RCP

1. Scand J Trauma Resusc Emerg Med. 2017 Jan 26;25(1):8. doi: 10.1186/s13049-017-0352-6.
Investigation of complications secondary to chest compressions before and after the 2010 cardiopulmonary resuscitation guideline changes by using multi-detector computed tomography: a retrospective study.
Beom JH1, You JS1, Kim MJ1, Seung MK2 , Park YS3, Chung HS1, Chung SP1, Park I1.
Abstract
BACKGROUND: The purpose of this study was to identify the relationship between the deeper and faster chest compressions suggested by the 2010 cardiopulmonary resuscitation guidelines and complications arising from chest compressions, using multi-detector computed tomography.
METHODS: We performed a retrospective analysis of prospective registry data. This study was conducted with in- and out-of-hospital cardiac arrest patients who underwent successful resuscitation in the emergency departments of two academic tertiary care centres from October 2006 to September 2010 (pre-2010 group) and from October 2011 to September 2015 (post-2010 group). We examined chest injuries related to chest compressions, classified as follows: rib fracture, sternal fracture, and other uncommon complications.
RESULTS: We enrolled 185 patients in this study. The most frequent complication to occur in both groups was rib fracture: 27 (62.8%) and 112 (78.9%) patients in the pre-2010 and post-2010 groups, respectively (p = 0.03). However, we observed no statistical differences in sternum fracture, the second most common complication (p = 0.80). Retrosternal and mediastinal haematoma were not reported in the pre-2010 group but 13 patients (9.1%) in the post-2010 group were reported to have haematoma (p = 0.04). Nine serious, life-threatening complications occurred, all in the post-2010 group. Among the younger group (less than 65 years old), 8 (38.1%) patients in the pre-2010 group and 40 (64.5%) in the post-2010 group sustained rib fractures.
DISCUSSION: The deeper and faster chest compressions for enhancing ROSC are associated with increased occurrence of complications. Additional studies are needed to compensate for the limitations of our study design.
CONCLUSIONS: This study found that the 2010 guidelines, recommending deeper and faster chest compressions, led to an increased proportion of rib fractures and retrosternal and mediastinal haematoma.

REGISTRES I REVISIONS

1. Am Heart J. 2016 Jul;177:129-37. doi: 10.1016/j.ahj.2016.04.018. Epub 2016 Apr 30.
Factors associated with out-of-hospital cardiac arrest with pulseless electric activity: A population-based study.
Ko DT1, Qiu F2, Koh M2, Dorian P3, Cheskes S4, Austin PC2, Scales DC5, Wijeysundera HC6, Verbeek PR7, Drennan I8, Ng T2, Tu JV6, Morrison LJ8.
Abstract
BACKGROUND:
Many patients with out-of-hospital cardiac arrest present with pulseless electric activity (PEA) rather than shockable rhythm. Despite improvements in resuscitation care, survival of PEA patients remains dismal. Our main

objective was to characterize out-of-hospital cardiac arrest patients by initial presenting rhythm and to evaluate independent determinants of PEA.
METHODS: A population-based study was conducted using the Toronto Rescu Epistry database with linkage to administrative data in Ontario, Canada. We included patients older than 20 years who had nontraumatic cardiac arrests from 2005 to 2010. Multivariable logistic regression models were constructed to determine factors predicting the occurrence of PEA vs shockable rhythm vs asystole.
RESULTS: Of the 9,882 included patients who received treatment, 24.5% had PEA, 26.3% had shockable rhythm, and 49.2% had asystole. Patients with PEA had a mean age of 72 years, 41.2% were female and had multiple comorbidities, and 53.4% were hospitalized in the past year. As compared with shockable rhythm, PEA patients were older, were more likely to be women, and had more comorbidities. As compared with asystole, PEA patients had similar baseline and clinical characteristics, but were substantially more likely to have an arrest witnessed by emergency medical services (odds ratio 13) or by bystander (odds ratio 3.24). Mortality at 30 days was 95.5%, 77.9%, and 98.9% for patients with PEA, shockable rhythm, asystole, respectively.
CONCLUSIONS: Patient characteristics differed substantially in those presenting with PEA and shockable rhythm. In contrast, the main distinguishing factor between PEA and asystole cardiac arrest related mainly to factors at the time of the cardiac arrest.

2. JMIR Mhealth Uhealth. 2017 May 17;5(5):e63. doi: 10.2196/mhealth.6926.
North American Public Opinion Survey on the Acceptability of Crowdsourcing Basic Life Support for Out-of-Hospital Cardiac Arrest With the PulsePoint Mobile Phone App.
Dainty KN1,2, Vaid H3, Brooks SC4.
Abstract
BACKGROUND: The PulsePoint Respond app is a novel system that can be implemented in emergency dispatch centers to crowdsource basic life support (BLS) for patients with cardiac arrest and facilitate bystander cardiopulmonary resuscitation (CPR) and automated external defibrillator use while first responders are en route.
OBJECTIVE: The aim of this study was to conduct a North American survey to evaluate the public perception of the above-mentioned strategy, including acceptability and willingness to respond to alerts.
METHODS: We designed a Web-based survey administered by IPSOS Reid, an established external polling vendor. Sampling was designed to ensure broad representation using recent census statistics.
RESULTS: A total of 2415 survey responses were analyzed (1106 from Canada and 1309 from the United States). It was found that 98.37% (1088/1106) of Canadians and 96% (1259/1309) of Americans had no objections to PulsePoint being implemented in their community; 84.27% (932/1106) of Canadians and 55.61% (728/1309) of Americans said they would download the app to become a potential responder to cardiac arrest, respectively. Among Canadians, those who said they were likely to download PulsePoint were also more likely to have ever had CPR training (OR 1.7, 95% CI 1.2-2.4; P=.002); however, this was not true of American respondents (OR 1.0, 95% CI 0.79-1.3; P=.88). When asked to imagine themselves as a cardiac arrest victim, 95.39% (1055/1106) of Canadians and 92.44% (1210/1309) of Americans had no objections to receiving crowdsourced help in a public

setting; 88.79% (982/1106) of Canadians and 84.87% (1111/1309) of Americans also had no objections to receiving help in a private setting, respectively. The most common concern identified with respect to PulsePoint implementation was a responder's lack of ability, training, or access to proper equipment in a public setting.
CONCLUSIONS: The North American public finds the concept of crowdsourcing BLS for out-of-hospital cardiac arrest to be acceptable. It demonstrates willingness to respond to PulsePoint CPR notifications and to accept help from others alerted by the app if they themselves suffered a cardiac arrest.

3. Am J Cardiol. 2017 Apr 15;119(8):1173-1178. doi: 10.1016/j.amjcard.2017.01.007. Epub 2017 Jan 25.
Outcomes After Percutaneous Coronary Intervention of Acute Coronary Syndrome Complicated With Cardiopulmonary Arrest (from a Japanese Multicenter Registry).
Numasawa Y1, Sawano M2, Miyata H3, Ueda I2, Noma S4, Suzuki M5, Kuno T6, Kodaira M6, Maekawa Y2, Fukuda K2, Kohsaka S2.
Abstract
Details on the characteristics and outcomes in patients with acute coronary syndrome (ACS) complicated with cardiopulmonary arrest (CPA) have been limited. We evaluated inhospital outcomes after percutaneous coronary intervention in these patients. From 2008 to 2014, 5,943 patients with ACS including 2,973 patients with ST-elevation myocardial infarction (STEMI) and 2,970 patients with non-STEMI or unstable angina (NSTE-ACS) were registered. In total, 264 patients experienced CPA within 24 hours of admission. Patients with CPA presented more frequently with cardiogenic shock (CS) (79.0% vs 7.7% in STEMI; 78.0% vs 1.1% in NSTE-ACS; p <0.001, respectively) and had a higher mortality rate (26.2% vs 3.8% in STEMI; 36.0% vs 1.6% in NSTE-ACS; p <0.001, respectively) than those without. On multivariate analysis, both age (odds ratio [OR] 1.04, 95% confidence interval [CI] 1.02 to 1.07, p = 0.002) and presence of CS (OR 5.54, 95% CI 2.19 to 17.13, p <0.001) were independent predictors of inhospital mortality in patients with ACS complicated with CPA and adjusted ORs increased exponentially under the presence of these variables (age ≥75 years: OR 3.16, 95% CI 2.14 to 4.70; CS: OR 18.70, 95% CI 12.40 to 28.40; presence of both these factors: OR 33.80, 95% CI 21.13 to 54.23).
In conclusion, the mortality rate after percutaneous coronary intervention remains high in patients with ACS complicated with CPA. Older age and shock status were strongly associated with inhospital mortality in these patients.

POST ATURADA

1. J Am Heart Assoc. 2017 May 20;6(5). pii: e003821. doi: 10.1161/JAHA.116.003821.
C-GRApH: A Validated Scoring System for Early Stratification of Neurologic Outcome After Out-of-Hospital Cardiac Arrest Treated With Targeted Temperature Management.
Kiehl EL1, Parker AM2, Matar RM3, Gottbrecht MF4, Johansen MC5, Adams MP2, Griffiths LA1, Dunn SP6, Bidwell KL6, Menon V1, Enfield KB7, Gimple LW8.
Abstract
BACKGROUND: Out-of-hospital cardiac arrest (OHCA) results in significant

morbidity and mortality, primarily from neurologic injury. Predicting neurologic outcome early post-OHCA remains difficult in patients receiving targeted temperature management.
METHODS AND RESULTS: Retrospective analysis was performed on consecutive OHCA patients receiving targeted temperature management (32-34°C) for 24 hours at a tertiary-care center from 2008 to 2012 (development cohort, n=122). The primary outcome was favorable neurologic outcome at hospital discharge, defined as cerebral performance category 1 to 2 (poor 3-5). Patient demographics, pre-OHCA diagnoses, and initial laboratory studies post-resuscitation were compared between favorable and poor neurologic outcomes with multivariable logistic regression used to develop a simple scoring system (C-GRApH). The C-GRApH score ranges 0 to 5 using equally weighted variables: (C): coronary artery disease, known pre-OHCA; (G): glucose ≥200 mg/dL; (R): rhythm of arrest not ventricular tachycardia/fibrillation; (A): age >45; (pH): arterial pH ≤7.0. A validation cohort (n=344) included subsequent patients from the initial site (n=72) and an external quaternary-care health system (n=272) from 2012 to 2014. The c-statistic for predicting neurologic outcome was 0.82 (0.74-0.90, P<0.001) in the development cohort and 0.81 (0.76-0.87, P<0.001) in the validation cohort. When subdivided by C-GRApH score, similar rates of favorable neurologic outcome were seen in both cohorts, 70% each for low (0-1, n=60), 22% versus 19% for medium (2-3, n=307), and 0% versus 2% for high (4-5, n=99) C-GRApH scores in the development and validation cohorts, respectively.
CONCLUSIONS: C-GRApH stratifies neurologic outcomes following OHCA in patients receiving targeted temperature management (32-34°C) using objective data available at hospital presentation, identifying patient subsets with disproportionally favorable (C-GRApH ≤1) and poor (C-GRApH ≥4) prognoses.

FV I DESFIBRIL·LACIÓ

1. Resuscitation. 2017 May 16. pii: S0300-9572(17)30217-4. doi: 10.1016/j.resuscitation.2017.05.017. [Epub ahead of print]
Automated external defibrillator and operator performance in out-of-hospital cardiac arrest.
Zijlstra JA1, Bekkers LE2, Hulleman M2, Beesems SG 2, Koster RW2.
Abstract
AIM: An increasing number of failing automated external defibrillators (AEDs) is reported: AEDs not giving a shock or other malfunction. We assessed to what extent AEDs are 'failing' and whether this had a device-related or operator-related cause.
METHODS: We studied analysis periods from AEDs used between January 2012 and December 2014. For each analysis period we assessed the correctness of the (no)-shock advice (sensitivity/specificity) and reasons for an incorrect (no)-shock advice. If no shock was delivered after a shock advice, we assessed the reason for no-shock delivery.
RESULTS: We analyzed 1114 AED recordings with 3310 analysis periods (1091 shock advices; 2219 no-shock advices). Sensitivity for coarse ventricular fibrillation was 99% and specificity for non-shockable rhythm detection 98%. The AED gave an incorrect shock advice in 4% (44/1091) of all shock advices, due to device-related (n=15) and operator-related errors (n=28) (one unknown). Of these 44 shock advices, only 2 shocks caused a rhythm

change. One percent (26/2219) of all no-shock advices was incorrect due to device-related (n=20) and operator-related errors (n=6). In 5% (59/1091) of all shock advices, no shock was delivered: operator failed to deliver shock (n=33), AED was removed (n=17), operator pushed 'off' button (n=8) and other (n=1). Of the 1073 analysis periods with a shockable rhythm, 67 (6%) did not receive an AED shock.
CONCLUSION: Errors associated with AED use are rare (4%) and when occurring are in 72% caused by the operator or circumstances of use. Fully automatic AEDs may prevent the majority of these errors.

TRAUMA

1. J Trauma Acute Care Surg. 2017 May 22. doi: 10.1097/TA.0000000000001585. [Epub ahead of print]
Development of the Emergency Preservation and Resuscitation for Cardiac Arrest from Trauma (EPR-CAT) Clinical Trial.
Tisherman SA1, Alam HB, Rhee PM, Scalea TM, Drabek T, Forsythe RM, Kochanek McCm PM.
Abstract
BACKGROUND: Patients who suffer a cardiac arrest from trauma rarely survive, even with aggressive resuscitation attempts, including an Emergency Department (ED) thoracotomy. Emergency Preservation and Resuscitation (EPR) was developed to utilize hypothermia to buy time to obtain hemostasis before irreversible organ damage occurs. Large animal studies have demonstrated that cooling to tympanic membrane temperature 10°C during exsanguination cardiac arrest can allow up to 2 hours of circulatory arrest and repair of simulated injuries with normal neurologic recovery.
STUDY DESIGN: The Emergency Preservation and Resuscitation for Cardiac Arrest from Trauma trial has been developed to test the feasibility and safety of initiating EPR. Select surgeons will be trained in the EPR technique. If a trained surgeon is available, the subject will undergo EPR. If not, the subject will be followed as a control subject. For this feasibility study, 10 EPR and 10 control subjects will be enrolled.
STUDY PARTICIPANTS: Victims of penetrating trauma who remain pulseless despite an ED thoracotomy.
INTERVENTIONS: EPR will be initiated via an intra-aortic flush of a large volume of ice-cold saline solution. Following surgical hemostasis, delayed resuscitation will be accomplished with cardiopulmonary bypass.
OUTCOME MEASURES: The primary outcome will be survival to hospital discharge without significant neurologic deficits. Secondary outcomes include long-term survival and functional outcome.
IMPLICATIONS: Once data from these 20 subjects are reviewed, revisions to the inclusion criteria and/or the EPR technique may then be tested in a second set of EPR and control subjects.
LEVEL OF EVIDENCE: III STUDY TYPE: Intervention study.

