicting ROSC in out-of-hospital cardiac arrest using expiratory carbon dioxide concentration: Is trend-detection instead of absolute threshold values the key?
Brinkrolf P1, Borowski M2, Metelmann C3, Lukas RP4, Pidde-Küllenberg L4, Bohn A5.
Abstract
AIM: Guidelines recommend detecting return of spontaneous circulation (ROSC) by a rising concentration of carbon dioxide in the exhalation air. As CO2 is influenced by numerous factors, no absolute cut-off values of CO2 to detect ROSC are agreed on so far. As trends in CO2 might be less affected by influencing factors, we investigated an approach which is based on detecting CO2-trends in real-time.
METHODS: We conducted a retrospective case-control study on 169 CO2 time series from out of hospital cardiac

arrests resuscitated by Muenster City Ambulance-Service, Germany. A recently developed statistical method for real-time trend-detection (SCARM) was applied to each time series. For each series, the percentage of time points with detected positive and negative trends was determined.
RESULTS: ROSC time series had larger percentages of positive trends than No-ROSC time series (p=0.003). The median percentage of positive trends was 15% in the ROSC time series (IQR: 5% to 23%) and 7% in the No-ROSC time series (IQR: 3% to 14%). A receiver operating characteristic (ROC) analysis yielded an optimal threshold of 13% to differentiate between ROSC and No-ROSC cases with a specificity of 58.4% and sensitivity of 73.9%; the area under the curve was 63.5%.
CONCLUSION: Patients with ROSC differed from patients without ROSC as to the percentage of detected CO2 trends, indicating the potential of our real-time trend-detection approach. Since the study was designed as a proof of principle and its calculated specificity and sensitivity are low, more research is required to implement CO2-trend-detection into clinical use.

DONACIÓ D'ÒRGANS

1. Transplant Direct. 2018 Jun 13;4(7):e366. doi: 10.1097/TXD.0000000000000802. eCollection 2018 Jul. First Scandinavian Protocol for Controlled Donation After Circulatory Death Using Normothermic Regional Perfusion.
Foss S1, Nordheim E1,2, Sørensen DW3, Syversen TB3, Midtvedt K1,2, Åsberg A1,4, Dahl T5, Bakkan PA1, Foss AE1, 6,7, Geiran OR2,5, Fiane AE2,5, Line PD1,2.
Abstract
Background: Donation after circulatory death (DCD) can increase the pool of available organs for transplantation. This pilot study evaluates the implementation of a controlled DCD (cDCD) protocol using normothermic regional perfusion in Norway.
Methods: Patients aged 16 to 60 years that are in coma with documented devastating brain injury in need of mechanical ventilation, who would most likely attain cardiac arrest within 60 minutes after extubation, were eligible. With the acceptance from the next of kin and their wish for organ donation, life support was withdrawn and cardiac arrest observed. After a 5-minute no-touch period, extracorporeal membrane oxygenation for post mortem regional normothermic regional perfusion was established. Cerebral and cardiac reperfusion was prevented by an aortic occlusion catheter. Measured glomerular filtration rates 1 year postengraftment were compared between cDCD grafts and age-matched grafts donated after brain death (DBD).
Results: Eight cDCD were performed from 2014 to 2015. Circulation ceased median 12 (range, 6-24) minutes after withdrawal of life-sustaining treatment. Fourteen kidneys and 2 livers were retrieved and subsequently transplanted. Functional warm ischemic time was 26 (20-51) minutes. Regional perfusion was applied for 97 minutes (54-106 minutes). Measured glomerular filtration rate 1 year postengraftment was not significantly different between cDCD and donation after brain death organs, 75 (65-76) vs 60 (37-112) mL/min per 1.73 m2 (P = 0.23). No complications have been observed in the 2 cDCD livers.
Conclusion: A protocol for cDCD is successfully established in Norway. Excellent transplant outcomes have encouraged us to continue this work addressing the shortage of organs for transplantation.
PMCID: PMC6056274

FEEDBACK

1. Resuscitation. 2018 Jul 3;130:111-117. doi: 10.1016/j.resuscitation.2018.06.035. [Epub ahead of print] Impact of a CPR feedback device on healthcare provider workload during simulated cardiac arrest.
Brown LL1, Lin Y2, Tofil NM3, Overly F4, Duff JP5, Bhanji F6, Nadkarni VM7, Hunt EA8, Bragg A9, Kessler D10, Bank I11, Cheng A12; International Network for Simulation-based Pediatric Innovation, Research, Education CPR Investigators (INSPIRE).
Abstract
OBJECTIVE: We aimed to describe the differences in workload between team leaders and CPR providers during a simulated pediatric cardiac arrest, to evaluate the impact of a CPR feedback device on provider workload, and to describe the association between provider workload and the quality of CPR.
METHODS: We conducted secondary analysis of data from a randomized trial comparing CPR quality in teams with and without use of a real-time visual CPR feedback device [1]. Healthcare providers (team leaders and CPR providers) completed the NASA Task Load Index survey after participating in a simulated cardiac arrest scenario. The effect of provider roles and real-time feedback on workload were compared with independent t-tests.
RESULTS: Team leaders reported higher levels of mental demand, temporal demand, performance-related workload and frustration, while CPR providers reported comparatively higher physical workload. CPR providers reported significantly higher average workload (control 58.5 vs. feedback 62.3; p = 0.035) with real-time feedback provided compared to the group without feedback. Providers with high workloads (average score >60) had an increased percentage of time with guideline-compliant CPR depth versus those with low workloads (average score

<60) (p = 0.034).
CONCLUSIONS: Healthcare providers reported high workloads during a simulated pediatric cardiac arrest. Physical and mental workloads differed based on provider role. CPR providers using a CPR feedback device reported increased average workloads. The quality of CPR improved with higher reported physical workloads.

FÀRMACS

1. N Engl J Med. 2018 Jul 18. doi: 10.1056/NEJMoa1806842. [Epub ahead of print]
A Randomized Trial of Epinephrine in Out-of-Hospital Cardiac Arrest.
Perkins GD1, Ji C1, Deakin CD1, Quinn T1, Nolan JP1, Scomparin C1, Regan S1, Long J1, Slowther A1, Pocock H1, Black JJM1, Moore F1, Fothergill RT1, Rees N1, O'Shea L1, Docherty M1, Gunson I1, Han K1, Charlton K1, Finn J1, Petrou S1, Stallard N1, Gates S1, Lall R1; PARAMEDIC2 Collaborators.
Abstract
Background: Concern about the use of epinephrine as a treatment for out-of-hospital cardiac arrest led the International Liaison Committee on Resuscitation to call for a placebo-controlled trial to determine whether the use of epinephrine is safe and effective in such patients.
Methods: In a randomized, double-blind trial involving 8014 patients with out-of-hospital cardiac arrest in the United Kingdom, paramedics at five National Health Service ambulance services administered either parenteral epinephrine (4015 patients) or saline placebo (3999 patients), along with standard care. The primary outcome was the rate of survival at 30 days. Secondary outcomes included the rate of survival until hospital discharge with a favorable neurologic outcome, as indicated by a score of 3 or less on the modified Rankin scale (which ranges from 0 [no symptoms] to 6 [death]).
Results: At 30 days, 130 patients (3.2%) in the epinephrine group and 94 (2.4%) in the placebo group were alive (unadjusted odds ratio for survival, 1.39; 95% confidence interval [CI], 1.06 to 1.82; P=0.02). There was no evidence of a significant difference in the proportion of patients who survived until hospital discharge with a favorable neurologic outcome (87 of 4007 patients [2.2%] vs. 74 of 3994 patients [1.9%]; unadjusted odds ratio, 1.18; 95% CI, 0.86 to 1.61). At the time of hospital discharge, severe neurologic impairment (a score of 4 or 5 on the modified Rankin scale) had occurred in more of the survivors in the epinephrine group than in the placebo group (39 of 126 patients [31.0%] vs. 16 of 90 patients [17.8%]).
Conclusions: In adults with out-of-hospital cardiac arrest, the use of epinephrine resulted in a significantly higher rate of 30-day survival than the use of placebo, but there was no significant between-group difference in the rate of a favorable neurologic outcome because more survivors had severe neurologic impairment in the epinephrine group.
(Funded by the U.K. National Institute for Health Research and others; Current Controlled Trials number, ISRCTN73485024 .).

2. Heart Lung Circ. 2018 Mar;27(3):280-290. doi: 10.1016/j.hlc.2017.07.004. Epub 2017 Aug 23.
Antiarrhythmics in Cardiac Arrest: A Systematic Review and Meta-Analysis.
Chowdhury A1, Fernandes B2, Melhuish TM3, White LD4.
Abstract
INTRODUCTION: It is widely accepted that antiarrhythmics play a role in cardiopulmonary resuscitation (CPR) universally, but the absolute benefit of antiarrhythmic use and the drug of choice in advanced life support remains controversial.
AIM: To perform a thorough, in-depth review and analysis of current literature to assess the efficacy of antiarrhythmics in advanced life support.
MATERIAL AND METHODS: Two authors systematically searched through multiple bibliographic databases including CINAHL, SCOPUS, PubMed, Web of Science, Medline(Ovid) and the Cochrane Clinical Trials Registry. To be included studies had to compare an antiarrhythmic to either a control group, placebo or another antiarrhythmic in adult cardiac arrests. These studies were independently screened for outcomes in cardiac arrest assessing the effect of antiarrhythmics on return of spontaneous circulation (ROSC), survival and neurological outcomes. Data was extracted independently, compared for homogeneity and level of evidence was evaluated using the Cochrane Collaboration's tool for assessing the risk of bias. The Mantel-Haenszel (M-H) random effects model was used and heterogeneity was assessed using the I2 statistic.
RESULTS AND DISCUSSION: The search of the literature yielded 30 studies, including 39,914 patients. Eight antiarrhythmic agents were identified. Amiodarone and lidocaine, the two most commonly used agents, showed no significant effect on any outcome either against placebo or each other. Small low quality studies showed benefits in isolated outcomes with esmolol and bretylium against placebo. The only significant benefit of one antiarrhythmic over another was demonstrated with nifekalant over lidocaine for survival to admission (p=0.003). On sensitivity analysis of a small number of high quality level one RCTs, both amiodarone and lidocaine had a significant increase in survival to admission, with no effect on survival to discharge.
CONCLUSIONS: This systematic review and meta-analysis suggests that, based on current literature and data, there

has been no conclusive evidence that any antiarrhythmic agents improve rates of ROSC, survival to admission, survival to discharge or neurological outcomes. Given the side effects of some of these agents, we recommend further research into their utility in current cardiopulmonary resuscitation guidelines.

TRAUMA

1. Medicine (Baltimore). 2018 Jul;97(28):e11480. doi: 10.1097/MD.0000000000011480. Survival rate variation among different types of hospitalized traumatic cardiac arrest: A retrospective and nationwide study.
Lai CY1, Tsai SH2, Lin FH3, Chu H4, Ku CH3,5, Wu CH6, Chung CH3, Chien WC3, Tsai CT7, Hsu HM8, Chu CM3,9,10,11.
Abstract
Studies regarding the prognostic factors for survival conditions and the proportions of survival to discharge among different types of hospitalized traumatic cardiac arrest (TCA) during the period of postresuscitation are limited. This nationwide study was designed to determine certain parameters and clarify the effect of various injuries on the survival of hospitalized TCA patients to discharge. Data were retrieved from the National Health Insurance Research Database (NHIRD) from 2007 to 2013 in Taiwan. We reviewed patients with a diagnosis of TCA using International Classification of Disease Clinical Modification, 9th revision codes (ICD-9-CM codes). Patients identified for analysis were simultaneously coded in traumatic etiology (ICD-9-CM codes: 800-999) and cardiac arrest (ICD-9-CM codes: 427.41 or 427.5). The determinants and effects of different types of injury on survival were evaluated by SPSS 22.0 (IBM, Armonk, NY).A total of 3481 cases of hospitalized TCA were selected from the NHIRD. The overall rate of survival to discharge was 22.1%. The results indicated a decreased adjusted odds ratio (aOR) of survival to discharge with higher numbers of organ failure (aOR: 0.82; 95% confidence interval [CI]: 0.73-0.92). Patients with ventricular fibrillation had a better discharge rate (aOR: 4.33; 95% CI: 3.29-5.70). Two parameters, transfer to another hospital and the number of intensive care unit beds, were positively correlated with survival. Compared with traffic accidents, different injuries associated with survival to discharge were identified; the aOR (95% CI) was 1.89 (1.12-3.19) for poisoning, 1.63 (1.13-2.36) for falls, and 2.00 (1.36-2.92) for drowning/suffocation. This study has shown that hospitalized TCA patients with multiple organ failure may be less likely to be discharged from the hospital. The presence of ventricular fibrillation rhythm on admission increased the odds of survival to discharge. In the phase of postcardiac arrest care, the number of intensive care unit beds and transfer to another hospital were positively correlated with survival. Those events attributed to traffic accidents have a much worse influence on the main outcome.
Free Article

2. BMJ Open. 2018 Jul 25;8(7):e022070. doi: 10.1136/bmjopen-2018-022070. Prehospital trauma death review in the State of Victoria, Australia: a study protocol.
Mercier E1,2, Cameron PA1,3, Smith K1,4,5, Beck B1, 2.
Abstract
INTRODUCTION: Regionalised trauma systems have been shown to improve outcomes for trauma patients. However, the evaluation of these trauma systems has been oriented towards in-hospital care. Therefore, the epidemiology and care delivered to the injured patients who died in the prehospital setting remain poorly studied. This study aims to provide an overview of a methodological approach to reviewing trauma deaths in order to assess the preventability, identify areas for improvements in the system of care provided to these patients and evaluate the potential for novel interventions to improve outcomes for seriously injured trauma patients.
METHODS AND ANALYSIS: The planned study is a retrospective review of prehospital and early in-hospital (<24 hours) deaths following traumatic out-of-hospital cardiac arrest that were attended by Ambulance Victoria between 2008 and 2014. Eligible patients will be identified from the Victorian Ambulance Cardiac Arrest Registry and linked with the National Coronial Information System. For patients who were transported to hospital, data will be linked the Victoria State Trauma Registry. The project will be undertaken in four phases: (1) survivability assessment; (2) preventability assessment; (3) identification of potential areas for improvement; and (4) identification of potentially useful novel technologies. Survivability assessment will be based on predetermined anatomical injuries considered unsurvivable. For patients with potentially survivable injuries, multidisciplinary expert panel reviews will be conducted to assess the preventability as well as the identification of potential areas for improvement and the utility of novel technologies.
ETHICS AND DISSEMINATION: The present study was approved by the Victorian Department of Justice and Regulation HREC (CF/16/272) and the Monash University HREC (CF16/532 - 2016000259). Results of the study will be published in peer-reviewed journals and reports provided to Ambulance Victoria, the Victorian State Trauma Committee and the Victorian State Government Department of Health and Human Services.

3. Eur J Trauma Emerg Surg. 2018 Jul 21. doi: 10.1007/s00068-018-0989-5. [Epub ahead of print] Traumatic cardiac arrest and resuscitative endovascular balloon occlusion of the aorta (REBOA): a preliminary analysis utilizing high fidelity invasive blood pressure recording and videography.

Wasicek PJ1, Yang S2, Teeter WA2, Hu P2, Stein DM2, Scalea TM2, Brenner ML2.
Abstract
PURPOSE: Aortic occlusion (AO) increases proximal perfusion and may improve rates of return of spontaneous circulation (ROSC). The objective of this study was to investigate the hemodynamic effects of cardiopulmonary resuscitation (CPR) and AO by REBOA on patients in traumatic cardiac arrest.
METHODS: Patients admitted between February 2013 and May 2017 at a tertiary center who suffered traumatic arrest, had an arterial line placed during resuscitation, and received CPR and REBOA which were included. In-hospital CPR data were obtained from videography. Arterial waveforms were recorded at 240 Hz.
RESULTS: 11 consecutive patients were included, 82% male; mean (± SD) age 37 ± 19 years. 55% suffered blunt trauma and the remaining penetrating injuries. 64% arrested out of hospital. During compressions with AO, the mean systolic blood pressure (SBP) was 70 ± 22 mmHg, mean arterial pressure (MAP) 43 ± 19 mmHg, and diastolic blood pressure (DBP) 26 ± 17 mmHg. Nine (82%) had ROSC, with eight having multiple periods of ROSC and arrest in the initial period. In-hospital mortality was 82%. Cardiac ultrasonography was used during arrest in 73%. In two patients with arterial line data before and after AO, SBP (mmHg) improved from 51 to 73 and 55 to 96 during arrest after AO.
CONCLUSIONS: High-quality chest compressions coupled with aortic occlusion may generate adequate perfusion pressures to increase the rate of ROSC. New technology capable of transducing central arterial pressure may help us to understand the effectiveness of CPR with and without aortic occlusion. REBOA may be a useful adjunct to high-quality chest compressions during arrest.

