Association of serum lactate with outcome after out-of-hospital cardiac arrest treated with therapeutic hypothermia.
Orban JC1, Novain M1, Cattet F1, Plattier R1, Nefzaoui M1, Hyvernat H2, Raguin O3, Kaidomar M4, Kerever S5, Ichai C1.

Abstract
AIMS: Lactate reflects hypoxic insult in many conditions and is considered as a prognosis factor. But, after cardiac arrest, its interest is still debated. Our study aimed to assess the prognosis value of lactate in out-of-hospital cardiac arrest patients treated with therapeutic hypothermia.
METHODS: This retrospective observational study included out-of-hospital cardiac arrest patients treated with therapeutic hypothermia in four ICUs. Lactate levels were compared at different times during the first 24 hours according to outcome at ICU discharge and to the type of death (multiorgan or neurologic failure).
RESULTS: Two hundred and seventy-two patients were included, 89 good outcome and 183 poor outcome. In the latter group, 171 patients died, from multiorgan failure in 30% and neurologic failure in 70%. Lactate levels were higher in the poor compared to the good outcome patients at admission (5.4 (3.3-9.4) vs. 2.2 (1.5-3.6) mmol/L; p<0.01), 12 hours (2.5 (1.6-4.7) vs. 1.4 (1.0-2.2) mmol/L; p<0.01) and 24 hours (1.8 (1.1-2.8) vs. 1.3 (0.9-2.1) mmol/L; p<0.01). Patients succumbing from multiorgan failure exhibited higher lactate levels compared to those dying from neurologic failure at admission (7.9 (3.9-12.0) vs. 5.2 (3.3-8.8) mmol/L; p<0.01), H12 (4.9 (2.1-8.9) vs. 2.2 (1.4-3.4) mmol/L; p<0.01) and H24 (3.3 (1.8-5.5) vs. 1.4 (1.1-2.5) mmol/L; p<0.01). Initial lactate levels showed an increasing proportion of poor outcome from the first to fourth quartile.
CONCLUSIONS: After out-of-hospital cardiac arrest treated with therapeutic hypothermia, lactate levels during the first 24 hours seem linked with ICU outcome. Patients dying from multiorgan failure exhibit higher initial lactate concentrations than patients succumbing from neurological failure.

Location of cardiac arrest and impact of pre-arrest chronic disease and medication use on survival.
Granfeldt A1, Wissenberg M2, Hansen SM3, Lippert FK4, Torp-Pedersen C3, Christensen EF5, Christiansen CF6.

Abstract
INTRODUCTION: Cardiac arrest in a private location is associated with a higher mortality when compared to public location. Past studies have not accounted for pre-arrest factors such as chronic disease and medication.
AIM: To investigate whether the association between cardiac arrest in a private location and a higher mortality can be explained by differences in chronic diseases and medication.
METHODS: We identified 27,771 out-of-hospital cardiac arrest patients ≥18 years old from the Danish Cardiac Arrest Registry (20012012). Using National Registries, we identified pre-arrest chronic disease and medication. To investigate the importance of cardiac arrest related factors and chronic disease and medication use we performed adjusted Cox regression analyses during day 0-7 and day 8-365 following cardiac arrest to calculate hazard ratios (HR) for death.
RESULTS: Day 0-7: Un-adjusted HR for death day 0-7 was 1.21 (95%CI:1.18-1.25) in private compared to public location. When including cardiac arrest related factors HR for death was 1.09 (95%CI:1.06-1.12). Adding chronic disease and medication to the analysis changed HR for death to 1.08 (95%CI:1.05-1.12). 8-365 day: The un-adjusted HR for death day 8-365 was 1.70 (95% CI: 1.43-2.02) in private compared to public location. When including cardiac arrest related factors the HR decreased to 1.39 (95% CI: 1.14-1.68). Adding chronic disease and medication to the analysis changed HR for death to 1.27 (95% CI:1.04-1.54).
CONCLUSION: The higher mortality following cardiac arrest in a private location is not fully explained by a higher prevalence of chronic disease and medication use in patients surviving until day 8.

