

1. Resuscitation. 2017 Apr 3. pii: S0300-9572(17)30156-9. doi: 10.1016/j.resuscitation.2017.04.005. [Epub ahead of print]

Outcome among VF/VT patients in the LINC (LUCAS IN Cardiac arrest) trial-A randomised, controlled trial.

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Abstract

INTRODUCTION: The LINC trial evaluated two ALS-CPR algorithms for OHCA patients, consisting of 3 minutes' mechanical chest compression (LUCAS) cycles with defibrillation attempt through compressions vs. 2 minutes' manual compressions with compression pause for defibrillation. The PARAMEDIC trial, using 2 minutes' algorithm found worse outcome for patients with initial VF/VT in the LUCAS group and they received more adrenalin compared to the manual group. We wanted to evaluate if these algorithms had any outcome effect for patients still in VF/VT after the initial defibrillation and how adrenalin timing impacted it.

METHOD: Both groups received manual chest compressions first. Based on non-electronic CPR process documentation, outcome, neurologic status and its relation to CPR duration prior to the first detected return of spontaneous circulation (ROSC), time to defibrillation and adrenalin given were analysed in the subgroup of VF/VT patients.

RESULTS: Seven hundred and fifty-seven patients had still VF/VT after initial chest compressions combined with a defibrillation attempt (374 received mechanical CPR) or not (383 received manual CPR). No differences were found for ROSC (mechanical CPR 58.3% vs. manual CPR 58.6%, $p=0.94$), or 6-month survival with good neurologic outcome (mechanical CPR 25.1% vs. manual CPR 23.0%, $p=0.50$). A significant difference was found regarding the time from start of manual chest compression to the first defibrillation (mechanical CPR: 4 (2-5) min vs manual CPR 3 (2-4) min, $P<0.001$). The time from the start of manual chest compressions to ROSC was longer in the mechanical CPR group.

CONCLUSIONS: No difference in short- or long-term outcomes was found between the 2 algorithms for patients still in VF/VT after the initial defibrillation. The time to the 1st defibrillation and the interval between defibrillations were longer in the mechanical CPR group without impacting the overall outcome, or the number of defibrillations required to achieve ROSC or adrenalin doses.

2. Resuscitation. 2017 Apr 1. pii: S0300-9572(17)30148-X. doi: 10.1016/j.resuscitation.2017.03.037. [Epub ahead of print]

Mechanical Chest Compressions Improve Rate of Return of Spontaneous Circulation and Allow for Initiation of Percutaneous Circulatory Support During Cardiac Arrest in the Cardiac Catheterization Laboratory.

Venturini JM1, Retzer E2, Estrada JR3, Friant J1, Beiser D4, Edelson D5, Paul J1, Blair J1, Nathan S1, Shah AP6.

Abstract

BACKGROUND: Performing advanced cardiac life support (ACLS) in the cardiac catheterization laboratory (CCL) is challenging. Mechanical chest compression (MCC) devices deliver compressions in a small space, allowing for simultaneous percutaneous coronary intervention and reduced radiation exposure to rescuers. In refractory cases, MCC devices allow rescuers to initiate percutaneous mechanical circulatory support (MCS) and extracorporeal life support (ECLS) during resuscitation. This study sought to assess the efficacy and safety of MCC when compared to manual compressions in the CCL.

METHODS: We performed a retrospective analysis of patients who received ACLS in the CCL at our institution between May 2011 and February 2016. Baseline characteristics, resuscitation details, and outcomes were compared between patients who received manual and mechanical compressions.

RESULTS: Forty-three patients (67% male, mean age 58 years) required chest compressions for cardiac arrest while in the CCL (12 manual and 31 MCC). Patients receiving MCC were more likely to achieve

return of spontaneous circulation (ROSC) (74% v 42%, $p=0.05$). Of those receiving MCC, twenty-two patients (71%) were treated with MCS. Patients receiving percutaneous ECLS were more likely to achieve ROSC (100% v. 53%, $p=0.003$) and suffered no episodes of limb loss or TIMI major bleeding. There were no significant differences in 30-day survival or survival to hospital discharge between groups.

CONCLUSIONS: Use of MCC during resuscitation of cardiac arrest in the CCL increases the rate of ROSC. Simultaneous implantation of MCS, including percutaneous ECLS, is feasible and safe during MCC-assisted resuscitation in the CCL.

RCP

1. Am J Emerg Med. 2017 Mar 25. pii: S0735-6757(17)30246-2. doi: 10.1016/j.ajem.2017.03.060. [Epub ahead of print]

Complete chest recoil during laypersons' CPR: Is it a matter of weight?

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Abstract

INTRODUCTION: Chest compressions depth and complete chest recoil are both important for high-quality Cardio-Pulmonary Resuscitation (CPR). It has been demonstrated that anthropometric variables affect chest compression depth, but there are no data about they could influence chest recoil. The aim of this study was to verify whether physical attributes influences chest recoil in lay rescuers.

METHODS: We evaluated 1 minute of compression-only CPR performed by 333 laypersons immediately after a Basic Life Support and Automated External Defibrillation (BLS/AED) course. The primary endpoint was to verify whether anthropometric variables influence the achievement a complete chest recoil. Secondary endpoint was to verify the influence of anthropometric variables on chest compression depth.

RESULTS: We found a statistically significant association between weight and percentage of compressions with correct release ($p\leq 0.001$) and this association was found also for height, BMI and sex. People who are heavier, who are taller, who have a greater BMI and who are male are less likely to achieve a complete chest recoil. Regarding chest compressions depth, we confirm that the more a person weighs, the more likely the correct depth of chest compressions will be reached.

CONCLUSIONS: Anthropometric variables affect not only chest compression depth, but also complete chest recoil. CPR instructors should tailor their attention during training on different aspect of chest compression depending on the physical characteristics of the attendee.

2. Resuscitation. 2017 Apr 3. pii: S0300-9572(17)30153-3. doi: 10.1016/j.resuscitation.2017.04.002. [Epub ahead of print]

Bystander capability to activate speaker function for continuous dispatcher assisted CPR in case of suspected cardiac arrest.

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Abstract

BACKGROUND: The European Resuscitation Council Guidelines 2015 recommend bystanders to activate their mobile phone speaker function, if possible, in case of suspected cardiac arrest. This is to facilitate continuous dialogue with the dispatcher including (if required) cardiopulmonary resuscitation instructions. The aim of this study was to measure the bystander capability to activate speaker function in case of suspected cardiac arrest.

METHOD: In 87 days, a systematic prospective registration of bystander capability to activate the speaker function, when cardiac arrest was suspected, was performed. For those asked, "can you activate your mobile phone's speaker function", audio recordings were examined and categorized into groups according

to the bystanders capability to activate speaker function on their own initiative, without instructions, or with instructions from the emergency medical dispatcher. Time delay was measured, in seconds, for the bystanders without pre-activated speaker function.

RESULTS: 42.0% (58) was able to activate the speaker function without instructions, 2.9% (4) with instructions, 18.1% (25) on own initiative and 37.0% (51) were unable to activate the speaker function. The median time to activate speaker function was 19s and 8s, with and without instructions, respectively.

CONCLUSION: Dispatcher assisted cardiopulmonary resuscitation with activated speaker function, in cases of suspected cardiac arrest, allows for continuous dialogue between the emergency medical dispatcher and the bystander. In this study, we found a 63.0% success rate of activating the speaker function in such situations.

3. Resuscitation. 2017 Apr 3. pii: S0300-9572(17)30133-8. doi: 10.1016/j.resuscitation.2017.03.034. [Epub ahead of print]

Barriers to Patient Positioning for Telephone Cardiopulmonary Resuscitation in Out-Of-Hospital Cardiac Arrest.

Langlais BT1, Panczyk M1, Sutter J2, Fukushima H3, Wu Z4, Iwami T5, Spaite D6, Bobrow B7.

Abstract

BACKGROUND: 9-1-1 callers often face barriers preventing them from starting Telephone CPR (TCPR). The most common problem is getting patients to a hard, flat surface. This study describes barriers callers report when trying to move patients to a hard, flat surface and assesses conditions associated with overcoming these barriers.

METHODS: We audited 2,396 out-of-hospital cardiac arrest (OHCA) audio recordings. A barrier was defined as any statement by the caller that the rescuer could not move the patient to the ground and into a supine position. Barriers were recorded and TCPR process metrics compared across the barrier and non-barrier groups.

RESULTS: There were 802 OHCA in the study group. Roughly 26% had a barrier. Telecommunicators were less likely to start TCPR instructions in the barrier group than in the non-barrier group (OR: 0.63, 95% CI: 0.45-0.88; p=0.007). Telecommunicator-directed bystander chest compressions were more than twice as likely to start in the non-barrier group (OR: 2.2, 95% CI: 1.6-3.2; p <0.001). Median time to first compression was longer in the barrier group (276s vs 171s; p<0.001). Rescuers were 3.7 times more likely to overcome a barrier and start compressions (OR: 3.7, 95% CI: 2.0-6.8; p<0.001) when multiple bystanders were present.

CONCLUSION: Inability to move patients to a hard, flat surface is associated with a reduced rate of TCPR and increased time to first compression. Assessing the conditions under which such barriers are overcome is important for telecommunicator training and can help improve rates and timeliness of TCPR

4. Am J Emerg Med. 2017 Mar 21. pii: S0735-6757(17)30217-6. doi: 10.1016/j.ajem.2017.03.050. [Epub ahead of print]

Body mass index and outcome of out-of-hospital cardiac arrest patients not treated by targeted temperature management.

Galatianou I1, Karlis G2, Apostolopoulos A3, Intas G4, Chalari E4, Gulati A5, Iacovidou N6, Chalkias A7, Xanthos T8.

Abstract

BACKGROUND: Obesity has been demonstrated to increase the risk of out-of-hospital cardiac arrest (OHCA) and may influence the quality and effectiveness of cardiopulmonary resuscitation. Our aim was to

investigate the association between body mass index (BMI) and the outcome of OHCA victims not treated by targeted temperature management.

METHODS: This was a prospective observational study of OHCA patients. The patients were categorized according to BMI into two groups: the normal BMI group (nBMI) and the elevated BMI group (eBMI). The primary endpoint was return of spontaneous circulation (ROSC), while secondary outcomes were survival to intensive care unit (ICU) admission and survival to ICU discharge.

RESULTS: Of the initial 99 patients who were transported to the Emergency Department, 84 (85%) were included in the study. Mean BMI was 29.8kg/m². Thirteen (15.5%) patients achieved ROSC and were admitted to the ICU, with the mean duration of ICU length of stay being 6.7±4.9days. Survival to ICU admission and ICU discharge were higher in the eBMI group (17.6% vs. 6.25%, p=0.010 and 10.3% vs. 6.25%, p=0.021, respectively). Survival to ICU discharge was higher in ventricular fibrillation patients compared to patients with non-shockable rhythms, irrespectively of their BMI (p=0.002). All patients that survived to ICU discharge did so with a cerebral performance category score of 2.