VENTILACIÓ

1. Resuscitation. 2018 Jul 3;130:57-60. doi: 10.1016/j.resuscitation.2018.07.002. [Epub ahead of print]
Defining the plateau point: When are further attempts futile in out-of-hospital advanced airway management?
Jarvis JL1, Barton D2, Wang H3.
Abstract
BACKGROUND: We sought to characterize the number of attempts required to achieve advanced airway management (AAM) success.
METHODS: Using 4 years of data from a national EMS electronic health record system, we examined the following subsets of attempted AAM: 1) cardiac arrest intubation (CA-ETI), 2) non-arrest medical intubation (MED-ETI), 3) non-arrest trauma intubation (TRA-ETI), 4) rapid-sequence intubation (RSI), 5) sedation-assisted ETI (SAI), and 6) supraglottic airway (SGA). We determined the first pass and overall success rates, as well as the point of additional attempt futility ("plateau point").
RESULTS: Among 57,209 patients there were 64,291 AAM. CA-ETI performance was: first-pass success (FPS) 71.4% (95% CI: 70.9-71.9%), 4 attempts to reach 91.5% (91.2-91.9%) success plateau. MED-ETI performance was: FPS 66.0% (95% CI: 65.1-67.0%), 3 attempts to reach 79.2% (78.4-80.0%) success plateau. TRA-ETI performance was: FPS 61.6% (95% CI: 59.3-63.9%), 3 attempts to reach 75.8% (73.7-77.8%) success plateau. RSI performance was: FPS 76.1% (95% CI: 75.1-77.1%), 5 attempts to reach 95.8% (95.3-96.2%) success plateau. SAI performance was: FPS 66.9% (95% CI: 65.1-68.6%), 3 attempts to 85.3% (83.9-86.6%) success plateau. SGA performance was: FPS 88.7% (95% CI: 88.0-89.3%), 5 attempts to reach 92.8% (92.3-93.4%) success plateau.
CONCLUSION: Multiple attempts are often needed to accomplish successful AAM. The number of attempts needed to accomplish AAM varies with AAM technique. These results may guide AAM practices.

2. Am J Emerg Med. 2018 Jun 30. pii: S0735-6757(18)30539-4. doi: 10.1016/j.ajem.2018.06.057. [Epub ahead of print]
Quantification of ventilation volumes produced by compressions during emergency department cardiopulmonary resuscitation.
McDannold R1, Bobrow BJ2, Chikani V3, Silver A4, Spaite DW5, Vadeboncoeur T6.
Abstract
BACKGROUND: Clinical investigations have shown improved outcomes with primary compression cardiopulmonary resuscitation strategies. It is unclear whether this is a result of passive ventilation via chest compressions, a low requirement for any ventilation during the early aspect of resuscitation or avoidance of inadvertent over-ventilation.
OBJECTIVES: To quantify whether chest compressions with guideline-compliant depth (>2 in) produce measurable and substantial ventilation volumes during emergency department resuscitation of out-of-hospital cardiac arrest.
METHODS: This was a prospective, convenience sampling of adult non-traumatic out-of-hospital cardiac arrest patients receiving on-going cardiopulmonary resuscitation in an academic emergency department from June 1, 2011 to July 30, 2013. Cardiopulmonary resuscitation quality files were analyzed using R-Series defibrillator/monitors (ZOLL Medical) and ventilation data were measured using a Non-Invasive Cardiac Output monitor (Philips/Respironics, Wallingford, CT).
RESULTS: cardiopulmonary resuscitation quality data were analyzed from 21 patients (17 males, median age 59).

The median compression depth was 2.2 in (IQR = 1.9, 2.5) and the median chest compression fraction was 88.4% (IQR = 82.2, 94.1). We were able to discern 580 ventilations that occurred during compressions. The median passive tidal volume recorded during compressions was 7.5 ml (IQR 3.5, 12.6). While the highest volume recorded was 45.8 ml, 81% of the measured tidal volumes were <20 ml.
CONCLUSION: Ventilation volume measurements during emergency department cardiopulmonary resuscitation after out-of-hospital cardiac arrest suggest that chest compressions alone, even those meeting current guideline recommendations for depth, do not provide physiologically significant tidal volumes.

ECOGRAFIA EN SVA

1. Resuscitation. 2018 Jan;122:65-68. doi: 10.1016/j.resuscitation.2017.11.056. Epub 2017 Nov 23.
Point-of-care ultrasound use in patients with cardiac arrest is associated prolonged cardiopulmonary resuscitation pauses: A prospective cohort study.
Clattenburg EJ1, Wroe P2, Brown S3, Gardner K2, Losonczy L2, Singh A2, Nagdev A4.
Abstract
OBJECTIVE: We aim to evaluate if point-of-care ultrasound use in cardiac arrest is associated with CPR pause duration.
METHODS: This is a prospective cohort study of patients with cardiac arrest (CA) presenting to an urban emergency department from July 2016 to January 2017. We collected video recordings of patients with CA in designated code rooms with video recording equipment. The CAs recordings were reviewed and coded by two abstractors. The primary outcome was the difference CPR pause duration when POCUS was and was not performed.
RESULTS: A total of 110 CPR pauses were evaluated during this study. The median CPR pause with POCUS performed lasted 17s (IQR 13 - 22.5) versus 11s (IQR 7 - 16) without POCUS. In addition, multiple regression analysis demonstrated that POCUS was associated with longer pauses (6.4s, 95%CI 2.1- 10.8); ultrasound fellowship trained faculty trended towards shorter CPR pauses (-4.1s, 95%CI -8.8-0.6) compared to non-ultrasound fellowship trained faculty; and when the same provider led the resuscitation and performed the POCUS, pause durations were 6.1s (95%CI 0.4 -11.8) longer than when another provider performed the POCUS.
CONCLUSION: In this prospective cohort trial of 24 patients with CA, POCUS during CPR pauses was associated with longer interruptions in CPR.

ORGANITZACIÓ I FORMACIÓ

1. Circulation. 2018 Jul 10;138(2):154-163. doi: 10.1161/CIRCULATIONAHA.118.033674.
How Do Resuscitation Teams at Top-Performing Hospitals for In-Hospital Cardiac Arrest Succeed? A Qualitative Study.
Nallamothu BK1,2, Guetterman TC3, Harrod M, Kellenberg JE 4, Lehrich JL4, Kronick SL5, Krein SL4,2, Iwashyna TJ4,2, Saint S4,2, Chan PS6.
Abstract
BACKGROUND: In-hospital cardiac arrest (IHCA) is common, and outcomes vary substantially across US hospitals, but reasons for these differences are largely unknown. We set out to better understand how top-performing hospitals organize their resuscitation teams to achieve high survival rates for IHCA.
METHODS: We calculated risk-standardized IHCA survival to discharge rates across American Heart Association Get With The Guidelines-Resuscitation registry hospitals between 2012 and 2014. We identified geographically and academically diverse hospitals in the top, middle, and bottom quartiles of survival for IHCA and performed a qualitative study that included site visits with in-depth interviews of clinical and administrative staff at 9 hospitals. With the use of thematic analysis, data were analyzed to identify salient themes of perceived performance by informants.
RESULTS: Across 9 hospitals, we interviewed 158 individuals from multiple disciplines including physicians (17.1%), nurses (45.6%), other clinical staff (17.1%), and administration (20.3%). We identified 4 broad themes related to resuscitation teams: (1) team design, (2) team composition and roles, (3) communication and leadership during IHCA, and (4) training and education. Resuscitation teams at top-performing hospitals demonstrated the following features: dedicated or designated resuscitation teams; participation of diverse disciplines as team members during IHCA; clear roles and responsibilities of team members; better communication and leadership during IHCA; and in-depth mock codes.
CONCLUSIONS: Resuscitation teams at hospitals with high IHCA survival differ from non-top-performing hospitals. Our findings suggest core elements of successful resuscitation teams that are associated with better outcomes and form the basis for future work to improve IHCA.

2. Cardiol Res Pract. 2018 Jun 10;2018:3687472. doi: 10.1155/2018/3687472. eCollection 2018.
Current Status of Knowledge about Cardiopulmonary Resuscitation among the University Students in the Northern

Region of Saudi Arabia.
Owaid Alsharari A1, Alduraywish A1, Ali Al-Zarea E1, Ibrahim Salmon N1, Ali Sheikh MS1.
Abstract
Background: Sudden cardiac arrest is a major public health problem in the world. Immediate initiation of high-quality cardiopulmonary resuscitation (CPR) significantly increased patient survival rate. Therefore, it is very important to train young people and increase public awareness of CPR for the long-term benefit of the community.
Objective: We aimed at estimating the level of knowledge and attitude towards cardiopulmonary resuscitation (CPR) among the university students in the northern region of Saudi Arabia.
Methodology: A cross-sectional, prospective study was conducted among the students of four northern region universities of Saudi Arabia (Jouf, Hail, Northern Borders, and Tabuk) between March and November 2017. A self-administered questionnaire was prepared in both Arabic and English languages and distributed to all the participants. All the data were collected and analyzed by using SPSS version 21.
Results: A total of 947 students from four universities completed the questionnaire: Jouf (57%), Hail (15%), Northern Borders (13%), and Tabuk (15%). Although 72% of students have previous knowledge about CPR, 49% of them lack knowledge about a medical emergency. Moreover, 59% failed to answer regarding CPR where only 41% wrote the ABC steps in the correct sequence. However, 67% of the participants had very poor knowledge, 89% of participants desired to receive additional CPR training course, and 49% of the students thought that CPR training should be a mandatory graduation requirement for all universities. There were no significant differences between male and female students. Students from medicine-related colleges have significantly ($p < 0.001$) more knowledge and scored better compared with non-medicine-related colleges. Tabuk University scored better compared to the others, but the overall knowledge and attitude scored were low.
Conclusions: Overall knowledge about CPR among the university students was not satisfactory; however, attitude towards CRP training was very positive. Our results suggested that there is a need for improvement of CPR education among Saudi university students, which will help to reduce the cardiac arrest mortality rate among the community.

3. Aerosp Med Hum Perform. 2018 Aug 1;89(8):754-759. doi: 10.3357/AMHP.5038.2018.
Medical Guidelines for Airline Travel: Management of In-Flight Cardiac Arrest.
Ruskin KJ, Ricaurte EM, Alves PM.
Abstract
Although cardiac arrest during airline flights is relatively uncommon, the unusual setting, limited resources, and the variability of the skills in medical volunteers present unique challenges. Survival in patients who suffer a witnessed arrest with a shockable rhythm who are treated promptly has improved since the advent of widely available automated external defibrillators (AEDs). In general, the chances of survival from an out-of-hospital cardiac arrest (OHCA) are greater when ventricular fibrillation (VF) is seen as the initial rhythm or if there is return of spontaneous circulation (ROSC). Not all in-flight cardiac arrests are witnessed because cabin crew or fellow passengers might simply assume that the victim is sleeping. Based upon a review of the literature on resuscitation after OHCA, we recommend that automatic external defibrillators be carried on all commercial airline flights, regardless of duration. Patients presenting with shockable rhythm (e.g., VF, unstable ventricular tachycardia) have the best prognosis for survival and usually require diversion of the aircraft for advanced cardiac life support (ACLS). Because diversion may require interruption of cardiopulmonary resuscitation (CPR) and may impact flight safety, the volunteer rescuer, cabin crew, flight crew, and medical consultation services should discuss the possible outcome and operational considerations before recommending a diversion for a patient with a nonshockable rhythm. The recommendations in this article were developed by members of the Air Transport Medicine and Aerospace Human Performance Committees and approved by the Council of the Aerospace Medical Association.Ruskin KJ, Ricaurte EM, Alves PM. Medical guidelines for airline travel: management of in-flight cardiac arrest. Aerosp Med Hum Perform. 2018; 89(8):754-759.

4. Arch Dis Child. 2018 Jul 14. pii: archdischild-2018-314893. doi: 10.1136/archdischild-2018-314893. [Epub ahead of print]
Two-thumb-encircling advantageous for lay responder infant CPR: a randomised manikin study.
Pellegrino JL1, Bogumil D2, Epstein JL3, Burke RV 2.
Abstract
OBJECTIVE: Paediatric health providers and educators influence infant mortality through advocacy and training within families and communities. This research sought to establish the efficacy and training of two-finger versus two-thumb-encircling techniques for lone responder infant chest compressions with ventilations in initially trained infant caregivers.
DESIGN: This is a randomised, cross-over educational intervention assessed on instrumented manikins using the 2015 guideline measures of quality infant cardiopulmonary resuscitation (CPR). Additional subjective data on the experience were collected through self-reporting.

SETTING: Non-healthcare community organisations and secondary school classrooms. PARTICIPANTS: Fourteen years or older, fluent in English and had not taken infant CPR in the last 5 years. INTERVENTIONS: Groups of eight participants were randomised to learn one technique, practised and then tested for 8 min. After a 30 min rest, the group repeated the process using the other technique. MAIN OUTCOME MEASURES: Mean chest compression depth and rate, compression fraction, and correct hand position; tiredness and pain as reported by the caregiver. RESULTS: The two-thumb-encircling technique achieved a deeper mean compression depth over the 8 min period (2.0 mm, p<0.01), closer to the minimum recommendation of 40 mm; the two-finger technique achieved higher percentages of compression fraction and complete recoil. Caregivers preferred the two-thumb technique (64%), and of these 70% had long fingernails. CONCLUSIONS: The two-thumb-encircling technique improved compression depth, over an 8 min scenario, and was preferred by caregivers. This adds to the existing literature on the advantages of two-thumb-encircling as a technique for lone and team infant CPR, which counters current guidelines.

5. High Alt Med Biol. 2018 Jul 16. doi: 10.1089/ham.2018.0050. [Epub ahead of print] The Use of E-Learning in Medical Education for Mountain Rescuers Concerning Hypothermia. Podsiadło P1,2, Kosiński S3,4, Darocha T2,5, Sałapa K6, Sanak T7, Brugger H8,9. Abstract
OBJECTIVE: Victims of mountain accidents are often exposed to wet and cold environments which may increase the risk of hypothermia. Mountain rescuers should be able to recognize and manage hypothermia. We aimed to assess relevant knowledge in professional and volunteer mountain rescuers, as well as to evaluate the efficacy of an e-learning platform for continuing medical education. METHODS: An e-learning platform was developed to provide access to updated information about hypothermia. Volunteer and professional mountain rescuers participated in an e-learning course. Pretest, post-test, and specific lesson test scores were compared. After 1 year, a follow-up course was performed. RESULTS: In total, 187 rescuers, comprising 136 (72.7%) volunteers and 51 (27.3%) professionals, were enrolled. Ahead of the course, no difference in knowledge was found between professionals and volunteers. After the course, one's knowledge of hypothermia increased significantly ($p < 0.001$). The scores achieved in the field management of hypothermia were better among professional rescuers than among volunteer rescuers ($p = 0.003$), whereas in post-traumatic hypothermia half of the results were insufficient in both groups. Moreover, 57 rescuers repeated the course after 12 months. While professionals partially retained the achieved level of knowledge, the volunteers had dropped back to their initial level. CONCLUSIONS: The e-learning course increased the knowledge of hypothermia among mountain rescuers. The poor retention after 1 year indicates that the interval between lectures should be reduced. An e-learning platform is an effective tool for the medical education of mountain rescuers.

6. Cardiol J. 2018 Jul 16. doi: 10.5603/CJ.a2018.0073. [Epub ahead of print] Schoolteachers as candidates to be basic life support trainers: A simulation trial. Jorge-Soto C, Abilleira-González M, Otero-Agra M, Barcala-Furelos R, Abelairas-Gómez C, Szarpak L1, Rodríguez-Núñez A.
Abstract
BACKGROUND: The aim was to assess future schoolteachers' basic life support (BLS) knowledge and willingness to include this content in school lessons. The aim was also to determine the learning effect of a brief BLS hands-on training session, supported by real-time feedback. METHODS: A convenience sample of 98 University students of Educational Sciences and Sports were recruited. The training program consisted of brief theoretical and hands-on interactive sessions with a 2/10 instructor/participants ratio. Knowledge and willingness was assessed by means of a survey. Chest compressions (CC) and ventilation quality were registered in 47 cases during 1 min cardiopulmonary resuscitation (CPR) tests. RESULTS: Fifty-eight percent of subjects declared to know how to perform CPR, 62% knew the correct chest compression/ventilation ratio but only one in four knew the CC quality standards. Eighty-eight percent knew what an automated external defibrillator (AED) was; willingness to use the device improved from 70% to 98% after training. Almost half of CCs were performed atan adequate rate. Men performed deeper compressions than women (56.1 ± 4.03 mm vs. 52.17 ± 5.51 mm, p = 0.007), but in both cases the mean value was within recommendations. Full chest recoil was better in women (72.2 ± 32.8% vs. 45.4 ± 32.9%, p = 0.009). All CCs were delivered with correct hand positions. CONCLUSIONS: Brief hands-on training supported by real-time feedback of CPR quality helps future schoolteachers improve their knowledge, self-confidence and CPR skills. BLS training should be implemented in University curricula for schoolteachers in order to promote their engagement in effective BLS training of schoolchildren. Free Article

7. Emerg (Tehran). 2018;6(1):e36. Epub 2018 Jun 16.

Awareness of Basic Life Support among Egyptian Medical Students; a Cross-Sectional Study.
Ghanem E1,2, Elgazar M1, Oweda K1, Tarek H1, Assaf F1, Ahmed El-Husseny MW3, Elgebaly A1, Abushouk AI2,4.
Abstract
Introduction: It is important for all medical and paramedical staff to be aware of basic life support (BLS) maneuvers. In this study, we aimed to evaluate the level of BLS awareness among Egyptian medical students.
Methods: The level of BLS knowledge was assessed using a validated questionnaire and the results were analyzed using an answer key, prepared from the Advanced Cardiac Life Support (ACLS) manual. We used the Student's t-test to analyze the association between awareness level and year of study, previous BLS training and practical experience.
Results: A total of 823 medical students with the mean age of 20.3 ± 2.7 years, from Al-Azhar medical schools completed the questionnaire (463 and 360 in academic and clinical years, respectively). About 72% and 84% of students failed to recognize the proper point of chest compression in adults and infants, respectively. Moreover, the majority (80%) did not know how to give rescue breathing in infants. Only 18% of students correctly identified early signs of shock and only 22% knew how to help patients with myocardial infarction. Being in clinical years, previous BLS training or practical experience were significantly associated with higher BLS knowledge scores ($p < 0.001$).
Conclusion: The level of BLS awareness among Egyptian medical students is generally poor. Introduction of regular BLS courses into the undergraduate curriculum is a must to increase the level of BLS knowledge among Egyptian future physicians.
Free Article

8. Prehosp Disaster Med. 2018 Jul 23:1-7. doi: 10.1017/S1049023X18000602. [Epub ahead of print]
Can a Software-Based Metronome Tool Enhance Compression Rate in a Realistic 911 Call Scenario Without Adversely Impacting Compression Depth for Dispatcher-Assisted CPR?
Scott G1, Barron T2, Gardett I1, Broadbent M1, Downs H3, Devey L3, Hinterman EJ4, Clawson J1, Olola C1.
Abstract
Introduction: Implementation of high-quality, dispatcher-assisted cardiopulmonary resuscitation (DA-CPR) is critical to improving survival from out-of-hospital cardiac arrest (OHCA). However, despite some studies demonstrating the use of a metronome in a stand-alone setting, no research has yet demonstrated the effectiveness of a metronome tool in improving DA-CPR in the context of a realistic 911 call or using instructions that have been tested in real-world emergency calls.
Hypothesis: Use of the metronome tool will increase the proportion of callers able to perform CPR within the target rate without affecting depth.
METHODS: The prospective, randomized, controlled study involved simulated 911 cardiac arrest calls made by layperson-callers and handled by certified emergency medical dispatchers (EMDs) at four locations in Salt Lake City, Utah USA. Participants were randomized into two groups. In the experimental group, layperson-callers received CPR pre-arrival instructions with metronome assistance. In the control group, layperson-callers received only pre-arrival instructions. The primary outcome measures were correct compression rate (counts per minute [cpm]) and depth (mm).
RESULTS: A total of 148 layperson-callers (57.4% assigned to experimental group) participated in the study. There was a statistically significant association between the number of participants who achieved the target compression rate and experimental study group (P=.003), and the experimental group had a significantly higher median compression rate than the control group (100 cpm and 89 cpm, respectively; P=.013). Overall, there was no significant correlation between compression rate and depth.
CONCLUSION: An automated software metronome tool is effective in getting layperson-callers to achieve the target compression rate and compression depth in a realistic DA-CPR scenario.