2. Emerg Med J. 2017 Jun;34(6):417-418. doi: 10.1136/emermed-2017-206808.1.
BET1: Pre-hospital finger thoracostomy in patients with traumatic cardiac arrest.
Jodie P1, Kerstin H1.
Abstract
A short cut review was carried out to see if 'finger' thoracostomy was a

safe and effective procedure to use in the pre-hospital setting in patients with traumatic cardiac arrest. Three relevant papers were found describing the use of this technique in the pre-hospital setting. The author, date and country of publication, patient group studied, study type, relevant outcomes, results study weaknesses of these papers are tabulated. Finger thoracostomy appears to be an acceptable and effective technique for trained physicians in the pre-hospital setting.

ECMO

1. Circulation. 2017 May 22. pii: CIR.0000000000000504. doi: 10.1161/CIR.0000000000000504. [Epub ahead of print]
Cardiopulmonary Resuscitation in Adults and Children With Mechanical Circulatory Support: A Scientific Statement From the American Heart Association.
Peberdy MA, Gluck JA, Ornato JP, Bermudez CA, Griffin RE, Kasirajan V, Kerber RE, Lewis EF, Link MS, Miller C, Teuteberg JJ, Thiagarajan R, Weiss RM, O'Neil B; American Heart Association Emergency Cardiovascular Care Committee; Council on Cardiopulmonary, Critical Care, Perioperative, and Resuscitation; Council on Cardiovascular Diseases in the Young; Council on Cardiovascular Surgery and Anesthesia; Council on Cardiovascular and Stroke Nursing; and Council on Clinical Cardiology.
Abstract
Cardiac arrest in patients on mechanical support is a new phenomenon brought about by the increased use of this therapy in patients with end-stage heart failure. This American Heart Association scientific statement highlights the recognition and treatment of cardiovascular collapse or cardiopulmonary arrest in an adult or pediatric patient who has a ventricular assist device or total artificial heart. Specific, expert consensus recommendations are provided for the role of external chest compressions in such patients

DISPOSITIUS DE FEEDBACK

1. Eur J Cardiovasc Nurs. 2017 Jun;16(5):453-457. doi: 10.1177/1474515117701060. Epub 2017 Mar 15.
Quality of chest compressions by healthcare professionals using real-time audiovisual feedback during in-hospital cardiopulmonary resuscitation.
Semark B1, Årestedt K1,2, Israelsson J2,3, von Wangenheim B4, Carlsson J4, Schildmeijer K1.
Abstract
INTRODUCTION: A high quality of chest compressions, e.g. sufficient depth (5-6 cm) and rate (100-120 per min), has been associated with survival. The patient's underlay affects chest compression depth. Depth and rate can be assessed by feedback systems to guide rescuers during cardiopulmonary resuscitation.
AIM: The purpose of this study was to describe the quality of chest compressions by healthcare professionals using real-time audiovisual feedback during in-hospital cardiopulmonary resuscitation.
METHOD: An observational descriptive study was performed including 63 cardiac arrest events with a resuscitation attempt. Data files were recorded by Zoll AED Pro, and reviewed by RescueNet Code Review software.

The events were analysed according to depth, rate, quality of chest compressions and underlay.
RESULTS: Across events, 12.7% (median) of the compressions had a depth of 5-6 cm. Compression depth of >6 cm was measured in 70.1% (median). The underlay could be identified from the electronic patient records in 54 events. The median compression depth was 4.5 cm (floor) and 6.7 cm (mattress). Across events, 57.5% (median) of the compressions were performed with a median frequency of 100-120 compressions/min and the most common problem was a compression rate of <100 (median=22.3%).
CONCLUSIONS: Chest compression quality was poor according to the feedback system. However, the distribution of compression depth with regard to underlay points towards overestimation of depth when treating patients on a mattress. Audiovisual feedback devices ought to be further developed. Healthcare professionals need to be aware of the strengths and weaknesses of their devices.

2. Am J Cardiol. 2017 May 4. pii: S0002-9149(17)30695-1. doi: 10.1016/j.amjcard.2017.04.007. [Epub ahead of print]
Real-Time Mobile Device-Assisted Chest Compression During Cardiopulmonary Resuscitation.
Sarma S1, Bucuti H2, Chitnis A2, Klacman A3, Dantu R2.
Abstract
Prompt administration of high-quality cardiopulmonary resuscitation (CPR) is a key determinant of survival from cardiac arrest. Strategies to improve CPR quality at point of care could improve resuscitation outcomes. We tested whether a low cost and scalable mobile phone- or smart watch-based solution could provide accurate measures of compression depth and rate during simulated CPR. Fifty health care providers (58% intensive care unit nurses) performed simulated CPR on a calibrated training manikin (Resusci Anne, Laerdal) while wearing both devices. Subjects received real-time audiovisual feedback from each device sequentially. Primary outcome was accuracy of compression depth and rate compared with the calibrated training manikin. Secondary outcome was improvement in CPR quality as defined by meeting both guideline-recommend compression depth (5 to 6 cm) and rate (100 to 120/minute). Compared with the training manikin, typical error for compression depth was <5 mm (smart phone 4.6 mm; 95% CI 4.1 to 5.3 mm; smart watch 4.3 mm; 95% CI 3.8 to 5.0 mm). Compression rates were similarly accurate (smart phone Pearson's R = 0.93; smart watch R = 0.97). There was no difference in improved CPR quality defined as the number of sessions meeting both guideline-recommended compression depth (50 to 60 mm) and rate (100 to 120 compressions/minute) with mobile device feedback (60% vs 50%; p = 0.3). Sessions that did not meet guideline recommendations failed primarily because of inadequate compression depth (46 ± 2 mm). In conclusion, a mobile device application-guided CPR can accurately track compression depth and rate during simulation in a practice environment in accordance with resuscitation guidelines.

ENTRENAMIENTO

1. Simul Healthc. 2017 Jun;12(3):139-147. doi: 10.1097/SIH.0000000000000205.
Using Simulation as an Investigational Methodology to Explore the Impact

of Technology on Team Communication and Patient Management: A Pilot Evaluation of the Effect of an Automated Compression Device.
Gittinger M1, Brolliar SM, Grand JA, Nichol G, Fernandez R.
Abstract
INTRODUCTION: This pilot study used a simulation-based platform to evaluate the effect of an automated mechanical chest compression device on team communication and patient management.
METHODS: Four-member emergency department interprofessional teams were randomly assigned to perform manual chest compressions (control, n = 6) or automated chest compressions (intervention, n = 6) during a simulated cardiac arrest with 2 phases: phase 1 baseline (ventricular tachycardia), followed by phase 2 (ventricular fibrillation). Patient management was coded using an Advanced Cardiovascular Life Support-based checklist. Team communication was categorized in the following 4 areas: (1) teamwork focus; (2) huddle events, defined as statements focused on re-establishing situation awareness, reinforcing existing plans, and assessing the need to adjust the plan; (3) clinical focus; and (4) profession of team member. Statements were aggregated for each team.
RESULTS: At baseline, groups were similar with respect to total communication statements and patient management. During cardiac arrest, the total number of communication statements was greater in teams performing manual compressions (median, 152.3; interquartile range [IQR], 127.6-181.0) as compared with teams using an automated compression device (median, 105; IQR, 99.5-123.9). Huddle events were more frequent in teams performing automated chest compressions (median, 4.0; IQR, 3.1-4.3 vs. 2.0; IQR, 1.4-2.6). Teams randomized to the automated compression intervention had a delay to initial defibrillation (median, 208.3 seconds; IQR, 153.3-222.1 seconds) as compared with control teams (median, 63.2 seconds; IQR, 30.1-397.2 seconds).
CONCLUSIONS: Use of an automated compression device may impact both team communication and patient management. Simulation-based assessments offer important insights into the effect of technology on healthcare teams.

REGISTRES I REVISIONS

1. Resuscitation. 2017 May 25. pii: S0300-9572(17)30225-3. doi: 10.1016/j.resuscitation.2017.05.025. [Epub ahead of print]
Out-of-Hospital Cardiac Arrests during Exercise among Urban Inhabitants in Japan: Insights from a Population-Based Registry of Osaka City.
Kiyohara K1, Sado J2, Matsuyama T3, Nishiyama C4, Kobayashi D5, Kiguchi T5, Hayashida S6, Kitamura Y2, Sobue T2, Nakata K7, Iwami T5, Kitamura T2.
Abstract
BACKGROUND: The patient characteristics, pre-hospital interventions, and outcomes of out-of-hospital cardiac arrests (OHCA) occurring during exercise, have not been sufficiently investigated among the general population.
METHODS: OHCA data from 2009 to 2015 were obtained from the population-based OHCA registry in Osaka City, Japan. Patients who suffered OHCA, which occurred during exercise before the arrival of emergency medical service personnel, were included. The primary endpoint was one-month survival with a favourable neurological outcome after OHCA, defined using the Glasgow-Pittsburgh cerebral performance category scale 1 or 2.

RESULTS: During the 7-year study period, 16,278 OHCAs were observed, and 52 (0.3%) occurred during exercise (male, n=41 [79%]; median age, 62 years). These incidents occurred mainly during running activities (n=14), followed by swimming (n=8), dance/social dance (n=6), tennis (n=4), and weight training (n=3). Within these exercise-related OHCAs, 47 (90%) were of cardiac origin, 45 (87%) were bystander-witnessed cardiac arrests, 49 (94%) received bystander-initiated cardiopulmonary resuscitation, and 30 (57%) received public-access defibrillation (PAD). Overall, 56% (29/52) had one-month survival with a favourable neurological outcome after OHCA, which was significantly higher among OHCAs of cardiac origin with PAD (77%, 23/30) than among those of cardiac origin without PAD (35%, 6/17) and among those of non-cardiac origin (0%, 0/5) ($p<0.001$).
CONCLUSION: In Osaka, OHCAs during exercise represented a small subset of the overall OHCA burden, but occurred during a wide variety of exercise activities. Patients with OHCA of cardiac origin had a good prognosis, and PAD played an important role in improving patient outcomes.

2. Ann Emerg Med. 2017 May 27. pii: S0196-0644(17)30322-0. doi: 10.1016/j.annemergmed.2017.03.026. [Epub ahead of print]
Nonphysician Out-of-Hospital Rapid Sequence Intubation Success and Adverse Events: A Systematic Review and Meta-Analysis.
Fouche PF1, Stein C2, Simpson P3, Carlson JN4, Doi SA5.
Abstract
STUDY OBJECTIVE: Rapid sequence intubation performed by nonphysicians such as paramedics or nurses has become increasingly common in many countries; however, concerns have been stated in regard to the safe use and appropriateness of rapid sequence intubation when performed by these health care providers. The aim of our study is to compare rapid sequence intubation success and adverse events between nonphysician and physician in the out-of-hospital setting.
METHODS: A systematic literature search of key databases including MEDLINE, EMBASE, and the Cochrane Library was conducted. Eligibility, data extraction, and assessment of risk of bias were assessed independently by 2 reviewers. A bias-adjusted meta-analysis using a quality-effects model was conducted for the primary outcomes of overall intubation success and first-pass intubation success and for adverse events when possible.
RESULTS: Eighty-three studies were included in the meta-analysis. There was a 2% difference in successful intubation proportion for physicians versus nonphysicians, 99% (95% confidence interval [CI] 98% to 99%) versus 97% (95% CI 95% to 99%). A 10% difference in first-pass rapid sequence intubation success was noted between physicians versus nonphysicians, 88% (95% CI 83% to 93%) versus 78% (95% CI 65% to 89%). For airway trauma, bradycardia, cardiac arrest, endobronchial intubation, hypertension, and hypotension, lower prevalences of adverse events were noted for physicians. However, nonphysicians had a lower prevalence of hypoxia and esophageal intubations. Similar proportions were noted for pulmonary aspiration and emesis. Nine adverse events estimates lacked precision, except for endobronchial intubation, and 4 adverse event analyses showed evidence of possible publication bias. Consequently, no reliable evidence exists for differences between physicians and nonphysicians for adverse events.
CONCLUSION: This analysis shows that physicians have a higher rapid sequence intubation first-pass and overall success, as well as mostly

lower rates of adverse events for rapid sequence intubation in the out-of-hospital setting. Nevertheless, for all success and adverse events no firm conclusion for a difference could be drawn because of lack of precision of meta-analytic estimates or selective reporting. First-pass success could be an area in which to focus quality improvement strategies for nonphysicians.

3. Circulation. 2017 May 30. pii: CIR.0000000000000507. doi: 10.1161/CIR.0000000000000507. [Epub ahead of print]
Recommendations for the Use of Mechanical Circulatory Support: Ambulatory and Community Patient Care: A Scientific Statement From the American Heart Association.
Cook JL, Colvin M, Francis GS, Grady KL, Hoffman TM, Jessup M, John R, Kiernan MS, Mitchell JE, Pagani FD, Petty M, Ravichandran P, Rogers JG, Semigran MJ, Toole JM; American Heart Association Heart Failure and Transplantation Committee of the Council on Clinical Cardiology; Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation; Council on Cardiovascular Disease in the Young; Council on Cardiovascular and Stroke Nursing; Council on Cardiovascular Radiology and Intervention; and Council on Cardiovascular Surgery and Anesthesia.

DONACIÓ EN ASISTÒLIA

1. Indian J Nephrol. 2017 May-Jun;27(3):205-209. doi: 10.4103/0971-4065.202843.
A Single-center Experience of Kidney Transplantation from Donation after Circulatory Death: Challenges and Scope in India.
Singh S1, Kumar S1, Dasgupta S1, Kenwar DB1, Rathi M2, Sharma A1, Kohli HS2, Jha V2, Gupta KL2, Minz M1.
Abstract
Donation after circulatory death (DCD) has never been attempted in India because of legal constraints and lack of guidelines for the withdrawal of life support in end-of-life situations. The present report describes the initial experience of transplantation of organs from DCD donors in a tertiary care center in India. Between 2011 and 2015, five donors had kidneys retrieved after cardiac arrest. These patients were declared dead after waiting for 5 min with no electrocardiographic signal on monitor following cardiopulmonary resuscitation (CPR), which was restarted in three patients till organ retrieval. All donors received heparin and underwent rapid cannulation of aorta, infusion of preservative cold solution, and immediate surface cooling of organs during retrieval surgery. 9/10 kidneys were utilized. Mean donor age was 29.6 ± 16.3 years, M:F 4:1 and mean age of recipients was 38.7 ± 10.8 years, M:F 7:2. Seven patients required dialysis in postoperative period. Mean postoperative day 0 urine output was 1.9 ± 2.6 L. Baseline creatinine achieved was 1.38 ± 0.35 mg/dl after a mean duration of 26.12 ± 15.4 days. Kidneys from donors where CPR was continued after the declaration of death (n = 3) had better recovery of renal function (time to reach baseline creatinine 21.2 ± 7.2 vs. 34.3 ± 23.7 days, baseline creatinine 1.36 ± 0.25 vs. 1.52 ± 0.45 mg%). In donors without CPR, one kidney never functioned and others had patchy cortical necrosis on protocol biopsy, which was not seen in the kidneys from donors with CPR. Kidneys from DCD donors can serve as a useful adjunct in deceased donor program. Continuing CPR after the

declaration of death seems to help in improving outcomes.