CONCLUSIONS: Survival to ICU admission and ICU discharge were higher in the eBMI group.

4. *Pediatr Int.* 2016 Aug;58(8):698-704. doi: 10.1111/ped.12881. Epub 2016 Apr 13.

Compression-only CPR training in elementary schools and student attitude toward CPR.

Kitamura T1, Nishiyama C2, Murakami Y3, Yonezawa T4, Nakai S4, Hamanishi M4, Marukawa S5, Sakamoto T6, Iwami T3.

Abstract

BACKGROUND: Little is known about the effectiveness of systematic cardiopulmonary resuscitation (CPR) training for elementary school children.

METHODS: We introduced systematic training of chest compression-only CPR and automated external defibrillator (AED) use to elementary school students aged 10-12 years at 17 schools. The questionnaire compared student attitudes towards CPR and their knowledge about it before and after CPR training. We also evaluated parent and teacher views about CPR training in school education. The primary outcome was positive attitude, defined as "yes" and "maybe yes" on a 5 point Likert-type scale of student attitudes towards CPR.¹ **RESULTS:** A total of 2047 elementary school students received CPR training. Of them, 1899 (92.8%) responded to the questionnaire regarding their attitude towards CPR before and after the training. Before training, 50.2% answered "yes" and 30.3% answered "maybe yes", to the question: "If someone suddenly collapses in front of you, can you do something such as check response or call emergency?" After training, their answers changed to 75.6% and 18.3% for "yes" and "maybe yes", respectively. Many of the students (72.3%, 271/370) who did not have a positive attitude before CPR training had a positive attitude after the training (P < 0.001). Most students understood how to perform CPR (97.7%) and use an AED (98.5%). Parents (96.2%, 1173/1220) and teachers (98.3%, 56/57) answered that it was "good" and "maybe good" for children to receive the training at elementary schools.

CONCLUSION: Systematic chest compression-only CPR training helped elementary school students to improve their attitude towards CPR.

5. *Resuscitation.* 2017 Apr 3. pii: S0300-9572(17)30155-7. doi: 10.1016/j.resuscitation.2017.04.004. [Epub ahead of print]

Bystander CPR is Associated with Improved Neurologically Favourable Survival in Cardiac Arrest Following Drowning.

Tobin JM1, Ramos WD2, Pu Y2, Wernicki PG 3, Quan L4, Rossano JW5.

Abstract

BACKGROUND: Cardiac arrest associated with drowning is a major public health concern with limited research available on outcome. This investigation aims to define the population at risk, and identify factors associated with neurologically favourable survival.

METHODS: The Cardiac Arrest Registry for Enhanced Survival (CARES) database was queried for patients who had suffered cardiac arrest following drowning between January 1, 2013 and December 31, 2015. The primary outcomes of interest were for favourable or unfavourable neurological outcome at hospital discharge, as defined by Cerebral Performance Category (CPC).

RESULTS: A total of 919 drowning patients were identified. Neurological outcome data was available in 908 patients. Neurologically favourable survival was significantly associated with bystander CPR (Odds Ratio (OR)=2.94; 95% Confidence Interval (CI) 1.86-4.64; $p<0.001$), witnessed drowning (OR=2.6; 95% CI 1.69-4.01; $p<0.001$) and younger age (OR=0.97, 95% CI 0.96-0.98; $p<0.001$). Public location of drowning (OR=1.17; 95% CI 0.77-1.79; $p=0.47$), male gender (OR=0.9, 95% CI 0.57-1.43; $p=0.66$), and shockable rhythm (OR=1.54; 95% CI 0.76-3.12; $p=0.23$), were not associated with favourable neurological survival. AED application prior to EMS was associated with a decreased likelihood of favourable neurological outcome (OR=0.38; 95% CI 0.28-0.66; $p<0.001$). In multivariate analysis, bystander CPR (adjusted OR 3.02, 95% CI 1.85-4.92, $p<0.001$), witnessed drowning (adjusted OR 3.27, 95% CI 2.0-5.36, $p<0.001$) and younger age (adjusted OR 0.97, 95% CI 0.96-0.98, $p<0.001$) remained associated with neurologically favourable survival.

CONCLUSIONS: Neurologically favourable survival after drowning remains low but is improved by bystander CPR. Shockable rhythms were uncommon and not associated with improved outcomes.

REGISTRES I REVISIONS

1. Curr Opin Crit Care. 2017 Apr 4. doi: 10.1097/MCC.0000000000000408. [Epub ahead of print]

Metrics save lives: value and hurdles faced.

Goodloe JM1, Idris AH.

Abstract

PURPOSE OF REVIEW: Affirmation of the importance of precision in fundamentals of resuscitation practices with improving neurologically intact survival from sudden cardiac arrest, correlated with both measurements of resuscitation metrics generically and recently further refined metric parameters specifically.

RECENT FINDINGS: Quality of baseline cardiopulmonary resuscitation (CPR) in historic intervention trials may not be 'high quality' as once assumed. Optimal chest compression rates are within the narrow spectrum of 106-108/min for adults. Optimal ventilation rates remain within the 8-10/min range.

SUMMARY: Although traditional CPR teaching of 'hard and fast' chest compressions has promoted a relatively easy to remember directive, the reality is that laypersons and medical professionals alike may unwittingly provide markedly suboptimal chest compression depths and rates. Prior resuscitation studies that focused upon airway adjuncts, defibrillation strategies, and/or pharmaceutical interventions that did not simultaneously gage the underlying CPR chest compression rates, chest compression fraction of time, and ventilation rates should be cautiously interpreted in light of discovery that assumption of 'high-quality CPR' without measurement of the metrics of such is likely a faulty assumption.

2. PLoS One. 2017 Apr 5;12(4):e0175257. doi: 10.1371/journal.pone.0175257. eCollection 2017.

Thromboelastometric analysis of the risk factors for return of spontaneous circulation in adult patients with out-of-hospital cardiac arrest.

Koami H1, Sakamoto Y1, Sakurai R2, Ohta M 2, Imahase H2, Yahata M2, Umeka M2, Miike T2, Nagashima F2, Iwamura T1, Yamada KC2, Inoue S3.

Abstract

It is well known that coagulopathy is observed in patients with out-of-hospital cardiac arrest (OHCA). Thrombolytic therapy for those patients has been controversial until now. The purpose of this study was to identify a significant predictor for return of spontaneous circulation (ROSC) of OHCA patients in the emergency department (ED) using whole blood viscoelastic testing. Adult non-trauma OHCA patients transported to our hospital that underwent thromboelastometry (ROTEM) during cardiopulmonary resuscitation between January 2013 and December 2015 were enrolled in this study. We divided patients into two groups based on the presence or absence of ROSC, and performed statistical analysis utilizing patient characteristics, prehospital data, laboratory data, and ROTEM data. Seventy-five patients were enrolled. The ROSC group and non-ROSC group included 23 and 52 patients, respectively. The logistic regression analysis, utilizing significant parameters by univariate analysis, demonstrated that lactate level [odds ratio (OR) 0.880, 95% confidence interval (CI) 0.785-0.986, $p = 0.028$] and A30 of EXTEM test [OR 1.039, 95% CI 1.010-1.070, $p = 0.009$] were independent risk factors for ROSC. The cut-off values of lactate and A30 in EXTEM were 12.0 mmol/L and A 48.0 mm, respectively. We defined a positive prediction for ROSC if the patient presented lower lactate level (<12.0 mmol/L) and higher A30 of EXTEM (≥ 48.0 mm) with high specificity (94.7%) and accuracy (75.0%). The present study showed that lactate level and ROTEM parameter of clot firmness were reliable predictors of ROSC in the ED for adult patients with OHCA

3. Resuscitation. 2017 Mar 28. pii: S0300-9572(17)30132-6. doi: 10.1016/j.resuscitation.2017.03.032. [Epub ahead of print]

Association between Bystander Cardiopulmonary Resuscitation and Redeemed Prescriptions for Antidepressants and Anxiolytics in Out-of-Hospital Cardiac Arrest Survivors.

Bundgaard K1, Hansen SM2, Mortensen RN3, Wissenberg M4, Hansen CM5, Lippert F6, Gislason G7, Køber L8, Nielsen J9, Torp-Pedersen C2, Rasmussen BS10, Kragholm K10.

Abstract

AIM: This study aimed to examine rates of redeemed prescriptions of antidepressants and anxiolytics, used as markers for cerebral dysfunction in out-of-hospital cardiac arrest (OHCA) survivors, and examine the association between bystander CPR and these psychoactive drugs.

METHODS: We included all 30-day survivors of OHCA in Denmark between 2001-2011, who had not redeemed prescriptions for antidepressants or anxiolytics in the last six months prior to OHCA. Main outcome measures were redeemed prescriptions of antidepressants and anxiolytics within one year after OHCA.

RESULTS: Among 2,001 30-day survivors, 174 (8.6% died and 12.0% redeemed a first prescription for an antidepressant and 8.2% for an anxiolytic drug within one year after arrest. The corresponding frequencies for redeemed prescribed drugs among age- and sex-matched population controls were 7.5% and 5.2%, respectively. Among survivors who received bystander CPR, prescriptions for antidepressants and anxiolytics were redeemed in 11.1% [95% CI 9.2-13.3%] and 6.3% [95% CI 4.9-8.0%] of the cases, respectively, versus 17.2% [95% CI 13.9-21.1%] and 13.4% [95% CI 10.5-17.0%], respectively, among patients who had not received bystander CPR. Adjusted for age, sex, year of arrest, comorbidity, witnessed status and socioeconomic status, bystander CPR was associated with significant reductions in redeemed prescriptions for antidepressants, Hazard Ratio (HR) 0.71 [95% CI 0.52-0.98], $P=.031$; and anxiolytics, HR 0.55 [95% CI 0.38-0.81], $P=.002$.

CONCLUSION: Relative to no bystander CPR, redeemed prescriptions for antidepressants and anxiolytics were significantly lower among 30-day survivors of OHCA who received bystander CPR, suggesting a cerebral dysfunction-lowering potential of bystander CPR

TARGET TEMPERATURE MANAGEMENT

1. Ther Adv Drug Saf. 2017 Mar;8(3):101-111. doi: 10.1177/2042098616679813. Epub 2016 Nov 29.

Adverse drug reactions in therapeutic hypothermia after cardiac arrest.

Witcher R1, Dzierba AL2, Kim C3, Smithburger PL3, Kane-Gill SL4.

Abstract

BACKGROUND: Therapeutic hypothermia (TH) improves survival and neurologic function in comatose survivors of cardiac arrest. Many medications used to support TH have altered pharmacokinetics and pharmacodynamics during this treatment. It is unknown if or at what frequency the medications used during TH cause adverse drug reactions (ADRs).

METHODS: A retrospective chart review was conducted for patients admitted to an intensive care unit (ICU) after cardiac arrest and treated with TH from January 2009 to June 2012 at two urban, university-affiliated, tertiary-care medical centres. Medications commonly used during TH were screened for association with significant ADRs (grade 3 or greater per Common Terminology Criteria for Adverse Events) using three published ADR detection instruments.