9. Artif Organs. 2018 Jul 25. doi: 10.1111/aor.13332. [Epub ahead of print]
Best life - "bringing ecmo simultion to life" - how medical simulation improved regional ecmo program.
Puślecki M1,2, Ligowski M2, Dąbrowski M1,3, Stefaniak S2, Ładzińska M2, Ładziński P4, Pawlak A5, Zieliński M1,5, Dąbrowska A1,3, Artyńska A6, Gezela M6, Sobczyński P6, Szarpak Ł7, Perek B2, Jemielity M2.
Abstract
BACKGROUND: The implemented "ECMO for Greater Poland" program takes full advantage of the ECMO (extracorporeal membrane oxygenation) perfusion therapy to promote health for 3.5 million inhabitants in the region (Greater Poland). The predominant subjects of implementation are patients with hypothermia, with severe reversible respiratory failure (RRF) and treatment of other critical states leading to heart failure such as sudden cardiac arrest, cardiogenic shock or acute intoxication. Finally, it promotes donor after circulatory death (DCD) strategy in selected organ donor cases. ECMO enables recovery of organs' function after unsuccessful lifesaving treatment.
AIM AND METHODS: Because this organizational model is complex and expensive, we use advanced high-fidelity medical simulation to prepare whole staff for the real-life implementation. During first 4 months we performed

scenarios mimicking 'ECMO for DCD', 'ECMO for ECPR (extended cardiopulmonary resuscitation)', 'ECMO for RRF' and 'ECMO in hypothermia'. It helped to create algorithms for aforementioned program arms. In the following months three ECMO courses for five departments in Poznan (capitol city of Greater Poland) were organized and standardized operating procedures for road ECMO transportation within Medical Emergency System were created. RESULTS: Soon after simulation program, in following Departments such as Cardiac Surgery and Transplantology, Pediatric Cardiac Surgery, Anesthesiology and Intensive Care, Surgery and Transplantology and Thoracic Surgery 38 procedures with ECMO perfusion therapy including 5 road transportation "on ECMO" were performed. The Maastricht category II DCD procedures were done four times on real patients and in two cases double successful kidney transplantations, for the first time in Poland, were carried out. ECMO was applied in 2 patients with hypothermia, 9 adult patients with heart failure and other 5 with RRF, for the first time in the region. In pediatric group ECMO was applied in 4 patients with RRF and 14 with heart failure after cardiac surgery procedures. Additionally, one child was treated successfully following 200 km - long road transport on ECMO. We reached good and promising effects especially in VV ECMO therapy. CONCLUSIONS: Simulation-based training enabled to build a successful procedural chain, to eliminate errors at the stage of identification, notification, transportation and providing ECMO perfusion therapy. We discovered the important role of medical simulation, not only to test the medical professional's skills, but also to promote ECMO therapy in patients with critical/life-threatening states. Moreover, it also resulted in increase of the potential organ pool from DCD in the Greater Poland region.

10. Curr Pharm Teach Learn. 2018 Jun;10(6):744-749. doi: 10.1016/j.cptl.2018.03.006. Epub 2018 Apr 7. Performance and retention of basic life support skills improve with a peer-led training program. Priftanji D1, Cawley MJ2, Finn LA3, Hollands JM4, Morel DW5, Siemianowski LA6, Bingham AL7. Abstract

BACKGROUND AND PURPOSE: Pharmacy students' performance and retention of Basic Life Support (BLS) skills were evaluated 120 days after completion of a peer-led BLS training program. EDUCATIONAL ACTIVITY AND SETTING: This was a single-center, parallel group, observational study. Doctor of pharmacy (PharmD) students in their third professional year completed a peer-led BLS training program (n = 148) and participated in a high-fidelity mannequin simulation activity 120 days later. Students were randomly assigned to rapid response teams (n = 24) of five to six members and the American Heart Association's standardized form for BLS assessment was used to assess BLS skills performance. The performance of skills was compared to that of students two years prior to the implementation of the peer-led BLS program. FINDINGS AND DISCUSSION: Students who received peer-led BLS training demonstrated retention of BLS skills 120 days after the BLS training program. The teams also displayed significant improvement of the skills evaluated when compared to student teams prior to implementation of the peer-led training (n = 22). Improvement was demonstrated for assessment of responsiveness (96% vs. 41%, $p < 0.001$), assessment for breathing (100% vs. 32%, $p < 0.001$), assessment for pulse (96% vs. 36%, $p < 0.001$), and administration of appropriate ventilation (100% vs. 32%, $p < 0.001$). Numerical superiority was exhibited for high-quality cardiopulmonary resuscitation (CPR) initiation by teams who received peer-led training (100% vs. 86%, $p = 0.101$). SUMMARY: Students who received peer-led BLS training demonstrated significant improvement in BLS skills performance and retention 120 days after the training program. Data suggests that peer-led BLS training can improve student BLS skills performance and retention.

11. Resuscitation. 2018 Jan;122:92-98. doi: 10.1016/j.resuscitation.2017.11.058. Epub 2017 Nov 26. 'She's sort of breathing': What linguistic factors determine call-taker recognition of agonal breathing in emergency calls for cardiac arrest?
Riou M1, Ball S2, Williams TA3, Whiteside A4, Cameron P5, Fatovich DM6, Perkins GD7, Smith K8, Bray J9, Inoue M2, O'Halloran KL10, Bailey P11, Brink D11, Finn J12. Comment in
- Cardiac arrest and breathing, why bother? [Resuscitation. 2018]
- Reply to: 'Cardiac arrest and breathing, why bother?' Because it's too late if we wait for a definitive diagnosis. [Resuscitation. 2018]

Abstract

BACKGROUND: In emergency ambulance calls, agonal breathing remains a barrier to the recognition of out-of-hospital cardiac arrest (OHCA), initiation of cardiopulmonary resuscitation, and rapid dispatch. We aimed to explore whether the language used by callers to describe breathing had an impact on call-taker recognition of agonal breathing and hence cardiac arrest. METHODS: We analysed 176 calls of paramedic-confirmed OHCA, stratified by recognition of OHCA (89 cases recognised, 87 cases not recognised). We investigated the linguistic features of callers' response to the question "is s/he breathing?" and examined the impact on subsequent coding by call-takers. RESULTS: Among all cases (recognised and non-recognised), 64% (113/176) of callers said that the patients were breathing (yes-answers). We identified two categories of yes-answers: 56% (63/113) were plain answers,

confirming that the patient was breathing ("he's breathing"); and 44% (50/113) were qualified answers, containing additional information ("yes but gasping"). Qualified yes-answers were suggestive of agonal breathing. Yet these answers were often not pursued and most (32/50) of these calls were not recognised as OHCA at dispatch. CONCLUSION: There is potential for improved recognition of agonal breathing if call-takers are trained to be alert to any qualification following a confirmation that the patient is breathing.

CURES **POST-RCE**

1. Crit Care Med. 2018 Jul 2. doi: 10.1097/CCM.0000000000003301. [Epub ahead of print]
Variation in Sedation and Neuromuscular Blockade Regimens on Outcome After Cardiac Arrest.
May TL1,2, Riker RR1, Fraser GL1, Hirsch KG3, Agarwal S4, Duarte C5, Friberg H6, Søreide E7, McPherson J8, Hand R9, Kent D2, Nielsen N10, Seder DB1.
Abstract
OBJECTIVES: Sedation and neuromuscular blockade protocols in patients undergoing targeted temperature management after cardiac arrest address patient discomfort and manage shivering. These protocols vary widely between centers and may affect outcomes.
DESIGN: Consecutive patients admitted to 20 centers after resuscitation from cardiac arrest were prospectively entered into the International Cardiac Arrest Registry between 2006 and 2016. Additional data about each center's sedation and shivering management practice were obtained via survey. Sedation and shivering practices were categorized as escalating doses of sedation and minimal or no neuromuscular blockade (sedation and shivering practice 1), sedation with continuous or scheduled neuromuscular blockade (sedation and shivering practice 2), or sedation with as-needed neuromuscular blockade (sedation and shivering practice 3). Good outcome was defined as Cerebral Performance Category score of 1 or 2. A logistic regression hierarchical model was created with two levels (patient-level data with standard confounders at level 1 and hospitals at level 2) and sedation and shivering practices as a fixed effect at the hospital level. The primary outcome was dichotomized Cerebral Performance Category at 6 months.
SETTING: Cardiac arrest receiving centers in Europe and the United states from 2006 to 2016 PATIENTS: Four-thousand two-hundred sixty-seven cardiac arrest patients 18 years old or older enrolled in the International Cardiac Arrest Registry.
INTERVENTIONS: None.
MEASUREMENTS AND MAIN RESULTS: The mean age was 62 ± 15 years, 36% were female, 77% out-of-hospital arrests, and mean ischemic time was 24 (± 18) minutes. Adjusted odds ratio (for age, return of spontaneous circulation, location of arrest, witnessed, initial rhythm, bystander cardiopulmonary resuscitation, defibrillation, medical history, country, and size of hospital) was 1.13 (0.74-1.73; p = 0.56) and 1.45 (1.00-2.13; p = 0.046) for sedation and shivering practice 2 and sedation and shivering practice 3, respectively, referenced to sedation and shivering practice 1.
CONCLUSION: Cardiac arrest patients treated at centers using as-needed neuromuscular blockade had increased odds of good outcomes compared with centers using escalating sedation doses and avoidance of neuromuscular blockade, after adjusting for potential confounders. These findings should be further investigated in prospective studies.

2. Resuscitation. 2018 Jun 26. pii: S0300-9572(18)30304-6. doi: 10.1016/j.resuscitation.2018.06.027. [Epub ahead of print]
Quantitative Assessment of Pupillary Light Reflex for Early Prediction of Outcomes After Out-of-Hospital Cardiac Arrest: A Multicentre Prospective Observational Study.
Tamura T1, Namiki J2, Sugawara Y3, Sekine K3, Yo K4, Kanaya T5, Yokobori S6, Roberts R6, Abe T6, Yokota H5, Sasaki J1.
Abstract
AIM: To clarify whether quantitative assessment of pupillary light reflexes (PLR) can predict the outcome of post-cardiac arrest (CA) patients during the first 72 hours after the return of spontaneous circulation (ROSC).
METHODS: Fifty adults resuscitated after non-traumatic out-of-hospital CA (OHCA) (mean age 64.1 years old, 36 males) were enrolled in four emergency hospitals. PLR was sequentially measured at 0, 6, 12, 24, 48, and 72 hours after ROSC by an automated portable infrared pupillometry. PLR values for each time point were compared between both survivors and non-survivors, and patients with either favourable (Cerebral Performance Category (CPC) 1 or 2) or unfavourable neurological outcomes.
RESULTS: Twenty-three patients survived for 90 days after CA, and 13 patients achieved favourable neurological outcomes. The PLR values of the survivors and patients with favourable neurological outcomes were consistently greater than those of non-survivors (P < 0.001) and those with unfavourable neurological outcomes (P < 0.001), respectively. The change in PLR over time was not statistically different between the outcome groups. The 0-hour PLR best predicted both 90-day survival (AUC = 0.82, cutoff 3%, sensitivity 0.87, specificity 0.80) and favourable neurological outcomes (AUC = 0.84, cutoff 6%, sensitivity 0.92, specificity 0.74). No patient with a 6-hour PLR less

than 3% survived for 90 days after CA.
CONCLUSIONS: Quantitatively measured PLR was consistently greater in survivors and patients with favourable neurological outcomes during the 72 hours after ROSC. Quantitative assessment of PLR at as early as 0 hours has a potential role for prognostication in post-CA patients.

3. Eur J Intern Med. 2018 Jun 26. pii: S0953-6205(18)30266-8. doi: 10.1016/j.ejim.2018.06.016. [Epub ahead of print]
Added value of the DIC score and of D-dimer to predict outcome after successfully resuscitated out-of-hospital cardiac arrest.
Buchtele N1, Schober A2, Schoergenhofer C3, Spiel AO4, Mauracher L5, Weiser C6, Sterz F7, Jilma B8, Schwameis M9.
Abstract
BACKGROUND: Recent Korean data suggest a high prevalence of overt disseminated intravascular coagulation (DIC) and a good predictive performance of the ISTH DIC score in successfully resuscitated out-of-hospital cardiac arrest.
OBJECTIVES: We hypothesised that in a European cohort of resuscitated out-of-hospital cardiac arrest patients the prevalence of DIC is substantially lower. Furthermore, the determination of D-dimer levels at admission, but not the DIC score, could improve mortality prediction above traditional predictors.
PATIENTS/METHODS: Data were extracted from a prospective cardiac arrest registry including patients admitted between 2006 and 2015, who achieved return of spontaneous circulation and had parameters for DIC score calculation available. The primary outcome was the prevalence of overt DIC at admission. Secondary outcomes included the association of overt DIC with 30-day mortality and the contribution of the DIC score and D-dimer levels to 30-day mortality prediction using logistic regression. Three stepwise models were evaluated by receiver-operating-characteristic analysis.
RESULTS: Out of 1179 patients 388 were included in the study. Overt DIC was present in 8% of patients and associated with substantial 30-day mortality (83% vs. 39%). The AUC for model 1, including traditional mortality predictors, was 0.83. The inclusion of D-dimer levels significantly improved prognostication above traditional predictors (model 3, AUC 0.89), whereas the inclusion of the DIC Score had no effect on mortality prediction (model 2, AUC 0.83).
CONCLUSION: Overt DIC was rare in a European cohort of out-of-hospital cardiac arrest patients. D-dimer levels improved 30-day mortality prediction and provided added value to assess early mortality risk after successful resuscitation.

4. Rev Esp Cardiol (Engl Ed). 2018 Jul 9. pii: S1885-5857(18)30219-6. doi: 10.1016/j.rec.2018.05.022. [Epub ahead of print]
Development and External Validation of an Early Prognostic Model for Survivors of Out-of-hospital Cardiac Arrest. [Article in English, Spanish]
Pérez-Castellanos A1, Martínez-Sellés M2, Uribarri A3, Devesa-Cordero C4, Sánchez-Salado JC5, Ariza-Solé A5, Sousa I4, Juárez M4, Fernández-Avilés F4.
Abstract
INTRODUCTION AND OBJECTIVES: Despite therapeutic hypothermia, unconscious survivors of out-of-hospital cardiac arrest have a high risk of death or poor neurologic function. Our objective was to assess the usefulness of the variables obtained in the early moments after resuscitation in the prediction of 6-month prognosis.
METHODS: A multicenter study was performed in 3 intensive cardiac care units. The analysis was done in 153 consecutive survivors of out-of-hospital cardiac arrest who underwent targeted temperature management between January 2007 and July 2015. Significant neurological sequelae at 6 months were considered to be present in patients with Cerebral Performance Categories Scale > 2. An external validation was performed with data from 91 patients admitted to a third hospital in the same time interval.
RESULTS: Among the 244 analyzed patients (median age, 60 years; 77.1% male; 50.0% in the context of acute myocardial ischemia), 107 patients (43.8%) survived with good neurological status at 6 months. The prediction model included 5 variables (Shockable rhythm, Age, Lactate levels, Time Elapsed to return of spontaneous circulation, and Diabetes - SALTED) and provided an area under the curve of 0.90 (95%CI, 0.85-0.95). When external validation was performed, the predictive model showed a sensitivity of 73.5%, specificity of 78.6%, and area under the curve of 0.82 (95%CI, 0.73-0.91).
CONCLUSIONS: A predictive model that includes 5 clinical and easily accessible variables at admission can help to predict the probability of survival without major neurological damage following out-of-hospital cardiac arrest.