POST-ROSC

1. Emerg Med Australas. 2017 May 31. doi: 10.1111/1742-6723.12809. [Epub ahead of print]
Effect of known history of heart disease on survival outcomes after out-of-hospital cardiac arrests.
Lee MH1, Fook-Chong S2,3, Wah W4, Shin SD5, Nishiuchi T6, Ko PC7, Naroo GY8, Wong KD9, Tiah L10, Monsomboon A11, Siddiqui FJ12, Ong ME13,14; PAROS Clinical Research Network.
Abstract
OBJECTIVE: We aimed to investigate the effect of known heart disease on post-out-of-hospital cardiac arrest (OHCA) survival outcomes, and its association with factors influencing survival.
METHODS: This was an observational, retrospective study involving an OHCA database from seven Asian countries in 2009-2012. Heart disease was defined as a documented diagnosis of coronary artery disease or congenital heart disease. Patients with non-traumatic arrests for whom resuscitation was attempted and with known medical histories were included. Differences in demographics, arrest characteristics and survival between patients with and without known heart disease were analysed. Multivariate logistic regression was performed to identify factors influencing survival to discharge.
RESULTS: Of 19 044 eligible patients, 5687 had known heart disease. They were older (77 vs 72 years) and had more comorbidities like diabetes (40.9 vs 21.8%), hypertension (60.6 vs 36.0%) and previous stroke (15.2 vs 10.1%). However, they were not more likely to receive bystander cardiopulmonary resuscitation (P = 0.205) or automated external defibrillation (P = 0.980). On univariate analysis, known heart disease was associated with increased survival (unadjusted odds ratio 1.16, 95% confidence interval 1.03-1.30). However, on multivariate analysis, heart disease predicted poorer survival (adjusted odds ratio 0.76, 95% confidence interval 0.58-1.00). Other factors influencing survival corresponded with previous reports.
CONCLUSIONS: Known heart disease independently predicted poorer post-OHCA survival. This study may provide information to guide future prospective studies specifically looking at family education for patients with heart disease and the effect on OHCA outcomes.

2. J Clin Neurophysiol. 2017 May 25. doi: 10.1097/WNP.0000000000000392. [Epub ahead of print]
SSEP in Therapeutic Hypothermia Era.
Maciel CB1, Morawo AO, Tsao CY, Youn TS, Labar DR , Rubens EO, Greer DM.
Abstract
PURPOSE: The reliability of somatosensory evoked potentials (SSEPs) in predicting outcome in comatose survivors of cardiac arrest treated with therapeutic hypothermia (TH) has been questioned. We investigated whether the absence of cortical (N20) responses was a reliable predictor of a nonawakening in the setting of TH.
METHODS: A retrospective review was conducted in cardiac arrest survivors treated with TH admitted to a single tertiary care hospital from April, 2010 to March, 2013 who underwent SSEP testing at various time points

after cardiac arrest. N20 responses were categorized as normal, present but abnormal, bilaterally absent, or inadequate for interpretation. Neurologic outcome was assessed at discharge by the Cerebral Performance Category Scale (CPC).
RESULTS: Ninety-three SSEP studies were performed in 73 patients. Fourteen patients had absent N20 responses; all had poor outcome (CPC 4-5). Eleven patients had absent N20 s during hypothermia, three of whom had follow-up SSEPs after rewarming and cortical responses remained absent. Fifty-seven patients had N20 peaks identified and had variable outcomes. Evaluation of 1 or more N20 peaks was limited or inadequate in 11.4% of SSEPs performed during the cooling because of artifact.
CONCLUSIONS: Somatosensory evoked potentials remain a reliable prognostic indicator in patients undergoing TH. The limited sample size of patients who had SSEP performed during TH and repeated after normothermia added to the effect of self-fulfilling prophecy limit the interpretation of the reliability of this testing when performed during cooling. Further prospective, multicenter, large scale studies correlating cortical responses in SSEPs during and after TH are warranted. Technical challenges are commonplace during TH and caution is advised in the interpretation of suboptimal recordings.

3. Med Intensiva. 2017 May 25. pii: S0210-5691(17)30141-9. doi: 10.1016/j.medin.2017.03.007. [Epub ahead of print]
The accuracy of PiCCO® in measuring cardiac output in patients under therapeutic hypothermia - Comparison with transthoracic echocardiography. [Article in English, Spanish]
Souto Moura T1, Aguiar Rosa S2, Germano N3, Cavaco R3, Sequeira T3, Alves M4, Papoila AL5, Bento L3.
Abstract
BACKGROUND: Invasive cardiac monitoring using thermodilution methods such as PiCCO® is widely used in critically ill patients and provides a wide range of hemodynamic variables, including cardiac output (CO). However, in post-cardiac arrest patients subjected to therapeutic hypothermia, the low body temperature possibly could interfere with the technique. Transthoracic Doppler echocardiography (ECHO) has long proved its accuracy in estimating CO, and is not influenced by temperature changes.
OBJECTIVE: To assess the accuracy of PiCCO® in measuring CO in patients under therapeutic hypothermia, compared with ECHO.
DESIGN AND PATIENTS: Thirty paired COECHO/COPiCCO measurements were analyzed in 15 patients subjected to hypothermia after cardiac arrest. Eighteen paired measurements were obtained at under 36°C and 12 at ≥36°C. A value of 0.5l/min was considered the maximum accepted difference between the COECHO and COPiCCO values.
RESULTS: Under conditions of normothermia (≥36°C), the mean difference between COECHO and COPiCCO was 0.030 l/min, with limits of agreement (-0.22, 0.28) - all of the measurements differing by less than 0.5 l/min. In situations of hypothermia (<36°C), the mean difference in CO measurements was -0.426 l/min, with limits of agreement (-1.60, 0.75), and only 44% (8/18) of the paired measurements fell within the interval (-0.5, 0.5). The calculated temperature cut-off point maximizing specificity was 35.95°C: above this temperature, specificity was 100%, with a false-positive rate of 0%.
CONCLUSIONS: The results clearly show clinically relevant discordance

between COECHO and COPiCCO at temperatures of <36°C, demonstrating the inaccuracy of PiCCO® for cardiac output measurements in hypothermic patients.

TARGET TEMEPERATURE MANAGEMENT

1. Ther Hypothermia Temp Manag. 2017 Jun 1. doi: 10.1089/ther.2017.0011. [Epub ahead of print]
Therapeutic Hypothermia for Asphyxial Out-of-Hospital Cardiac Arrest Due to Drowning: A Systematic Review of Case Series and Case Reports.
Suen KK1, Leung R2, Leung LP2.
Abstract
The objective of this review was to summarize published evidence of the effectiveness of therapeutic hypothermia in patients with drowning-associated asphyxial out-of-hospital cardiac arrest (OHCA) and to explore any preliminary favorable factors in the management of therapeutic hypothermia to improve survival and neurological outcome. Drowning may result in asphyxial OHCA or hypothermic OHCA, but the former does not provide any potential neuroprotective effect as the latter may do. Electronic literature searches of Ovid Medline, Embase, Cochrane Library, and Scopus were performed for all years from inception to July 2016. Primary studies in the form of case reports, letters to the editor, and others with higher quality are included, but guidelines, reviews, editorials, textbook chapters, conference abstracts, and nonhuman studies are excluded. Non-English articles are excluded. Relevant studies are then deemed eligible if the drowning OHCA patient's initial temperature was above 28°C, which implies asphyxial cardiac arrest, and intentional therapeutic hypothermia was instituted. Because of the narrow scope of interest and strict definition of the condition, limited studies addressed it, and no randomized controlled trials (RCT) could be selected. Thirteen studies covering 35 patients are included. No quantitative synthesis, assessment of study quality, or assessment of bias was performed. It is conjectured that extended therapeutic hypothermia of 48-72 hours might help prevent reperfusion injury during the intermediate phase of postcardiac arrest care to benefit patients of drowning-associated asphyxial OHCA, but this finding only serves as preliminary observation for future research. No conclusive recommendation could be made regarding the duration of and the time of onset of therapeutic hypothermia. Future research should put effort on RCT, particularly the effect of extended duration of 48-72 hours. Important parameters should be reported in detail. Asphyxial and hypothermic OHCA should be differentiated.

2. Ther Hypothermia Temp Manag. 2017 May 30. doi: 10.1089/ther.2017.0015. [Epub ahead of print]
Targeted Temperature Management Effectiveness in the Elderly: Insights from a Large Registry.
Mader TJ1, Westafer LM1, Nathanson BH2, Villarroel N1, Coute RA3, McNally BF4.
Abstract
Targeted temperature management (TTM) is recommended for all comatose adult out-of-hospital cardiac arrest (OHCA) patients with shockable first documented rhythm. However, studies examining the use and benefits of TTM among patients aged 75 and older are lacking. Using the Cardiac Arrest

Registry to Enhance Survival (CARES) dataset registry from 2013 to 2015. Study criteria included being 75 years of age or older, survival to hospital admission, and known in-hospital mortality and CPC (Cerebral Performance Categories Scale) Scores. The study outcomes were in-hospital mortality and poor neurologic outcomes (CPC Scores 3 or 4) at hospital discharge among survivors. Hierarchical logistic regression and propensity score matching were used for multivariable adjustment. Two thousand nine hundred eighty-two patients met study inclusion criteria. One thousand three hundred fifty-seven (45.5%) received TTM in the admitting hospital. Receipt of TTM was more likely among men, those with a shockable first documented rhythm, and those with their event witnessed. There was no significant association with TTM and in-hospital mortality among patients with ventricular fibrillation (odds ratio [OR] = 0.88; 95% confidence interval [CI] [0.62-1.25]), p = 0.487 within the cohort. However, patients with a nonshockable first rhythm receiving TTM had higher odds of in-hospital mortality ($p < 0.001$). Propensity score results showed a modest association with TTM and increased mortality (OR) = 1.22, 95% CI [1.01-1.47]; p = 0.036 and no association with poor neurologic outcome (OR = 1.18; 95% CI [0.82-1.69]; p = 0.379) in the elderly. TTM is often provided to OHCA patients over age 75 though the benefits, particularly among nonshockable first documented rhythm patients are unclear. A randomized trial is needed to definitively answer who among OHCA event survivors aged 75 and older should receive this treatment.

3. Oxid Med Cell Longev. 2017;2017:8704352. doi: 10.1155/2017/8704352. Epub 2017 May 1.
Therapeutic Hypothermia Reduces Oxidative Damage and Alters Antioxidant Defenses after Cardiac Arrest.
Hackenhaar FS1,2, Medeiros TM1,2, Heemann FM1,2, Behling CS1,2, Putti JS1,2, Mahl CD1,2, Verona C1,2,3, da Silva ACA1,2, Guerra MC4, Gonçalves CAS4, Oliveira VM3, Riveiro DFM3, Vieira SRR5, Benfato MS1,2 .
Abstract
After cardiac arrest, organ damage consequent to ischemia-reperfusion has been attributed to oxidative stress. Mild therapeutic hypothermia has been applied to reduce this damage, and it may reduce oxidative damage as well. This study aimed to compare oxidative damage and antioxidant defenses in patients treated with controlled normothermia versus mild therapeutic hypothermia during postcardiac arrest syndrome. The sample consisted of 31 patients under controlled normothermia (36°C) and 11 patients treated with 24 h mild therapeutic hypothermia (33°C), victims of in- or out-of-hospital cardiac arrest. Parameters were assessed at 6, 12, 36, and 72 h after cardiac arrest in the central venous blood samples. Hypothermic and normothermic patients had similar S100B levels, a biomarker of brain injury. Xanthine oxidase activity is similar between hypothermic and normothermic patients; however, it decreases posthypothermia treatment. Xanthine oxidase activity is positively correlated with lactate and S100B and inversely correlated with pH, calcium, and sodium levels. Hypothermia reduces malondialdehyde and protein carbonyl levels, markers of oxidative damage. Concomitantly, hypothermia increases the activity of erythrocyte antioxidant enzymes superoxide dismutase, glutathione peroxidase, and glutathione S-transferase while decreasing the activity of serum paraoxonase-1. These findings suggest that mild therapeutic hypothermia reduces oxidative damage and alters antioxidant defenses in postcardiac

arrest patients.

FV I DESFIBRIL·LACIÓ

1. Pediatr Emerg Care. 2017 Jun;33(6):427-431. doi: 10.1097/PEC.0000000000001156.
Catecholaminergic Polymorphic Ventricular Tachycardia.
Wall JJ1, Iyer RV.
Abstract
Catecholaminergic polymorphic ventricular tachycardia is a rare cause of exercise-induced arrhythmia and sudden cardiac death in the pediatric patient. This arrhythmia is difficult to diagnose in the emergency department, given the range of presentations; thus, a familiarity with and high index of suspicion for this pathology are crucial. Furthermore, recognition of the characteristic electrocardiogram findings and knowledge of the management of the symptomatic patient are necessary, given the risk of arrhythmia recurrence and cardiac arrest. In this review, we discuss the presentation, differential diagnosis, and management of catecholaminergic polymorphic ventricular tachycardia for the emergency care provider.

PEDIATRIA

1. ASAIO J. 2017 May 23. doi: 10.1097/MAT.0000000000000603. [Epub ahead of print]
Pediatric Extracorporeal Life Support Organization Registry International Report 2016.
Barbaro RP1, Paden ML, Guner YS, Raman L, Ryerson LM, Alexander P, Nasr VG, Bembea MM, Rycus PT, Thiagarajan RR; ELSO member centers.
Abstract
The purpose of this report is to describe the international growth, outcomes, complications, and technology used in pediatric extracorporeal life support (ECLS) from 2009 to 2015 as reported by participating centers in the Extracorporeal Life Support Organization (ELSO). To date, there are 59,969 children who have received ECLS in the ELSO Registry; among those, 21,907 received ECLS since 2009 with an overall survival to hospital discharge rate of 61%. In 2009, 2,409 ECLS cases were performed at 157 centers. By 2015, that number grew to 2,992 cases in 227 centers, reflecting a 24% increase in patients and 55% growth in centers. ECLS delivered to neonates (0-28 days) for respiratory support was the largest subcategory of ECLS among children <18-years old. Overall, 48% of ECLS was delivered for respiratory support and 52% was for cardiac support or extracorporeal life support to support cardiopulmonary resuscitation (ECPR). During the study period, over half of children were supported on ECLS with centrifugal pumps (51%) and polymethylpentene oxygenators (52%). Adverse events including neurologic events were common during ECLS, a fact that underscores the opportunity and need to promote quality improvement work.