Extracorporeal cardiopulmonary resuscitation.
Yam N1, McMullan DM1.
Author information:
Abstract
Extracorporeal life support (ECLS) is used for patients in isolated or combined cardiopulmonary failures. The use of ECLS to rescue patients with cardiac arrest that is refractory to conventional cardiopulmonary resuscitation has been shown to improve survival in many patient populations. Increasing recognition of the survival benefit associated with extracorporeal cardiopulmonary resuscitation (ECPR) has led to increased use of ECPR during the past decade. This review provides an overview of ECPR utilization; population-based clinical outcomes, resource utilization and costs associated this advanced form of life support therapy.

Accuracy of point-of-care focused echocardiography in predicting outcome of resuscitation in cardiac arrest patients: a systematic review and meta-analysis.
Tsou PY1, Kurbedin J2, Chen YS3, Chou EH2, Lee MG4, Lee MC5, Ma MH4, Chen SC4, Lee CC6.
Abstract
OBJECTIVE: We aim to summarize current evidence on the value of Point-of-Care (POC) focused echocardiography in the assessment of short-term survival in patients with cardiac arrest.
METHODS: PubMed and EMBASE were searched from inception to July 2016 for eligible studies that evaluated the utility of POC echocardiography in patients with cardiac arrest. Modified QUADAS was used to appraise the quality of included studies. A random-effect bivariate model and a hierarchical summary receiving operating curve were used to summarize the performance characteristics of focused echocardiography.
RESULTS: Initial search identified 961 citations of which 15 were included in our final analysis. A total of 1695 patients had POC echocardiography performed during resuscitation. Ultrasonography was mainly utilized to detect spontaneous cardiac movement (SCM) and identify reversible causes of cardiac arrest. Subcostal, apical and parasternal views were used to identify cardiac tamponade, pulmonary embolism, and pleural view for tension pneumothorax. Results of meta-analysis showed that SCM detected by focused echocardiography had a pooled sensitivity (0.95, 95%CI: 0.72-0.99) and specificity (0.80, 95%CI: 0.63-0.91) in predicting return of spontaneous circulation (ROSC) during cardiac arrest, with a positive likelihood ratio of 4.8 (95% CI: 2.5-9.4) and a negative likelihood ratio of 0.06 (95%CI: 0.01-0.39).
CONCLUSION: POC focused echocardiography can be used to identify reversible causes and predict short-term outcome in patients with cardiac arrest. In patients with a low pretest probability for ROSC, absence of SCM on echocardiography can predict a low likelihood of survival and guide the decision of resuscitation termination.

Categorization of survival and death after cardiac arrest.
Matthews EA1, Magid-Bernstein J1, Presciutti A1, Rodriguez A1, David R1, Park S1, Claassen J1, Agarwal S2.
Abstract
BACKGROUND: Most cardiac arrest (CA) patients remain comatose post-resuscitation, prompting goals-of-care (GOC) conversations. The impact of these conversations on patient outcomes has not been well described.
METHODS: Patients (n=385) treated for CA in Columbia University ICUs between 2008-2015 were retrospectively categorized into various modes of survival and death based on documented GOC discussions. Patients were deemed "medically unstable" if there was evidence of hemodynamic instability at the time of discussion. Cerebral performance category (CPC) greater than 2 was defined as poor outcome at discharge and one-year post-arrest.
RESULTS: The survival rate was 31%(n=118); most commonly after early recovery without any discussions (57%,n=67), followed by survival due to family wishes despite physicians predicting poor neurological prognosis (20%,n=24), and then survival after physician/family agreement of favorable prognosis (17%,n=20).

The survivors due to family wishes had significantly worse outcomes compared to the early recovery group (discharge:p=0.01; one-year:p=0.06) and agreement group (p <0.001; p<0.001), though 2 patients did achieve favorable recovery. Among nonsurvivors (n=267), withdrawal of life-sustaining therapy (WLST) while medically unstable was most common (31%;n=83), followed by death after care was capped (24%,n=65), then WLST while medically stable (17%,n=45). Death despite full support, brain death and WLST due to advanced directives were less common causes.