RESULTS: A total of 229 patients were included, the majority being males with median age of 62 presenting with an out-of-hospital cardiac arrest in pulseless electrical activity or asystole. The most common comorbidities were hypertension, coronary artery disease, and diabetes mellitus. There were 670 possible ADRs and 69 probable ADRs identified. Of the 670 possible ADRs, propofol, fentanyl, and acetaminophen were the most common drugs associated with ADRs. Whereas fentanyl, insulin, and propofol were the most common drugs associated with a probable ADR. Patients were managed with TH for a median of 22 hours, with 38% of patients surviving to hospital discharge.

CONCLUSIONS: Patients undergoing TH after cardiac arrest frequently experience possible adverse reactions associated with medications and the corresponding laboratory abnormalities are significant. There is a need for judicious use and close monitoring of drugs in the setting of TH until recommendations for dose adjustments are available to help prevent ADRs.

2. Resuscitation. 2017 Apr 1. pii: S0300-9572(17)30121-1. doi: 10.1016/j.resuscitation.2017.03.021. [Epub ahead of print]

Effect of Prolonged Targeted Temperature Management on Left Ventricular Myocardial Function after Out-of-Hospital Cardiac Arrest - A Randomised, Controlled Trial.

Grejs AM1, Nielsen BR2, Juhl-Olsen P3, Gjedsted J3, Sloth E3, Heiberg J3, Frederiksen CA2, Jeppesen AN4, Duez CH5, Hamre PD6, Søreide E7, Kirkegaard H5.

Abstract

AIM: To evaluate post-cardiac arrest myocardial dysfunction during prolonged targeted temperature management (TTM) compared with standard TTM in comatose out-of-hospital cardiac arrest (OHCA) survivors.

METHODS: A randomised, controlled trial comparing myocardial function after TTM at $33 \pm 1^\circ\text{C}$ for 48h compared with 24h. A total of 105 OHCA patients were computer-randomised to 24h (n=50) or 48h (n=55) of TTM. Transthoracic echocardiography was performed after 24h, 48h and 72h. Echocardiographic parameters were evaluated by an investigator who was blinded to randomisation. The primary endpoint was peak systolic mitral annular velocity (S') measured as the difference in the period from 24h to 72h. The model was adjusted for age, primary rhythm and heart rate. The secondary outcomes were global peak longitudinal strain, left ventricular ejection fraction (LVEF), tricuspid annular plane systolic excursion (TAPSE) and the diastolic measures e' and E/e' .

RESULTS: The mean difference of S' was significantly increased in the 48h group compared with the 24h group: -1.14cm/sec (-1.83 ; -0.45), $p=0.001$. This difference was consistent after adjusting the data ($p=0.008$). However, there were no significant changes between the study groups with respect to the adjusted secondary outcomes of global peak longitudinal strain ($p=0.07$), LVEF ($p=0.31$), TAPSE ($p=0.91$), e' ($p=0.26$) and E/e' ($p=0.18$).

CONCLUSION: Prolonged TTM at 33°C of 48h compared with 24h in comatose OHCA survivors may improve the recovery of post-cardiac arrest left myocardial dysfunction demonstrated by the echocardiographic outcome.

3. Ther Hypothermia Temp Manag. 2016 Jun;6(2):63-70. doi: 10.1089/ther.2015.0024. Epub 2016 Feb 24.

Liquid Ventilation for the Induction of Ultrafast Hypothermia in Resuscitation Sciences: A Review.

Abstract

Liquid ventilation was initially proposed for lung lavage and respiratory support. More recently, it was also investigated as an experimental strategy for ultrafast cooling or organ preservation during ischemic disorders. The goal of this article is to identify and review the studies that investigated liquid ventilation in the field of resuscitation sciences. An exhaustive analysis of the literature was performed using the Medline database up to 15th September 2015. Articles were selected according to their relevance. All articles focusing on respiratory support were excluded. On the basis of 76 retrieved studies from the Medline database, 29 were included in this review. All studies were experimental reports and most of them investigated the cooling properties of liquid ventilation in animal models of experimental cardiac arrest or coronary artery occlusion in rabbits or pigs. Animal studies demonstrated a wide range of potential applications of total liquid ventilation in resuscitation sciences. This strategy is able to provide ultrafast cooling, independent of the body weight. In animal models of cardiopulmonary resuscitation, it was shown to provide potent benefits widely linked to cooling rapidity.

CURES POSTROSC

1. Resuscitation. 2017 Mar 31. pii: S0300-9572(17)30150-8. doi: 10.1016/j.resuscitation.2017.03.039. [Epub ahead of print]

Out of Hospital Cardiac Arrest Survivors with Inconclusive Coronary Angiogram: Impact of Cardiovascular Magnetic Resonance on Clinical Management and Decision-Making.

Baritussio A1, Zorzi A2, Ghosh Dastidar A3, Susana A2, Mattesi G2, Rodrigues JC3, Biglino G3, Scatteia A3, De Garate E3, Strange J3, Cacciavillani L2, Iliceto S2, Nisbet A3, Angelini GD3, Corrado D2, Perazzolo Marra M2, Bucciarelli-Ducci C4.

Abstract

BACKGROUND: Non-traumatic out of hospital cardiac arrest (OHCA) is the leading cause of death worldwide, mainly due to acute coronary syndromes. Urgent coronary angiography with view to revascularisation is recommended in patients with suspected acute coronary syndrome. Diagnosis and management of patients with inconclusive coronary angiogram (unobstructed coronaries or unidentified culprit lesion) is challenging. We sought to assess the role of Cardiovascular Magnetic Resonance (CMR) in the diagnosis and management of OHCA survivors with an inconclusive coronary angiogram.

METHODS AND RESULTS: This is a retrospective multicentre CMR registry analysis of OHCA survivors with an inconclusive angiogram. Clinical, ECG and multi-modality imaging data were analysed. Clinical impact of CMR was defined as a change in diagnosis or management. Out of 174 OHCA survivors referred for CMR, 110 patients (63%, 84 male, median age 58) had an inconclusive angiogram. CMR identified a pathologic substrate in 76/110 patients (69%): ischemic heart disease was found in 45 (41%) and non-ischemic heart disease in 31 (28%). A structurally normal heart was found in 25 patients (23%) and non-specific findings in 9 (8%). As compared to trans-thoracic echocardiogram, CMR proved to be superior in identifying a pathologic substrate (69% vs 54%, $p=0.018$). The CMR study carried a clinical impact in 70% of patients, determining a change in diagnosis in 25%, in management in 29% and a change in both in 16%.

CONCLUSIONS: CMR showed a promising role in the diagnostic work-up of OHCA survivors with inconclusive angiogram and its wider use should be considered.

2. Eur Heart J. 2017 Mar 29. doi: 10.1093/eurheartj/ehx104. [Epub ahead of print]

Distance to invasive heart centre, performance of acute coronary angiography, and angioplasty and associated outcome in out-of-hospital cardiac arrest: a nationwide study.

Tranberg T1, Lippert FK2, Christensen EF3,4, Stengaard C1, Hjort J1, Lassen JF1, Petersen F5, Jensen JS6, Bäck C7, Jensen LO8, Ravkilde J9, Bøtker HE1, Terkelsen CJ1.

Abstract

Aims: To evaluate whether the distance from the site of event to an invasive heart centre, acute coronary angiography (CAG)/percutaneous coronary intervention (PCI) and hospital-level of care (invasive heart centre vs. local hospital) is associated with survival in out-of-hospital cardiac arrest (OHCA) patients.

Methods and results: Nationwide historical follow-up study of 41 186 unselected OHCA patients, in whom resuscitation was attempted between 2001 and 2013, identified through the Danish Cardiac Arrest Registry. We observed an increase in the proportion of patients receiving bystander CPR (18% in 2001, 60% in 2013, $P < 0.001$), achieving return of spontaneous circulation (ROSC) (10% in 2001, 29% in 2013, $P < 0.001$) and being admitted directly to an invasive centre (26% in 2001, 45% in 2013, $P < 0.001$). Simultaneously, 30-day survival rose from 5% in 2001 to 12% in 2013, $P < 0.001$. Among patients achieving ROSC, a larger proportion underwent acute CAG/PCI (5% in 2001, 27% in 2013, $P < 0.001$). The proportion of patients undergoing acute CAG/PCI annually in each region was defined as the CAG/PCI index. The following variables were associated with lower mortality in multivariable analyses: direct admission to invasive heart centre (HR 0.91, 95% CI: 0.89-0.93), CAG/PCI index (HR 0.33, 95% CI: 0.25-0.45), population density above 2000 per square kilometre (HR 0.94, 95% CI: 0.89-0.98), bystander CPR (HR 0.97, 95% CI: 0.95-0.99) and witnessed OHCA (HR 0.87, 95% CI: 0.85-0.89), whereas distance to the nearest invasive centre was not associated with survival.

Conclusion: Admission to an invasive heart centre and regional performance of acute CAG/PCI were associated with improved survival in OHCA patients, whereas distance to the invasive centre was not. These results support a centralized strategy for immediate post-resuscitation care in OHCA patients.

3. *Angiology*. 2017 Jan 1:3319717699500. doi: 10.1177/0003319717699500. [Epub ahead of print]

Clinical Profile, Management, and Outcome in Patients With Out-of-Hospital Cardiac Arrest and ST Segment Elevation Myocardial Infarction.

Arabi AR1, Patel A1, Al Suwaidi J1, Gehani AA1, Singh R2, Albinali HA1.

Abstract

AIM OF THE STUDY: We studied the clinical profile, management, and outcomes of patients with out-of-hospital cardiac arrest (OHCA) with and without ST-elevation myocardial infarction (STEMI).

METHODS: Retrospective analysis of the 20-year registry data (January 1991- June 2010) was conducted on patients with cardiac disease hospitalized at Hamad General Hospital and Qatar Heart Hospital, Doha, Qatar.

RESULTS: A total of 987 patients with OHCA were admitted to the cardiology department during the study period; among them, 296 (30%) patients had STEMI. Compared to the patients with OHCA without STEMI, the patients who had OHCA with STEMI were younger (53 ± 13 vs 58 ± 16 years; $P = .001$), more likely to be male (78% vs 34%; $P = .001$), smokers (35% vs 14%) but less likely to have hypertension (30% vs 48%; $P = .001$), diabetes (32% vs 47%, $P = .001$), and chronic renal failure (3.4% vs 9%; $P = .002$). The use of thrombolytic treatment in patients with STEMI increased from 21.6% (period 1991-1095) to 44.4% (period 2006-2010); $P = .04$.

CONCLUSION: Percutaneous coronary intervention had increased significantly during the last quarter of the study. There was a decline in the in-hospital mortality among patients with STEMI during the last quarter of the study.

DEFIBRIL-LACIÓ

1. *IEEE Trans Biomed Eng*. 2017 Mar 30. doi: 10.1109/TBME.2017.2688380. [Epub ahead of print]

ECG-based Classification of Resuscitation Cardiac Rhythms for Retrospective Data Analysis.