2. J Med Internet Res. 2017 May 29;19(5):e183. doi: 10.2196/jmir.7379.
Adherence to AHA Guidelines When Adapted for Augmented Reality Glasses for Assisted Pediatric Cardiopulmonary Resuscitation: A Randomized Controlled

Trial.
Siebert JN1, Ehrler F2, Gervaix A1, Haddad K 1, Lacroix L1, Schrurs P3, Sahin A3, Lovis C2, Manzano S1.
Abstract
BACKGROUND: The American Heart Association (AHA) guidelines for cardiopulmonary resuscitation (CPR) are nowadays recognized as the world's most authoritative resuscitation guidelines. Adherence to these guidelines optimizes the management of critically ill patients and increases their chances of survival after cardiac arrest. Despite their availability, suboptimal quality of CPR is still common. Currently, the median hospital survival rate after pediatric in-hospital cardiac arrest is 36%, whereas it falls below 10% for out-of-hospital cardiac arrest. Among emerging information technologies and devices able to support caregivers during resuscitation and increase adherence to AHA guidelines, augmented reality (AR) glasses have not yet been assessed. In order to assess their potential, we adapted AHA Pediatric Advanced Life Support (PALS) guidelines for AR glasses.
OBJECTIVE: The study aimed to determine whether adapting AHA guidelines for AR glasses increased adherence by reducing deviation and time to initiation of critical life-saving maneuvers during pediatric CPR when compared with the use of PALS pocket reference cards.
METHODS: We conducted a randomized controlled trial with two parallel groups of voluntary pediatric residents, comparing AR glasses to PALS pocket reference cards during a simulation-based pediatric cardiac arrest scenario-pulseless ventricular tachycardia (pVT). The primary outcome was the elapsed time in seconds in each allocation group, from onset of pVT to the first defibrillation attempt. Secondary outcomes were time elapsed to (1) initiation of chest compression, (2) subsequent defibrillation attempts, and (3) administration of drugs, as well as the time intervals between defibrillation attempts and drug doses, shock doses, and number of shocks. All these outcomes were assessed for deviation from AHA guidelines.
RESULTS: Twenty residents were randomized into 2 groups. Time to first defibrillation attempt (mean: 146 s) and adherence to AHA guidelines in terms of time to other critical resuscitation endpoints and drug dose delivery were not improved using AR glasses. However, errors and deviations were significantly reduced in terms of defibrillation doses when compared with the use of the PALS pocket reference cards. In a total of 40 defibrillation attempts, residents not wearing AR glasses used wrong doses in 65% (26/40) of cases, including 21 shock overdoses >100 J, for a cumulative defibrillation dose of 18.7 Joules per kg. These errors were reduced by 53% (21/40, P<.001) and cumulative defibrillation dose by 37% (5.14/14, P=.001) with AR glasses.
CONCLUSIONS: AR glasses did not decrease time to first defibrillation attempt and other critical resuscitation endpoints when compared with PALS pocket cards. However, they improved adherence and performance among residents in terms of administering the defibrillation doses set by AHA.

2. Resuscitation. 2017 May 25. pii: S0300-9572(17)30223-X. doi: 10.1016/j.resuscitation.2017.05.023. [Epub ahead of print]
Epinephrine Dosing Interval and Survival Outcomes During Pediatric In-Hospital Cardiac Arrest. (Ull a aquest!)
Hoyme DB1, Patel SS2, Samson RA3, Raymond TT4, Nadkarni VM5, Gaies MG6, Atkins DL7; American Heart Association Get With the

Guidelines–Resuscitation Investigators.
Abstract
BACKGROUND: Current guidelines recommend epinephrine every 3 to 5minutes during cardiopulmonary resuscitation. For adults with in-hospital cardiac arrest (IHCA), longer dosing intervals are associated with improved survival to discharge. This study investigates whether longer epinephrine dosing intervals were associated with improved survival to discharge during pediatric IHCA.
METHODS: Retrospective review of AHA Get With The Guidelines-Resuscitation registry identified 1,630 pediatric IHCAs that met inclusion criteria. Average epinephrine dosing interval was defined by dividing duration of resuscitation after first dose of epinephrine by total doses. Average dosing intervals were categorized as 1 to 5minutes,>5 to <8minutes, and 8 to <10minutes/dose. Primary outcome was survival to hospital discharge. Multivariable logistic regression models controlled for age, gender, illness category, location of arrest, arrest duration, time of day, and time to first epinephrine dose. Secondary analysis separated patients on vasoactive infusion at the time of arrest from those without an infusion in place.
RESULTS: Odds ratios (OR) calculated using 1 to 5minutes/dose interval as reference. For the total cohort, adjusted OR for survival to hospital discharge for >5 to <8minutes was 1.81 (95% CI 1.26-2.59), and 8 to <10minutes 2.64 (95% CI 1.53-4.55). For patients not receiving vasoactive infusion, adjusted OR for survival to discharge for >5 to <8minutes was 1.99 (95% CI 1.29-3.06) and 8 to <10minutes 2.67 (95% CI 1.14-5.04).
CONCLUSIONS: Longer average dosing intervals than currently recommended for epinephrine administration during pediatric IHCA were associated with improved survival to hospital discharge.

3. Pediatr Emerg Care. 2017 May 30. doi: 10.1097/PEC.0000000000001191. [Epub ahead of print]
An Ethical Justification for Termination of Resuscitation Protocols for Pediatric Patients.
Muñoz MG1, Beyda DH.
Abstract
OBJECTIVE: The aim of this article was to compare specific characteristics and outcomes among adult and pediatric out-of-hospital cardiac arrest (OHCA) patients to show that the existing literature warrants the design and implementation of pediatric studies that would specifically evaluate termination of resuscitation protocols. We also address the emotional and practical concerns associated with ceasing resuscitation efforts on scene when treating pediatric patients.
METHODS: Relevant prospective and retrospective studies were used to compare characteristics and outcomes between adult and pediatric OHCA patients. Characteristics analyzed were nonwitnessed arrests, absence of shockable rhythm, no return of spontaneous circulation, and survival to hospital discharge.
RESULTS: Cases of unwitnessed arrests by EMS providers are substantially the same in pediatric patients (41.0%-96.3%) compared with their adult counterparts (47.4%-97.7%). The adult studies revealed 57.6% to 92.2% of patients without an initial shockable rhythm. The pediatric studies showed a range of 64.0% to 98.0%. The range of adult patients without return of spontaneous circulation was 54.8% to 95.4%, and the range in pediatric

patients was 68.2% to 95.6%. Survival rates among the adult studies ranged from 0.8% to 9.3% (mean, 5.0%; median, 5.2%), and in the pediatric studies they were 2.0% to 26.2% (mean, 9.2%; median, 7.7%).
CONCLUSIONS: The data compared demonstrate that characteristics and outcomes are virtually identical between adult and pediatric OHCA patients. We also found the 3 chief barriers hindering further research to be invalid impediments to moving forward. This review warrants designing pediatric studies that would specifically correlate termination of resuscitation protocols with patient survival and include predictive values.

ECMO

1. Resuscitation. 2017 May 25. pii: S0300-9572(17)30224-1. doi: 10.1016/j.resuscitation.2017.05.024. [Epub ahead of print]
Prevalence, natural history, and time-dependent outcomes of a multi-center North American cohort of out-of-hospital cardiac arrest extracorporeal CPR candidates.
Reynolds JC1, Grunau BE2, Elmer J3, Rittenberger JC3, Sawyer KN3, Kurz MC4, Singer B5, Proudfoot A6, Callaway CW3.
Abstract
AIM: Estimate prevalence of ECPR-eligible subjects in a large, North American, multi-center cohort, describe natural history with conventional resuscitation, and predict optimal timing of transition to ECPR.
METHODS: Secondary analysis of clinical trial enrolling adults with non-traumatic OHCA. Primary outcome was survival to discharge with favorable outcome (mRS 0-3). Subjects were additionally classified as survival with unfavorable outcome (mRS 4-5), ROSC without survival (mRS 6), or without ROSC. We plotted subject accrual as a function of resuscitation duration (CPR onset to return of spontaneous circulation (ROSC) or termination of resuscitation), and estimated time-dependent probabilities of ROSC and mRS 0-3 at discharge. Adjusted logistic regression models tested the association between resuscitation duration and survival with mRS 0-3.
RESULTS: Of 11,368 subjects, 1,237 (10.9%; 95%CI 10.3-11.5%) were eligible for ECPR, Of these, 778 (63%) achieved ROSC, 466 (38%) survived to discharge, and 377 (30%) had mRS 0-3 at discharge. Half with eventual mRS 0-3 achieved ROSC within 8.8minutes (95%CI 8.3-9.2minutes) of resuscitation, and 90% within 21.0minutes (95%CI 19.1-23.7minutes). Time-dependent probabilities of ROSC and mRS 0-3 declined over elapsed resuscitation, and the likelihood of additional cases with mRS 0-3 beyond 20minutes was 8.4% (95%CI 5.9-11.0%). Resuscitation duration was independently associated with survival to discharge with mRS 0-3 (OR 0.95; 95%CI 0.92-0.97).
CONCLUSION: Approximately 11% of subjects were eligible for ECPR. Only one-third survived to discharge with favorable outcome. Performing 9-21minutes of conventional resuscitation captured most ECPR-eligible subjects with eventual mRS 0-3 at hospital discharge.

2. Surgery. 2017 May 24. pii: S0039-6060(17)30236-2. doi: 10.1016/j.surg.2017.03.020. [Epub ahead of print]
Review of 1,000 consecutive extracorporeal membrane oxygenation runs as a

quality initiative.
Lovvorn HN 3rd1, Hardison DC2, Chen H3, Westrick AC4, Danko ME2, Bridges BC5, Walsh WF6, Pietsch JB2.
Abstract
BACKGROUND: Extracorporeal membrane oxygenation is a resource-intensive mode of life-support potentially applicable when conventional therapies fail. Given the initial success of extracorporeal membrane oxygenation to support neonates and infants in the 1980s, indications have expanded to include adolescents, adults, and selected moribund patients during cardiopulmonary resuscitation. This single-institution analysis was conducted to evaluate programmatic growth, outcomes, and risk for death despite extracorporeal membrane oxygenation across all ages and diseases.
METHODS: Beginning in 1989, we registered prospectively all extracorporeal membrane oxygenation patient data with the Extracorporeal Life Support Organization. We queried this registry for our institution-specific data to compare the parameter of "discharge alive" between age groups (neonatal, pediatric, adult), disease groups (respiratory, cardiac, cardiopulmonary resuscitation), and modes of extracorporeal membrane oxygenation (veno-venous; veno-arterial). Extracorporeal membrane oxygenation-specific complications (mechanical, hemorrhagic, neurologic, renal, cardiovascular, pulmonary, infectious, metabolic) were analyzed similarly. Descriptive statistics, Kaplan-Meier, and linear regression analyses were conducted.
RESULTS: After 1,052 extracorporeal membrane oxygenation runs, indications have expanded to include adults, to supplement cardiopulmonary resuscitation, to support hemodialysis in neonates and plasmapheresis in children, and to bridge all age patients to heart and lung transplant. Overall survival to discharge was 52% and was better for respiratory diseases ($P < .001$). Probability of individual survival decreased to <50% if pre-extracorporeal membrane oxygenation mechanical ventilation exceeded respectively 123 hours for cardiac, 166 hours for cardiopulmonary resuscitation, and 183 hours for respiratory diseases ($P = .013$). Complications occurred most commonly among cardiac and cardiopulmonary resuscitation runs ($P < .001$), the veno-arterial mode ($P < .001$), and in adults ($P = .044$).
CONCLUSION: Our extracorporeal membrane oxygenation program, an Extracorporeal Life Support Organization-designated Center of Excellence, has experienced substantial growth in volume and indications, including increasing age and disease severity. Considering the entire cohort, pre-extracorporeal membrane oxygenation ventilation exceeding 7 days was associated with an increased probability of death.

3. J Pediatr. 2017 Mar;182:107-113. doi: 10.1016/j.jpeds.2016.12.025. Epub 2016 Dec 30.
Should Extracorporeal Membrane Oxygenation Be Offered? An International Survey.
Kuo KW1, Barbaro RP2, Gadepalli SK3, Davis MM4, Bartlett RH3, Odetola FO2.
Abstract
OBJECTIVES: To assess the current attitudes of extracorporeal membrane oxygenation (ECMO) program directors regarding eligibility for ECMO among children with cardiopulmonary failure.
STUDY DESIGN: Electronic cross-sectional survey of ECMO program directors at ECMO centers worldwide within the Extracorporeal Life Support

Organization directory (October 2015-December 2015).
RESULTS: Of 733 eligible respondents, 226 (31%) completed the survey, 65% of whom routinely cared for pediatric patients. There was wide variability in whether respondents would offer ECMO to any of the 5 scenario patients, ranging from 31% who would offer ECMO to a child with trisomy 18 to 76% who would offer ECMO to a child with prolonged cardiac arrest and indeterminate neurologic status. Even physicians practicing the same specialty sometimes held widely divergent opinions, with 50% of pediatric intensivists stating they would offer ECMO to a child with severe developmental delay and 50% stating they would not. Factors such as quality of life and neurologic status influenced decision making and were used to support decisions for and against offering ECMO.
CONCLUSIONS: ECMO program directors vary widely in whether they would offer ECMO to various children with cardiopulmonary failure. This heterogeneity in physician decision making underscores the need for more evidence that could eventually inform interinstitutional guidelines regarding patient selection for ECMO.