CONCLUSIONS: Most survivors due to family wishes despite poor neurological prognosis die or have poor outcomes at one-year. However, a small number achieve favorable recovery, demonstrating limitations with current prognostication methods. Among nonsurvivors, most WLST occurs while medically unstable, suggesting an overestimation of WLST due to unfavorable neurological prognosis.

Long-term survival following out-of-hospital cardiac arrest.
Andrew E1,2, Nehme Z3,2,4, Wolfe R2, Bernard S3,2, 5, Smith K3,2,4,6.

Abstract
OBJECTIVE: Although the factors associated with short-term survival from out-of-hospital cardiac arrest (OHCA) are well established, relatively little is known about the factors that influence long-term survival. In this study, we describe the 15-year survival outcomes of OHCA survivors and examine the influence of peri-arrest factors and 12-month outcomes on long-term survival.

METHODS: Survivors of OHCA between 2000 and 2014 identified from the Victorian Ambulance Cardiac Arrest Registry were linked with state-wide death records. Kaplan-Meier survival curves and Cox regression models were used to estimate long-term survival outcomes.

RESULTS: A total of 3449 patients were included with a mean survival duration of 11.9 (95% CI 11.7 to 12.1) years. The 1-year survival rate was 92.2% (95% CI 91.3% to 93.1%), while the 5, 10 and 15-year survival rates were 81.4% (95% CI 79.9% to 82.8%), 70.1% (95% CI 67.9% to 72.1%) and 62.3% (95% CI 58.9% to 65.5%), respectively. The standardised mortality rate of OHCA survivors was 5.6 times that of the standard Australian population in the first-year postarrest, but approached that of the standard population 5 years postarrest. Few peri-arrest factors were independently associated with long-term survival after discharge. Rather, transport to a percutaneous coronary intervention-capable hospital and discharge home from hospital were associated with longevity. Returning to work and favourable physical/functional recovery were associated with improved survival after 12 months.

CONCLUSIONS: OHCA survivors experience relatively favourable long-term survival after discharge from hospital. While peri-arrest factors had little influence on long-term survival after hospital discharge, favourable recovery postdischarge was associated with improved long-term outcomes.

ORGANITZACIÓ

In-hospital cardiac arrest epidemiology in a mature rapid response system.
Jones D1, Mercer I2, Heland M3, Detering K4, Radford S1, Hart G1, O'Donnell D5, Bellomo R1.

Abstract
An audit examined the epidemiology of in-hospital cardiac arrests 5 years after a rapid response system was introduced, exploring the frequency of arrests in monitored and unmonitored areas. Details of the initial cardiac rhythm and what proportion of events were preceded by a medical emergency team call were also assessed.

Lay persons alerted by mobile application system initiate earlier cardio-pulmonary resuscitation: a comparison with SMS- based system notification.
Luce CM1, Sandro M2, Roman B3, Claudio B3, Giulio C4, François R4, Romano M3, Catherine K5, Tiziano M4, Angelo A4.
Abstract

AIM: We compared the time to initiation of cardiopulmonary resuscitation (CPR) by lay responders and/or first responders alerted either via Short Message Service (SMS) or by using a mobile application-based alert system (APP).

METHODS: The Ticino Registry of Cardiac Arrest collects all data about out-of-hospital cardiac arrests (OHCAs) occurring in the Canton of Ticino. At the time of a bystander's call, the EMS dispatcher sends one ambulance and alerts the first-responders network made up of police officers or fire brigade equipped with an automatic external defibrillator, the so called "traditional" first responders, and - if the scene was considered safe - lay responders as well. We evaluated the time from call to arrival of traditional first responders and/or lay responders when alerted either via SMS or the new developed mobile APP.

RESULTS: Over the study period 593 OHCAs have occurred. Notification to the first responders network was sent via SMS in 198 cases and via mobile APP in 134 cases. Median time to first responder/lay responder arrival on scene was significantly reduced by the APP-based system (3.5 [2.8-5.2]) compared to the SMS-based system (5.6 [4.2-8.5] min, p 0.0001). The proportion of lay responders arriving first on the scene significantly increased (70% vs. 15%, p<0.01) with the APP. Earlier arrival of a first responder or of a lay responder determined a higher survival rate.