Bahrami Rad A, Eftestol T, Engan K, Irusta U, Kvaloy JT, Kramer-Johansen J, Wik L, Katsaggelos AK.

Abstract

There is a need to monitor the heart rhythm in resuscitation to improve treatment quality. Resuscitation rhythms are categorized into: ventricular tachycardia (VT), ventricular fibrillation (VF), pulseless electrical activity (PEA), asystole (AS), and pulse-generating rhythm (PR). Manual annotation of rhythms is time-consuming and infeasible for large datasets. Our objective was to develop ECG-based algorithms for the retrospective and automatic classification of resuscitation cardiac rhythms.

METHODS: The dataset consisted of 1631 3-second ECG segments with clinical rhythm annotations, obtained from 298 out-of-hospital cardiac arrest patients. 47 wavelet and time domain based features were computed from the ECG. Features were selected using a wrapper-based feature selection architecture. Classifiers based on Bayesian decision theory, k-nearest neighbor, k-local hyperplane distance nearest neighbor, artificial neural network (ANN), and ensemble of decision trees were studied.

RESULTS: The best results were obtained for ANN classifier with Bayesian regularization back propagation training algorithm with 14 features, which forms the proposed algorithm. The overall accuracy for the proposed algorithm was 78.5%. The sensitivities (and positive-predictive-values) for AS, PEA, PR, VF, and VT were 88.7% (91.0%), 68.9% (70.4%), 65.9% (69.0%), 86.2% (83.8%), and 78.8% (72.9%), respectively.

CONCLUSIONS: The results demonstrate that it is possible to classify resuscitation cardiac rhythms automatically, but the accuracy for the organized rhythms (PEA and PR) is low.

SIGNIFICANCE: We have made an important step towards making classification of resuscitation rhythms more efficient in the sense of minimal feedback from human experts

TRAUMA

1. Can J Surg. 2016 Dec;59(6):374-382.

Use of intraosseous devices in trauma: a survey of trauma practitioners in Canada, Australia and New Zealand.

Engels PT1, Erdogan M1, Widder SL1, Butler MB1, Kureshi N1, Martin K1, Green RS1.

Abstract

BACKGROUND: Although used primarily in the pediatric population for decades, the use of intraosseous (IO) devices in the resuscitation of severely injured adult trauma patients has recently become more commonplace. The objective of this study was to determine the experience level, beliefs and attitudes of trauma practitioners in Canada, Australia and New Zealand regarding the use of IO devices in adult trauma patients.

METHODS: We administered a web-based survey to all members of 4 national trauma and emergency medicine organizations in Canada, Australia and New Zealand. Survey responses were analyzed using descriptive statistics, univariate comparisons and a proportional odds model.

RESULTS: Overall, 425 of 1771 members completed the survey, with 375 being trauma practitioners. IO devices were available to 97% (353 of 363), with EZ-IO being the most common. Nearly all physicians (98%, 357 of 366) had previous training with IO devices, and 85% (223 of 261) had previously used an IO device in adult trauma patients. Most respondents (79%, 285 of 361) were very comfortable placing an IO catheter in the proximal tibia. Most physicians would always or often use an IO catheter in a patient without intravenous access undergoing CPR for traumatic cardiac arrest (84%, 274 of 326) or in a hypotensive patient (without peripheral intravenous access) after 2 attempts or 90 s of trying to establish vascular access (81%, 264 of 326).

CONCLUSION: Intraosseous devices are readily available to trauma practitioners in Canada, Australia and New Zealand, and most physicians are trained in device placement. Most physicians surveyed felt comfortable using an IO device in resuscitation of adult trauma patients and would do so for indications broader than current guidelines.

VENTILACIÓ

1. Scand J Trauma Resusc Emerg Med. 2017 Apr 4;25(1):36. doi: 10.1186/s13049-017-0379-8.

Effect of an interactive cardiopulmonary resuscitation assist device with an automated external defibrillator synchronised with a ventilator on the CPR performance of emergency medical service staff: a randomised simulation study.

Nitzschke R1, Doehn C2, Kersten JF3, Blanz J2, Kalwa TJ4, Scotti NA4, Kubitz JC2.

Abstract

BACKGROUND: The present study evaluates whether the quality of advanced cardiac life support (ALS) is improved with an interactive prototype assist device. This device consists of an automated external defibrillator linked to a ventilator and provides synchronised visual and acoustic instructions for guidance through the ALS algorithm and assistance for face-mask ventilations.

METHODS: We compared the cardiopulmonary resuscitation (CPR) quality of emergency medical system (EMS) staff members using the study device or standard equipment in a mannequin simulation study with a prospective, controlled, randomised cross-over study design. Main outcome was the effect of the study device compared to the standard equipment and the effect of the number of prior ALS trainings of the EMS staff on the CPR quality. Data were analysed using analyses of covariance (ANCOVA) and binary logistic regression, accounting for the study design.

RESULTS: In 106 simulations of 56 two-person rescuer teams, the mean hands-off time was 24.5% with study equipment and 23.5% with standard equipment (Difference 1.0% (95% CI: -0.4 to 2.5%); $p = 0.156$). With both types of equipment, the hands-off time decreased with an increasing cumulative number of previous CPR trainings ($p = 0.042$). The study equipment reduced the mean time until administration of adrenaline (epinephrine) by 23 s ($p = 0.003$) and that of amiodarone by 17 s ($p = 0.016$). It also increased the mean number of changes in the person doing chest compressions (0.6 per simulation; $p < 0.001$) and decreased the mean number of chest compressions (2.8 per minute; $p = 0.022$) and the mean number of ventilations (1.8 per minute; $p < 0.001$). The chance of administering amiodarone at the appropriate time was higher, with an odds ratio of 4.15, with the use of the study equipment CPR.com compared to the standard equipment ($p = 0.004$). With an increasing number of prior CPR trainings, the time intervals in the ALS algorithm until the defibrillations decreased with standard equipment but increased with the study device.

CONCLUSIONS: EMS staff with limited training in CPR profit from guidance through the ALS algorithm by the study device. However, the study device somehow reduced the ALS quality of well-trained rescuers and thus can only be recommended for ALS provider with limited experience.

FEEDBACK

1. PLoS One. 2017 Apr 3;12(4):e0169046. doi: 10.1371/journal.pone.0169046. eCollection 2017.

Effectiveness of feedback with a smartwatch for high-quality chest compressions during adult cardiac arrest: A randomized controlled simulation study.

Ahn C1,2, Lee J1, Oh J1,3, Song Y3, Chee Y4, Lim TH1,3, Kang H1,3, Shin H1.

Abstract

Previous studies have demonstrated the potential for using smartwatches with a built-in accelerometer as feedback devices for high-quality chest compression during cardiopulmonary resuscitation. However, to the best of our knowledge, no previous study has reported the effects of this feedback on chest compressions in action. A randomized, parallel controlled study of 40 senior medical students was conducted to examine the effect of chest compression feedback via a smartwatch during cardiopulmonary resuscitation of manikins. A feedback application was developed for the smartwatch, in which visual feedback was provided for chest compression depth and rate. Vibrations from smartwatch were used to indicate the chest compression rate. The participants were randomly allocated to the intervention and control groups, and they performed chest compressions on manikins for 2 min continuously with or without feedback, respectively. The proportion of accurate chest compression depth (≥ 5 cm and ≤ 6 cm) was assessed as the primary outcome, and the chest compression depth, chest compression rate, and the proportion of complete

chest decompression (≤ 1 cm of residual leaning) were recorded as secondary outcomes. The proportion of accurate chest compression depth in the intervention group was significantly higher than that in the control group ($64.6 \pm 7.8\%$ versus $43.1 \pm 28.3\%$; $p = 0.02$). The mean compression depth and rate and the proportion of complete chest decompressions did not differ significantly between the two groups (all $p > 0.05$). Cardiopulmonary resuscitation-related feedback via a smartwatch could provide assistance with respect to the ideal range of chest compression depth, and this can easily be applied to patients with out-of-hospital arrest by rescuers who wear smartwatches.

RECERCA EXPERIMENTAL

1. Heart Lung Circ. 2016 Dec 19. pii: S1443-9506(16)31727-9. doi: 10.1016/j.hlc.2016.11.008. [Epub ahead of print]

Cenchaquin Effects in a Swine Model of Ventricular Fibrillation: Cenchaquin and Cardiac Arrest.

Papalexopoulou K1, Chalkias A2, Pliatsika P1, Papalois A3, Papapanagiotou P1, Papadopoulos G4, Arnaoutoglou E4, Petrou A4, Gulati A5, Xanthos T 6.

Abstract

BACKGROUND: Cenchaquin citrate is a novel agent being developed for use in the treatment of haemorrhagic shock. The aim of our study was to assess whether the administration of cenchaquin would improve initial resuscitation success, 24-hour survival, and neurologic outcome compared with adrenaline alone in a porcine model of ventricular fibrillation.

METHODS: Ventricular fibrillation was induced in 20 healthy Landrace/Large White piglets. The animals were randomised to receive placebo plus adrenaline 0.02mg/kg ($n=10$, Group C) and adrenaline 0.02mg/kg plus cenchaquin 0.015mg/kg ($n=10$, Group S). All animals were resuscitated according to the 2010 European Resuscitation Council guidelines. Haemodynamic variables were measured before arrest, during arrest and resuscitation, and during the first two hours after return of spontaneous circulation (ROSC). Survival and a neurologic alertness score were measured at 24hours after ROSC.

RESULTS: A significant difference was observed in ROSC rate between the two groups, as 10 animals (100%) from Group S and 4 animals (40%) from Group C achieved ROSC ($p=0.011$). Systolic, diastolic, and mean aortic pressure and coronary perfusion pressure were significantly higher in Group S at the end of the second cycle of CPR. In our study, all subjects with ROSC survived for 24hours, while we observed no statistically significant differences in neurologic examination (Group C 100 ± 0 , Group S 96 ± 12.64 ; $p=0.527$).

CONCLUSION: The addition of cenchaquin to adrenaline improved ROSC rates in a swine model of VF cardiac arrest.

2. Neonatology. 2017 Apr 6;112(1):80-86. doi: 10.1159/000458515. [Epub ahead of print]

Association between Brain and Kidney Near-Infrared Spectroscopy and Early Postresuscitation Mortality in Asphyxiated Newborn Piglets.

Solevåg AL1, Schmölzer GM, Nakstad B, Saugstad OD, Cheung PY.

Abstract

BACKGROUND: Early outcome predictors after delivery room cardiopulmonary resuscitation (CPR) of asphyxiated newborns are needed.

OBJECTIVES: To investigate if cerebral (rScO₂) and renal (rSrO₂) tissue oxygen saturation 30 min after return of spontaneous circulation (ROSC) are different between surviving versus nonsurviving piglets with asphyxia-induced cardiac arrest and CPR. Further, to investigate the relationship of rScO₂ and rSrO₂ to cardiac output (CO), blood pressure (BP), and biochemical variables 30 min and 4 h after ROSC.