RECERCA EXPERIMENTAL

1. Shock. 2017 May 30. doi: 10.1097/SHK.0000000000000914. [Epub ahead of print]
Duration of Untreated Cardiac Arrest and Clinical Relevance of Animal Experiments: The Relationship Between the "No-Flow" Duration and the Severity of Post-Cardiac Arrest Syndrome in a Porcine Model.
Babini G1, Grassi L, Russo I, Novelli D, Boccardo A, Luciani A, Fumagalli F, Staszewsky L, Fiordaliso F, De Maglie M, Salio M, Zani DD, Letizia T, Masson S, Luini MV, Pravettoni D, Scanziani E, Latini R, Ristagno G.
Abstract
INTRODUCTION: The study investigated the effect of untreated cardiac arrest (CA), i.e. "no-flow" time, on post-resuscitation myocardial and neurological injury, and survival in a pig model to identify an optimal duration that adequately reflects the most frequent clinical scenario.
METHODS: An established model of myocardial infarction followed by CA and cardiopulmonary resuscitation was used. Twenty-two pigs were subjected to 3 no-flow durations: short (8-10 min); intermediate (12-13 min); and long (14-15 min). Left ventricular ejection fraction (LVEF) was assessed together with thermodilution cardiac output (CO) and high sensitivity cardiac troponin T (hs-cTnT). Neurological impairment was evaluated by neurological scores, serum neuron specific enolase (NSE), and histopathology.
RESULTS: More than 60% of animals survived when the duration of CA was ≤13 min, compared to only 20% for a duration ≥14 min. Neuronal degeneration and neurological scores showed a trend towards a worse recovery for longer no-flow durations. No animals achieved a good neurological recovery for a no-flow ≥14 min, in comparison to a 56% for a duration ≤13 min ($p = 0.043$). Serum NSE levels significantly correlated with the no-flow duration ($r = 0.892$). Longer durations of CA were characterized by lower LVEF and CO compared to shorter durations ($p < 0.05$). The longer was the no-flow time, the higher was the number of defibrillations delivered ($p = 0.043$). The defibrillations delivered significantly correlated with LVEF and plasma hs-cTnT.
CONCLUSIONS: Longer no-flow durations caused greater post-resuscitation

myocardial and neurological dysfunction and reduced survival. An untreated CA of 12-13 min may be an optimal choice for a clinically relevant model.

2. Mil Med Res. 2017 May 30;4:16. doi: 10.1186/s40779-017-0127-4. eCollection 2017.
A safety evaluation of profound hypothermia-induced suspended animation for delayed resuscitation at 90 or 120 min.
Liu Y1, Li S2, Li Z1, Zhang J1, Han JS1, Zhang Y1, Yin ZT1, Wang HS1.
Abstract
BACKGROUND: The successful treatment of military combat casualties with penetrating injuries is significantly dependent on the time needed to get the patient to an adequate treatment facility. Profound hypothermia-induced suspended animation for delayed resuscitation (SADR) is a novel approach for inducing cardiac arrest and buying additional time for such injuries. However, the time used to safely administer circulatory arrest (CA) is controversial. The goal of this study was to evaluate the safety of hypothermia-induced SADR over 90 and 120 min time intervals.
METHODS: Sixteen male BAMA minipigs were randomized into two groups: CA90 group (90 min, n = 8) and CA120 group (120 min, n = 8). Cannulation of the right common carotid arteries and internal jugular veins was performed to establish cardiopulmonary bypass for each animal. Through the perfusion of cold organ preservation solution (OPS), cardioplegia and profound hypothermia (15 °C) were induced. After CA, cardiopumonary bypass (CPB) was restarted, and the animals were gradually re-warmed and resuscitated. The animals were assisted with ventilators until spontaneous breathing was achieved. The index of hemodynamic perioperative serum chemistry values [alanine transaminase (ALT), aspartate aminotransferase (AST), creatinine (CR), lactic dehydrogenase (LDH) and troponin T (TnT)] and survival were observed from pre-operation to 7 days post-operation.
RESULTS: Fifteen animals were enrolled in the experiment, while 1 animal in CA120 group died from surgical error. All 8 animals in CA90 group recovered, with only 1 animal displaying mild disability. However, in CA120 group, only 2 animals survived with severe disability, and the other 5 animals died after 2 days post-operation. In CA90 group, the perioperative serum chemistry values increased at 1 day post-operation (ALT 84.43 ± 18.65 U/L; AST 88.99 ± 23.19 U/L; Cr 87.90 ± 24.49 μmol/L; LDH 1894.13 ± 322.26 U/L; TnT 0.849 ± 0.135 ng/ml) but decreased to normal or almost normal levels at 7 days post-operation (ALT 52.48 ± 9.04 U/L; AST 75.23 ± 21.46 U/L; Cr 82.69 ± 18.41 μmol/L; LDH 944.67 ± 834.32 U/L; TnT 0.336 ± 0.076 ng/ml).
CONCLUSIONS: Profound hypothermia-induced SADR is an effective method for inducing cardiac arrest. Our results indicate that inducing CA for 90 min (at 15 °C) is safer than doing so for 120 min. Our results indicate that 120 min of CA at 15 °C is dangerous and can result in high mortality and severe neurological complications. Further experimentation is needed to determine whether 120 min of CA at temperatures lower than 15 °C can lead to safe recovery.

3. Shock. 2017 May 29. doi: 10.1097/SHK.0000000000000909. [Epub ahead of print]
Extracorporeal Life Support Increases Survival After Prolonged Ventricular Fibrillation Cardiac Arrest in the Rat.
Magnet IAM1, Ettl F, Schober A, Warenits AM, Grassmann D, Wagner M,

Schriefl C, Clodi C, Teubenbacher U, Högler S, Weihs W, Sterz F, Janata A.
Abstract
BACKGROUND: Extracorporeal life support (ECLS) for cardiopulmonary resuscitation (CPR) may increase end organ perfusion and thus survival when conventional CPR fails. The aim was to investigate, if after ventricular fibrillation cardiac arrest in rodents ECLS improves outcome compared to conventional CPR.
METHODS: In 24 adult male Sprague-Dawley rats (460 to 510 g) resuscitation was started after 10 min of no-flow with ECLS (consisting of an open reservoir, roller pump and membrane oxygenator, connected to a cannulas in the jugular vein and femoral artery, n = 8) or CPR (mechanical chest compressions plus ventilations, n = 8) and compared to a sham group (n = 8). After return of spontaneous circulation (ROSC), all rats were maintained at 33°C for 12 h. Survival to 14 days, neurologic deficit scores and overall performance categories were assessed.
RESULTS: ECLS lead to sustained ROSC in 8/8 (100%) and neurological intact survival to 14 days in 7/8 rats (88%), compared to 5/8 (63%) and 1/8 CPR rats. The median survival time was 14 days (IQR: 14-14) in the ECLS and 1 day (IQR: 0 to 5) for the CPR group (p = 0.004).
CONCLUSION: In a rat model of prolonged ventricular fibrillation cardiac arrest, ECLS with mild hypothermia produces 100% resuscitability and 88% long-term survival, significantly better than conventional CPR.

4. Acta Anaesthesiol Scand. 2017 May 28. doi: 10.1111/aas.12911. [Epub ahead of print]
Reduced right ventricular diameter during cardiac arrest caused by tension pneumothorax - a porcine ultrasound study.
Caap P1, Aagaard R1,2,3, Sloth E4,5, Løfgren B1,6,7, Granfeldt A7,8.
Abstract
INTRODUCTION: Advanced life support (ALS) guidelines recommend ultrasound to identify reversible causes of cardiac arrest. Right ventricular (RV) dilatation during cardiac arrest is commonly interpreted as a sign of pulmonary embolism. The RV is thus a focus of clinical ultrasound examination. Importantly, in animal studies ventricular fibrillation and hypoxia results in RV dilatation. Tension pneumothorax (tPTX) is another reversible cause of cardiac arrest, however, the impact on RV diameter remains unknown.
AIM: To investigate RV diameter evaluated by ultrasound in cardiac arrest caused by tPTX or hypoxia.
METHODS: Pigs were randomized to cardiac arrest by either tPTX (n = 9) or hypoxia (n = 9) and subsequently resuscitated. Tension pneumothorax was induced by injection of air into the pleural cavity. Hypoxia was induced by reducing tidal volume. Ultrasound images of the RV were obtained throughout the study. Tension pneumothorax was decompressed after the seventh rhythm analysis. The primary endpoint was RV diameter after the third rhythm analysis.
RESULTS: At cardiac arrest the RV diameter was 17 mm (95% CI: 13; 21) in the tPTX group and 36 mm (95% CI: 33; 40) in the hypoxia group (P < 0.01, n = 9 for both). At third rhythm analysis RV diameter was smaller in the

tPTX group: 12 mm (95% CI: 7; 16) vs. hypoxia group: 28 mm (25; 32) (P < 0.01). After decompression no difference existed between groups: tPTX 29 mm (95% CI: 23; 34) vs. hypoxia 29 mm (95% CI: 20; 38).
CONCLUSION: The RV diameter is smaller during cardiopulmonary resuscitation in cardiac arrest caused by tPTX when compared with hypoxia. The difference disappears after tPTX decompression.

CASE REPORTS

1. J Cardiovasc Med (Hagerstown). 2017 May 29. doi: 10.2459/JCM.0000000000000531. [Epub ahead of print]
Ventricular fibrillation and long-QT syndrome due to panhypopituitarism.
Aste M1, Capellini C, Schiappacasse E, Devoto G, Brignole M.
Abstract
A 68-year-old man presented with ventricular fibrillation and acquired long QT due to panhypopituitarism that disappeared completely within 48 h from replacement hormonal therapy. Panhypopituitarism is not well recognized as a reversible cause of ventricular fibrillation and long-QT syndrome in medical literature. In the present case, pituitary apoplexy exhausted an already chronically hypofunctioning pituitary gland, causing QT prolongation, torsades de pointes and several cardiac arrests due to ventricular fibrillation.

2. Am J Emerg Med. 2017 May 11. pii: S0735-6757(17)30375-3. doi: 10.1016/j.ajem.2017.05.011. [Epub ahead of print]
Pediatric out-of-hospital cardiac arrest caused by left coronary-artery agenesis with primary shockable rhythm. A brief report.
Weigeldt M1, Lahmann S2, Krieger K3, Buttenberg S4, Stephan V5, Stiller B6, Stengel D7.
Abstract
BACKGROUND: To illustrate a rare cause of out-of-hospital cardiac arrest in children, its differential diagnoses, emergency and subsequent treatment at various steps in the rescue chain, and potential outcomes.
CASE PRESENTATION: A 4-year-old boy with unknown agenesis of the left coronary ostium sustained out-of-hospital cardiac arrest. Bystander cardio-pulmonary resuscitation was initiated and defibrillation was performed via an automated external defibrillator (AED) shortly after paramedics arrived at the scene, restoring sinus rhythm and spontaneous circulation. After admission to the intensive care unit the child was intubated for airway and seizure control. Further diagnostic work-up by angiography revealed agenesis of the left coronary artery. After initial seizures, the boy's neurological recovery was complete. He subsequently underwent successful internal mammary artery in-situ bypass surgery to the trunk of the left coronary artery. One year after cardiac arrest, the patient had completely recovered with no physical or intellectual sequelae. A catheter examination proved excellent growth of the bypass and good cardiac function.
CONCLUSIONS: This case illustrates the long term outcome after agenesis of the LCA while reiterating that prompt access to pediatric defibrillation may be lifesaving-albeit in a minority of pediatric OHCA.

FV I DESFIBRIL·LACIÓ

1. Resuscitation. 2017 Jun 14. pii: S0300-9572(17)30254-X. doi: 10.1016/j.resuscitation.2017.06.011. [Epub ahead of print]
Double sequential defibrillation therapy for out-of-hospital cardiac arrests: the London experience.
Emmerson AC1, Whitbread M2, Fothergill RT1.
Abstract
BACKGROUND: Despite advances in treatment for out-of-hospital cardiac arrest (OHCA), a subgroup of patients remain in refractory ventricular fibrillation (RVF) during resuscitation. Recent evidence suggests that double sequential defibrillation (DSD), where two shocks are delivered to the patient in quick succession, may provide an effective therapy for RVF. This study describes the characteristics and survival outcomes of OHCA patients treated by ambulance clinicians using a local DSD protocol in an attempt to resolve RVF.
METHODS: This is a retrospective, observational analysis of patients who received DSD by the London Ambulance Service from 1st July 2015 to 31st December 2016. A comparator group of patients who received more than six consecutive standard shocks (not DSD) for persistent VF was also identified. Outcomes included pre-hospital return of spontaneous circulation (ROSC), ROSC sustained to hospital, and survival to hospital discharge. DSD patients who survived to hospital discharge are reported in further detail.
RESULTS: During the 18-month study period, 45 patients were treated with DSD: a third obtained a pre-hospital ROSC and 7% survived to hospital discharge. We observed similar ROSC and survival rates amongst those who received standard defibrillation only.
CONCLUSION: Our observational study did not find any clear benefit of DSD use by EMS in the treatment of RVF. However, we find that 3 patients, who were treated with DSD following unsuccessful single shocks, had their VF terminated. Prospective randomised clinical trials are urgently needed to investigate the potential value of DSD in the pre-hospital setting.

POST ACR

1. Anatol J Cardiol. 2017 Jun 22. doi: 10.14744/AnatolJCardiol.2017.7578. [Epub ahead of print]
Comet assay in evaluating deoxyribonucleic acid damage after out-of-hospital cardiac arrest.
Hazuková R1, Rezácová M, Köhlerová R, Tomek T, Cermáková E, Kocí J, Pleskot M.
Abstract
OBJECTIVE: This study aimed to investigate whether out-of-hospital cardiac arrest (OHCA) may induce severe DNA damage measured using comet assay in successfully resuscitated humans and to evaluate a short-term prognostic role.
METHODS: In this prospective, controlled, blinded study (1/2013-1/2014), 41 patients (age, 63±14 years) successfully resuscitated from non traumatic OHCA and 10 healthy controls (age, 53±17 years) were enrolled. DNA damage [double-strand breaks (DSBs) and single-strand breaks (SSBs)] was measured using comet assay in peripheral lymphocytes sampled at admission. Clinical data were recorded (according to Utstein style). A good short-term prognosis was defined as survival for 30 days.
RESULTS: Among the patients, there were 71% (29/41) short-term survivors.

After OHCA, DNA damage (DSBs and SSBs) was higher (11.0±7.6% and 0.79±2.41% in tail) among patients than among controls (1.96±1.63% and 0.02±0.03% in tail), and it was more apparent for DSBs ($p<0.001$ and $p=0.085$). There was no difference in the DNA damage between patients with cardiac and non-cardiac etiology, or between survivors and nonsurvivors. Among Utstein style parameters, ventricular fibrillation, asystole, and early electrical defibrillation influenced DSBs; none of the factors influenced SSBs. Factors influencing survival were SSBs, ventricular fibrillation, length of cardiopulmonary resuscitation by professionals ≤15 min, cardiogenic shock, and postanoxic encephalopathy. In contrast to DSBs [area under the curve (AUC)=0.520], SSBs seem to have a potential in prognostication (AUC=0.639).
CONCLUSION: This study for the first time demonstrates revelation of DNA damage using comet assay in patients successfully resuscitated from OHCA. Whether DNA damage measured using comet assay may be a prognostic marker remains unknown, although our data may encourage some suggestions.