CONCLUSIONS: The mobile APP system is highly efficient in the recruitment of first responders, significantly reducing the time to the initiation of CPR thus increasing survival rates.

TRAUMA

Effect and accuracy of emergency dispatch telephone guidance to bystanders in trauma: post-hoc analysis of a prospective observational study.

Bakke HK1,2, Steinvik T3, Ruud H4, Wisborg T3,5,6.

Abstract

BACKGROUND: Emergency medical communication centres (EMCCs) dispatch and allocate ambulance resources, and provide first-aid guidance to on-scene bystanders. We aimed to 1) evaluate whether dispatcher guidance improved bystander first aid in trauma, and 2) to evaluate whether dispatchers and on-scene emergency medical services (EMS) crews identified the same first aid measures as indicated.

METHODS: For 18 months, the crew on the first EMS crew responding to trauma calls used a standard form to assess bystander first aid. Audio recordings of the corresponding telephone calls from bystanders to the EMCC were reviewed.

RESULTS: A total of 311 trauma calls were included. The on-scene EMS crew identified needs for the following first-aid measures: free airway in 26 patients, CPR in 6 patients, and hypothermia prevention in 179 patients. EMCC dispatchers advised these measures, respectively, in 16 (62%), 5 (83%), and 54 (30%) of these cases. Dispatcher guidance was not correlated with correctly performed bystander first aid. For potentially life saving first aid measures, all (20/20) callers who received dispatcher guidance attempted first aid, while only some few (4/22) of the callers who did not receive dispatcher guidance did not attempt first aid.

DISCUSSION: Overall, the EMCC dispatchers had low sensitivity and specificity for correctly identifying trauma patients requiring first-aid measures. Dispatcher guidance did not significantly influence whether on-scene bystander first aid was performed correctly or attempted in this study setting, with a remarkably high willingness to perform first-aid. However, the findings for potentially lifesaving measures suggests that there may be differences that this study was unable to detect.

CONCLUSION: This study found a high rate of first-aid willingness and performance, even without dispatcher prompting, and a low precision in dispatcher advice. This underlines the need for further knowledge about how to increase EMCC dispatchers' possibility to identify trauma patients in need of first aid. The correlation between EMCC-guidance and bystander first aid should be investigated in study settings with lower spontaneous first-aid rates.

Management of pregnancy and obstetric complications in prehospital trauma care: prehospital resuscitative hysterotomy/perimortem caesarean section.

Battaloglu E1, Porter K2.

Abstract

The need for prehospital resuscitative hysterotomy/perimortem caesarean section is rare. The procedures can be daunting and clinically challenging for practitioners. Maternal death can be averted by swift and decisive action. This guideline serves to inform prehospital practitioners about conducting maternal resuscitation following cardiac arrest, provides an evidence-based framework to support decision making and highlights areas for improvement in prehospital care.

Organ Donation, an Unexpected Benefit of Aggressive Resuscitation of Trauma Patients Presenting "Dead on Arrival".

Alarhayem AQ1, Cohn SM2, Muir MT3, Myers JG3, Fuqua J3, Eastridge BJ3.

Abstract

BACKGROUND: We sought to determine if aggressive resuscitation in trauma patients presenting without vital signs or "dead on arrival" (DOA) was futile. We also sought to determine if organ donation was an unexpected benefit of aggressive resuscitation.

STUDY DESIGN: We conducted a review of adults presenting to our Level 1 trauma center with no signs of life (pulse = 0; systolic blood pressure = 0; and no evidence of neurologic activity, GCS = 3). Primary outcome was survival to hospital discharge or major organ donation (heart, lung, kidney, liver or pancreas were harvested). We compared our survival rates to that of the National Trauma Data Bank (NTDB) in 2012. Patient demographics, Emergency Department (ED) vital signs and outcomes were analyzed.

RESULTS: 340 patients presented with no signs of life to our ED following injury (median ISS = 40). There were 7 survivors to discharge, but only 5 (1.5%) were functionally independent (4 were victims of penetrating trauma). Of the 333 non-survivors, 12 patients (3.6%) donated major organs (16 kidneys, 2 hearts, 4 livers, and 2 lungs). An analysis of the NTDB yielded a comparable survival rate for those presenting "DOA", with the overall survival rate being 1.8% (100/5,384); 2.3% for blunt trauma, and 1.4% for penetrating trauma.