5. Biomarkers. 2018 Jul 17:1-25. doi: 10.1080/1354750X.2018.1499804. [Epub ahead of print]
The association between plasma miR-122-5p release pattern at admission and all-cause mortality or shock after out-of-hospital cardiac arrest.

Gilje P1, Frydland M2, Bro-Jeppesen J2, Dankiewicz J3, Friberg H3, Rundgren M3, Devaux Y4, Stammet P5, Al-Mashat M6, Jögi J6, Kjaergaard J2, Hassager C2, Erlinge D1.
Abstract
BACKGROUND: Data suggests that the plasma levels of the liver-specific miR-122-5p might both be a marker of cardiogenic shock and a prognostic marker of out-of-hospital cardiac arrest (OHCA). Our aim was to characterize plasma miR-122-5p at admission after OHCA and to assess the association between miR-122-5p and relevant clinical factors such all-cause mortality and shock at admission after OHCA.
METHODS: In the pilot trial, 10 survivors after OHCA were compared to 10 age- and sex-matched controls. In the main trial, 167 unconscious survivors of OHCA from the Targeted Temperature Management (TTM) trial were included.
RESULTS: In the pilot trial, plasma miR-122-5p at admission after OHCA was 400-fold elevated compared to controls. In the main trial, plasma miR-122-5p at admission was independently associated with lactate and bystander cardiopulmonary resuscitation. miR-122-5p at admission was not associated with shock at admission ($p = 0.14$) or all-cause mortality ($p = 0.35$). Target temperature (33°C vs 36°C) was not associated with miR-122-5p levels at any time point.
CONCLUSIONS: After OHCA, miR-122-5p demonstrate a marked acute increase in plasma and is independently associated with lactate and bystander resuscitation. However, miR-122-5p at admission is not associated with all-cause mortality or shock at admission.

6. Zhonghua Wei Zhong Bing Ji Jiu Yi Xue. 2018 Jun;30(6):554-557. doi: 10.3760/cma.j.issn.2095-4352.2018.06.010.
[Comparison of the accuracy of predicting poor outcome of coma after cardiopulmonary resuscitation with two kinds of electroencephalogram techniques].
[Article in Chinese]
Yang Q1, Meng H, Li Z, Lai C, Wang J, Su Y.
Abstract
OBJECTIVE: To compare the accuracy of electroencephalography (EEG) grading scale with amplitude-integrated electroencephalography (aEEG) in predicting poor outcomes (3-month), who sustained coma after cardiopulmonary resuscitation (CPR) in adults.
METHODS: A retrospective study was conducted. The patients with post-anoxic coma admitted to intensive care unit (ICU) of Tongren Hospital, Capital Medical University from March 2010 to June 2017 were enrolled. EEG was registered and recorded at least once within 7 days of coma after CPR, while not being subjected to therapeutic hypothermia. General data, Glasgow coma scale (GCS), EEG grading and aEEG model were collected. According to Glasgow prognosis score (GOS) of 3-month outcome, patients were divided into poor prognosis group (GOS 1-2) and good prognosis group (GOS 3-5), and the differences of related indexes between the two groups were compared. The predictive ability of aEEG model and EEG grading for brain function prognosis was evaluated by receiver operating characteristic (ROC) curve.
RESULTS: Fifty-four patients were included, with 31 males and 23 females, and age of (53.9±19.3) years. Among the EEG Young grades, 17 cases (31.5%) were grade 1, 4 cases (7.4%) were grade 2-5, and 33 cases (61.1%) were grade 6. Among the aEEG model grades, 26 cases (48.1%) had slow wave pattern grade 1, 23 cases (42.6%) had suppressed mode grade 4, 4 cases (7.4%) had status epilepticus mode grade 2, and 1 case (1.9%) had burst suppression mode grade 3. Thirty-six patients had poor prognosis 3-month after onset, 26 of them died and 10 had persistent vegetative state. The prognosis was good in 18 cases, including 16 cases with severe neurological disability and 2 cases with moderate neurological disability. There was no significant difference in gender, age, anoxic time between two groups with different prognosis, while the degree of consciousness disorder in poor prognosis group was more severe than that in good prognosis group (GCS score: 4.1±1.7 vs. 5.0±2.1, $P < 0.05$). The consistency test showed that different physicians had good consistency in EEG grading and aEEG model (Kappa values were 0.917 and 0.932, respectively). It was shown by ROC curve analysis that the area under ROC curve (AUC) of aEEG model and EEG grading for predicting poor prognosis of coma patients after CPR were 0.815 and 0.720, respectively (both $P < 0.01$); when the cut-off value of aEEG was 2.5, the sensitivity was 79.3%, the specificity was 77.4%, the positive likelihood ratios (PLR) was 3.508, and the negative likelihood ratios (NLR) was 0.267; when the cut-off value of EEG grading was 4.5, the sensitivity was 82.8%, the specificity was 61.3%, the PLR was 2.140, and NLR was 0.281.
CONCLUSIONS: aEEG model was more accurate in prognosticating poor outcomes (3-month) in patients with post-anoxic coma, when compared to EEG grading. Its operation was simple, so aEEG is very suitable in ICU.
Free Article

7. Scand J Trauma Resusc Emerg Med. 2018 Jul 13;26(1):59. doi: 10.1186/s13049-018-0529-7.
Neurologic outcome after out-of-hospital cardiac arrest could be predicted with the help of bispectral-index during early targeted temperature management.
Park JH1, Oh JH1, Choi SP1, Wee JH 2.

Abstract
BACKGROUND: Outcome prediction is crucial for out-of-hospital cardiac arrest (OHCA) survivors. Several attempts have been made to use the bispectral index (BIS) for this purpose. We aimed to investigate the prognostic power of the BIS during the early stage of targeted temperature management (TTM) after OHCA.
METHODS: From Jan 2014 to Feb 2017, the BIS was determined in OHCA patients as soon as possible after the start of TTM. We injected a neuro-muscular blocking agent and recoded the BIS value and the time when the electromyographic (EMG) factor reached zero. The primary outcome was the cerebral performance category scale (CPC) score at 6 months, and a poor outcome was defined as a CPC score of 3, 4, or 5. The exclusion criteria were age under 18 years, traumatic cardiac arrest, and BIS data with a non-zero EMG factor.
RESULTS: Sixty-five patients were included in this study. Good outcomes were observed for 16 patients (24.6%), and poor outcomes were observed for 49 patients (75.4%). The mean time of BIS recording was 2.3 ± 1.0 h after return of spontaneous circulation (ROSC). The mean BIS values of the good outcome and poor outcome groups were 35.6 ± 13.1 and 5.5 ± 9.2, respectively ($p < 0.001$). The area under the curve was 0.961. Use of a cut-off value of 20.5 to predict a good outcome yielded a sensitivity of 87.5% and specificity of 93.9%. Use of a cut-off value of 10.5 to predict a poor outcome yielded a sensitivity of 87.8% and specificity of 100%.
CONCLUSION: With the help of BIS, physicians could predict that a patient who has BIS value over 20.5 after ROSC could have a big chance to get good neurological outcome in less than three hours.
Free Article

8. Shock. 2018 Jul 25. doi: 10.1097/SHK.0000000000001227. [Epub ahead of print]
Plasma Adenylate Levels are Elevated in Cardiopulmonary Arrest Patients and May Predict Mortality.
Sumi Y1,2, Ledderose C2, Li L2, Inoue Y1,3, Okamoto K1, Kondo Y1,2, Sueyoshi K1,2, Junger WG2,4, Tanaka H1.
Abstract
Cerebral and cardiac dysfunction cause morbidity and mortality in post-cardiac arrest syndrome (PCAS) patients. Predicting clinical outcome is necessary to provide the optimal level of life support for these patients. In this pilot study, we examined whether plasma ATP and adenylate levels have value in predicting clinical outcome in PCAS patients. In total, 15 patients who experienced cardiac arrest outside the hospital setting and who could be reanimated were enrolled in this study. Healthy volunteers (n = 8) served as controls. Of the 15 PCAS patients, 8 died within 4 days after resuscitation. Of the 7 survivors, 2 lapsed into vegetative states, 1 survived with moderate disabilities, and 4 showed good recoveries. Arterial blood samples were drawn immediately after successful resuscitation and return of spontaneous circulation (ROSC). The concentrations of ATP and other adenylates in plasma were assessed with high performance liquid chromatography. PCAS patients had significantly higher ATP levels than healthy controls. Plasma ATP levels correlated with lactate levels, Acute Physiology and Chronic Health Evaluation (APACHE) II scores, and the time it took to regain spontaneous circulation (time-to-ROSC). Plasma adenylate levels in patients who died after resuscitation were significantly higher than in survivors. Based on our results and receiver operating characteristic curve analysis, we conclude that plasma adenylate levels may help predict outcome in PCAS patients.

9. Resuscitation. 2018 Jul 20. pii: S0300-9572(18)30364-2. doi: 10.1016/j.resuscitation.2018.07.021. [Epub ahead of print]
Routine blood markers from different biological pathways improve early risk stratification in cardiac arrest patients: Results from the prospective, observational COMMUNICATE study.
Isenschmid C1, Kalt J1, Gamp M2, Tondorf T2, Becker C3, Tisljar K4, Locher S2, Schuetz P5, Marsch S6, Hunziker S7.
Abstract
INTRODUCTION: Prognostication of cardiac arrest patients admitted to the intensive care unit (ICU) may influence treatment decision, but remains challenging. We evaluated the incremental usefulness of routine blood markers from different biological pathways for predicting fatal outcome and neurological deficits in cardiac arrest patients.
METHODS: We prospectively included consecutive, adult cardiac arrest patients upon ICU admission. We recorded initial clinical parameters and measured blood markers of cardiac injury/stress (troponin, BNP, CK), inflammation/infection (WBC, CRP, procalcitonin) and shock (lactate, creatinine, urea). The primary and secondary endpoints were all-cause in-hospital mortality and bad neurological outcome defined by the Cerebral Performance Category (CPC) score.
RESULTS: Mortality in the 321 included patients was 49% (n = 156). Procalcitonin (adjusted odds ratio 1.84, 95%CI 1.34 to 2.53, $p < 0.001$; AUC 0.73) and lactate (adjusted odds ratio 7.29, 95%CI 3.05 to 17.42, $p < 0.001$; AUC 0.70) were identified as independent prognostic factors for mortality and significantly improved discrimination of a parsimonious clinical model including resuscitation measures (no-flow time, shockable rhythm) and initial vital signs (Glasgow coma scale, respiratory rate) from an AUC of 0.79 to 0.84 ($p < 0.001$). Cardiac markers did not further improve the model. Results for neurological outcome were similar with model improvements by procalcitonin and lactate from AUC 0.83 to 0.87 ($p = 0.004$).
CONCLUSION: Assessment of routine markers of inflammation/infection and shock provide significant improvements for prognostication of cardiac arrest patients, while cardiac markers did not further improve

statistical models. Combination of blood markers and clinical parameters may help to improve initial management decisions in this vulnerable patient population.

10. Resuscitation. 2018 Jul 19. pii: S0300-9572(18)30360-5. doi: 10.1016/j.resuscitation.2018.07.017. [Epub ahead of print]
The impact of diastolic blood pressure values on the neurological outcome of cardiac arrest patients.
Annoni F1, Dell'anna AM1, Franchi F2, Creteur J1, Scolletta S3, Vincent JL1, Silvio Taccone F4.
Abstract
AIM: Which haemodynamic variable is the best predictor of neurological outcome remains unclear. We investigated the association of several haemodynamic variables with neurological outcome in CA patients.
METHODS: Retrospective analysis of adult comatose survivors of CA admitted to the intensive care unit (ICU) of a University Hospital. Exclusion criteria were early death due to withdrawal of care, missing haemodynamic data and use of intra-aortic balloon pump or extracorporeal membrane oxygenation. We retrieved CA characteristics; lactate concentration and cardiovascular sequential organ failure assessment (cSOFA) score on admission; systolic (SAP), diastolic (DAP), mean arterial pressure (MAP), and the use of vasopressors and inotropic agents during the first 6 hours of ICU stay. Unfavourable neurological outcome (UO) was defined as a 3-month cerebral performance category score of 3-5.
RESULTS: Among the 170 patients (median age 63 years, 67% male, 60% out-of-hospital CA), 106 (63%) had UO. Admission lactate was higher in patients with UO than in those with favourable neurological outcome (4.0[2.4-7.3] vs. 2.5[1.4-6.0] mEq/L; p = 0.003) as was the cSOFA (3 [1-4] vs. 2[0-3]; p = 0.007). The lowest DAP during the first 6 hours after ICU admission was significantly lower in patients with unfavourable neurological outcome, notably in patients with high cSOFA scores. In multivariable analysis, high adrenaline doses and the lowest value of DAP during the first 6 hours after ICU admission was significantly associated with unfavourable neurological outcome.
CONCLUSIONS: In CA patients admitted to the ICU, low DAP during the first 6 hours is an independent predictor of unfavourable neurological outcome at 3 months.

11. Am J Emerg Med. 2018 Jun 23. pii: S0735-6757(18)30514-X. doi: 10.1016/j.ajem.2018.06.049. [Epub ahead of print]
Effect of hypertension across the age group on survival outcomes in out-of-hospital cardiac arrest.
Jung E1, Park JH2, Ro YS3, Song KJ2, Ryu HH4, Lee SC5, Do Shin S6.
Abstract
OBJECTIVE: There are few studies on the effects hypertension has on survival outcomes in out-of-hospital-cardiac arrest (OHCA) patients, although hypertension is a major risk factor for the incidence of cardiac arrest. This study aims to investigate whether hypertension is associated with survival outcomes in cardiac arrest patients across age groups.
METHODS: This study was conducted using the national cardiac arrest registry of OHCA patients who survived to hospital admission from 2012 to 2016. The clinical histories of hypertension were obtained from patients' medical records. The endpoint was cerebral performance category (CPC) 1 and 2 (good CPC) and survival to discharge. Multivariable logistic regression analysis was performed on the data collected. The final model with an interaction term was evaluated to compare the effects of hypertension across age groups.
RESULTS: A total 11,610 patients (61.0% hypertensive patients and 39.0% non-hypertensive patients) were included. The group over 80 years old with hypertension were more likely to have good neurologic recovery (AOR 2.53 [1.43-4.50]) and those under 65 years old with hypertension were more likely to survive to hospital discharge with statistical significance (AOR 1.19 [1.04-1.35]).
CONCLUSIONS: Hypertension does not imply poor survival outcomes independently for all ages, as those over 80 years of age can have rather good neurological outcomes

TARGET TEMPERATURE MANAGEMENT

1. Anesth Essays Res. 2018 Apr-Jun;12(2):506-511. doi: 10.4103/aer.AER_47_18.
Comparison of Nasopharyngeal Temperature Measured at Fossa of Rosenmuller and Blindly Inserted Temperature Probe with Esophageal Temperature: A Cross-Sectional Study.
Duggappa AKH1, Mathew S1, Gupta DN2, Muhamed S1, Nanjangud P1, Kordcal AR1.
Abstract
Introduction: Monitoring body temperature and maintaining normothermia are now essentially the standard-of-care during anesthesia. This study was designed to compare the temperature measured by nasopharyngeal temperature probes inserted by landmark method and fiberscope-guided method with esophageal temperature. We hypothesized that placing the temperature probe at the level of fossa of Rosenmuller will reflect core temperature as it is in close relationship to the brain.

Subjects and Methods: Sixty-five patients aged 18-60 years were enrolled in this cross-sectional study. Two methods were used in our study to place the temperature probes. In landmark-based method, we inserted temperature probe through nostril for a depth equal to philtrum-tragus distance. In fiberscope-guided method, the temperature probe was inserted into nostril and its tip was positioned at fossa of Rosenmuller under fiberscope guidance.
Results: The nasopharyngeal temperatures were recorded at seven time intervals along with esophageal temperature. Mean temperatures were calculated at three different sites. The degree of agreement between two methods at seven time intervals was also calculated. Both methods had good correlation with esophageal temperature. Depth of insertion of temperature probes was documented. There was difference in depth of insertion of temperature probe of around 4.26 cm between two methods, probe length from philtrum to tragus (D1) being longer than distance from fossa of Rosenmuller to nares (D2).
Conclusions: Nasopharyngeal temperature measured at fossa of Rosenmuller with probe inserted by fiberscope-guided method and that measured by landmark-based method with probe inserted according to philtrum-tragus distance shows good correlation with esophageal temperature.
Free Article

2. Am J Emerg Med. 2018 Jul 11. pii: S0735-6757(18)30581-3. doi: 10.1016/j.ajem.2018.07.024. [Epub ahead of print]
A systematic review of safety and adverse effects in the practice of therapeutic hypothermia.
Karcioglu O1, Topacoglu H2, Dikme O3, Dikme O4 .
Abstract
OBJECTIVE: To carry out a systematic review to estimate the rate and magnitude of adverse effects following therapeutic hypothermia (TH) procedure in patients resuscitated from out-of-hospital cardiac arrest (OHCA) and highlight the specific complications seen after the procedure.
METHODS: A systematic review of currently published studies was performed following standard guidelines. Online database searches were performed for controlled trials for the last twenty years. Papers were examined for methodological soundness before being included. Data were independently extracted by two blinded reviewers. Studies were also assessed for bias using the Cochrane criteria. The adverse effects attributed to TH in the literature were appraised critically.
RESULTS: The initial data search yielded 78 potentially relevant studies; of these, 59 were excluded for some reason. The main reason for exclusion (n = 43, 55.8%) was that irrelevance to adverse effects of TH. Finally, 19 underwent full-text review. Studies were of high-to-moderate (n = 12, 63%) to low-to-very low (n = 7, 37%) quality. Five studies (27.7%) were found to have high risk of bias, while 8 (42.1%) had low risk of bias.
INTERPRETATION: Although adverse effects related to the practice of TH have been studied extensively, there is substantial heterogeneity between study populations and methodologies. There is a considerable incidence of side effects attributed to the procedure, e.g., from life-threatening ventricular arrhythmias to self-limited consequences. Most studies analyzed in this systematic review indicated that the procedure of TH has not caused severe adverse effects leading to significant alterations in the outcomes following resuscitation from OHCA.
PROSPERO, registration number is: CRD42018075026.