REGISTRES I REVISIONS

1. NASN Sch Nurse. 2016 Sep;31(5):263-70. doi: 10.1177/1942602X16655839. Epub 2016 Aug 2.
Cardiac Emergency Response Planning for Schools: A Policy Statement.
Rose K1, Martin Goble M2, Berger S3, Courson R3, Fosse G3, Gillary R3, Halowich J3, Indik JH3, Konig M3, Lopez-Anderson M3, Murphy MK3, Newman MM3, Ranous J3, Sasson C3, Taras H3, Thompson A3.
Abstract
A sudden cardiac arrest in school or at a school event is potentially devastating to families and communities. An appropriate response to such an event-as promoted by developing, implementing, and practicing a cardiac emergency response plan (CERP)-can increase survival rates. Understanding that a trained lay-responder team within the school can make a difference in the crucial minutes between the time when the victim collapses and when emergency medical services arrive empowers school staff and can save lives. In 2015, the American Heart Association convened a group of stakeholders to develop tools to assist schools in developing CERPs. This article reviews the critical components of a CERP and a CERP team, the factors that should be taken into account when implementing the CERP, and recommendations for policy makers to support CERPs in schools.

2. Am J Emerg Med. 2017 Jun 15. pii: S0735-6757(17)30470-9. doi: 10.1016/j.ajem.2017.06.026. [Epub ahead of print]
Bi-objective approach for placing ground and air ambulance base and helipad locations in order to optimize EMS response.
Shahriari M1, Bozorgi-Amiri A2, Tavakoli S3, Yousefi-Babadi A4.
Abstract
Shortening the travel time of patient transfer has clinical implications for many conditions such as cardiac arrest, trauma, stroke and STEMI. As resources are often limited precise calculations are needed. In this paper we consider the location problem for both ground and aerial emergency medical services. Given the uncertainty of when patients are in need of prompt medical attention we consider these demand points to be uncertain. We consider various ways in which ground and helicopter ambulances can work together to make the whole process go faster. We develop a

mathematical model that minimizes travel time and maximizes service level. We use a compromising programming method to solve this bi-objective mathematical model. For numerical experiments we apply our model to a case study in Lorestan, Iran, using geographical and population data, and the location of the actual hospital based in the capital of the province. Results show that low-accessibility locations are the main focus of the proposed problem and with mathematical modeling access to a hospital is vastly improved. We also found out that once the budget reaches a certain point which suffices for building certain ambulance bases more investments does not necessarily result in less travel time.

3. Eur Heart J Acute Cardiovasc Care. 2017 Mar 1:2048872617694675. doi: 10.1177/2048872617694675. [Epub ahead of print]
Factors modifying performance of a novel citizen text message alert system in improving survival of out-of-hospital cardiac arrest.
Pijls RW1, Nelemans PJ1, Rahel BM1, Gorgels AP1.
Abstract
AIMS: Recently we found that the text message alert system increases survival of sudden out-of-hospital cardiac arrest. The aim of the present study is to explore the contribution of the system to survival specifically in resuscitation settings with prolonged delay of start of resuscitation.
METHODS AND RESULTS: Data were used from consecutive patients resuscitated for out-of-hospital cardiac arrest during a two-year period in the Dutch province Limburg. Survival of 291 cases with out-of-hospital cardiac arrest where one or more volunteers attended (Scenario 2) was compared with survival of 131 cases with out-of-hospital cardiac arrest where no volunteers attended and only standard care was given (Scenario 1). Multivariable logistic regression models including terms for interaction between scenario and the covariate coding for resuscitation setting were used to test for effect modification. The highest impact on survival of the alert system was observed in cases of (a) witnessed arrests (odds ratio=2.25; 95% confidence interval: 1.27-4.00; p=0.005); (b) arrests that occurred in the home (odds ratio=2.28; 95% confidence interval: 1.21-4.28; p=0.011); (c) arrival of the ambulance with a delay of 7-10 min (odds ratio=2.63; 95% confidence interval: 1.09-6.35; p=0.032); and (d) arrests at evening/night (odds ratio=3.07; 95% confidence interval: 1.34-7.03; p=0.008). Due to the low sample size, p-values from tests for interaction were non-significant.
CONCLUSION: The contribution of the alert system to survival is most substantial in cases of witnessed arrest, in the home situation, at slightly delayed arrival of the first ambulance and during the evening/night.

4. Resuscitation. 2017 Jun 14. pii: S0300-9572(17)30252-6. doi: 10.1016/j.resuscitation.2017.06.009. [Epub ahead of print]
Variability in the initiation of resuscitation attempts by emergency medical services personnel during out-of-hospital cardiac arrest.
Brooks SC1, Schmicker RH2, Cheskes S3, Christenson J4, Craig A5, Daya M6, Kudenchuk PJ7, Nichol G8, Zive D6, Morrison LJ9; Resuscitation Outcomes Consortium Investigators.
Abstract
BACKGROUND: Some patients with out-of-hospital cardiac arrest (OHCA)

assessed by emergency medical services (EMS) do not receive attempts at resuscitation on the basis of perceived futility.
AIMS: 1) To measure variability in the initiation of resuscitation attempts in EMS-assessed OHCA patients across EMS agencies, 2) to evaluate the association between selected EMS agency characteristics and the proportion of patients receiving resuscitation attempts, and 3) to evaluate the association between proportion receiving resuscitation attempts and survival.
METHODS: A retrospective cohort study using data from 129 EMS agencies participating in the Resuscitation Outcomes Consortium (ROC) epidemiologic registry (EPISTRY) - Cardiac Arrest from 12/01/2005 to 12/31/2010. We included non-traumatic OHCA patients assessed by EMS.
RESULTS: We included 86,912 OHCA patients. Overall, 54.8% had resuscitation attempted by EMS providers, varying from 23.9% to 100% (p=<0.001) across EMS agencies. The proportion of patients receiving a resuscitation attempt was 7.87% less (95% CI 3.73-12.0) among agencies with longer average response intervals (≥6minutes) compared with shorter average response intervals (<6minutes) and 16.9% less (95% CI 11.9-21.9) among agencies with higher levels of advanced life support (ALS) availability (≥50% of available units) compared with lower levels of ALS availability (<50% of available units). There was a moderate positive correlation between the proportion of patients with resuscitation attempts and survival to hospital discharge (r=0.54, p<0.001).
CONCLUSIONS: The proportion of patients with OHCA who receive resuscitation attempts is variable across EMS agencies and is associated with EMS response interval, ALS unit availability and geographic region. On average, survival was higher among EMS agencies more likely to initiate resuscitation.

5. Epilepsia. 2017 Mar;58(3):356-362. doi: 10.1111/epi.13644. Epub 2016 Dec 18.
Ictal asystole: A systematic review.
Tényi D1, Gyimesi C1, Kupó P2, Horváth R1, Bóné B1, Barsi P3, Kovács N1,4, Simor T2, Siegler Z5, Környei L6, Fogarasi A5, Janszky J1,4.
Abstract
OBJECTIVE: To comprehensively analyze ictal asystole (IA) on a large number of subjects.
METHODS: We performed a systematic review of case report studies of patients diagnosed with IA (1983-2016). Each included case was characterized with respect to patient history, IA seizure characteristics, diagnostic workup, and therapy. In addition, comparative analyses were also carried out: two alignments were developed based on the delay between epilepsy onset and IA onset ("new-onset" if <1 year, "late-onset" if ≥1 year) and asystole duration (asystole was "very prolonged" if lasted >30 s).
RESULTS: One hundred fifty-seven cases were included. All patients had focal epilepsy. In 7% of cases IA developed during a secondary generalized tonic-clonic seizure. Both the seizure-onset zone and the focal seizure activity at asystole beginning were usually temporal ($p < 0.001$ and $p = 0.001$, respectively) and were lateralized to the left hemisphere in 62% ($p = 0.005$ and $p = 0.05$, respectively). Asystole duration was 18 ± 14 s (mean±SD) (range 3-96 s); 73% of patients had late-onset, 27% had new-onset IA. Compared to late-onset IA, new-onset IA was associated with

female gender (p = 0.023), preexisting heart condition (p = 0.014), focal seizure activity at asystole beginning (p = 0.012), normal neuroimaging (p = 0.013), normal interictal EEG (p < 0.001), auditory aura (p = 0.012), and drug-responsive epilepsy (p < 0.001). "Very prolonged" asystole was associated with secondary generalized tonic-clonic seizures (p = 0.003) and tended to occur in extratemporal lobe seizures (p = 0.074). No IA-related death was reported.
SIGNIFICANCE: Characteristics considered to be typical of IA (focal, left temporal seizures appearing on grounds of a long-lasting, intractable epilepsy) seem only partially legitimate. We suggest that in new-onset IA, female gender and a preexisting heart condition could serve as predispositions in an otherwise benign epilepsy. We speculate that in late-onset IA, male-predominant changes in neuronal networks in chronic, intractable epilepsy and an accompanying autonomic dysregulation serve as facilitating factors.

6. Am J Emerg Med. 2017 Jun 7. pii: S0735-6757(17)30451-5. doi: 10.1016/j.ajem.2017.06.012. [Epub ahead of print]
Characteristics and outcome among 14,933 adult cases of in-hospital cardiac arrest: A nationwide study with the emphasis on gender and age.
Al-Dury N1, Rawshani A2, Israelsson J3, Strömsöe A4, Aune S5, Agerström J6, Karlsson T7, Ravn-Fischer A8, Herlitz J9.
University of Gothenburg, Institute of Medicine, Sahlgrenska Academy, Sweden; Sahlgrenska University Hospital, Dept. of Medicine, Gothenburg, Sweden; University of Borås, Borås, Sweden.
Abstract
AIM: To investigate characteristics and outcome among patients suffering in-hospital cardiac arrest (IHCA) with the emphasis on gender and age.
METHODS: Using the Swedish Register of Cardiopulmonary Resuscitation, we analyzed associations between gender, age and co-morbidities, etiology, management, 30-day survival and cerebral function among survivors in 14,933 cases of IHCA. Age was divided into three ordered categories: young (18-49years), middle-aged (50-64years) and older (65years and above). Comparisons between men and women were age adjusted.
RESULTS: The mean age was 72.7years and women were significantly older than men. Renal dysfunction was the most prevalent co-morbidity. Myocardial infarction/ischemia was the most common condition preceding IHCA, with men having 27% higher odds of having MI as the underlying etiology. A shockable rhythm was found in 31.8% of patients, with men having 52% higher odds of being found in VT/VF. After adjusting for various confounders, it was found that men had a 10% lower chance than women of surviving to 30days. Older individuals were managed less aggressively than younger patients. Increasing age was associated with lower 30-day survival but not with poorer cerebral function among survivors.
CONCLUSION: When adjusting for various confounders, it was found that men had a 10% lower chance than women of surviving to 30 days after in-hospital cardiac arrest. Older individuals were managed less aggressively than younger patients, despite a lower chance of survival. Higher age was, however, not associated with poorer cerebral function among survivors.

TARGET TEMPERATURE MANAGEMENT

1. Intensive Care Med. 2017 Apr;43(4):485-495. doi: 10.1007/s00134-017-4709-0. Epub 2017 Feb 20.
Targeted temperature management after intraoperative cardiac arrest: a multicenter retrospective study.
Constant AL1,2, Mongardon N3,4,5, Morelot Q6,7,8, Pichon N9, Grimaldi D1, Bordenave L10, Soummer A11, Sauneuf B12, Merceron S1, Ricome S13, Misset B14,15, Bruel C14, Schnell D16, Boisramé-Helms J16,17, Dubuisson E18, Brunet J 12, Lasocki S19,20, Cronier P21, Bouhemad B22, Carreira S23, Begot E9, Vandenbunder B 24, Dhonneur G3,4, Jullien P18, Resche-Rigon M6,7,8, Bedos JP1, Montlahuc C6,7,8, Legriel S25,26,27.
Abstract
PURPOSE: Few outcome data are available about temperature management after intraoperative cardiac arrest (IOCA). We describe targeted temperature management (TTM) (32-34 °C) modalities, adverse events, and association with 1-year functional outcome in patients with IOCA.
METHODS: Patients admitted to 11 ICUs after IOCA in 2008-2013 were studied retrospectively. The main outcome measure was 1-year functional outcome.
RESULTS: Of the 101 patients [35 women and 66 men; median age, 62 years (interquartile range, 42-72)], 68 (67.3%) were ASA PS I to III and 57 (56.4%) had emergent surgery. First recorded rhythms were asystole in 44 (43.6%) patients, pulseless electrical activity in 36 (35.6%), and ventricular fibrillation/tachycardia in 20 (19.8%). Median times from collapse to cardiopulmonary resuscitation and return of spontaneous circulation (ROSC) were 0 min (0-0) and 10 min (4-20), respectively. The 30 (29.7%) patients who received TTM had an increased risk of infection (P = 0.005) but not of arrhythmia, bleeding, or metabolic/electrolyte disorders. By multivariate analysis, one or more defibrillation before ROSC was positively associated with a favorable functional outcome at 1-year (OR 3.06, 95% CI 1.05-8.95, P = 0.04) and emergency surgery was negatively associated with 1-year favorable functional outcome (OR 0.36; 95% CI 0.14-0.95, P = 0.038). TTM use was not independently associated with 1-year favorable outcome (OR 0.82; 95% CI 0.27-2.46, P = 0.72).
CONCLUSIONS: TTM was used in less than one-third of patients after IOCA. TTM was associated with infection but not with bleeding or coronary events in this setting. TTM did not independently predict 1-year favorable functional outcome after IOCA in this study.