CONCLUSIONS: Trauma patients presenting "Dead on Arrival" rarely (1. 5%) achieve functional independence. However, organ donation appears to be an under-recognized outcome benefit (3.6%) of the resuscitation of injury victims arriving without vital signs.

FÀRMACS

Effectiveness of Prehospital Epinephrine Administration in Improving Long-term Outcomes of Witnessed Out-of-hospital Cardiac Arrest Patients with Initial Non-shockable Rhythms.

Tomio J, Nakahara S, Takahashi H, Ichikawa M, Nishida M, Morimura N, Sakamoto T.

Abstract

OBJECTIVE: We evaluated the association between prehospital epinephrine administration by emergency medical services (EMS) and the long-term outcomes of out-of-hospital cardiac arrest (OHCA) with initial pulseless electrical activity (PEA) or asystole.

METHODS: We conducted a controlled, propensity-matched, retrospective cohort study by using Japan's nationwide OHCA registry database. We studied 110,239 bystander-witnessed OHCA patients aged 15-94 years with initial non-shockable rhythms registered between January 2008 and December 2012. We created 1-1 matched pairs of patients with or without epinephrine by using sequential risk set matching based on time-dependent propensity scores to balance the patients' severity and characteristics. We compared overall and neurologically intact survival 1 month after OHCA between cases and controls using conditional logistic regression models by category of the initial rhythm.

RESULTS: Propensity matching created 7,431 pairs in patients with PEA and 8,906 pairs in those with asystole. Epinephrine administration was associated with higher overall survival (4.49% vs. 2.96%; odds ratio [OR], 1.55; 95% confidence interval [CI], 1.30-1.85) but not with neurologically intact survival (0.98% vs. 0.78%; OR, 1.26; 95% CI, 0.89-1.78) in patients with PEA, and with higher overall survival (2.38% vs. 1.04%; OR, 2.34; 95% CI, 1.82-3.00) and neurologically intact survival (0.48% vs. 0.22%; OR, 2.28; 95% CI, 1.31-3.96) in those with asystole.

CONCLUSIONS: Prehospital epinephrine administration by EMS is favorably associated with long-term neurological outcomes in patients with initial asystole and with long-term survival outcomes in those with PEA.

Electrical Storm in ICD Recipients with Arrhythmogenic Right Ventricular Cardiomyopathy.
Yin K1, Ding L1, Hua W1, Zhang S1.
Abstract
BACKGROUND: Implantable cardioverter defibrillator (ICD) is the most important management for prevention of sudden cardiac death (SCD) in patients with arrhythmogenic right ventricular cardiomyopathy (ARVC). However, some patients may receive multiple ICD therapies in a short period, a condition referred as "electrical storm".
OBJECTIVES: This study aimed to determine the prevalence, therapeutic options, and prognostic implications of ES in ARVC patients with an ICD.
METHODS: We retrospectively analyzed the baseline and follow-up data of 39 ARVC patients with an ICD. ES was defined as three or more separated episodes of ventricular tachycardia or ventricular fibrillation (VT/VF) within a 24-h period.
RESULTS: During a median follow-up of 49 months (rang, 6-225), 12/39 (31%) patients suffered at least one episode of ES. The interval between the first ES and the initial ICD implantation ranged from 1 to 109 months, and ES was the first ICD discharge in 3 patients. The median number of VT/VF events per ES was 4 (range, 3-39). Five patients experienced 20 episodes of ES that were treated by antitachycardia pacing (ATP) only, while the other 7 patients suffered shock therapies during ES. In 3 patients, ES required emergency hospitalization, and the repeatedly occurred VT/VF was finally subsided by intravenous amiodarone. There was no significant difference in actual survival between patients with and without such an event.
CONCLUSIONS: ES is not rare in ARVC patients with an ICD for prevention of SCD, but it does not independently confer increased mortality. Intravenous amiodarone is effective in management of ES when VT/VF repeatedly occurred.