3. Ther Hypothermia Temp Manag. 2018 Jul 17. doi: 10.1089/ther.2018.0012. [Epub ahead of print]
Mild Therapeutic Hypothermia Increases Glutathione Levels in Postcardiac Arrest Patients.
Hackenhaar FS1,2, Medeiros TM1,2, Heemann FM1,2, Behling CS1,2, Mahl CD1,2, Verona C1,2,3, Silva ACA1,2, Oliveira VM3, Riveiro DFM3, Vieira SRR4, Benfato MS1,2.
Abstract
Ischemia-reperfusion (I/R)-induced oxidative stress is one of the main mechanisms of tissue injury after cardiac arrest (CA). A decrease in antioxidant defenses may contribute to I/R injury. The present study aims to investigate the influence of mild therapeutic hypothermia (MTH) on levels of nonenzymatic antioxidants after CA. We investigated antioxidant levels at 6, 12, 36, and 72 hours after CA in central venous blood samples of patients admitted to intensive care. The sample consisted of 31 patients under controlled normothermia (36°C) and 11 patients treated with 24 hours of MTH (33°C). Erythrocyte glutathione (GSH) levels were elevated by MTH, increasing at 6, 12, 36, and 72 hours after CA in hypothermic patients (mean GSH levels in normothermic patients: 6 hours = 73.89, 12 hours = 56.45, 36 hours = 56.46, 72 hours = 61.80 vs. hypothermic patients: 6 hours = 176.89, 12 hours = 198.78, 36 hours = 186.96, and 72 hours = 173.68 μmol/g of protein). Vitamin C levels decreased significantly at 6 and 12 hours after CA in hypothermic patients (median vitamin C levels in normothermic patients: 6 hours = 7.53, 12 hours = 9.40, 36 hours = 8.56, and 72 hours = 8.51 vs. hypothermic patients: 6 hours = 5.46, 12 hours = 5.44, 36 hours = 6.10, and 72 hours = 5.89 mmol/L), coinciding with the period of therapeutic hypothermia. Vitamin E and nitric oxide levels were not altered by hypothermic treatment. These findings suggest that MTH alters nonenzymatic antioxidants differently, decreasing circulating vitamin C levels during treatment; however, MTH elevates GSH levels, possibly protecting tissues from I/R injury after CA.

4. Resuscitation. 2018 Jul 24. pii: S0300-9572(18)30365-4. doi: 10.1016/j.resuscitation.2018.07.022. [Epub ahead of print]
Continuous Surface EMG Power Reflects the Metabolic Cost of Shivering During Targeted Temperature Management After Cardiac Arrest.
May TL1, Riker RR2, Gagnon DJ3, Duarte C4, McCrum B5, Hoover C6, Seder DB7.
Abstract
AIM: Shivering may interfere with targeted temperature management (TTM) after cardiac arrest, contributing to secondary brain injury. Early identification of shivering is challenging with existing tools. We hypothesized that shivering detected by continuous surface sEMG monitoring would be validated with calorimetry and detected earlier than by intermittent clinical observation.
METHODS: This prospective observational study enrolled a convenience sample of comatose adult cardiac arrest patients treated with TTM at 33 °C. Clinical shivering was monitored hourly using the Bedside Shivering Assessment Scale (BSAS) by bedside nurses who administered intermittent neuromuscular blockade (NMB) when BSAS ≥ 1. The research team monitored independently for shivering with BSAS every 15 minutes during continuous blinded monitoring of oxygen consumption (VO2) via indirect calorimetry and sEMG power during the maintenance phase of TTM. A sustained 20% increase in the 5-minute rolling average of VO2 above baseline identified the Gold Standard shivering threshold (VO2-20).
RESULTS: Among 18 patients, clinical shivering was detected 23 times in 14 patients. Hierarchical models to predict a shiver event determined by the VO2-20 for sEMG power and BSAS revealed an AUC for sEMG power of 0.92 (95%CI = 0.88-0.95), and 0.90 (CI = 0.87-0.94) for BSAS. The optimal threshold of sEMG to predict VO2-20 was 32 decibels (dB), and this was exceeded 38 (29-56) minutes before nurse-detected shivering.
CONCLUSIONS: Shivering was detected by sEMG power earlier than by clinical assessment with BSAS, with similar accuracy compared to the indirect calorimetry gold standard. Continuous sEMG monitoring appears useful for clinical assessment and research for shivering during TTM.

5. J Crit Care. 2018 Jul 18;47:227-231. doi: 10.1016/j.jcrc.2018.07.019. [Epub ahead of print]
Association between the neutrophil-to-lymphocyte ratio and neurological outcomes in patients undergoing targeted temperature management after cardiac arrest.
Kim HJ1, Park KN1, Kim SH1, Lee BK2, Oh SH1, Moon HK1, Jeung KW2, Choi SP3, Cho IS4, Youn CS5.
Abstract
PURPOSE: This study aimed to elucidate the association between the neutrophil-to-lymphocyte ratio (NLR) and neurological outcomes in out-of-hospital cardiac arrest (OHCA) patients treated with targeted temperature management (TTM).
MATERIALS AND METHODS: A retrospective study was performed on patients treated with TTM after OHCA. Patients were divided into two groups according to their calculated NLRs (NLR < 6 and NLR ≥ 6). The primary outcome was poor neurological outcome at 6 months as defined by a Cerebral Performance Category between 3 and 5.
RESULTS: A total of 216 were included and 131 subjects had poor neurological outcomes at 6 months. In the univariate model, NLRs ≥ 6 at 48 and 72 h after ROSC were associated with poor neurological outcomes (OR: 3.716, 95% CI: 1.243-11.114; OR: 7.429, 95% CI: 3.693-14.945, respectively). In the multivariate logistic regression analysis, an NLR ≥ 6 at 72 h was associated with poor neurological outcomes after adjusting for history of HTN, shockable rhythm, cardiac cause of arrest and time from collapse to ROSC and highest WBC, hs-CRP, lactate and pneumonia (OR = 3.299, 95% CI = 1.080-10.081).
CONCLUSIONS: An NLR ≥ 6 at 72 h after the ROSC is associated with poor neurological outcomes at 6 months after CA.

6. Resuscitation. 2018 Jan;122:79-86. doi: 10.1016/j.resuscitation.2017.11.052. Epub 2017 Nov 22.
Neuron-specific enolase and S-100b in prolonged targeted temperature management after cardiac arrest: A randomised study.
Duez CHV1, Grejs AM2, Jeppesen AN2, Schrøder AD3, Søreide E4, Nielsen JF5, Kirkegaard H6.
Abstract
BACKGROUND: We aimed to investigate the impact of prolonged targeted temperature management (TTM) in cardiac arrest patients on release of serum levels of NSE and S-100b and their prognostic performances.
METHODS: This is a substudy of the Targeted Temperature Management for 24 vs 48h trial. NSE and S-100b levels were analysed retrospectively in serum samples collected upon admission, at 24, 48, and 72h after reaching the target temperature of 33±1°C. The primary outcome was biomarker serum concentrations and secondary outcome was the cerebral performance category score after 6 months.
RESULTS: 115 patients from two centres were analysed. NSE and S-100b levels did not differ between TTM groups at any single time-point. Poor outcome patients had higher biomarker levels at 24, 48, and 72h: NSE: 9.73 (7.2; 10.9) versus 20.40 (12.7; 27.2), 8.86 (6.6; 9.6) versus 17.47 (11.1; 37.3) and 6.23 (5.3; 8.5) versus 31.05 (12.8; 52.5)

respectively and S-100b: 0.09 (0.07; 0.11) versus 0.23 (0.19; 0.39), 0.08 (0.07; 0.09) versus 0.18 (0.15; 0.33) and 0.07 (0.06; 0.08) versus 0.13 (0.09; 0.23). The daily changes in NSE from admission to Day 2 after the cardiac arrest (CA) were also related to the outcome (p=0.003 and p=0.02). The best prediction of outcome was found at 72h for NSE and at 24h as well as 48h for S100b.
CONCLUSIONS: No clinically relevant differences were found in the levels of NSE or S-100b between standard and prolonged TTM. Prognostic reliability of NSE and S-100b was unaltered by prolonged TTM.

7. Resuscitation. 2018 Jul 24. pii: S0300-9572(18)30367-8. doi: 10.1016/j.resuscitation.2018.07.024. [Epub ahead of print]
Highly malignant routine EEG predicts poor prognosis after cardiac arrest in the Target Temperature Management trial.
Backman S1, Cronberg T2, Friberg H3, Ullén S4, Horn J5, Kjaergaard J6, Hassager C7, Wanscher M8, Nielsen N9, Westhall E10.
Abstract
INTRODUCTION: Routine EEG is widely used and accessible for post arrest neuroprognostication. Recent studies, using standardised EEG terminology, have proposed highly malignant EEG patterns with promising predictive ability.
OBJECTIVES: To validate the performance of standardised routine EEG patterns to predict neurological outcome after cardiac arrest.
METHODS: In the prospective multicenter Target Temperature Management trial, comatose cardiac arrest patients were randomised to different temperature levels (950 patients, 36 sites). According to the prospective protocol a routine EEG was performed in patients who remained comatose after the 36 hours temperature control intervention. EEGs were retrospectively reviewed blinded to outcome using the standardised American Clinical Neurophysiology Society terminology. Highly malignant, malignant and benign EEG patterns were correlated to poor and good outcome, defined by best achieved Cerebral Performance Category up to 180 days.
RESULTS: At 20 sites 207 patients had a routine EEG performed at median 76 hours after cardiac arrest. Highly malignant patterns (suppression or burst-suppression with or without discharges) had a high specificity for poor outcome (98%, CI 92-100), but with limited sensitivity (31%, CI 24-39). Our false positive patient had a burst-suppression pattern during ongoing sedation. A benign EEG, i.e. continuous normal-voltage background without malignant features, identified patients with good outcome with 77% (CI 66-86) sensitivity and 80% (CI 73-86) specificity.
CONCLUSION: Highly malignant routine EEG after targeted temperature management is a strong predictor of poor outcome. A benign EEG is an important indicator of a good outcome for patients remaining in coma.

ELECTROFISIOLOGIA I DESFIBRIL·LACIÓ

1. IEEE Trans Biomed Eng. 2018 Apr 16. doi: 10.1109/TBME.2018.2827304. [Epub ahead of print]
A Multistage Algorithm for ECG Rhythm Analysis during Piston Driven Mechanical Chest Compressions.
Isasi I, Irusta U, Aramendi E, Ayala U, Alonso E, Kramer-Johansen J, Eftestol T.
Abstract
OBJECTIVE: An accurate rhythm analysis during cardiopulmonary resuscitation (CPR) would contribute to increase survival from out-of-hospital cardiac arrest. Piston-driven mechanical compression devices are frequently used to deliver CPR. The objective of this work was to design a method to accurately diagnose the rhythm during compressions delivered by a piston-driven device.
METHODS: Data was gathered from 230 out-of-hospital cardiac arrest patients treated with the LUCAS 2 mechanical CPR device. The dataset comprised 201 shockable and 844 nonshockable ECG segments, whereof 270 were asystole (AS) and 574 organized rhythm (OR). A multistage algorithm (MSA) was designed, which included two artifact filters based on a recursive least squares algorithm, a rhythm analysis algorithm from a commercial defibrillator, and an ECG-slope based rhythm classifier. Data was partitioned randomly and patient-wise into training (60%) and test (40%) for optimization and validation, and statistically meaningful results were obtained repeating the process 500 times.
RESULTS: The mean (standard deviation) sensitivity (SE) for shockable rhythms, specificity (SP) for nonshockable rhythms, and total accuracy of the MSA solution were: 91.7 (6.0), 98.1 (1.1) and 96.9 (0.9), respectively. The SP for AS and OR were 98.0 (1.7) and 98.1 (1.4), respectively.
CONCLUSIONS: The SE/SP were above the 90/95% values recommended by the American Heart Association for shockable and nonshockable rhythms other than sinus rhythm, respectively.

2. Resuscitation. 2018 Jul 3;130:73-80. doi: 10.1016/j.resuscitation.2018.06.036. [Epub ahead of print]
Experiences and outcome from the implementation of a national Swedish automated external defibrillator registry.

Fredman D1, Ringh M1, Svensson L1, Hollenberg J 1, Nordberg P1, Djärv T1, Hasselqvist-Ax I1, Wagner H2, Forsberg S1, Nord A1, Jonsson M1, Claesson A3.
Abstract
BACKGROUND: Early cardiopulmonary resuscitation (CPR) and defibrillation with an Automated External Defibrillator (AED) increase survival from out-of-hospital cardiac arrest (OHCA). Although international guidelines recommend the use of AED registries to increase AED use, little is known about implementation. The aim of this paper is to describe the development of a national AED registry, to analyse the coverage and barriers to register AEDs.
METHODS: The Swedish AED Registry (SAEDREG) was initiated in 2009 with the purpose of gathering the data of all public AEDs in Sweden. Data on all AEDs between 2013 and 2016 were included in the study. Additionally, data of non-registered AEDs was collected in one region using a survey to AED owners focusing on AED functionality.
RESULTS: The number of AEDs doubled between 2013-2016. A total of 6703 AEDs (30%) were removed due to unavailability of validation. At the end of 2016, AEDs were most frequently registered in offices and workplaces, 45% (n = 7241) followed by shops, 7% (n = 1200). In the Gotland region, 218 AEDs, 57% (n = 124) were registered in the SAEDREG. Of n = 94 Non-registered AED functionality was high, the main reason not to register was unawareness of the SAEDREG, 74.5%. Of those aware of the register but not having registered, 25% stated "hard to register" as cause.
CONCLUSIONS: A national AED registry may gather information of AEDs on a national level. Although numbers have doubled between 2013-2016 in Sweden, a large proportion is still non-registered. More awareness of the registry and easier registration process is needed. General AED functionality seems high regardless of registered or non-registered AEDs. A key area for future research may be to use AED-registers to ascertain effectiveness of AED programs in terms of actual patient outcome.

3. Resuscitation. 2018 Jan;122:54-60. doi: 10.1016/j.resuscitation.2017.11.053. Epub 2017 Nov 24.
Interaction of defibrillation waveform with the time to defibrillation or the number of defibrillation attempts on survival from out-of-hospital cardiac arrest.
Hagihara A1, Onozuka D2, Ono J2, Nagata T3, Hasegawa M4.
Abstract
AIM: Early biphasic defibrillation is effective in out-of-hospital cardiac arrest (OHCA) cases. In the resuscitation of patients with OHCA, it is not clear how the defibrillation waveform interacts with the time to defibrillation to influence patient survival. The second, and any subsequent, shocks need to be administered by an on-line physician in Japan. Thus, we investigated the interaction between the defibrillation waveform and time to or the number of defibrillation on resuscitation outcomes.
METHODS: This prospective observational study used data for all OHCAs that occurred between 2005 and 2014 in Japan. To investigate the interaction effect between the defibrillation waveform and the time to defibrillation or the number of defibrillations on the return to spontaneous circulation (ROSC), 1-month survival, and cerebral performance category (CPC) (1, 2), we assessed the modifying effects of the defibrillation waveform and the time to or the number of defibrillation on additive scale (i.e., the relative excessive risk due to interaction, RERI) and multiplicative scale (i.e., ratio of odds ratios (ORs)).
RESULTS: In total, 71,566 cases met the inclusion criteria. For the measure of interaction between the defibrillation waveform and the time to defibrillation, ratio of ORs for ROSC was 0.84 (0.75-0.94), implying that the effect of time to first defibrillation on ROSC was negatively modified by defibrillation waveform. For the interaction between the defibrillation waveform and the number of defibrillations, RERI and ratio of ORs for CPC (1, 2) was -0.25 (-0.47 to -0.06) and 0.79 (0.67-0.93), respectively. It is implied that the effect of number of defibrillation on CPC (1, 2) was negatively modified by defibrillation waveform.
CONCLUSIONS: An increased number of defibrillations was associated with a decreased ROSC in the case of biphasic and monophasic defibrillation, while an increased number of defibrillations was related to an increased 1-month survival rate and CPC (1, 2) only in the case of biphasic defibrillation. When two or more defibrillations were performed, a biphasic waveform was more effective in terms of long-term survival than a monophasic waveform.