METHODS: Anesthetized, mechanically ventilated piglets (1-3 days, 1.7-2.4 kg) were used. rScO₂, rSrO₂, SpO₂, right common carotid artery flow, and arterial BP were measured continuously. CO was measured with echocardiography. The piglets were asphyxiated until cardiac arrest and resuscitated. Piglets that survived 4 h after ROSC (n = 12) were compared with piglets that died before planned euthanasia at 4 h (n = 13). Left ventricular, and kidney and brain tissue lactate were analyzed. Correlations between variables were assessed.

RESULTS: Thirty minutes after ROSC, median rSrO₂ (43% [n = 10] vs. 25% [n = 2], p = 0.003) but not rScO₂ (46% [41-55] [n = 10] vs. 40% [22-45] [n = 5], p = 0.08) was higher in survivors than in nonsurvivors. Arterial lactate was negatively correlated and pH positively correlated with rScO₂ and rSrO₂. Left ventricular, but not kidney or brain lactate was negatively correlated with rScO₂ and rSrO₂. There was no correlation between CO or BP and rScO₂ or rSrO₂.

CONCLUSIONS: Despite satisfactory CO and BP vital organ oxygenation can be poor. Tissue oxygen saturation, pH, and lactate, as measures of anaerobic metabolism, may reflect vital organ oxygenation and outcome

CASE REPORTS

1. J Med Invest. 2017;64(1.2):184-186. doi: 10.2152/jmi.64.184.

Sudden cardiac death during first-time jogging.

Kurata H1, Ishigami A, Tokunaga I, Nagasaki Y, Nishimura A .

Abstract

With increased interest in fitness and health care, jogging has become more popular as an exercise to promote health. However, sudden cardiac death during sports or exercise has also been reported. Some apparently healthy elderly individuals take up sports for both recreation and health improvement based only on completion of a questionnaire, without undergoing medical evaluation. We report the case of a 66-year-old Japanese man who suddenly died of acute ischemic heart disease during first-time jogging. He collapsed an hour after starting. A trainer promptly started cardiopulmonary resuscitation. An automated external defibrillator (AED) was applied, and defibrillation was attempted once by bystanders. However, he remained in cardiopulmonary arrest until he reached the emergency department, where he was pronounced dead. The autopsy found concentric hypertrophy of the left ventricular wall without fibrosis or degeneration, atherosclerotic changes in the coronary arteries, and severe lung congestion. We diagnosed death from acute myocardial ischemia. We suspect that many healthy elderly individuals have provoked a heart attack by prematurely attempting moderate or vigorous exercise, as in this case. The elderly require comprehensive medical assessment before exercise can be started. Moreover, this case shows that an AED is not always helpful.

RCP

1. Resuscitation. 2017 Apr 17. pii: S0300-9572(17)30169-7. doi: 10.1016/j.resuscitation.2017.04.016. [Epub ahead of print]

Effects of bystander CPR following out-of-hospital cardiac arrest on hospital costs and long-term survival.

Geri G1, Fahrenbruch C2, Meischke H3, Painter I3, White L4, Rea TD2, Weaver MR3.

Abstract

BACKGROUND: Bystander cardiopulmonary resuscitation (CPR) is associated with a greater likelihood of survival to hospital discharge after out-of-hospital cardiac arrest (OHCA). However the long-term survival benefits in relationship to cost have not been well-studied. We evaluated bystander CPR, hospital-based costs, and long-term survival following OHCA in order to assess the potential cost-effectiveness of bystander CPR.

PATIENTS AND METHODS: We conducted a retrospective cohort study of consecutive EMS-treated OHCA patients ≥ 12 years who arrested prior to EMS arrival and outside a nursing facility between 2001 and 2010 in greater King County, WA. Utstein-style information was obtained from the EMS registry, including 5-year survival. Costs from the OHCA hospitalization were obtained from the Washington State

Comprehensive Hospital Abstract Reporting System. Cost effectiveness was based on hospital costs divided by quality-adjusted life years (QALYs) for a 5-year follow-up window.

RESULTS: Of the 4,448 eligible patients, 18.5% (n=824) were discharged alive from hospital and 12.1% (n=539) were alive at 5 years. Five-year survival was higher in patients who received bystander CPR (14.3% vs. 8.7%, $p < 0.001$) translating to an average 0.09 QALYs associated with bystander CPR. The average (SD) total cost of the initial acute care hospitalization was USD 19,961 (40,498) for all admitted patients and USD 75,175 (52,276) for patients alive at year 5. The incremental cost-effectiveness ratio associated with bystander CPR was USD 48,044 per QALY.

CONCLUSION: Based on this population-based investigation, bystander CPR was positively associated with long-term survival and appears cost-effective.

2. Prehosp Emerg Care. 2017 Apr 19:1-8. doi: 10.1080/10903127.2017.1308605. [Epub ahead of print]
Evaluating Barriers to Bystander CPR among Laypersons before and after Compression-only CPR Training.

Boulant AJ, Halliday MH, Comer AC, Levy MJ, Seaman KG, Lawner BJ.

Abstract

OBJECTIVE: Bystander CPR is an essential part of out-of-hospital cardiac arrest (OHCA) survival. EMS and public safety jurisdictions have embraced initiatives to teach compression-only CPR to laypersons in order to increase rates of bystander CPR. We examined barriers to bystander CPR amongst laypersons participating in community compression-only CPR training and the ability of the training to alleviate these barriers. The barriers analyzed include fear of litigation, risk of disease transmission, fear of hurting someone as a result of doing CPR when unnecessary, and fear of hurting someone as a result of doing CPR incorrectly.

METHODS: Laypersons attending community compression-only CPR training were administered surveys before and after community CPR training. Data were analyzed via standard statistical analyses.

RESULTS: A total of 238 surveys were collected and analyzed between September 2015 and January 2016. The most common reported motivation for attending CPR training was "to be prepared/just in case" followed by "infant or child at home." Respondents reported that they were significantly more likely to perform CPR on a family member than a stranger in both pre-and post-training responses. Nevertheless, reported self-confidence in and likelihood of doing CPR on both family and strangers increased from pre-training to post-training. There was a statistically significant decrease in reported likelihood of all four barriers to prevent respondents from performing bystander CPR when pre-training responses were compared to post-training responses. Previous CPR training and history of having witnessed a sudden cardiac arrest (SCA) were both associated with decreased barriers to CPR, but previous training had no effect on reported likelihood of or confidence in performing CPR.

CONCLUSION: The training initiative studied significantly reduced the reported likelihood of all barriers studied to prevent respondents from performing bystander CPR and also increased the reported confidence in doing CPR and likelihood of doing CPR on both strangers and family. However, it did not alleviate the pre-training discrepancy between likelihood of performing CPR on strangers versus family. Previous CPR training or certification had no impact on likelihood of or confidence in performing CPR.

3. Resuscitation. 2017 Apr 17. pii: S0300-9572(17)30169-7. doi: 10.1016/j.resuscitation.2017.04.016. [Epub ahead of print]

Effects of bystander CPR following out-of-hospital cardiac arrest on hospital costs and long-term survival.

Geri G1, Fahrenbruch C2, Meischke H3, Painter I3, White L4, Rea TD2, Weaver MR3.

Abstract

BACKGROUND: Bystander cardiopulmonary resuscitation (CPR) is associated with a greater likelihood of survival to hospital discharge after out-of-hospital cardiac arrest (OHCA). However the long-term survival benefits in relationship to cost have not been well-studied. We evaluated bystander CPR, hospital-based costs, and long-term survival following OHCA in order to assess the potential cost-effectiveness of bystander CPR.

PATIENTS AND METHODS: We conducted a retrospective cohort study of consecutive EMS-treated OHCA patients ≥ 12 years who arrested prior to EMS arrival and outside a nursing facility between 2001 and 2010 in greater King County, WA. Utstein-style information was obtained from the EMS registry, including 5-year survival. Costs from the OHCA hospitalization were obtained from the Washington State Comprehensive Hospital Abstract Reporting System. Cost effectiveness was based on hospital costs divided by quality-adjusted life years (QALYs) for a 5-year follow-up window.

RESULTS: Of the 4,448 eligible patients, 18.5% (n=824) were discharged alive from hospital and 12.1% (n=539) were alive at 5 years. Five-year survival was higher in patients who received bystander CPR (14.3% vs. 8.7%, $p < 0.001$) translating to an average 0.09 QALYs associated with bystander CPR. The average (SD) total cost of the initial acute care hospitalization was USD 19,961 (40,498) for all admitted patients and USD 75,175 (52,276) for patients alive at year 5. The incremental cost-effectiveness ratio associated with bystander CPR was USD 48,044 per QALY.

CONCLUSION:

Based on this population-based investigation, bystander CPR was positively associated with long-term survival and appears cost-effective.

FÀRMACS

1. Exp Ther Med. 2017 Apr;13(4):1598-1603. doi: 10.3892/etm.2017.4155. Epub 2017 Feb 22.

Outcome of out-of-hospital cardiac arrest after fibrinolysis with reteplase in comparison to the return of spontaneous circulation after cardiac arrest score in a geographic region without emergency coronary intervention.

Luiz T1, Wilhelms A1, Madler C1, Pollach G1, Haaff B2, Grüttner J3, Viergutz T4.

Abstract

Coronary occlusion and pulmonary embolism are responsible for the majority of cases of out-of-hospital cardiac arrest (OHCA). Despite previous favourable results of pre-hospital fibrinolysis in cases of OHCA, the benefit could not be confirmed in a large controlled study using the fibrinolytic tenecteplase. For reteplase (r-PA), there are hardly any data regarding pre-hospital fibrinolysis during ongoing resuscitation. The present study reported results using r-PA therapy in a German physician-supported Emergency Medical Services system. The data of OHCA patients who received pre-hospital fibrinolytic treatment with r-PA after an individual risk/benefit assessment were retrospectively analysed. To assess the effectiveness of this approach, the rate of patients with a return of spontaneous circulation (ROSC) was compared with the corresponding figure that was calculated with the help of the RACA (ROSC after cardiac arrest) score. The RACA algorithm predicts the probability of ROSC based on data from the German Resuscitation Registry. Further outcome data comprised hospital discharge rate and neurologic status at discharge. From 2001 to 2009, 43 patients (mean age, 58.5 years; 65.1% male; 58.1% ventricular fibrillation) received r-PA. Of these, 20 patients (46.5%) achieved ROSC, compared to a probability of 49.8% according to the RACA score ($P=0.58$). A total of 8 patients (18.6%) were discharged alive, including 5 (11.2%) with a good neurological outcome. For the analysed small patient collective, pre-hospital r-PA did not offer any benefits with regard to the ROSC rate. Further analyses of larger patient numbers on a nationwide registry basis are recommended.

REGISTRES I REVISIONS

1. Am J Bioeth. 2017 May;17(5):6-16. doi: 10.1080/15265161.2017.1299239.

Caring for Patients or Organs: New Therapies Raise New Dilemmas in the Emergency Department.