POST ATURADA

The Role of Post-Resuscitation Electrocardiogram in Patients With ST-Segment Changes in the Immediate Post-Cardiac Arrest Period.
Kim YJ1, Min SY2, Lee DH3, Lee BK3, Jeung KW3, Lee HJ4, Shin J4, Ko BS1, Ahn S1, Nam GB5, Lim KS1, Kim WY6.
Abstract
OBJECTIVES: The authors aimed to evaluate the role of post-resuscitation electrocardiogram (ECG) in patients showing significant ST-segment changes on the initial ECG and to provide useful diagnostic indicators for physicians to determine in which out-of-hospital cardiac arrest (OHCA) patients brain computed tomography (CT) should be performed before emergency coronary angiography.
BACKGROUND: The usefulness of immediate brain CT and ECG for all resuscitated patients with nontraumatic OHCA remains controversial.
METHODS: Between January 2010 and December 2014, 1,088 consecutive adult nontraumatic patients with return of spontaneous circulation who visited the emergency department of 3 tertiary care hospitals were enrolled. After excluding 245 patients with obvious extracardiac causes, 200 patients were finally included.
RESULTS: The patients were categorized into 2 groups: those with ST-segment changes with spontaneous subarachnoid hemorrhage (SAH) (n = 50) and those with OHCA of suspected cardiac origin group (n = 150). The combination of 4 ECG characteristics including narrow QRS (<120 ms), atrial fibrillation, prolonged QTc interval (≥460 ms), and ≥4 ST-segment depressions had a 66.0% sensitivity, 80.0% specificity, 52.4% positive predictive value, and 87.6% negative predictive value for predicting SAH. The area under the receiver-operating characteristic curves in the post-resuscitation ECG findings was 0.816 for SAH.
CONCLUSIONS: SAH was observed in a substantial number of OHCA survivors (25.0%) with significant ST-segment changes on post-resuscitation ECG. Resuscitated patients with narrow QRS complex and any 2 ECG

findings of atrial fibrillation, QTc interval prolongation, or ≥4 ST-segment depressions may help identify patients who need brain CT as the next diagnostic work-up.

Brain Gray Matter MRI Morphometry for Neuroprognostication After Cardiac Arrest.
Silva S1, Peran P, Kerhuel L, Malagurski B, Chauveau N, Bataille B, Lotterie JA, Celsis P, Aubry F, Citerio G, Jean B, Chabanne R, Perlbarg V, Velly L, Galanaud D, Vanhaudenhuyse A, Fourcade O, Laureys S, Puybasset L.
Abstract
OBJECTIVES: We hypothesize that the combined use of MRI cortical thickness measurement and subcortical gray matter volumetry could provide an early and accurate in vivo assessment of the structural impact of cardiac arrest and therefore could be used for long-term neuroprognostication in this setting.
DESIGN: Prospective cohort study.
SETTING: Five Intensive Critical Care Units affiliated to the University in Toulouse (France), Paris (France), Clermont-Ferrand (France), Liège (Belgium), and Monza (Italy).
PATIENTS: High-resolution anatomical T1-weighted images were acquired in 126 anoxic coma patients ("learning" sample) 16 ± 8 days after cardiac arrest and 70 matched controls. An additional sample of 18 anoxic coma patients, recruited in Toulouse, was used to test predictive model generalization ("test" sample). All patients were followed up 1 year after cardiac arrest.
INTERVENTIONS: None.
MEASUREMENTS AND MAIN RESULTS: Cortical thickness was computed on the whole cortical ribbon, and deep gray matter volumetry was performed after automatic segmentation. Brain morphometric data were employed to create multivariate predictive models using learning machine techniques. Patients displayed significantly extensive cortical and subcortical brain volumes atrophy compared with controls. The accuracy of a predictive classifier, encompassing cortical and subcortical components, has a significant discriminative power (learning area under the curve = 0.87; test area under the curve = 0.96). The anatomical regions which volume changes were significantly related to patient's outcome were frontal cortex, posterior cingulate cortex, thalamus, putamen, pallidum, caudate, hippocampus, and brain stem.
CONCLUSIONS: These findings are consistent with the hypothesis of pathologic disruption of a striatopallidal-thalamo-cortical mesocircuit induced by cardiac arrest and pave the way for the use of combined brain quantitative morphometry in this setting. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