ECMO

1. Pediatr Crit Care Med. 2018 Jun 29. doi: 10.1097/PCC.0000000000001642. [Epub ahead of print]
Factors Associated With Mortality in Children Who Successfully Wean From Extracorporeal Membrane Oxygenation.
Howard TS1, Kalish BT1, Rajagopal SK2, Williams K 3, Zalieckas J4, Thiagarajan RR5,6, Alexander PMA5,6.
Abstract
OBJECTIVES: Extracorporeal membrane oxygenation is an established therapy for cardiac and respiratory failure unresponsive to usual care. Extracorporeal membrane oxygenation mortality remains high, with ongoing risk of death even after successful decannulation. We describe occurrence and factors associated with mortality in

children weaned from extracorporeal membrane oxygenation.
DESIGN: Retrospective cohort study.
SETTING: Two hundred five extracorporeal membrane oxygenation centers reporting to the Extracorporeal Life Support Organization.
SUBJECTS: Eleven thousand ninety-six patients, less than 18 years, supported with extracorporeal membrane oxygenation during 2007-2013, who achieved organ recovery before decannulation.
INTERVENTIONS: None.
MEASUREMENTS AND MAIN RESULTS: Primary outcome was hospital mortality less than or equal to 30 days post extracorporeal membrane oxygenation decannulation. Among 11,096 patients, indication for extracorporeal membrane oxygenation cannulation was respiratory (6,206; 56%), cardiac (3,663; 33%), or cardiac arrest (extracorporeal cardiopulmonary resuscitation, 1,227; 11%); the majority were supported with venoarterial extracorporeal membrane oxygenation at some stage in their course (8,576 patients; 77%). Mortality was 13%. Factors associated with mortality included younger age (all < 1 yr categories compared with older, $p < 0.05$), lower weight among neonates (≤ 3 vs > 3 kg; $p < 0.001$), mode of extracorporeal membrane oxygenation support (venoarterial extracorporeal membrane oxygenation compared with venovenous extracorporeal membrane oxygenation, $p < 0.001$), longer admission to extracorporeal membrane oxygenation cannulation time (≥ 28 vs < 28 hr; $p < 0.001$), cardiac and extracorporeal cardiopulmonary resuscitation compared with respiratory extracorporeal membrane oxygenation (both $p < 0.001$), extracorporeal membrane oxygenation duration greater than or equal to 135 hours ($p < 0.001$), preextracorporeal membrane oxygenation hypoxemia (PO_2 ≤ 43 vs > 43 mm Hg; $p < 0.001$), preextracorporeal membrane oxygenation acidemia ($p < 0.001$), and extracorporeal membrane oxygenation complications, particularly cerebral or renal (both $p < 0.001$).
CONCLUSIONS: Despite extracorporeal membrane oxygenation decannulation for organ recovery, 13% of patients die in hospital. Mortality is associated with patient factors, preextracorporeal membrane oxygenation illness severity, and extracorporeal membrane oxygenation management. Evidence-based strategies to optimize readiness for extracorporeal membrane oxygenation decannulation and postextracorporeal membrane oxygenation decannulation care are needed.

2. BMJ Open. 2018 May 18;8(5):e019811. doi: 10.1136/bmjopen-2017-019811.
Impact of extracorporeal cardiopulmonary resuscitation on outcomes of elderly patients who had out-of-hospital cardiac arrests: a single-centre retrospective analysis.
Goto T1,2, Morita S2, Kitamura T3, Natsukawa T2, Sawano H2, Hayashi Y2, Kai T2.
Abstract
OBJECTIVES: Little is known about the effectiveness of extracorporeal cardiopulmonary resuscitation (ECPR) for elderly patients who had out-of-hospital cardiac arrest (OHCA). The aim of this study was to examine the impact of age on outcomes among patients who had OHCA treated with ECPR.
DESIGN: Single-centre retrospective cohort study.
SETTING: A critical care centre that covers a population of approximately 1 million residents.
PARTICIPANTS: Patients who had consecutive OHCA aged ≥18 years who underwent ECPR from 2005 to 2013.
PRIMARY AND SECONDARY OUTCOME MEASURES: Primary outcomes were 1 month neurologically favourable outcomes and survival. To determine the association between advanced age and each outcome, we fitted multivariable logistic regression models using: (1) age as a continuous variable and (2) age as a categorical variable (<50 years, 50-59 years, 60-69 years and ≥70 years).
RESULTS: Overall, 144 patients who had OHCA who underwent ECPR were eligible for our analyses. The proportion of neurologically favourable outcomes was 7%, while survival was 19% in patients who had OHCA. After the adjustment for potential confounders, while advanced age was non-significantly associated with neurologically favourable outcomes (adjusted OR 0.96 (95% CI 0.91 to 1.01), p=0.08), the association between advanced age and the poor survival rate was significant (adjusted OR 0.96 (95% CI 0.93 to 0.99), p=0.04). Additionally, compared with age <50 years, age ≥70 years was non-significantly associated with poor neurological outcomes (adjusted OR 0.08 (95% CI 0.01 to 1.00), p=0.051), whereas age ≥70 years was significantly associated with worse survival in the adjusted model (adjusted OR 0.14 (95% CI 0.03 to 0.80), p=0.03).
CONCLUSIONS: In our analysis of consecutive OHCA data from a critical care hospital in an urban area of Japan, we found that advanced age was associated with the lower rate of 1-month survival in patients who had OHCA who underwent ECPR. Although larger studies are required to confirm these results, our findings suggest that ECPR may not be beneficial for patients who had OHCA aged ≥70 years.

3. Eur Heart J Acute Cardiovasc Care. 2018 Jul 1:2048872618789052. doi: 10.1177/2048872618789052. [Epub ahead of print]
Development and validation of a prognostic model for survival in patients treated with venoarterial extracorporeal membrane oxygenation: the PREDICT VA-ECMO score.
Wengenmayer T1,2, Duerschmied D1,2, Graf E3, Chiabudini M3, Benk C4, Mühlschlegel S1, Philipp A5, Lubnow

M6, Bode C1,2, Staudacher DL1,2.
Abstract
AIMS: Several scoring systems have been introduced for prognostication after initiating venoarterial extracorporeal membrane oxygenation (VA-ECMO) therapy. However, static scores offer limited guidance once VA-ECMO is implanted, although continued allocation of healthcare resources is critical. Patients requiring continued VA-ECMO support are extremely unstable, with minimal heart function and multi-organ failure in most cases. The aim of the present study was to develop and validate a dynamic prognostic model for patients treated with VA-ECMO.
METHODS AND RESULTS: A derivation cohort included 205 all-comers undergoing VA-ECMO implantation at a tertiary referral hospital (51% received VA-ECMO during resuscitation and 43% had severe shock). Two prediction models based on point-of-care biomarkers were developed using penalised logistic regression in an elastic net approach. A validation cohort was recruited from an independent tertiary referral hospital. Comparators for the prediction of hospital survival were the SAVE score (area under the receiver operation characteristic curve (AUC) of 0.686), the SAPS score (AUC 0.679), the APACHE score (AUC 0.662) and the SOFA score (AUC 0.732) in 6-hour survivors. The 6-hour PREDICT VA-ECMO score (based on lactate, pH and standard bicarbonate concentration) outperformed the comparator scores with an AUC of 0.823. The 12-hour PREDICT VA-ECMO integrated lactate, pH and standard bicarbonate concentration at 1 hour, 6 hours and 12 hours after ECMO insertion allowed even better prognostication (AUC 0.839). Performance of the scores in the external validation cohort was good (AUCs 0.718 for the 6-hour score and 0.735 for the 12-hour score, respectively).
CONCLUSION: In patients requiring VA-ECMO therapy, a dynamic score using three point-of-care biomarkers predicts hospital mortality with high reliability. Furthermore, the PREDICT scores are the first scores for extracorporeal cardiopulmonary resuscitation patients.

4. Resuscitation. 2018 Jul 11. pii: S0300-9572(18)30343-5. doi: 10.1016/j.resuscitation.2018.07.012. [Epub ahead of print]
Neurologic Outcomes after Extracorporeal Membrane Oxygenation Assisted CPR for Resuscitation of Out-of-Hospital Cardiac Arrest Patients: A Systematic Review.
Beyea MM1, Tillmann BW2, Iansavichene AE3, Randhawa VK4, Van Aarsen K5, Nagpal AD6.
Abstract
INTRODUCTION: Extracorporeal membrane oxygenation-assisted CPR (ECPR) is an evolving adjunct for resuscitation of OHCA patients. The primary objective of this systematic review was to assess survival-to-hospital discharge with good neurologic recovery after OHCA among patients treated with ECPR compared to conventional CPR (CCPR).
METHODS: A systematic search of MEDLINE® and EMBASE® electronic databases was performed from inception until July 2016 to identify studies reporting ECPR use in adults with OHCA and survival outcomes.
RESULTS: Of the 1512 citations identified, 75 studies met our inclusion criteria (63 case series and 12 cohort studies). Among case series, 0 to 71.4% of patients treated with ECPR survived to discharge with a good neurologic outcome. Subgroup analysis of the cohort studies demonstrated survival-to-hospital discharge with good neurologic recovery in the ECPR group ranging from 8.3 to 41.6% compared to 1.5 to 9.1% in the CCPR group. Five cohort studies adjusted for confounders, 3 of which demonstrated significantly increased adjusted odds ratios of survival among the ECPR-treated patients. Due to significant heterogeneity ($I2 = 63\%$, $p = 0.03$), pooling of outcomes and a meta-analysis were not conducted.
CONCLUSION: Although a trend towards improved survival with good neurologic outcome was reported in controlled, low-risk of bias cohort studies, a preponderance of low quality evidence may ascribe an optimistic effect size of ECPR on survival among OHCA patients. Our confidence in a clinically relevant difference in outcomes compared to current standards of care for OHCA remains weak. In this state of equipoise, high quality RCT data is urgently needed.

5. Resuscitation. 2018 Jan;122:69-75. doi: 10.1016/j.resuscitation.2017.11.057. Epub 2017 Nov 26.
Improving cannulation time for extracorporeal life support in refractory cardiac arrest of presumed cardiac cause - Comparison of two percutaneous cannulation techniques in the catheterization laboratory in a center without on-site cardiovascular surgery.
Voicu S1, Henry P2, Malissin I3, Dillinger J-G2, Koumoulidis A4, Magkoutis N4, Yannopoulos D5, Logeart D2, Manzo-Silberman S 2, Péron N3, Deye N6, Megarbane B3, Sideris G2.
Abstract
BACKGROUND: Cardiac arrest (CA) without return of spontaneous circulation can be treated with veno-arterial extracorporeal membrane oxygenation (vaECMO) implemented surgically or percutaneously. We performed a study assessing time for vaECMO percutaneous cannulation in the catheterization laboratory.
METHODS: Single-centre retrospective study in a University hospital without on-site cardiovascular surgery, including patients aged >18 receiving vaECMO for out- or in-hospital refractory CA of presumed cardiac cause between 2010 and 2016, cannulated by interventional cardiologists. Cannulation time using anatomic landmarks

vessel puncture and conventional wires (first period) was compared with ultrasound guidance puncture and stiff wires (second period). Data are expressed as medians (interquartile range) and percentages.
RESULTS: Forty-six patients were included, age 56 (49-62), 34 in the first period. Shockable initial rhythm occurred in 29 (63%), 36 (78%) had ischemic heart disease and 26 (57%) acute myocardial infarction (AMI). Out-of-hospital refractory CA occurred in 27 (59%) patients. Time from out-of-hospital refractory CA to admission was 100 (80-118) min. Cannulation was successful in 42 (91%) patients. Cannulation time was 14 (10-21) min, 17 (12-26) (first) and 8 (6-12) min (second period), p<0.001. Survival to discharge was 9%. In out-of-hospital versus in-hospital, time from CA to vaECMO was 120 (115-140) versus 82 (58-102) min, p=0.011, survival was 7% (two patients) versus 11% (two patients), p=0.35 respectively. All survivors had shockable initial rhythm.
CONCLUSION: In these refractory CA patients with high prevalence of AMI and good feasibility of percutaneous vaECMO in the catheterization laboratory, cannulation time was shorter using ultrasound guidance and stiff wires.

PEDIATRIA

1. Resuscitation. 2018 Jun 27. pii: S0300-9572(18)30306-X. doi: 10.1016/j.resuscitation.2018.06.029. [Epub ahead of print]
Effects of dispatcher-assisted bystander cardiopulmonary resuscitation on neurological recovery in paediatric patients with out-of-hospital cardiac arrest based on the pre-hospital emergency medical service response time interval.
Chang I1, Lee SC2, Shin SD3, Song KJ3, Ro YS3, Park JH3, So YK3.
Abstract
OBJECTIVES: We investigated the effect of bystander cardiopulmonary resuscitation (BCPR) with dispatcher assistance (DA) on neurological outcomes based on the response time interval (RTI) of the pre-hospital emergency medical service (EMS) among paediatric patients with out-of-hospital cardiac arrest (OHCA).
METHODS: This retrospective registry study was conducted on paediatric patients (< 19 years old) with OHCA who were assessed by EMS providers between 2012 and 2016. The primary outcome was good neurological recovery based on BCPR with or without DA and the EMS RTI. Differential effects of BCPR with DA based on the EMS RTI were analysed by multivariable logistic regression analysis with interaction terms.
RESULTS: Adjusted odds ratios (AORs) and corresponding 95% confidence intervals (95% CIs) for good neurological recovery were 2.22 (1.27-3.88) for BCPR with DA and 1.51 (0.77-2.97) for BCPR without DA compared to no BCPR. The faster EMS RTI group (< 5 minutes) had better neurological recovery than the later EMS RTI group (≥ 5 minutes) (AOR: 1.87 [1.04-3.29]). The AORs for good neurological recovery following BCPR with DA based on the EMS RTI were 2.52 (0.91-6.97) in the faster EMS RTI group and 2.17 (1.13-4.19) in the later EMS RTI group compared to the no BCPR group.
CONCLUSION: BCPR with DA and a faster EMS RTI were significantly associated with good neurological recovery in paediatric patients with OHCA. When the EMS RTI was delayed, the association of BCPR with DA with good neurological recovery was preserved in paediatric patients with OHCA.

2. Emerg Med Australas. 2018 Jul 18. doi: 10.1111/1742-6723.13127. [Epub ahead of print]
Out-of-hospital arrests attending an Australian tertiary paediatric emergency department over 13 years: An observational study.
Day E1, Hort JR1.
Abstract
OBJECTIVE: In paediatric cardiopulmonary arrest, International Liaison Committee on Resuscitation (ILCOR) states, 'there are no simple guidelines to determine when resuscitative efforts become futile'. Considerations to assist this decision-making include cause of arrest, pre-existing medical conditions, age, site of arrest, duration of untreated cardiopulmonary arrest, witnessed arrest and presence of shockable rhythm. Outcomes are poor in out-of-hospital cardiac arrests (OHCA), particularly for infants. This single-centre observational study describes the characteristics and outcomes of the subgroup of children presenting to our hospital's ED following OHCA still receiving cardiac compressions, to assist development of guidelines for future resuscitation efforts in our ED, particularly for cessation of cardiopulmonary resuscitation (CPR).
METHODS: The ED database was searched for children presenting in cardiopulmonary arrest receiving cardiac compressions. Data were reviewed on pre-hospital, ED and hospital management and outcome, particularly looking at considerations outlined by ILCOR.
RESULTS: From January 2000 to December 2013, 60 children were identified: median age 1.71 years; 87% arresting at home; 68% with bystander CPR; median CPR duration pre-hospital 42 min, and in ED 19.5 min; total CPR median 61 min. Fifty patients (83%) died in ED, 10 (17%) were admitted to intensive care but all died within 4 days.
CONCLUSION: Children presenting to ED still receiving cardiac compressions following OHCA had a universally poor outcome, regardless of age and underlying cause. This implies resuscitative efforts could be discontinued earlier in this subgroup. A national, multicentre study is needed to determine if this finding is reproducible with a larger population.

3. Resuscitation. 2018 Jul 18. pii: S0300-9572(18)30346-0. doi: 10.1016/j.resuscitation.2018.07.015. [Epub ahead of print]
Chest Compression Rates and Pediatric In-hospital Cardiac Arrest Survival Outcomes.
Sutton RM1, Reeder RW2, Landis W3, Meert KL4, Yates AR5, Berger JT6, Newth CJ7, Carcillo JA8, McQuillen PS9, Harrison RE10, Moler FW11, Pollack MM12, Carpenter TC13, Notterman DA14, Holubkov R2, Dean JM2, Nadkarni VM3, Berg RA3; Eunice Kennedy Shriver National Institute of Child Health, Human Development Collaborative Pediatric Critical Care Research Network Investigators, (CPCCRN); CPCCRN Investigators. Collaborators: (26)
Zuppa AF3, Graham K3, Twelves C3, Diliberto MA3, Tomanio E6, Kwok J7, Bell MJ15, Abraham A8, Sapru A16, Alkhouli MF9 , Heidemann S4, Pawluszka A4, Hall MW5, Steele L5, Shanley TP17, Weber M11, Dalton HJ18, Bell A13, Mourani PM13, Malone K 13, Telford R19, Locandro C19, Coleman W19, Peterson A19, Thelen J19, Doctor A20.
Abstract
AIM: The primary aim of this study was to evaluate the association between chest compression rates and 1) arterial blood pressure and 2) survival outcomes during pediatric in-hospital cardiopulmonary resuscitation (CPR).
METHODS: Prospective observational study of children ≥37 weeks gestation and <19 years old who received CPR in an intensive care unit (ICU) as part of the Pediatric Intensive Care Unit Quality of CPR Study (PICqCPR) of the Collaborative Pediatric Critical Care Research Network (CPCCRN). Arterial blood pressure and compression rate were determined from manually extracted arterial line waveform data during the first 10 minutes of CPR. The primary outcome was survival to hospital discharge. Modified Poisson regression models assessed the association between rate categories (80-<100, 100-120 [Guidelines], >120-140, >140) and outcomes.
RESULTS: Compression rate data were available for 164 patients. More than half (98/164; 60%) were < 1 year old. Return of circulation was achieved in 148/164 (90%); survival to hospital discharge in 77/164 (47%). Percentage of events with average rate within Guidelines was 32.9%. Compared to Guidelines, higher rate categories were associated with lower systolic blood pressures (>120-140, p = 0.010; >140, p = 0.077), but not survival. A rate between 80-<100 per minute was associated with a higher rate of survival to hospital discharge (aRR 1.92, CI95 1.13, 3.29, p = 0.017) and survival with favorable neurological outcome (aRR 2.12, CI95 1.09, 4.13, p = 0.027) compared to Guidelines.
CONCLUSION: Non-compliance with compression rate Guidelines was common in this multicenter cohort. Among ICU patients, slightly lower rates were associated with improved outcomes compared to Guidelines.