Prabhu A1, Parker LS2, DeVita MA3.

Abstract

Two potentially lifesaving protocols, emergency preservation and resuscitation (EPR) and uncontrolled donation after circulatory determination of death (uDCDD), currently implemented in some U.S. emergency departments (EDs), have similar eligibility criteria and initial technical procedures, but critically different goals. Both follow unsuccessful cardiopulmonary resuscitation and induce hypothermia to "buy time": one in trauma patients suffering cardiac arrest, to enable surgical repair, and the other in patients who unexpectedly die in the ED, to enable organ donation. This article argues that to fulfill patient-focused fiduciary obligations and maintain community trust, institutions implementing both protocols should adopt and publicize policies to guide ED physicians to utilize either protocol for particular patients, in order to address the appearance of conflict of interest arising from the protocols' similarities. It concludes by analyzing ethical implications of incentives that may influence institutions to develop the expertise required for uDCDD but not EPR.

2. Prehosp Emerg Care. 2017 Apr 20:1-12. doi: 10.1080/10903127.2017.1308604. [Epub ahead of print]

Improvements in Out-of-Hospital Cardiac Arrest Survival from 1998 to 2013.

Yamaguchi Y, Woodin JA, Gibo K, Zive DM, Daya MR.

Abstract

OBJECTIVES: Out-of-hospital cardiac arrest (OHCA) remains a major public health burden. Aggregate OHCA survival to hospital discharge has reportedly remained unchanged at 7.6% for almost 30 years from 1970 to 2008. We examined the trends in adult OHCA survival over a 16-year period from 1998 to 2013 within a single EMS agency.

METHODS: Observational cohort study of adult OHCA patients treated by Tualatin Valley Fire & Rescue (TVF&R) from 1998 to 2013. This is an ALS first response fire agency that maintains an active Utstein style cardiac arrest registry and serves a population of approximately 450,000 in 9 incorporated cities in Oregon. Primary outcomes were survival to hospital discharge in all patients and in the subgroup with witnessed ventricular fibrillation/pulseless ventricular tachycardia (VF/VT). The impact of key covariates on survival was assessed using univariate logistic regression. These included patient factors (age and sex), event factors (location of arrest, witnessed status, and first recorded cardiac arrest rhythm), and EMS system factors (response time interval, bystander CPR, and non-EMS AED shock). We used multivariate logistic regression to examine the impact of year increment on survival after multiple imputation for missing data. Sensitivity analysis was performed with complete cases.

RESULTS: During the study period, 2,528 adult OHCA had attempted field resuscitation. The survival rate for treated cases increased from 6.7% to 18.2%, with witnessed VF/VT cases increasing from 14.3% to

31.4% from 1998 to 2013. Univariate analysis showed that younger age, male sex, public location of arrest, bystander or EMS witnessed event, initial rhythm of pulseless electrical activity (PEA) or VF/VT, bystander CPR, non-EMS AED shock, and a shorter EMS response time were independently associated with survival. After adjustment for covariates, the odds of survival increased by 9% (OR 1.09, 95%CI: 1.05-1.12) per year in all treated cases, and by 6% (OR 1.06, 95% 1.01-1.10) per year in witnessed VF/VT subgroups. Findings remained consistent on sensitivity analysis.

CONCLUSIONS: Overall survival from treated OHCA has increased over the last 16 years in this community. These survival increases demonstrate that OHCA is a treatable condition that warrants further investigation and investment of resources.

3. PLoS One. 2017 Apr 19;12(4):e0176143. doi: 10.1371/journal.pone.0176143. eCollection 2017.

Association of body mass index with clinical outcomes for in-hospital cardiac arrest adult patients following extracorporeal cardiopulmonary resuscitation.

Gil E1, Na SJ1, Ryu JA1, Lee DS 1, Chung CR1, Cho YH2, Jeon K1,3, Sung K2, Suh GY1,3, Yang JH1,4.
Abstract

BACKGROUND: Obesity might be associated with disturbance of cannulation in situation of extracorporeal cardiopulmonary resuscitation (ECPR). However, limited data are available on obesity in the setting of ECPR. Therefore, we investigated the association between body mass index (BMI) and clinical outcome in patients underwent ECPR.

METHODS: From January 2004 to December 2013, in-hospital cardiac arrest patients who had ECPR were enrolled from a single-center registry. We divided patients into four group according to BMI defined with the WHO classification (underweight, BMI < 18.5, n = 14; normal weight, BMI = 18.5-24.9, n = 118; overweight, BMI = 25.0-29.9, n = 53; obese, BMI ≥ 30, n = 15). The primary outcome was survival to hospital discharge.

RESULTS: Analysis was carried out for a total of 200 adult patients (39.5% females). Their median BMI was 23.20 (interquartile range, 20.93-25.80). The rate of survival to hospital discharge was 31.0%. There was no significant difference in survival to hospital discharge among the four groups (underweight, 35.7%; normal, 31.4%; overweight, 30.2%; obese, 26.7%, p = 0.958). Neurologic outcomes (p = 0.85) and procedural complications (p = 0.40) were not significantly different among the four groups either. SOFA score, initial arrest rhythm, and CPR to extracorporeal membrane oxygenation (ECMO) pump on time were significant predictors for survival to discharge, but not BMI.

CONCLUSION: BMI was not associated with in-hospital mortality who underwent ECPR. Neurologic outcomes at discharge or procedural complications following ECPR were not related with BMI either.

4. Resuscitation. 2017 Apr 14. pii: S0300-9572(17)30157-0. doi: 10.1016/j.resuscitation.2017.04.006. [Epub ahead of print]

Recognising Out-of-Hospital Cardiac Arrest During Emergency Calls Increases Bystander Cardiopulmonary Resuscitation and Survival.

Viereck S1, Møller TP2, Ersbøll AK3, Bækgaard JS2, Claesson A4, Hollenberg J4, Folke F2, Lippert FK2.
Abstract

BACKGROUND: Initiation of early bystander cardiopulmonary resuscitation (CPR) depends on bystanders' or medical dispatchers' recognition of out-of-hospital cardiac arrest (OHCA). The primary aim of our study was to investigate if OHCA recognition during the emergency call was associated with bystander CPR, return of spontaneous circulation (ROSC), and 30-day survival. Our secondary aim was to identify patient-, setting-, and dispatcher-related predictors of OHCA recognition.

METHODS: We performed an observational study of all OHCA patients' emergency calls in the Capital Region of Denmark from 01/01/2013-31/12/2013. OHCAs were collected from the Danish Cardiac Arrest Registry and the Mobile Critical Care Unit database. Emergency call recordings were identified and evaluated. Multivariable logistic regression analyses were applied to all OHCAs and witnessed OHCAs only to analyse the association between OHCA recognition and bystander CPR, ROSC, and 30-day survival. Univariable logistic regression analyses were applied to identify predictors of OHCA recognition.

RESULTS: We included 779 emergency calls in the analyses. During the emergency calls, 70.1% (n=534) of OHCAs were recognised; OHCA recognition was positively associated with bystander CPR (odds ratio [OR]=7.84, 95% confidence interval [CI]: 5.10-12.05) in all OHCAs; and ROSC (OR=1.86, 95% CI: 1.13-3.06) and 30-day survival (OR=2.80, 95% CI: 1.58-4.96) in witnessed OHCA. Predictors of OHCA recognition were addressing breathing (OR=1.76, 95% CI: 1.17-2.66) and callers located by the patient's side (OR=2.16, 95% CI: 1.46-3.19).

CONCLUSIONS: Recognition of OHCA during emergency calls was positively associated with the provision of bystander CPR, ROSC, and 30-day survival in witnessed OHCA.

TRAUMA

1. J Trauma Acute Care Surg. 2017 May;82(5):910-914. doi: 10.1097/TA.0000000000001345.

Resuscitative endovascular balloon occlusion of the aorta or resuscitative thoracotomy with aortic clamping for noncompressible torso hemorrhage: A retrospective nationwide study.

Aso S1, Matsui H, Fushimi K, Yasunaga H.

Abstract

BACKGROUND: Resuscitative endovascular balloon occlusion of the aorta (REBOA) is an emerging treatment for noncompressible torso hemorrhage. It remains unclear if REBOA is superior to resuscitative thoracotomy with aortic cross-clamping (RT) in terms of improving outcomes. This study compared in-hospital outcomes between REBOA and RT in trauma patients with uncontrolled hemorrhagic shock, using data from a national inpatient database in Japan.

METHODS: Using the Diagnosis Procedure Combination database, we identified patients who received REBOA or RT within 1 day after admission from July 1, 2010, to March 31, 2014. We excluded those with penetrating thoracic injuries. Propensity score-adjusted analyses were performed to compare in-hospital mortality and other in-hospital outcomes.

RESULTS: Eligible patients (n = 259) were classified into the REBOA group (n = 191) or the RT group (n = 68). In the propensity score-adjusted Cox regression analysis, the two groups did not differ significantly with respect to in-hospital mortality (hazard ratio, 0.94; 95% confidence interval, 0.60-1.48). There were also no significant differences between the groups in ventilator-free days, intensive care unit-free days, total amount of fluid infusion within 1 day after admission, total amount of transfusion within 1 day after admission, or total hospitalization costs.

CONCLUSION: In this retrospective nationwide study, in-hospital outcomes were not significantly different between REBOA and RT in trauma patients with uncontrolled hemorrhagic shock

2. Am Surg. 2017 Apr 1;83(4):337-340.

The Novel Use of Resuscitative Endovascular Balloon Occlusion of the Aorta to Explore a Retroperitoneal Hematoma in a Hemodynamically Unstable Patient.

Rosenthal MD, Raza A, Markle S, Croft CA, Mohr AM, Smith RS.

Abstract

Balloon occlusion of the aorta was first described by C.W. Hughes in 1954, when it was used as a tamponade device for three wounded soldiers during the Korean War suffering from intra-abdominal hemorrhage. Currently, the device is indicated in trauma patients as a surrogate for resuscitative thoracotomy. Brenner et al. reported a case series describing the use of resuscitative endovascular balloon occlusion of the aorta (REBOA) in advanced hemorrhagic shock. Their conclusion was that "it is a feasible method for proximal aortic control." We describe the novel use of REBOA before retroperitoneal hematoma exploration in a hemodynamically unstable patient. Reported is a 19-year-old blunt trauma victim where REBOA was successfully deployed as a means for proximal arterial control before a Zone 1 retroperitoneal hematoma exploration. The source of the patient's hemorrhagic shock was multifactorial: grade V hepatic injury, retrohepatic inferior vena cava laceration, and right renal vein avulsion with Zone 1 retroperitoneal hematoma. Immediate return of perfusion pressure, as systolic pressures increased from 50 to 150 mm Hg. Hemodynamic improvements were accompanied by decreased transfusion and vasopressor requirements. In addition, the surgeons were able to enter the retroperitoneal hematoma under controlled conditions. REBOA is an attractive new tool to gain proximal aortic control in select patients with hemorrhagic shock. It is less morbid, possibly more efficient, and appears to be more effective than resuscitative thoracotomy. REBOA is certainly feasible for proximal aortic control before retroperitoneal exploration, and should be considered in select patients.