Initial arterial carbon dioxide tension is associated with neurological outcome after resuscitation from cardiac arrest.
Tolins ML1, Henning DJ1, Gaieski DF2, Grossestreuer AV3, Jaworski A4, Johnson NJ5.
Abstract
STUDY OBJECTIVES: To determine the relationships between partial pressure of arterial carbon dioxide (PaCO2), prescribed minute ventilation (MV), and neurologic outcome in patients resuscitated from cardiac arrest.
METHODS: This was a retrospective cohort study utilizing a multicenter database of adult patients with return of spontaneous circulation (ROSC) after cardiac arrest. The primary outcome was neurologic status at hospital discharge, defined by Cerebral Performance Category (CPC) score: CPC 1-2 was favorable, CPC 3-5 was poor. We compared rates of initial normocarbia (PaCO2 31-49mmHg) and mean sequential PaCO2 measurements obtained over the first 24hours. We also assessed the influence of MV on the PaCO2 at initial, 6, 12, 18, and 24hours after cardiac arrest using univariate linear regression.
RESULTS: One hundred and fourteen patients from 3 institutions met inclusion criteria. Overall, 46/114 (40.4%, 95% CI: 31.4-49.4%) patients survived to hospital discharge, and 33/114 (28.9%, 20.6-37.2%) had CPC 1-2 at the time of discharge. A total of 38.9% (95% CI: 29.9-47.9%) of patients had initial normocarbia; 43.2% (28.6-57.8%) of these patients were discharged with CPC 1-2, compared with 20.3% (10.8-29.8%) of dyscarbic

patients. By 6hours, neurologic outcomes were not significantly associated with PaCO2. Prescribed MV was not associated with PaCO2 at any time point with the exception of a weak correlation at hour 18.

CONCLUSION: Initial normocarbia was associated with favorable neurological outcome in patients resuscitated from cardiac arrest. This relationship was not seen at subsequent time points. There was no significant association between prescribed MV and PaCO2 or neurologic outcome.

VENTILACIÓ

Favorable Neurocognitive Outcome with Low Tidal Volume Ventilation After Cardiac Arrest.
Beitler JR1, Ghafouri TB2, Jinadasa SP3, Mueller A4, Hsu L5, Anderson RJ6, Joshua J7, Tyagi S8, Malhotra A9, Sell RE10, Talmor D11.
Abstract
RATIONALE: Neurocognitive outcome after out-of-hospital cardiac arrest (OHCA) often is poor even when initial resuscitation succeeds. Lower tidal volumes (VT) attenuate extrapulmonary organ injury in other disease states and are neuro-protective in preclinical models of critical illness.

OBJECTIVE: To evaluate the association between VT and neurocognitive outcome following OHCA.

METHODS: Propensity-adjusted analysis of two-center retrospective cohort of OHCA patients who received mechanical ventilation for at least the first 48 hours of hospitalization. VT was calculated as the time-weighted average over the first 48 hours, in mL/kg predicted body weight (PBW). The primary endpoint was favorable neurocognitive outcome (cerebral performance category 1-2) at discharge.

MEASUREMENTS AND MAIN RESULTS: Of 256 included patients, 38% received time-weighted average VT > 8 mL/kg PBW during the first 48 hours. Lower VT was independently associated with favorable neurocognitive outcome in propensity-adjusted analysis (OR 1.61, 95% CI 1.13-2.28 per 1 mL/kg PBW decrease in VT; p=.008). This finding was robust to several sensitivity analyses. Lower VT also was associated with more ventilator-free days (ß = 1.78, 95% CI 0.39-3.16 per 1 mL/kg PBW decrease; p=.012) and shock-free days (ß = 1.31, 95% CI 0.10-2.51; p=.034). VT was not associated with hypercapnia (p=1.00). While the propensity score incorporated several biologically relevant covariates, only height, weight, and admitting hospital were independent predictors of VT ≤ 8 mL/kg PBW.