2. Crit Care. 2017 Jun 20;21(1):153. doi: 10.1186/s13054-017-1729-7.
Protein S100 as outcome predictor after out-of-hospital cardiac arrest and targeted temperature management at 33 °C and 36 °C.
Stammet P1, Dankiewicz J2, Nielsen N3, Fays F4, Collignon O4, Hassager C5, Wanscher M6, Undèn J7, Wetterslev J8, Pellis T9, Aneman A10, Hovdenes J11, Wise MP12, Gilson G13, Erlinge D2, Horn J14, Cronberg T15, Kuiper M16, Kjaergaard J5, Gasche Y17, Devaux Y18, Friberg H19; Target Temperature Management after Out-of-Hospital Cardiac Arrest (TTM) trial investigators.
Abstract
BACKGROUND: We aimed to investigate the diagnostic performance of S100 as an outcome predictor after out-of-hospital cardiac arrest (OHCA) and the potential influence of two target temperatures (33 °C and 36 °C) on serum levels of S100.
METHODS: his is a substudy of the Target Temperature Management after Out-of-Hospital Cardiac Arrest (TTM) trial. Serum levels of S100 were

measured a posteriori in a core laboratory in samples collected at 24, 48, and 72 h after OHCA. Outcome at 6 months was assessed using the Cerebral Performance Categories Scale (CPC 1-2 = good outcome, CPC 3-5 = poor outcome).
RESULTS: We included 687 patients from 29 sites in Europe. Median S100 values were higher in patients with a poor outcome at 24, 48, and 72 h: 0.19 (IQR 0.10-0.49) versus 0.08 (IQR 0.06-0.11) μg/ml, 0.16 (IQR 0.10-0.44) versus 0.07 (IQR 0.06-0.11) μg/L, and 0.13 (IQR 0.08-0.26) versus 0.06 (IQR 0.05-0.09) μg/L ($p < 0.001$), respectively. The ability to predict outcome was best at 24 h with an AUC of 0.80 (95% CI 0.77-0.83). S100 values were higher at 24 and 72 h in the 33 °C group than in the 36 °C group (0.12 [0.07-0.22] versus 0.10 [0.07-0.21] μg/L and 0.09 [0.06-0.17] versus 0.08 [0.05-0.10], respectively) ($p < 0.02$). In multivariable analyses including baseline variables and the allocated target temperature, the addition of S100 improved the AUC from 0.80 to 0.84 (95% CI 0.81-0.87) ($p < 0.001$), but S100 was not an independent outcome predictor. Adding S100 to the same model including neuron-specific enolase (NSE) did not further improve the AUC.
CONCLUSIONS: The allocated target temperature did not affect S100 to a clinically relevant degree. High S100 values are predictive of poor outcome but do not add value to present prognostication models with or without NSE. S100 measured at 24 h and afterward is of limited value in clinical outcome prediction after OHCA.

3. J Clin Neurophysiol. 2017 Jul;34(4):381-390. doi: 10.1097/WNP.0000000000000375.
EEG Characteristics in Cooled and Rewarmed Periods in Post-cardiac Arrest Therapeutic Hypothermia Patients.
Kim K1, Pargeon KL, Labar AS, Friedman O, Kandula PN, Labar DR.
Abstract
PURPOSE: Continuous video EEG is a tool to assess brain function in injuries, including cardiac arrest (CA). In post-CA therapeutic hypothermia (TH) studies, some EEG features are linked to poor prognosis, but the evolvement of EEG characteristics during two temperature phases and its significance is unclear. We systematically analyzed EEG characteristics in cooled and rewarmed phases of post-CA therapeutic hypothermia patients and investigated their correlation to patient outcome.
METHODS: This is a retrospective study of EEG analyses, from a single academic center, of 20 patients who underwent CA and therapeutic hypothermia. For each patient, three 30-minute EEG segments in cooled and rewarmed phases were analyzed for continuity, frequency, interictal epileptiform discharges, and seizures. Mortality at the time of discharge was used as outcome.
RESULTS: Rewarming was associated with the emergence of interictal epileptiform discharges, 2.6 times as likely compared with the cooled period ($P = 0.03$), and was not affected by systemic factors. Continuity, frequency, and discrete seizures were unaffected by temperature and did not show variance within each temperature phase. There was a trend toward the emergence of interictal epileptiform discharges upon rewarming and mortality, but it was not statistically significant.
CONCLUSIONS: Increased interictal epileptiform discharges with rewarming in post-CA therapeutic hypothermia patients may suggest poor prognosis, but a larger scale prospective study is needed.

4. Ann Intensive Care. 2017 Dec;7(1):70. doi: 10.1186/s13613-017-0294-1. Epub 2017 Jun 19.
Targeted temperature management in the ICU: guidelines from a French expert panel.
Cariou A1, Payen JF2, Asehnoune K3, Audibert G4, Botte A5, Brissaud O6, Debaty G7, Deltour S8, Deye N9, Engrand N10, Francony G11, Legriel S12, Levy B13, Meyer P14, Orban JC15, Renolleau S16, Vigue B17, De Saint Blanquat L18, Mathien C19, Velly L20; Société de Réanimation de Langue Française (SRLF) and the Société Française d'Anesthésie et de Réanimation (SFAR) In conjunction with the Association de Neuro Anesthésie Réanimation de Langue Française (ANARLF), the Groupe Francophone de Réanimation et Urgences Pédiatriques (GFRUP), the Société Française de Médecine d'Urgence (SFMU), and the Société Française Neuro-Vasculaire (SFNV).
Abstract
Over the recent period, the use of induced hypothermia has gained an increasing interest for critically ill patients, in particular in brain-injured patients. The term "targeted temperature management" (TTM) has now emerged as the most appropriate when referring to interventions used to reach and maintain a specific level temperature for each individual. TTM may be used to prevent fever, to maintain normothermia, or to lower core temperature. This treatment is widely used in intensive care units, mostly as a primary neuroprotective method. Indications are, however, associated with variable levels of evidence based on inhomogeneous or even contradictory literature. Our aim was to conduct a systematic analysis of the published data in order to provide guidelines.
We present herein recommendations for the use of TTM in adult and paediatric critically ill patients developed using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) method. These guidelines were conducted by a group of experts from the French Intensive Care Society (Société de Réanimation de Langue Française [SRLF]) and the French Society of Anesthesia and Intensive Care Medicine (Société Francaise d'Anesthésie Réanimation [SFAR]) with the participation of the French Emergency Medicine Association (Société Française de Médecine d'Urgence [SFMU]), the French Group for Pediatric Intensive Care and Emergencies (Groupe Francophone de Réanimation et Urgences Pédiatriques [GFRUP]), the French National Association of Neuro-Anesthesiology and Critical Care (Association Nationale de Neuro-Anesthésie Réanimation Française [ANARLF]), and the French Neurovascular Society (Société Française Neurovasculaire [SFNV]). Fifteen experts and two coordinators agreed to consider questions concerning TTM and its practical implementation in five clinical situations: cardiac arrest, traumatic brain injury, stroke, other brain injuries, and shock. This resulted in 30 recommendations: 3 recommendations were strong (Grade 1), 13 were weak (Grade 2), and 14 were experts' opinions. After two rounds of rating and various amendments, a strong agreement from voting participants was obtained for all 30 (100%) recommendations, which are exposed in the present article.

5. Neurophotonics. 2017 Apr;4(2):021106. doi: 10.1117/1.NPh.4.2.021106. Epub 2017 Jun 13.
Prediction of brain tissue temperature using near-infrared spectroscopy.

Holper L1, Mitra S2, Bale G3, Robertson N2, Tachtsidis I3.
Abstract
Broadband near-infrared spectroscopy (NIRS) can provide an endogenous indicator of tissue temperature based on the temperature dependence of the water absorption spectrum. We describe a first evaluation of the calibration and prediction of brain tissue temperature obtained during hypothermia in newborn piglets (animal dataset) and rewarming in newborn infants (human dataset) based on measured body (rectal) temperature. The calibration using partial least squares regression proved to be a reliable method to predict brain tissue temperature with respect to core body temperature in the wavelength interval of 720 to 880 nm with a strong mean predictive power of [Formula: see text] (animal dataset) and [Formula: see text] (human dataset). In addition, we applied regression receiver operating characteristic curves for the first time to evaluate the temperature prediction, which provided an overall mean error bias between NIRS predicted brain temperature and body temperature of [Formula: see text] (animal dataset) and [Formula: see text] (human dataset). We discuss main methodological aspects, particularly the well-known aspect of over- versus underestimation between brain and body temperature, which is relevant for potential clinical applications.

ECMO

1. Anaesthesiol Intensive Ther. 2017;49(2):106-109. doi: 10.5603/AIT.2017.0029.
Difficulties in funding of VA-ECMO therapy for patients with severe accidental hypothermia.
Kosiński S, Darocha T1, Jarosz A, Czerw A, Podsiadło P, Sanak T, Gałązkowski R, Piątek J, Konstanty-Kalandyk J, Ziętkiewicz M, Kusza K, Krzych ŁJ, Drwiła R.
Abstract
BACKGROUND: Severe accidental hypothermia is defined as a core temperature below 28 Celsius degrees. Within the last years, the issue of accidental hypothermia and accompanying cardiac arrest has been broadly discussed and European Resuscitation Council (ERC) Guidelines underline the importance of Extracorporeal Rewarming (ECR) in treatment of severely hypothermic victims. The study aimed to evaluate the actual costs of ECR with VA-ECMO and of further management in the Intensive Care Unit of patients admitted to the Severe Accidental Hypothermia Centre in Cracow, Poland.
METHODS: We carried out the economic analysis of 31 hypothermic adults in stage III-IV (Swiss Staging) treated with VA ECMO. Twenty-nine individuals were further managed in the Intensive Care Unit. The actual treatment costs were evaluated based on current medication, equipment, and dressing pricing. The costs incurred by the John Paul II Hospital were then collated with the National Health Service (NHS) funding, assessed based on current financial contract.
RESULTS: In most of the cases, the actual treatment cost was greater than the funding received by around 10000 PLN per patient. The positive financial balance was achieved in only 4 (14%) individuals; other 25 cases (86%) showed a financial loss.
CONCLUSION: Performed analysis clearly shows that hospitals undertaking ECR may experience financial loss due to implementation of effective treatment recommended by international guidelines. Thanks to new NHS

funding policy since January 2017 such loss can be avoided, what shall encourage hospitals to perform this expensive, yet effective method of treatment.

2. Crit Care. 2017 Jun 22;21(1):157. doi: 10.1186/s13054-017-1744-8.
Influence of low-flow time on survival after extracorporeal cardiopulmonary resuscitation (eCPR).
Wengenmayer T1,2, Rombach S3, Ramshorn F3, Biever P4,3, Bode C4,3, Duerschmied D4,3, Staudacher DL4,3.
Abstract
BACKGROUND: Venoarterial extracorporeal membrane oxygenation (VA-ECMO) support under extracorporeal cardiopulmonary resuscitation (eCPR) is the last option and may be offered to selected patients. Several factors predict outcome in these patients, including initial heart rhythm, comorbidities, and bystander cardiopulmonary resuscitation (CPR). We evaluated outcomes of all VA-ECMO patients treated within the last 5 years at our center in respect to low-flow duration during CPR.
METHODS: We report retrospective registry data on all patients with eCPR treated at a university hospital between October 2010 and May 2016.
RESULTS: A total of 133 patients (mean age 58.7 ± 2.6 years, Simplified Acute Physiology Score II score at admission 48.1 ± 3.4) were included in the analysis. The indication for eCPR was either in-hospital or out-of-hospital cardiac arrest without return of spontaneous circulation (n = 74 and 59, respectively). There was a significant difference in survival rates between groups (eCPR in-hospital cardiac arrest [IHCA] 18.9%, eCPR out-of-hospital cardiac arrest [OHCA] 8.5%; $p < 0.042$). Mean low-flow duration (i.e., duration of mechanical CPR until VA-ECMO support) was 59.6 ± 5.0 minutes in all patients and significantly shorter in IHCA patients than in OHCA patients (49.6 ± 5.9 vs. 72.2 ± 7.4 minutes, $p = 0.001$). Low-flow time strongly correlated with survival ($p < 0.001$) and was an independent predictor of mortality.
CONCLUSIONS: Time to full support is an important and alterable predictor of patient survival in eCPR, suggesting that VA-ECMO therapy should be established as fast as possible in the selected patients destined for eCPR.

VIA INTRAÒSSIA

1. Resuscitation. 2017 Jun 16. pii: S0300-9572(17)30256-3. doi: 10.1016/j.resuscitation.2017.06.014. [Epub ahead of print]
Intraosseous Compared to Intravenous Drug Resuscitation in Out-of-Hospital Cardiac Arrest.
Feinstein BA1, Stubbs BA2, Rea T3, Kudenchuk PJ4 .
Abstract
AIMS: Although the intraosseous (IO) route is increasingly used for vascular access in out-of-hospital cardiac arrest (OHCA), little is known about its comparative effectiveness relative to intravenous (IV) access. We evaluated clinical outcomes following OHCA comparing drug administration via IO versus IV routes.
METHODS: This retrospective cohort study evaluated Emergency Medical Services (EMS)-treated adults with atraumatic OHCA in a large metropolitan EMS system between 9/1/2012-12/31/2014. Access was classified as IO or IV based on the route of first EMS drug administration. Study endpoints were survival to hospital discharge, return of spontaneous circulation (ROSC)

and survival to hospital admission.
RESULTS: Among 2164 adults with OHCA, 1800 met eligibility criteria, 1525 of whom were treated via IV and 275 principally via tibial-IO routes. Compared to IV, IO-treated patients were younger, more often women, had unwitnessed OHCA, a non-cardiac aetiology, and presented with non-shockable rhythms. IO versus IV-treated patients were less likely to survive to hospital discharge (14.9% vs 22.8%, p=0.003), achieve ROSC (43.6% vs 55.5%, p <0.001) or be hospitalized (38.5% vs 50.0% p <0.001). In multivariable adjusted analyses, IO treatment was not associated with survival to discharge (odds ratio (95% confidence interval) (OR=0.81 (0.55, 1.21), p=0.31), but was associated with a lower likelihood of ROSC (OR=0.67 (0.50, 0.88), p=0.004) and survival to hospitalization (OR=0.68 (0.51, 0.91), p=0.009).
CONCLUSION: Though not independently associated with survival to discharge, principally tibial IO versus IV treatment was associated with a lower likelihood of ROSC and hospitalization. How routes of vascular access influence clinical outcomes after OHCA merits additional study.