3. J Trauma Acute Care Surg. 2017 Apr 18. doi: 10.1097/TA.0000000000001514. [Epub ahead of print]

Vascular complications from resuscitative endovascular balloon occlusion of the aorta (REBOA): Life over limb?

Taylor JR 3rd1, Harvin JA, Martin C, Holcomb JB, Moore LJ.

Abstract

BACKGROUND: Vascular complications from resuscitative endovascular balloon occlusion of the aorta (REBOA) have been reported as high as 13% with some patients requiring lower extremity amputation. We sought to review our institutions series of REBOA and assess our vascular complications.

METHODS: Retrospective review of all patients undergoing REBOA from October 2011 through July 2016. Data was gathered from the Memorial Hermann Trauma registry and the hospital electronic medical records. Operative details and vascular injuries from arterial access for REBOA insertion were recorded.

RESULTS: 48 patients underwent REBOA during our study period. 38 had the 14FR system placed and 10 had the 7FR system placed. Of the 24 surviving to removal of the 14FR sheath, 19 had primary repair of the arteriotomy without vascular complication. The other 5 required additional vascular procedures to repair arteriotomy with no lower extremity amputations. There were no vascular complications of sheath removal with the 7FR system, with no amputations.

CONCLUSIONS: Implementation of REBOA can be done safely without increased risk of vascular access complications or limb loss. The 14FR system will more likely require further vascular procedures to address the access site, while the 7FR system will not.

LEVEL OF EVIDENCE: IIType of Study: Therapeutic/Care Management.

TARGET TEMPERATURE MANAGEMENT

1. Ther Hypothermia Temp Manag. 2017 Apr 18. doi: 10.1089/ther.2016.0006. [Epub ahead of print]

Factors Associated with Delayed Cooling in Cardiac Arrest Patients.

Pearson DA1, Mayer K2, Wares CM1, Runyon MS1, Studnek JR3, Ward SL4, Kraft KM4, Heffner AC1,5.

Abstract

Therapeutic hypothermia has been shown to improve neurologic outcome in medical cardiac arrest patients, yet little is known about factors that delay target temperature achievement. Our primary aim was to identify factors associated with not achieving our institutional "door-to-cool" (DTC) performance goal (emergency department [ED] arrival to temperature of 34°C) of ≤4 hours. Secondary aims included whether achievement of DTC goal was associated with timing of bolus neuromuscular blockade (NMB), survival, or functional outcome. This was a retrospective cohort study of a medical cardiac arrest quality improvement (QI) database that included patients treated from November 2007 to August 2012. The database was queried for patient demographics, arrest characteristics, specific cooling techniques used, whether patients underwent emergent computed tomography imaging or cardiac catheterization, and patient outcomes. Logistic regression was used to assess the factors associated with DTC goal performance and outcomes. We enrolled 327 patients, median age 58, median return of spontaneous circulation (ROSC) time of 21 minutes (interquartile range [IQR] 14-29 minutes), and shockable initial rhythm in 61%. One hundred forty-four (44%) patients survived to hospital discharge, 133 (41%) with good functional outcome, as defined as cerebral performance category 1-2. Induction with cold IV fluids [OR 0.50 (CI: 0.29-0.85)] and NMB administration within 2 hours of ED arrival [OR 2.95 (CI: 1.17-7.43)] was associated with achieving DTC goal. Logistic regression showed that achievement of DTC goal ≤4 hours [OR 0.59 (0.32-1.09)] was not associated with good functional outcome. In our single-center cohort, initiation of cold intravenous fluids (IVF) and early NMB administration were associated with improved DTC goal performance of 4 hours. However, patients achieving DTC goals were not associated with improved outcomes.

2. Heart Lung. 2017 Apr 11. pii: S0147-9563(17)30102-4. doi: 10.1016/j.hrtlng.2017.03.001. [Epub ahead of print]

The esophageal cooling device: A new temperature control tool in the intensivist's arsenal.

Hegazy AF1, Lapierre DM2, Butler R2, Martin J3, Althenayan E4.

Abstract

BACKGROUND: Therapeutic hypothermia has been demonstrated to improve neurological outcome in comatose survivors of cardiac arrest. Current temperature control modalities however, have several limitations. Exploring innovative methods of temperature management has become a necessity.

METHODS: We describe the first use of a novel esophageal cooling device as a sole modality for hypothermia induction, maintenance and rewarming in a series of four postcardiac arrest patients. The device was inserted in a manner similar to standard orogastric tubes and connected to an external heat exchange unit.

RESULTS: A mean cooling rate of 0.42 °C/hr (SD ± 0.26) was observed. An average of 4 hr 24 min (SD ± 2 hr 6 min) was required to reach target temperature, and this was maintained 90.25% (SD ± 16.20%) of the hypothermia protocol duration. No adverse events related to device use were encountered. Questionnaires administered to ICU nursing staff regarding ease-of-use of the device and its performance were rated as favorable.

CONCLUSIONS: When used as a sole modality, objective performance parameters of the esophageal-cooling device were found to be comparable to standard temperature control methods. More research is required to further quantify efficacy, safety, assess utility in other patient populations, and examine patient outcomes with device use in comparison to standard temperature control modalities.

CURES POST ROSC

1. Crit Care Med. 2017 Apr 20. doi: 10.1097/CCM.0000000000002412. [Epub ahead of print]

Cerebral Recovery Index: Reliable Help for Prediction of Neurologic Outcome After Cardiac Arrest.

Tjepkema-Cloostermans MC1, Hofmeijer J, Beishuizen A, Hom HW, Blans MJ, Bosch FH, van Putten MJAM.

Abstract

OBJECTIVE: Early electroencephalography measures contribute to outcome prediction of comatose patients after cardiac arrest. We present predictive values of a new cerebral recovery index, based on a combination of quantitative electroencephalography measures, extracted every hour, and combined by the use of a random forest classifier.

DESIGN: Prospective observational cohort study.

SETTING: Medical ICU of two large teaching hospitals in the Netherlands.

PATIENTS: Two hundred eighty-three consecutive comatose patients after cardiac arrest.

INTERVENTIONS: None.

MEASUREMENTS AND MAIN RESULTS: Continuous electroencephalography was recorded during the first 3 days. Outcome at 6 months was dichotomized as good (Cerebral Performance Category 1-2, no or moderate disability) or poor (Cerebral Performance Category 3-5, severe disability, comatose, or death). Nine quantitative electroencephalography measures were extracted. Patients were randomly divided over a training and validation set. Within the training set, a random forest classifier was fitted for each hour after cardiac arrest. Diagnostic accuracy was evaluated in the validation set. The relative contributions of resuscitation parameters and patient characteristics were evaluated. The cerebral recovery index ranges from 0 (prediction of death) to 1 (prediction of full recovery). Poor outcome could be predicted at a threshold of 0.34 without false positives at a sensitivity of 56% at 12 hours after cardiac arrest. At 24 hours, sensitivity

of 65% with a false positive rate of 6% was obtained. Good neurologic outcome could be predicted with sensitivities of 63% and 58% at a false positive rate of 6% and 7% at 12 and 24 hours, respectively. Adding patient characteristics was of limited additional predictive value.

CONCLUSIONS: A cerebral recovery index based on a combination of intermittently extracted, optimally combined quantitative electroencephalography measures provides unequalled prognostic value for comatose patients after cardiac arrest and enables bedside EEG interpretation of unexperienced readers.

2. Resuscitation. 2017 Apr 17. pii: S0300-9572(17)30173-9. doi: 10.1016/j.resuscitation.2017.04.020. [Epub ahead of print]

Association of Time from Arrest to Percutaneous Coronary Intervention with Survival Outcomes after Out-of-Hospital Cardiac Arrest.

Jeong J1, Ro YS2, Shin SD3, Song KJ4, Hong KJ5, Ahn KO6.

Abstract

BACKGROUND: Timely post-resuscitation coronary reperfusion therapy is recommended; however, the timing of immediate coronary reperfusion for out-of-hospital cardiac arrest (OHCA) has not been established. We studied the effect of the time interval from arrest to percutaneous coronary intervention (PCI) on resuscitated OHCA patients.

METHODS: All witnessed OHCA patients with a presumed cardiac etiology received successful PCI at hospitals between 2013 and 2015, excluding cases with unknown information regarding the time from arrest to PCI and survival outcomes. The main exposure of interest was the time interval from arrest to ballooning or stent placement in coronary arteries, and cases were categorized into five groups of 0-90, 90-120, 120-150, and 150-180minutes and 3-6hours. The endpoint was survival with good neurological recovery. Multivariable logistic regression analysis was performed, adjusting for patient-community, prehospital, and hospital factors.

RESULTS: A total of 765 patients (24.1% received PCI within 90minutes; 31.0% in 90-120minutes; 17.8% in 120-150minutes; 12.3% in 150-180minutes; 14.9% in 3-6hours after arrest) were included. Good neurological recovery was more frequent in the early PCI groups than the delayed PCI group (63.6%, 55.3%, 47.8%, 33.0%, and 42.1%, respectively). The adjusted OR (95% CI) for good neurological recovery compared with the most early PCI group was 0.86 (0.53-1.39) in the PCI group between 90-120minutes; 0.76 (0.45-1.31) in the PCI group between 120-150minutes; 0.42 (0.22-0.79) in the PCI group between 150-180minutes; and 0.53 (0.30-0.93) in PCI group after 3hours.

CONCLUSIONS: Among resuscitated OHCA patients with a presumed cardiac etiology and successful PCI, patients who received a delayed coronary intervention after 150min from arrest were less likely to have neurologically intact survival compared to those who received an early intervention.

3. Crit Care Med. 2017 Apr 6. doi: 10.1097/CCM.0000000000002335. [Epub ahead of print]

Neuron-Specific Enolase Predicts Poor Outcome After Cardiac Arrest and Targeted Temperature Management: A Multicenter Study on 1,053 Patients.

Streitberger KJ1, Leithner C, Wattenberg M, Tonner PH, Hasslacher J, Joannidis M, Pellis T, Di Luca E, Födisch M, Krannich A, Ploner CJ, Storm C.

Abstract

OBJECTIVE: Outcome prediction after cardiac arrest is important to decide on continuation or withdrawal of intensive care. Neuron-specific enolase is an easily available, observer-independent prognostic biomarker. Recent studies have yielded conflicting results on its prognostic value after targeted temperature management.

DESIGN, SETTING, AND PATIENTS: We analyzed neuron-specific enolase serum concentrations 3 days after nontraumatic in-hospital cardiac arrest and out-of-hospital cardiac arrest and outcome of patients from five hospitals in Germany, Austria, and Italy. Patients were treated at 33°C for 24 hours. Cerebral Performance Category was evaluated upon ICU discharge. We performed case reviews of good outcome patients with neuron-specific enolase greater than 90 µg/L and poor outcome patients with neuron-specific enolase less than or equal to 17 µg/L (upper limit of normal).