RECERCA EXPERIMENTAL

1. Exp Ther Med. 2018 Jul;16(1):37-44. doi: 10.3892/etm.2018.6136. Epub 2018 May 7.
Protective effects of nicorandil against cerebral injury in a swine cardiac arrest model.
Zhu F1, Zhong X1, Zhou Y1, Hou Z1, Hu H1, Liang L1, Chen J1, Chen Q1, Ji X1, Shang D1.
Abstract
The present study investigated the effects of nicorandil on cerebral injury following cardiopulmonary resuscitation (CPR) in a swine model of cardiac arrest. CPR was performed on swine following 4 min induced ventricular fibrillation. Surviving animals were randomly divided into 3 groups: A nicorandil group (n=8), a control group (n=8) and a sham group (n=4). The sham group underwent the same surgical procedure to imitate cardiac arrest, but ventricular fibrillation was not induced. When the earliest observable return of spontaneous circulation (ROSC) was detected, the nicorandil and control groups received injections of nicorandil and saline, respectively. Swine serum was collected at baseline and 5 min, 0.5, 3 and 6 h following ROSC. Serum levels of neuron-specific enolase (NSE), S100β, tumor necrosis factor α (TNF-α) and interleukin 6 (IL-6) were measured using ELISA. Animals were euthanized and brain tissue samples were collected and assessed using light and electron microscopy 6 h following ROSC. The expression of aquaporin-4 (AQP-4) in the brain tissue was measured using western blotting. Malondialdehyde (MDA) and glutathione (GSH) levels in the brain tissue were determined using thiobarbituric acid and thiobenzoic acid colorimetric methods, respectively. Serum NSE and S100β were significantly higher in the nicorandil and control groups following CPR, compared with baseline (P<0.05). Additionally, NSE and S100β levels were significantly lower in the nicorandil group compared with the control (P<0.05). Pathological examinations and electron microscopy indicated that nicorandil reduced brain tissue damage. TNF-α and IL-6 levels were significantly decreased in the nicorandil group compared with the control group (P<0.05). Furthermore, AQP-4 expression in brain tissue 6 h following ROSC was significantly lower in the nicorandil group compared with the control group (P<0.05). MDA and GSH levels in swine brain tissue decreased and increased, respectively, in the nicorandil group compared with the control group (P<0.05). The results of the present study demonstrate that nicorandil exerts a protective effect against brain injury following cardiac arrest by reducing oxidative damage, inflammatory responses and brain edema post-ROSC.

2. J Trauma Acute Care Surg. 2018 Jul;85(1):101-107. doi: 10.1097/TA.0000000000001858.

Location is everything: The hemodynamic effects of REBOA in Zone 1 versus Zone 3 of the aorta.
Tibbits EM1, Hoareau GL, Simon MA, Davidson AJ, DeSoucy ES, Faulconer ER, DuBose JJ, Neff LP, Grayson JK, Williams TK, Johnson MA.
Abstract
OBJECTIVES: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is an emerging technology to augment proximal blood pressure during the resuscitation of patients with noncompressible torso hemorrhage. Currently, placement choice, supraceliac (Zone 1) versus infrarenal (Zone 3) aorta, depends on injury patterns, but remains a highly debated topic. We sought to compare the proximal hemodynamic support provided by Zone 1 versus Zone 3 REBOA placement and the degree of hemodynamic instability upon reperfusion following intervention.
METHODS: Eighteen anesthetized swine underwent controlled hemorrhage of 25% total blood volume, followed by 45 minutes of Zone 1 REBOA, Zone 3 REBOA, or no intervention (control). They were then resuscitated with shed blood, aortic balloons were deflated, and 5 hours of critical care ensued prior to euthanasia. Physiologic parameters were recorded continuously, and blood was drawn for analysis at specified intervals. Significance was defined as $p < 0.05$.
RESULTS: There were no significant differences between groups at baseline or during the initial 30 minutes of hemorrhage. During the intervention period, average proximal MAP was significantly greater in Zone 1 animals when compared with Zone 3 animals (127.9 ± 1.3 vs. 53.4 ± 1.1 mm Hg) and greater in Zone 3 animals when compared with control animals (42.9 ± 0.9 mm Hg). Lactate concentrations were significantly higher in Zone 1 animals (9.6 ± 0.4 mmol/L) when compared with Zone 3 animals (5.1 ± 0.3 mmol/L) and control animals (4.2 ± 0.8 mmol/L).
CONCLUSIONS: In our swine model of hemorrhagic shock, Zone 3 REBOA provided minimal proximal hemodynamic support when compared with Zone 1 REBOA, albeit with less ischemic burden and instability upon reperfusion. In cases of impending hemodynamic collapse, Zone 1 REBOA placement may be more efficacious regardless of injury pattern, whereas Zone 3 should be reserved only for relatively stable patients with ongoing distal hemorrhage.

3. J Trauma Acute Care Surg. 2018 Jul;85(1):25-32. doi: 10.1097/TA.0000000000001932.
Mobile forward-looking infrared technology allows rapid assessment of resuscitative endovascular balloon occlusion of the aorta in hemorrhage and blackout conditions.
Barron MR1, Kuckelman JP, McClellan JM, Derickson MJ, Phillips CJ, Marko ST, Sokol K, Eckert MJ, Martin MJ.
Abstract
INTRODUCTION: Objective assessment of final resuscitative endovascular balloon occlusion of the aorta (REBOA) position and adequate distal aortic occlusion is critical in patients with hemorrhagic shock, especially as feasibility is being increasingly investigated in the prehospital setting. We propose that mobile forward-looking infrared (FLIR) thermal imaging is a fast, reliable, and noninvasive method to assess REBOA position and efficacy in scenarios applicable to battlefield and prehospital care.
METHODS: Ten swine were randomized to a 40% hemorrhage group (H, n = 5) or nonhemorrhage group (NH, n = 5). Three experiments were completed after Zone I placement of a REBOA catheter. Resuscitative endovascular balloon occlusion of the aorta was deployed for 30 minutes in all animals followed by randomized continued deployment versus sham in both light and blackout conditions. Forward-looking infrared images and hemodynamic data were obtained. Images were presented to 62 blinded observers for assessment of REBOA inflation status.
RESULTS: There was no difference in hemodynamic or laboratory values at baseline. The H group was significantly more hypotensive (mean arterial pressure 44 vs. 60 mm Hg, $p < 0.01$), vasodilated (systemic vascular resistance 634 vs. 938dyn·s/cm, $p = 0.02$), and anemic (hematocrit 12 vs. 23.2%, $p < 0.01$). Hemorrhage group animals remained more hypotensive, anemic, and acidotic throughout all three experiments. There was a significant difference in the temperature change (ΔTemp) measured by FLIR between animals with REBOA inflated versus not inflated (5.7°C vs. 0.7°C, $p < 0.01$). The H and NH animals exhibited equal magnitudes of ΔTemp in both inflated and deflated states. Blinded observer analysis of FLIR images correctly identified adequate REBOA inflation and aortic occlusion 95.4% at 5 minutes and 98.8% at 10 minutes (positive predictive value at 5 minutes = 99% and positive predictive value at 10 minutes = 100%).
CONCLUSIONS: Mobile thermal imaging is an easy, rapid, and reliable method for assessing distal perfusion after occlusion by REBOA. Smartphone-based FLIR technology allows for confirmation of adequate REBOA placement at the point of care, and performance was not degraded in the setting of major hemorrhage or blackout conditions.

4. Am J Physiol Heart Circ Physiol. 2018 Jul 13. doi: 10.1152/ajpheart.00208.2018. [Epub ahead of print]
Hypothermia elongates the contraction-relaxation cycle in explanted human failing heart decreasing the time for ventricular filling during diastole.
Hiis HG1, Cosson MV1, Dahl CP2, Fiane AE3, Levy FO4, Andersen GØ5, Krobert KA.
Abstract
Targeted temperature management (TTM) is part of the standardized treatment for cardiac arrest patients. Hypothermia decreases cerebral oxygen consumption and induces bradycardia, thus, increasing the heart rate may

be considered to maintain cardiac output. We hypothesized that increasing heart rate during hypothermia would impair diastolic function. Human left ventricular trabeculae obtained from explanted hearts of patients with terminal heart failure were stimulated at 0.5 Hz and contraction-relaxation cycles recorded. Maximal developed force (Fmax), maximal rate of development of force ((dF/dt)max), time to peak force (TPF), time to 80% relaxation (TR80) and relaxation time (RT=TR80-TPF) were measured at 37-33-31-29°C. At these temperatures, stimulation frequency was increased from 0.5 to 1.0 to 1.5 Hz. At 1.5 Hz, concentration-response curves for the beta-adrenergic receptor (β-AR) agonist isoproterenol were performed. Fmax, TPF and RT increased when temperature was lowered, whereas the (dF/dt)max decreased. At all temperatures, increasing stimulation frequency increased Fmax and (dF/dt)max, whereas TPF and RT decreased. At 31 and 29°C, resting tension increased at 1.5 Hz, which was ameliorated by β-AR stimulation. At all temperatures, maximal β-AR stimulation increased Fmax, (dF/dt)max and maximal systolic force, whereas resting tension decreased progressively with lowering temperature. β-AR stimulation reduced TPF and RT to the same extent at all temperatures, despite the more elongated contraction-relaxation cycle at lower temperatures. Diastolic dysfunction during hypothermia results from an elongation of the contraction-relaxation cycle which decreases the time for ventricular filling. Hypothermic bradycardia protects the heart from diastolic dysfunction and increasing the heart rate during hypothermia should be avoided.

5. Artif Organs. 2018 Jul 17. doi: 10.1111/aor.13147. [Epub ahead of print]
Improved Outcome in an Animal Model of Prolonged Cardiac Arrest Through Pulsatile High Pressure Controlled Automated Reperfusion of the Whole Body.
Kreibich M1, Trummer G1, Beyersdorf F1, Scherer C1, Förster K1, Taunyane I1, Benk C1.
Abstract

The reperfusion period after extracorporeal cardiopulmonary resuscitation has been recognized as a key player in improving the outcome after cardiac arrest (CA). Our aim was to evaluate the effects of high mean arterial pressure (MAP) and pulsatile flow during controlled automated reperfusion of the whole body. Following 20 min of normothermic CA, high MAP, and pulsatile blood flow (pulsatile group, n = 10) or low MAP and nonpulsatile flow (nonpulsatile group, n = 6) controlled automated reperfusion of the whole body was commenced through the femoral vessels of German landrace pigs for 60 min. Afterwards, animals were observed for eight days. Blood samples were analyzed throughout the experiment and a species-specific neurologic disability score (NDS) was used for neurologic evaluation. In the pulsatile group, nine animals finished the study protocol, while no animal survived postoperative day four in the nonpulsatile group. NDS were significantly better at any given time in the pulsatile group and reached overall satisfactory outcome values. In addition, blood analyses revealed lower levels of lactate in the pulsatile group compared to the nonpulsatile group. This study demonstrates superior survival and neurologic outcome when using pulsatile high pressure automated reperfusion following 20 min of normothermic CA compared to nonpulsatile flow and low MAP. This study strongly supports regulating the reperfusion period after prolonged periods of CA.

6. Eur J Trauma Emerg Surg. 2018 Jul 13. doi: 10.1007/s00068-018-0980-1. [Epub ahead of print]
Resuscitation with centhaquin and 6% hydroxyethyl starch 130/0.4 improves survival in a swine model of hemorrhagic shock: a randomized experimental study.
Kontouli Z1, Staikou C2, Iacovidou N1,3,4, Mamais I5,6,7, Kouskouni E1,8, Papalois A9, Papapanagiotou P4, Gulati A10, Chalkias A11,12,13, Xanthos T14.
Author information:
Abstract

PURPOSE: To investigate the effects of the combination of centhaquin and 6% hydroxyethyl starch 130/0.4 (HES 130/0.4) in a swine model of hemorrhagic shock.
METHODS: Twenty Landrace-Large White pigs were instrumented and subjected to hemorrhagic shock. The animals were randomly allocated in two experimental groups, the control (group CO, n = 10) and the centhaquin groups (0.015 mg/kg, n = 10, group CH). Acute hemorrhage was induced by stepwise blood withdrawal (18 mL/min) from the internal jugular vein until MAP decreased to 40-45 mmHg, whereas anesthesia remained constant. All animals received HES 130/0.4 solution in the resuscitation phase until their mean arterial pressure (MAP) reached 90% of the baseline. The animals were observed for 60 min, during which no further resuscitation was attempted.
RESULTS: The total amount of blood and the bleeding time did not differ significantly between group CO and group CH (120 ± 13 vs. 120 ± 14 mL, p = 0.6; 20 ± 2 vs. 20 ± 1 min, p = 0.62, respectively). During the hemorrhagic phase, only a difference in heart rate (97.6 ± 4.4 vs. 128.4 ± 3.6 beats/min, p = 0.038) was observed between the two groups. The time required to reach the target MAP was significantly shorter in the centhaquin group compared to controls (13.7 ± 0.4 vs. 19.6 ± 0.84 min, p = 0.012). During the resuscitation phase, a statistical significant difference was observed in MAP (75.2 ± 1.6 vs. 89.8 ± 2.1 mmHg, p = 0.02) between group CO and group CH. During the observation phase, a statistical significant difference was observed in SVR (1109 ± 32.65 vs. 774.6 ± 21.82 dyn s/cm5, p = 0.039) and cardiac output (5.82 ± 0.31 vs. 6.9 ± 0.78 L/min, p = 0.027) between the two groups. Two animals of group CO and seven animals of group CH survived for 24 h (p = 0.008). We observed a marked increase in microvascular capillary permeability in group CO compared to group CH, with the wet/dry weight ratio being

significantly higher in group CO compared to group CH (4.8 ± 1.6 vs. 3.08 ± 0.6, p < 0.001). CONCLUSIONS: The combination of centhaquin 0.015 mg/kg and HES 130/0.4 resulted in shorter time to target MAP, lower wet-to-dry ratio, and better survival rates after resuscitation from hemorrhagic shock.

7. J Trauma Acute Care Surg. 2018 Jul 17. doi: 10.1097/TA.0000000000002008. [Epub ahead of print] EVAC versus REBOA in a Swine Model of Hemorrhage and Ischemia Reperfusion Injury.
Williams TK1,2, Tibbits EM2,3,4, Hoareau GL2, Simon MA 2,4,5, Davidson AJ2,3,4, DeSoucy ES2,3,4, Robert Faulconer E2, Kevin Grayson J2, Neff LP2,6, Austin Johnson M2,7.
Abstract
BACKGROUND: Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) is effective at limiting hemorrhage from non-compressible sources and restoring, yet causes progressive distal ischemia, supraphysiologic pressures and increased cardiac afterload. Endovascular Variable Aortic Control (EVAC) addresses these limitations, while still controlling hemorrhage. Previous work demonstrated improved outcomes following a 90-minute intervention period in an uncontrolled hemorrhage model. The present study compares automated EVAC to REBOA over an occlusion period reflective of contemporary REBOA usage.
METHODS: Following instrumentation, 12 Yorkshire-cross swine underwent controlled 25% hemorrhage, a 45-minute intervention period of EVAC or REBOA, and subsequent resuscitation with whole blood and critical care for the remainder of a six-hour experiment. Hemodynamics were acquired continuously and laboratory parameters were assessed at routine intervals. Tissue was collected for histopathologic analysis.
RESULTS: No differences were seen in baseline parameters. During intervention, EVAC resulted in more physiologic proximal pressure augmentation compared to REBOA (101 mmHg vs 129 mmHg 95CI 105-151, p=0.04). During critical care, EVAC animals required less than half the amount of crystalloid (3450 ml 95CI 1215-5684 vs 7400 ml 95CI 6148-8642, p<0.01) and vasopressors (21.5 ng/kg 95CI 7.5-35.5 vs 50.5 ng/kg 95CI 40.5-60.5, p=0.05) when compared to REBOA animals. EVAC resulted in lower peak and final lactate levels. EVAC animals had less aortic hyperemia from reperfusion with aortic flow rates closer to baseline (36 ml/kg/min 95CI 30-44 vs 51 mL/kg/min 95CI 41-61, p=0.01).
CONCLUSION: For short durations of therapy, EVAC produces superior hemodynamics and less ischemic insult than REBOA in this porcine controlled hemorrhage model, with improved outcomes during critical care. This study suggests EVAC is a viable strategy for in-hospital management of patients with hemorrhagic shock from non-compressible sources. Survival studies are needed to determine if these early differences persist over time.
LEVEL OF EVIDENCE: 1 STUDY TYPE: Translational Science.