ECOS

1. Breathe (Sheff). 2017 Jun;13(2):100-111. doi: 10.1183/20734735.004717.
Novel approaches to ultrasonography of the lung and pleural space: where are we now?
Lichtenstein D1.
Abstract
This review article is an update of what should be known for practicing basic lung ultrasound in the critically ill (LUCI) and is also of interest for less critical disciplines (e.g. pulmonology). It pinpoints on the necessity of a professional machine (not necessarily a sophisticated one) and probe. It lists the 10 main signs of LUCI and some of the main protocols made possible using LUCI: the BLUE protocol for a respiratory failure, the FALLS protocol for a circulatory failure, the SESAME protocol for a cardiac arrest and the investigation of a ventilated acute respiratory distress syndrome patient, etc. It shows how the field has been fully standardised to avoid confusion.
KEY POINTS: A simple ultrasonography unit is fully adequate, with minimal filters, and provides a unique probe for integrating the lung into a holistic, whole-body approach to the critically ill. Interstitial syndrome is strictly defined. Its clinical relevance in the critically ill is standardised for defining haemodynamic pulmonary oedema, pneumonia and pulmonary embolism.Pneumothorax is strictly and sequentially defined by the A'-profile (at the anterior wall in a supine or semirecumbent patient, abolished lung siding plus the A-line sign) and then the lung point.The BLUE protocol integrates lung and venous ultrasound findings for expediting the diagnosis of acute respiratory failure, following pathophysiology, allowing prompt diagnosis of pneumonia, haemodynamic pulmonary oedema, exacerbated chronic obstructive pulmonary disease or asthma, pulmonary embolism or pneumothorax, even in clinically challenging presentations.
EDUCATIONAL AIMS: To understand that the use of lung ultrasound, although long standardised, still needs educational efforts for its best use, a suitable machine, a suitable universal probe and an appropriate culture.To be able to use a terminology that has been fully standardised to avoid any

confusion of useless wording.To understand the logic of the BLUE points, three points of interest enabling expedition of a lung ultrasound examination in acute respiratory failure.To be able to cite, in the correct hierarchy, the seven criteria of the B-line, then those of interstitial syndrome.To understand the sequential thinking when making ultrasound diagnosis of pneumothorax.To be able to use the BLUE protocol for building profiles of pneumonia (or acute respiratory distress syndrome) and understand their limitations.To understand that lung ultrasound can be used for the direct analysis of an acute respiratory failure (the BLUE protocol), an acute circulatory failure (the FALLS protocol) and even a cardiac arrest (SESAME protocol), following a pathophysiological approach.To understand that the first sequential target in the SESAME protocol (search first for pneumothorax in cardiac arrest) can also be used in countless more quiet settings of countless disciplines, making lung ultrasound in the critically ill cost-, time- and radiation-saving.To be able to perform a BLUE protocol in challenging patients, understanding how the best lung ultrasound can be obtained from bariatric or agitated, dyspnoeic patients.

PEDIATRIA

1. J Pediatr. 2017 Mar;182:311-314.e1. doi: 10.1016/j.jpeds.2016.11.012. Epub 2016 Nov 29.
Cardiac Arrest in Pediatric Patients Receiving Azithromycin.
Valdés SO1, Kim JJ2, Niu MC3, de la Uz CM2, Miyake CY2, Moffett BS4.
Abstract
OBJECTIVE: To compare outcomes of pediatric patients treated with azithromycin compared with penicillin or cephalosporin. We hypothesized that azithromycin use would not be associated with increased cardiac mortality in the pediatric population.
STUDY DESIGN: Retrospective cohort study from the Pediatric Health Information System database between 2008 and 2012. Patients <19 years of age with a principal diagnosis of community-acquired pneumonia who received an antibiotic were included. Primary outcomes were cardiopulmonary resuscitation (CPR) and mortality. Secondary outcomes were ventricular arrhythmias incidences and readmission for ventricular arrhythmia. Statistical analysis was performed with the $\chi 2$ test. Multivariable analysis was performed to control for potential confounders among patient, event, and treatment characteristics.
RESULTS: A total of 82 982 patients (54.3% males) met study criteria. Median age was 2.6 years (IQR 1.2-5.9 years) and median length of stay was 2 days (IQR 2-4 days). Azithromycin was used in 5039 (6.1%); penicillin or cephalosporin was used in 77 943 (93.9%). Overall prevalence of antibiotic-associated CPR was 0.14%. Patients receiving a macrolide antibiotic had a lower prevalence of CPR compared with patients receiving a penicillin or cephalosporin (0.04% vs 0.14%, P = .04), and there was no difference in mortality. Multivariable analysis did not find an association between macrolide use and CPR.
CONCLUSIONS: In contrast to recent adult studies, among children hospitalized for community-acquired pneumonia, azithromycin use was not associated with a greater prevalence of cardiac arrest compared with penicillin or cephalosporin use.

2. Int J Nurs Pract. 2017 Jun 19. doi: 10.1111/ijn.12561. [Epub ahead of print]
Helping Babies Breathe implementation in Zanzibar, Tanzania.
Wilson GM1, Ame AM2, Khatib MM3, Rende EK4, Hartman AM 4, Blood-Siegfried J4.
Abstract
AIM: To assess the efficacy and feasibility of implementing Helping Babies Breathe, a neonatal resuscitation programme for resource-limited environments.
BACKGROUND: This quality improvement project focused on training midwives on Helping Babies Breathe to address high rates of neonatal mortality secondary to birth asphyxia.
METHODS: The convenience sample was 33 midwives in Zanzibar, Tanzania. The train-the-trainer strategy with repeated measures design was used to assess knowledge and skills at 3 time points. Observations were completed during "real-time" deliveries, and a focused interview generated feedback regarding satisfaction and sustainability.
RESULTS: Knowledge scores and resuscitation skills significantly improved and were sustained, $P < .05$. Of the 62 birth observations, 19% needed intervention. All were appropriately resuscitated and survived.
CONCLUSION: Results indicate that participants retained knowledge and skills and used them in clinical practice. Observations demonstrated that participants took appropriate actions when presented with a baby who was not breathing.

ESTUDIS EXPERIMENTALS

1. J Trauma Acute Care Surg. 2017 Jul;83(1):139-143. doi: 10.1097/TA.0000000000001502.
Incremental balloon deflation following complete resuscitative endovascular balloon occlusion of the aorta results in steep inflection of flow and rapid reperfusion in a large animal model of hemorrhagic shock.
Davidson AJ1, Russo RM, Ferencz SE, Cannon JW, Rasmussen TE, Neff LP, Johnson MA, Williams TK.
Abstract
INTRODUCTION: To avoid potential cardiovascular collapse after resuscitative endovascular balloon occlusion of the aorta (REBOA), current guidelines recommend methodically deflating the balloon for 5 minutes to gradually reperfuse distal tissue beds. However, anecdotal evidence suggests that this approach may still result in unpredictable aortic flow rates and hemodynamic instability. We sought to characterize aortic flow dynamics following REBOA as the balloon is deflated in accordance with current practice guidelines.
METHODS: Eight Yorkshire-cross swine were splenectomized, instrumented, and subjected to rapid 25% total blood volume hemorrhage. After 30 minutes of shock, animals received 60 minutes of Zone 1 REBOA with a low-profile REBOA catheter. During subsequent resuscitation with shed blood, the aortic occlusion balloon was gradually deflated in stepwise fashion at the rate of 0.5 mL every 30 seconds until completely deflated. Aortic flow rate and proximal mean arterial pressure (MAP) were measured continuously over the period of balloon deflation.
RESULTS: Graded balloon deflation resulted in variable initial return of aortic flow (median, 78 seconds; interquartile range [IQR], 68-105

seconds). A rapid increase in aortic flow during a single-balloon deflation step was observed in all animals (median, 819 mL/min; IQR, 664-1241 mL/min) and corresponded with an immediate decrease in proximal MAP (median, 30 mm Hg; IQR, 14.5-37 mm Hg). Total balloon volume and time to return of flow demonstrated no correlation (r = 0.016).
CONCLUSION: This study is the first to characterize aortic flow during balloon deflation following REBOA. A steep inflection point occurs during balloon deflation that results in an abrupt increase in aortic flow and a concomitant decrease in MAP. Furthermore, the onset of distal aortic flow was inconsistent across study animals and did not correlate with initial balloon volume or relative deflation volume. Future studies to define the factors that affect aortic flow during balloon deflation are needed to facilitate controlled reperfusion following REBOA.

2. J Trauma Acute Care Surg. 2017 Jul;83(1):61-70. doi: 10.1097/TA.0000000000001518.
The effect of resuscitative endovascular balloon occlusion of the aorta, partial aortic occlusion and aggressive blood transfusion on traumatic brain injury in a swine multiple injuries model.
Johnson MA1, Williams TK, Ferencz SE, Davidson AJ, Russo RM, O'Brien WT Sr, Galante JM, Grayson JK, Neff LP.
Abstract
BACKGROUND: Despite clinical reports of poor outcomes, the degree to which resuscitative endovascular balloon occlusion of the aorta (REBOA) exacerbates traumatic brain injury (TBI) is not known. We hypothesized that combined effects of increased proximal mean arterial pressure (pMAP), carotid blood flow (Qcarotid), and intracranial pressure (ICP) from REBOA would lead to TBI progression compared with partial aortic occlusion (PAO) or no intervention.
METHODS: Twenty-one swine underwent a standardized TBI via computer Controlled cortical impact followed by 25% total blood volume rapid hemorrhage. After 30 minutes of hypotension, animals were randomized to 60 minutes of continued hypotension (Control), REBOA, or PAO. REBOA and PAO animals were then weaned from occlusion. All animals were resuscitated with shed blood via a rapid blood infuser. Physiologic parameters were recorded continuously and brain computed tomography obtained at specified intervals.
RESULTS: There were no differences in baseline physiology or during the initial 30 minutes of hypotension. During the 60-minute intervention period, REBOA resulted in higher maximal pMAP (REBOA, 105.3 ± 8.8; PAO, 92.7 ± 9.2; Control, 48.9 ± 7.7; p = 0.02) and higher Qcarotid (REBOA, 673.1 ± 57.9; PAO, 464.2 ± 53.0; Control, 170.3 ± 29.4; p < 0.01). Increases in ICP were greatest during blood resuscitation, with Control animals demonstrating the largest peak ICP (Control, 12.8 ± 1.2; REBOA, 5.1 ± 0.6; PAO, 9.4 ± 1.1; p < 0.01). There were no differences in the percentage of animals with hemorrhage progression on CT (Control, 14.3%; 95% confidence interval [CI], 3.6-57.9; REBOA, 28.6%; 95% CI, 3.7-71.0; and PAO, 28.6%; 95% CI, 3.7-71.0).
CONCLUSION: In an animal model of TBI and shock, REBOA increased Qcarotid and pMAP, but did not exacerbate TBI progression. PAO resulted in physiology closer to baseline with smaller increases in ICP and pMAP. Rapid blood resuscitation, not REBOA, resulted in the largest increase in ICP after intervention, which occurred in Control animals. Continued

studies of the cerebral hemodynamics of aortic occlusion and blood transfusion are required to determine optimal resuscitation strategies for multi-injured patients.

3. J Trauma Acute Care Surg. 2017 Jul;83(1 Suppl 1):S170-S176. doi: 10.1097/TA.0000000000001476.
Field and en route resuscitative endovascular occlusion of the aorta: A feasible military reality?
Reva VA1, Hörer TM, Makhnovskiy AI, Sokhranov MV, Samokhvalov IM, DuBose JJ.
Abstract
BACKGROUND: Severe noncompressible torso hemorrhage remains a leading cause of potentially preventable death in modern military conflicts. Resuscitative endovascular occlusion of the aorta (REBOA) has demonstrated potential as an effective adjunct to the treatment of noncompressible torso hemorrhage in the civilian early hospital and even prehospital settings-but the application of this technology for military prehospital use has not been well described. We aimed to assess the feasibility of both field and en route prehospital REBOA in the military exercise setting, simulating a modern armed conflict.
METHODS: Two adult male Sus Scrofa underwent simulated junctional combat injury in the context of a planned military training exercise. Both underwent zone I REBOA in conjunction with standard tactical combat casualty care interventions-one during point of injury care and the other during en route flight care. Animals were sequentially evacuated to two separate forward surgical teams by rotary wing platform where the balloon position was confirmed by chest x-ray. Animals then underwent different damage control thoracic and abdominal procedures before euthanasia.
RESULTS: The first swine underwent immediate successful REBOA at the point of injury 7 minutes and 30 seconds after the injury. It required 6 minutes total from initiation of procedure to effective aortic occlusion. Total occlusion time was 60 minutes. In the second animal, the REBOA placement procedure was initiated immediately after take off (17 minutes and 40 seconds after the injury). Although the movements and vibration of flight were not significant impediments, we only succeeded to put a 6-French (Fr) sheath into a femoral artery during the 14 minutes flight due to lighting and visualization challenges. After the sheath had been upsized in the forward surgical team, the REBOA catheter was primarily placed in zone I followed by its replacement to zone III. Both animals survived to study completion and the termination of training. No complications were observed in either animal.
CONCLUSION: Our study demonstrates the potential feasibility of REBOA for use during tactical field and en route (flight) care of combat casualties. Further study is needed to determine the optimal training and utilization protocols required to facilitate the effective incorporation of REBOA into military prehospital care capabilities.

CASE REPORTS

1. J Anesth. 2017 Feb;31(1):140-143. doi: 10.1007/s00540-016-2281-3. Epub 2016 Nov 10.
A successfully treated case of cardiac arrest after Caesarean section complicated by pheochromocytoma crisis and amniotic fluid embolism.

Mita K1, Tsugita K2, Yasuda Y3, Matsuki Y1 , Obata Y1, Matsuki Y2, Kamisawa S2, Shigemi K1,2.

Abstract
Both pheochromocytoma and amniotic fluid embolism (AFE) are important causes of maternal mortality. We present a case of a 29-year-old woman who developed cardiac arrest after Caesarean section, complicated by both pheochromocytoma crisis and AFE. After resuscitation, the patient developed multiple organ dysfunction, rhabdomyolysis and disseminated intravascular coagulation (DIC). After institution of multidisciplinary interventions (including the use of an intra-aortic balloon pump, extracorporeal membrane oxygenation, continuous hemodiafiltration, and neuroprotective therapeutic hypothermia) the patient made a full recovery without any apparent neurological deficit.

2. Ann Ital Chir. 2017 Jan 20;6. pii: S2239253X17026408.
Spontaneous liver rupture associated with anticoagulant therapy A case report.
Clementi M, Colozzi S, Guadagni S, Pessia B, Sista F, Schietroma M, Della Penna A, Amicucci G.

Abstract
Spontaneous hepatic rupture without underlying liver diseases is uncommon entity. We report a rare case of spontaneous rupture of liver hematoma in patient treated with warfarin end enoxaparin sodium because of pulmonary embolism. Two day after admission the patient complained generalized abdominal pain and hemodynamic instability. The abdominal US and TC scan revealed free fluid and lesion at right liver lobe. The patient, despite intravenous fluid support and blood transfusion, was hemodinamically instable and urgent laparotomy was needed. At laparotomy, it was found that a subcapsular haematoma, involving the diaphragmatic face of the right liver, had ruptured into peritoneum. Hepatic bleeding was stopped using a conservative approach by Pringle manoeuvre, parenchymal suture and fibrin sealant. There was no complication related to hepatic surgery but the patient died because of new massive pulmonary embolism 10 days after surgery. The absence of underlying liver pathology was confirmed by autopsy examination. This case report suggests that the possibility of spontaneous liver rupture should be considered in patients being treated with oral anticoagulants. Early diagnosis are critically important given the high morbidity and mortality. Aggressive resuscitation and immediate exploratory laparotomy is needed when hemodynamic instability occurs. In our case a quick, safe and effective control of bleeding was provided by partial vascular occlusion, parenchymal suture and topical haemostatic agent.