MEASUREMENTS AND MAIN RESULTS: A neuron-specific enolase serum concentration greater than 90 µg/L predicted Cerebral Performance Category 4-5 with a positive predictive value of 99%, false positive rate of 0.5%, and a sensitivity of 48%. All three patients with neuron-specific enolase greater than 90 µg/L and Cerebral Performance Category 1-2 had confounders for neuron-specific enolase elevation. A neuron-specific enolase serum concentration less than or equal to 17 µg/L excluded Cerebral Performance Category 4-5 with a negative predictive value of 92%. The majority of 14 patients with neuron-specific enolase less than or equal to 17 µg/L who died had a cause of death other than hypoxic-ischemic encephalopathy. Specificity and sensitivity for prediction of poor outcome were independent of age, sex, and initial rhythm but higher for out-of-hospital cardiac arrest than for in-hospital cardiac arrest patients.

CONCLUSION: High neuron-specific enolase serum concentrations reliably predicted poor outcome at ICU discharge. Prediction accuracy differed and was better for out-of-hospital cardiac arrest than for in-hospital cardiac arrest patients. Our "in-the-field" data indicate 90 µg/L as a threshold associated with almost no false positives at acceptable sensitivity. Confounders of neuron-specific enolase elevation should be actively considered: neuron-specific enolase-producing tumors, acute brain diseases, and hemolysis. We strongly recommend routine hemolysis quantification. Neuron-specific enolase serum concentrations less than or equal to 17 µg/L argue against hypoxic-ischemic encephalopathy incompatible with reawakening.

4. Crit Care. 2017 Apr 13;21(1):96. doi: 10.1186/s13054-017-1677-2.

Early predictors of poor outcome after out-of-hospital cardiac arrest.

Martinell L1, Nielsen N2, Herlitz J3, Karlsson T4, Horn J5, Wise MP6, Undén J7, Rylander C8.

Abstract

BACKGROUND: Early identification of predictors for a poor long-term outcome in patients who survive the initial phase of out-of-hospital cardiac arrest (OHCA) may facilitate future clinical research, the process of care and information provided to relatives. The aim of this study was to determine the association between variables available from the patient's history and status at intensive care admission with outcome in unconscious survivors of OHCA.

METHODS: Using the cohort of the Target Temperature Management trial, we performed a post hoc analysis of 933 unconscious patients with OHCA of presumed cardiac cause who had a complete 6-month follow-up. Outcomes were survival and neurological function as defined by the Cerebral Performance Category (CPC) scale at 6 months after OHCA. After multiple imputations to compensate for missing data, backward stepwise multivariable logistic regression was applied to identify factors independently predictive of a poor outcome (CPC 3-5). On the basis of these factors, a risk score for poor outcome was constructed.

RESULTS: We identified ten independent predictors of a poor outcome: older age, cardiac arrest occurring at home, initial rhythm other than ventricular fibrillation/tachycardia, longer duration of no flow, longer duration of low flow, administration of adrenaline, bilateral absence of corneal and pupillary reflexes, Glasgow Coma Scale motor response 1, lower pH and a partial pressure of carbon dioxide in arterial blood value lower than 4.5 kPa at hospital admission. A risk score based on the impact of each of these variables in the model yielded a median (range) AUC of 0.842 (0.840-0.845) and good calibration. Internal validation of the score using bootstrapping yielded a median (range) AUC corrected for optimism of 0.818 (0.816-0.821).

CONCLUSIONS: Among variables available at admission to intensive care, we identified ten independent predictors of a poor outcome at 6 months for initial survivors of OHCA. They reflected pre-hospital circumstances (six variables) and patient status on hospital admission (four variables). By using a simple and easy-to-use risk scoring system based on these variables, patients at high risk for a poor outcome after OHCA may be identified early.

ECMO

1. Resuscitation. 2017 Apr 14. pii: S0300-9572(17)30167-3. doi: 10.1016/j.resuscitation.2017.04.014. [Epub ahead of print]

A Pre-Hospital Extracorporeal Cardio Pulmonary Resuscitation (ECPR) strategy for treatment of refractory out hospital cardiac arrest: an observational study and propensity analysis.

Lamhaut L1, Hutin A2, Puymirat E3, Jouan J4, Raphalen JH5, Jouffroy R5, Jaffry M6, Dagrón C5, An K5, Dumas F7, Marijon E8, Bougouin W9, Tourtier JP10, Baud F5, Jouven X8, Danchin N3, Spaulding C8, Carli P11.

Abstract

BACKGROUND: Out of hospital cardiac arrest (OHCA) mortality rates remain very high with poor neurological outcome in survivors. Extracorporeal cardiopulmonary resuscitation (ECPR) is one of the treatments of refractory OHCA. This study used data from the mobile intensive care unit (MOICU) as part of the emergency medical system of Paris, and included all consecutive patients treated with ECPR (including pre-hospital ECPR) from 2011 to 2015 for the treatment of refractory OHCA, comparing two historical ECPR management strategies.

METHODS: We consecutively included refractory OHCA patients. In Period 1, ECPR was indicated in selected patients after 30min of advanced life support; in- or pre-hospital implementation depended on estimated transportation time and ECPR team availability. In Period 2, patient care relied on early ECPR initiation after 20min of resuscitation, stringent patient selection, epinephrine dose limitation and deployment of ECPR team with initial response team. Primary outcome was survival with good neurological function Cerebral Performance Category score (CPC score) 1 and 2 at ICU discharge or day 28.

FINDINGS: A total of 156 patients were included. (114 in Period 1 and 42 in Period 2). Baseline characteristics were similar. Mean low-flow duration was shorter by 20min ($p < 0.001$) in Period 2. Survival was significantly higher in Period 2: 29% vs 8% ($P < 0.001$), as confirmed by the multivariate analysis and propensity score. When combining stringent patient selection with an aggressive strategy, the survival rate increased to 38%. Pre-hospital ECPR implementation in itself was not an independent predictor of improved survival, but it was part of the strategy in Period 2.

INTERPRETATION: Our data suggest that ECPR in specific settings in the management of refractory OHCA is feasible and can lead to a significant increase in neurological intact survivors. These data, however, need to be confirmed by a large RCT.

RECERCA EXPERIMENTAL

1. Crit Care Med. 2017 Apr 20. doi: 10.1097/CCM.0000000000002464. [Epub ahead of print]

The Right Ventricle Is Dilated During Resuscitation From Cardiac Arrest Caused by Hypovolemia: A Porcine Ultrasound Study.

Aagaard R1, Granfeldt A, Bøtker MT, Mygind-Klausen T, Kirkegaard H, Løfgren B.

Abstract

OBJECTIVES: Dilation of the right ventricle during cardiac arrest and resuscitation may be inherent to cardiac arrest rather than being associated with certain causes of arrest such as pulmonary embolism. This study aimed to compare right ventricle diameter during resuscitation from cardiac arrest caused by hypovolemia, hyperkalemia, or primary arrhythmia (i.e., ventricular fibrillation).

DESIGN: Thirty pigs were anesthetized and then randomized to cardiac arrest induced by three different methods. Seven minutes of untreated arrest was followed by resuscitation. Cardiac ultrasonographic images were obtained during induction of cardiac arrest, untreated cardiac arrest, and resuscitation. The right ventricle diameter was measured. Primary endpoint was the right ventricular diameter at the third rhythm analysis.

SETTING: University hospital animal laboratory.

SUBJECTS: Female crossbred Landrace/Yorkshire/Duroc pigs (27-32 kg).

INTERVENTIONS: Pigs were randomly assigned to cardiac arrest caused by either hypovolemia, hyperkalemia, or primary arrhythmia.

MEASUREMENTS AND MAIN RESULTS: At the third rhythm analysis during resuscitation, the right ventricle diameter was 32 mm (95% CI, 29-35) in the hypovolemia group, 29 mm (95% CI, 26-32) in the hyperkalemia group, and 25 mm (95% CI, 22-28) in the primary arrhythmia group. This was larger than baseline for all groups ($p = 0.03$). When comparing groups at the third rhythm analysis, the right ventricle was larger for hypovolemia than for primary arrhythmia ($p < 0.001$).

CONCLUSIONS: The right ventricle was dilated during resuscitation from cardiac arrest caused by hypovolemia, hyperkalemia, and primary arrhythmia. These findings indicate that right ventricle dilation may be inherent to cardiac arrest, rather than being associated with certain causes of arrest. This contradicts a widespread clinical assumption that in hypovolemic cardiac arrest, the ventricles are collapsed rather than dilated.

2. J Trauma Acute Care Surg. 2017 Apr 18. doi: 10.1097/TA.0000000000001502. [Epub ahead of print]

Incremental balloon deflation following complete reboa 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 over 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, IQR 68-105sec). A rapid increase in aortic flow during a single balloon deflation step was observed in all animals (Median 819 mL/min IQR 664-1241mL/min) and corresponded with an immediate decrease in proximal MAP (Median 30 mmHg IQR 14.5-37mmHg). 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 impact aortic flow during balloon deflation are needed to facilitate controlled reperfusion following REBOA.

CASE REPORTS

1. Echo Res Pract. 2017 Apr 18. pii: ERP-17-0007. doi: 10.1530/ERP-17-0007. [Epub ahead of print]

Confirmed early myocardial rupture in a patient with pulseless electrical activity (PEA) following late presentation of ST elevation myocardial infarction.

Sekar B1,2,3, Martins J1,2,3, Petkar S1,2,3.

Abstract

A 69 year old male, an ex-smoker, was admitted with ongoing chest pain of 11 hours duration. Past medical history included treated hypertension and gastro-oesophageal reflux disease. He delayed seeking medical attention as he assumed the pain to be due to indigestion and kept taking antacids without much symptomatic relief. Clinical examination on arrival was unremarkable. Admission 12 lead electrocardiogram (ECG) was diagnostic of a recent anterolateral myocardial infarction (MI) (Figure 1a). Bedside trans-thoracic echocardiogram (TTE) confirmed an established anterolateral MI (Video 1, Figure 1b). Unfortunately, en route to the cardiac catheter laboratory for a primary percutaneous coronary intervention (PPCI), he suffered a cardiac arrest, due to pulseless electrical activity. An urgent repeat TTE confirmed

significant pericardial effusion due to myocardial rupture with thrombus in the left ventricular apex (Figure 1c, Video 2). Attempts at resuscitating him were unsuccessful. It is rare to see and confirm a diagnosis of early myocardial rupture outside the autopsy room, as it is an extremely serious and lethal mechanical complication of acute MI. PEA in a patient with a first MI and without overt heart failure has a high predictive accuracy for this diagnosis. Anterior location of MI, age >70 years, and female sex are risk factors for myocardial rupture, while a patent infarct related artery, either after PPCI or fibrinolytic therapy appears to be protective. As in this case, when time allows, TTE plays an invaluable role in diagnosing this condition.