8. Shock. 2018 Jul 25. doi: 10.1097/SHK.0000000000001234. [Epub ahead of print] Therapeutic Hypothermia After Cardiac Arrest: Involvement of the Risk Pathway in Mitochondrial PTP-Mediated Neuroprotection.
Jahandiez V1,2, Cour M1,2, Abrial M2, Loufouat J2, Ovize M2, Argaud L1,2.
Abstract
Therapeutic hypothermia is neuroprotective after cardiac arrest (CA) via poorly understood mechanisms. It may prevent mitochondrial permeability transition pore (PTP) opening, an event which plays a pivotal role in ischemia-reperfusion injury. PTP is the main end-effector of the Reperfusion Injury Salvage Kinase (RISK) signaling pathway. We hypothesized that therapeutic hypothermia activates the RISK pathway, thereby preventing PTP opening and its deleterious neurological consequences after CA. Four groups of New Zealand White rabbits were subjected to 15 minutes of CA and 120 minutes of reperfusion: Control, HT (hypothermia at 32°-34°C), NIM (specific PTP inhibition with N-methyl-4-isoleucine-cyclosporine at the onset of reperfusion), and HT+NIM. A Sham group only underwent surgery. The following measurements were taken: pupillary reflexes and brain damage biomarkers (NSE and S100β), RISK pathway activation in brain cortex (total and phosphorylated forms of both Akt and ERK) and PTP opening in isolated brain mitochondria. Therapeutic hypothermia and pharmacological PTP inhibition preserved the pupillary reflexes and prevented the increase in both NSE and S100β ($p < 0.05$ versus controls). These two interventions also enhanced ($p < 0.05$ versus controls) the phospho-Akt/Akt ratio to a similar extent while preventing a CA-induced increase in phospho-ERK/ERK ratio. This Akt activation in the HT and NIM groups was associated with an attenuation of CA-induced PTP opening. In this model, therapeutic hypothermia promoted the activation of the RISK signaling pathway via Akt and limited CA-induced brain injury by preventing PTP opening.

9. Front Pediatr. 2018 Jul 10;6:192. doi: 10.3389/fped.2018.00192. eCollection 2018. Successful Resuscitation in a Model of Asphyxia and Hemorrhage to Test Different Volume Resuscitation Strategies. A Study in Newborn Piglets After Transition.
Mendler MR1, Schwarz S1, Hechenrieder L1, Kurth S1, Weber B2, Höfler S2, Kalbitz M2, Mayer B3, Hummler HD1,4.
Abstract
Background: Evidence for recommendations on the use of volume expansion during cardiopulmonary resuscitation in newborn infants is limited. Objectives: To develop a newborn piglet model with asphyxia, hemorrhage, and

cardiac arrest to test different volume resuscitation on return of spontaneous circulation (ROSC). We hypothesized that immediate red cell transfusion reduces time to ROSC as compared to the use of an isotonic crystalloid fluid. Methods: Forty-four anaesthetized and intubated newborn piglets [age 32 h (12-44 h), weight 1,220 g (1,060-1,495g), Median (IQR)] were exposed to hypoxia and blood loss until asystole occurred. At this point they were randomized into two groups: (1) Crystalloid group: receiving isotonic sodium chloride (n = 22). (2) Early transfusion group: receiving blood transfusion (n = 22). In all other ways the piglets were resuscitated according to ILCOR 2015 guidelines [including respiratory support, chest compressions (CC) and epinephrine use]. One hour after ROSC piglets from the crystalloid group were randomized in two sub-groups: late blood transfusion and infusion of isotonic sodium chloride to investigate the effects of a late transfusion on hemodynamic parameters. Results: All animals achieved ROSC. Comparing the crystalloid to early blood transfusion group blood loss was 30.7 ml/kg (22.3-39.6 ml/kg) vs. 34.6 ml/kg (25.2-44.7 ml/kg), Median (IQR). Eleven subjects did not receive volume expansion as ROSC occurred rapidly. Thirty-three animals received volume expansion (16 vs. 17 in the crystalloid vs. early transfusion group). 14.1% vs. 10.5% of previously extracted blood volume in the crystalloid vs. early transfusion group was infused before ROSC. There was no significant difference in time to ROSC between groups [crystalloid group: 164 s (129-198 s), early transfusion group: 163 s (162-199 s), Median (IQR)] with no difference in epinephrine use. Conclusions: Early blood transfusion compared to crystalloid did not reduce time to ROSC, although our model included only a moderate degree of hemorrhage and ROSC occurred early in 11 subjects before any volume resuscitation occurred.
Free Article

10. Shock. 2018 Jul 25. doi: 10.1097/SHK.0000000000001235. [Epub ahead of print]
The Effects of the Duration of Aortic Balloon Occlusion on Outcomes of Traumatic Cardiac Arrest in a Porcine Model.
Xu J1,2,3, Shen P1,2,4, Gao Y1,2, Xia S1,2,5, Liu S1,2, Li Z3, Zhou G1,2, Xu Y1,2, Zhang M1,2.
Abstract
Aortic balloon occlusion (ABO) facilitates the success of cardiopulmonary resuscitation (CPR) in non-traumatic cardiac arrest, and is also effective in controlling traumatic hemorrhage; however, a prolonged occlusion results in irreversible organ injury and death. In this study, we investigated the effects of ABO on CPR outcomes and its optimal duration for post-resuscitation organ protection in a porcine model of traumatic cardiac arrest (TCA).Twenty-seven male domestic pigs weighing 33 ± 4 kg were utilized. Forty percent of estimated blood volume was removed within 20 min. The animals were then subjected to 5 min of untreated ventricular fibrillation and 5 min of CPR. Coincident with the start of CPR, the animals were randomized to receive either 30-min ABO (n = 7), 60-min ABO (n = 8) or control (n = 12). Meanwhile, fluid resuscitation was initiated by the infusion of normal saline with 1.5 times of hemorrhage volume in 1 h, and finished by the reinfusion of 50% of the shed blood in another 1 h. The resuscitated animals were monitored for 6 h and observed for an additional 18 h.During CPR, coronary perfusion pressure was significantly increased followed by a higher rate of resuscitation success in the 30-min and 60-min ABO groups compared to the control group. However, post-resuscitation cardiac, neurologic dysfunction and injuries were significantly milder accompanied with less renal and intestinal injuries in the 30-min ABO group than in the other two groups.In conclusion, ABO augmented the efficacy of CPR after TCA, and furthermore a 30-min ABO improved post-resuscitation cardiac and neurologic outcomes without exacerbating the injuries of kidney and intestine.

CASE REPORTS

1. Chin Med Sci J. 2018 Jun 30;33(2):127-129. doi: 10.24920/31807.
Successful Resuscitation with Extracorporeal Membrane Oxygenation in a Case with Prolonged Cardiac Arrest.
Wang XN1, Pham SM2.
Abstract
This case study describes a 25-year-old patient who had a witnessed cardiac arrest in the medical intensive care unit. The patient received 107 minutes of cardiopulmonary resuscitation before the veno-arterial extracorporeal membrane oxygenation was initiated. During extracorporeal life support, the patient's cardiac function improved. The patient was weaned from extracorporeal membrane oxygenation on day 6 and was discharged without physical and neurological complications on day 28. The successful resuscitation in this case attributed to high-quality CCPR and timely ECMO support

2. Case Rep Emerg Med. 2018 Jun 4;2018:7525313. doi: 10.1155/2018/7525313. eCollection 2018.
Accidental Drowning: The Importance of Early Measures of Resuscitation for a Successful Outcome.
Sulovic LS1, Pavlovic AP2, Zivkovic JB1, Zivkovic ZN1, Filipovic-Danic SS3, Trpkovic SV2.
Abstract
Case Report: The case of a drowning teenager is described involving application of cardiopulmonary resuscitation

(CPR) by an untrained rescuer in the field and fast transport to a hospital enabling a positive resuscitation outcome despite an underorganized emergency medical service in a rural area. In our case hypoxia led to extended functional disorders of the cardiovascular system, which fully recovered after adequate therapy. Conclusion: Knowledge about BLS measures by ordinary citizens, together with continuous education of health professionals concerning modern techniques of CPR, is crucial for increasing the number of patients surviving after cardiac arrest.

3. Case Rep Emerg Med. 2018 Jun 4;2018:5243105. doi: 10.1155/2018/5243105. eCollection 2018. Intra-Abdominal Hemorrhage following Cardiopulmonary Resuscitation: A Report of Two Cases. Koutserimpas C1, Ioannidis A1, Siaperas P1, Skarpas A1, Tellos A1, Velimezis G1, Karanikas I1. Abstract

Cardiopulmonary resuscitation (CPR) represents an emergency procedure, consisting of chest compressions and artificial ventilation. Two rare cases of intra-abdominal bleeding following cardiac compressions are reported. The first case was a 29-year-old female with massive pulmonary embolism (PE). Following CPR due to cardiac arrest, she showed signs of intra-abdominal bleeding. A liver laceration was found and sutured. The patient passed away, due to massive PE. The second patient was a 62-year-old female, suffering from cardiac arrest due to drowning at sea. CPR was performed in situ. At presentation to the emergency department she showed signs of intra-abdominal bleeding. The origin of the hemorrhage was found to be vessels of the lesser curvature of the stomach, which were ligated. Regarding the first patient PE has already been described as a cause for liver lacerations in CPR due to stasis and liver enlargement. The second case is the first report of gastric vessel injury without gastric rupture/laceration and pneumoperitoneum. Complications of CPR should not represent a drawback to performing cardiac compressions. Parenchymatic injuries have been related to inappropriate technique of chest compressions during basic life support. Therefore, it is of utmost importance for the providers to refresh their knowledge of performing CPR.

4. Rev Med Chil. 2018 Feb;146(2):260-265. doi: 10.4067/s0034-98872018000200260. [Extracorporeal cardiopulmonay resuscitation: case report on an out-of-hospital cardiopulmonary arrest]. [Article in Spanish]
Herrada L1, Santelices JL1, Orrego R2, Díaz R2. Abstract

Out-of-hospital cardiopulmonary arrest (OHCA) is highly lethal. Although overall survival is increasing, hospital discharge with good neurological prognosis remains low and highly variable. In some countries, protocols are being implemented, which include techniques in cardiopulmonary resuscitation, allowing a better neurological prognosis for those patients who undergo an OHCA. Following these new techniques and the incorporation of these new protocols already accepted in the guidelines of advanced cardiopulmonary resuscitation, we report a 54 years old male who presented an OHCA and received advanced cardiopulmonary by a professional team in situ. He was transferred to the emergency department, where optimal advanced resuscitation was continued, until the connection to extracorporeal cardiopulmonary support, with the aim of reestablishing blood flow, a technique known as cardiopulmonary resuscitation (ECPR: extracorporeal cardiopulmonary resuscitation). The patient was discharged from the hospital 25 days later.

5. Respir Med Case Rep. 2018 Jun 19;25:66-67. doi: 10.1016/j.rmcr.2018.06.011. eCollection 2018. Deep accidental hypothermia accompanied with cardiac arrest after alcohol and drug poisoning treated with extracorporeal life support.
Grapatsas K1,2, Leivaditis V1, Panagiotopoulos I3, Spiliotopoulos K4, Koletsis E5, Dahm M1, Kosmidis C6, Laskou S6, Zarogoulidis P7, Katsaounis A6, Pavlidis E6, Giannakidis D6, Koulouris C6, Mantalovas S6, Konstantinou F 8, Amaniti A9, Munteanu A6, Surlin V6, Sapalidis K6, Kesisoglou I6. Abstract

Deep accidental hypothermia is an unusual clinical entity in developed countries. We report a case of a 30 year old male Caucasian patient with accidental severe hypothermia who was transferred to the emergency department of our hospital after prolonged exposure in the urban city's night environment cold as a result of alcohol and drugs abuse. The patient was found unconscious in the first early hours from onlookers. The time that the patient remained unconscious is unknown. During the transfer to the hospital because of cardiac arrest cardiopulmonary resuscitation began. In the emergency department an extracorporeal life support system (ECLS) was implanted under cardiopulmonary resuscitation in order to achieve hemodynamic stabilization and rapid and safe rewarming. The patient's rewarming lasted 6 hours. The patient was extubated the next day.

6. Ther Hypothermia Temp Manag. 2018 Jul 11. doi: 10.1089/ther.2018.0009. [Epub ahead of print]

Successful Therapeutic Hypothermia in a Propofol-Related Cardiac Arrest Case: A Case Report and Literature Review.
Yildiz H1.
Author information:
Abstract
Targeted temperature management (therapeutic hypothermia) is a treatment method used to prevent potential complications that can develop in relation to the increased temperature in the brain as a result of cardiac arrest. Due to costs and various health policies there is no comprehensive study in the world that has been able to guide the relevant literature on therapeutic hypothermia. We have presented a 25-year-old female patient in our study who developed cardiac arrest after the administration of propofol for sedation before undergoing a diagnostic upper gastroscopy procedure and received a successful therapeutic hypothermia therapy following a resuscitation of 19 minutes.

7. Acute Med Surg. 2018 May 25;5(3):292-295. doi: 10.1002/ams2.345. eCollection 2018 Jul.
Successful treatment of pulmonary embolism-induced cardiac arrest by thrombolysis and targeted temperature management during pregnancy.
Oami T1, Oshima T1, Oku R1, Nakanishi K 1.
Abstract
Background: Thrombolysis for pulmonary embolism and targeted temperature management for cardiac arrest are controversial treatments in pregnancy.
Case: A 37-year-old woman at 23 weeks gestation presented with persistent dyspnea. She experienced cardiac arrest soon after arrival at the emergency room. Massive right ventricular dilatation on echocardiography during the transient return of spontaneous circulation suggested pulmonary embolism. We administered recombinant tissue plasminogen activator for suspected pulmonary embolism to successfully resuscitate the patient experiencing refractory cardiac arrest despite heparin infusion. After an additional dose of monteplase for persistent shock with remaining right ventricular dilatation on echocardiography, maternal hemodynamics dramatically improved, but fetal heart rate transiently decreased. Targeted temperature management was initiated for delayed recovery of consciousness. She fully recovered consciousness without neurological deficit. However, the fetus was aborted because of fetal hydrops.
Conclusion: Thrombolysis and targeted temperature management should be considered as treatment options for pulmonary embolism-induced cardiac arrest during pregnancy.
FREE ARTICLE

8. Perfusion. 2018 Jan;33(1):71-73. doi: 10.1177/0267659117720493. Epub 2017 Jul 12.
Scedosporium apiospermum infection: lethal complication after extracorporeal cardiopulmonary resuscitation.
Mei Y1, Chen X1, Sun K1, Lv J1, Sun H1, Zhang J1.
Abstract
In recent years, the development of extracorporeal membrane oxygenation (ECMO) technology has led to its extensive use in clinical practice. In particular, ECMO can play an important role in cardiopulmonary resuscitation (CPR). The American Heart Association CPR guidelines recommend its use in patients with cardiac arrest due to reversible disorders, along with high-quality CPR. This is called extracorporeal cardiopulmonary resuscitation (ECPR). However, it is important to be aware of the possibility of infection-related complications. Here, we report on a patient who suffered a cardiac arrest in hospital and was rescued with ECMO, but who subsequently developed an infection with Scedosporium apiospermum.

9. Emerg Med Australas. 2018 Jul 15. doi: 10.1111/1742-6723.13134. [Epub ahead of print]
The need for improving access to emergency care through community involvement in low- and middle-income countries: A case study of cardiac arrest in Hanoi, Vietnam.
Hoang BH1, Dao XD1, Nakahara S2, Sakamoto T2.
Abstract
Out-of-hospital cardiac arrest patients require immediate interventions by bystanders and emergency medical services (EMS). However, in many low- and middle-income countries (LMIC), bystanders witnessing a cardiac arrest rarely perform chest compressions and contact EMS. This paper attempts to draw lessons from a case of a patient with a cardiac arrest who could have survived with immediate interventions. A 40 year old man collapsed following electrocution at a construction site. His colleagues immediately transferred him to hospital via taxi, without performing chest compressions. At the hospital he showed ventricular fibrillation; resuscitation attempts failed and he died. Ventricular fibrillation due to electrocution is a benign type of cardiac arrest. The chance of survival increases with immediate chest compressions and prompt defibrillation. We discuss the reasons why the

bystanders did not perform resuscitation or contact EMS and identify approaches for the improvement of pre-hospital care in LMICs.

10. Heart Lung Circ. 2018 Mar;27(3):e1-e3. doi: 10.1016/j.hlc.2017.04.014. Epub 2017 May 25.
Factors Promoting Survival After Prolonged Resuscitation Attempts: A Case of Survival With Good Neurological Outcome Following 60 Minutes of Downtime After Out-of-Hospital Cardiac Arrest.
Bell D1, Gluer R2, Murdoch D2.
Abstract
BACKGROUND: Sudden cardiac arrest is a significant cause of death affecting approximately 25,000 people in Australia annually.
METHODS: We present an out-of-hospital cardiac arrest (OHCA) with prolonged down time and recurrent ventricular arrhythmias treated with extra-corporeal membrane oxygenation.
RESULTS: The patient survived to hospital discharge with good neurological outcome.
CONCLUSION: The patient's excellent outcome was a result of immediate good quality CPR, high level premorbid function, reversible cause of arrest and rapid access to an ECMO centre.

11. Prehosp Disaster Med. 2017 Dec;32(6):682-683. doi: 10.1017/S1049023X17006653. Epub 2017 Jul 3.
On-Scene Rescue Breathing Resulting in Gastric Perforation and Massive Pneumoperitoneum.
Butterfield M1, Peredy T1.
Abstract
Rescue breathing performed too vigorously or by untrained individuals may cause gastric distension and perforation. A 26-year-old woman is presented who developed acute abdominal pain and distension after receiving rescue breathing following a heroin overdose. Massive pneumoperitoneum was seen on chest x-ray, and on subsequent laparotomy, a 4cm laceration was found in the lesser curvature of the stomach. Review of the literature suggests that the lesser curvature is particularly susceptible to perforation following over-distension. Emergency personnel should be aware of this rare, but serious, complication. Expansion of community and first responder naloxone use in the proper clinical setting may further diminish utilization of rescue breathing.