CONCLUSIONS: Lower VT following OHCA is independently associated with favorable neurocognitive outcome, more ventilator-free days, and more shock-free days. These findings suggest a role for low-VT ventilation after cardiac arrest.

DESFIBRIL·LACIÓ

Prehospital Predictors of Initial Shockable Rhythm in Out-of-Hospital Cardiac Arrest: Findings From the Taichung Sudden Unexpected Death Registry (THUNDER).
Lin YN1, Chang SS1, Wang LM2, Chi HT2 , Ueng KC3, Tsai CF3, Phan CS4, Lu LH5, Hii CH6, Chung YT7, Chugh SS8, Chen MF9, Wu TJ10, Chang KC11.
Abstract
OBJECTIVE: To identify the incidence and prehospital predictors of ventricular tachycardia/ventricular fibrillation (VT/VF) as the initial arrhythmia in patients with out-of-hospital cardiac arrest (OHCA) in central Taiwan.

PATIENTS AND METHODS: The Taichung Sudden Unexpected Death Registry program encompasses the Taichung metropolitan area in central Taiwan, with a population of 2.7 million and 17 destination hospitals for patients with OHCA. We performed a detailed analysis of demographic characteristics, circumstances of cardiac arrest, and emergency medical service records using the Utstein Style.

RESULTS: From May 1, 2013, through April 30, 2014, resuscitation was attempted in 2013 individuals with OHCA, of which 384 were excluded due to trauma and noncardiac etiologies. Of the 1629 patients with presumed cardiogenic OHCA, 7.9% (n=129) had initial shockable rhythm; this proportion increased to 18.8% (61 of 325) in the witnessed arrest subgroup. Male sex (odds ratio [OR], 2.45; 95% CI, 1.46-4.12; P<.001), age younger than 65 years (OR, 2.39, 95% CI, 1.58-3.62; P<.001), public location of arrest (OR, 4.61; 95% CI, 2.86-

7.44; P<.001), and witnessed status (OR, 3.98; 95% CI, 2.62-6.05; P<.001) were independent predictors of VT/VF rhythm.

CONCLUSION: The proportion of patients with OHCA presenting with VT/VF was generally low in this East Asian population. Of the prehospital factors associated with VT/VF, public location of OHCA was the strongest predictor of VT/VF in this population, which may affect planning and deployment of emergency medical services in central Taiwan.

FEEDBACK

Development of a diagnostic feedback device to assess neonatal cardiopulmonary resuscitation chest compression performance.
Lloyd D, van den Heever D, Dellimore K, Smith J.
Abstract
Neonatal cardiopulmonary resuscitation (NCPR) is an important intervention to save the lives of newborns who suffer from cardiac and respiratory arrest. Despite its importance there is a dearth of NCPR research and no commercially available feedback device suitable for use during NCPR. The aim of this study is to develop a diagnostic feedback device in the form of a patch placed on the infant's chest. The diagnostic feedback patch measures both the compression depth and force during NCPR, while giving audio-visual feedback according to current NCPR guidelines. The patch was systematically evaluated by conducting a series of hardware validation tests to assess the depth, force and feedback performance. The average errors in the depth and force were found to be 10.8% and 12.4%, respectively, with maximal errors below 20.7% and 24.1%. These results along with positive outcome of the feedback test suggest that the device is reliable on a hardware level and is suitable for further evaluation in a clinical setting.

Ventricular Fibrillation and Tachycardia detection from surface ECG using time-frequency representation images as input dataset for machine learning.
Mjahad A1, Rosado-Muñoz A2, Bataller-Mompeán M3, Francés-Víllora JV3, Guerrero-Martínez JF3.
Abstract

ECMO

Extracorporeal life support for refractory ventricular tachycardia.
Bhandary SP1, Joseph N2, Hofmann JP3, Saranteas T4, Papadimos TJ3.
Abstract
Extracorporeal life support (ECLS) is a very effective bridging therapy in patients with refractory ventricular tachycardia (VT) associated with cardiogenic shock. A moribund patient in extremis, is not amenable to optimization by standard ACC/AHA guidelines. New approaches and novel salvage techniques are necessary to improve outcomes in patients with refractory clinical settings such as malignant ventricular arrhythmias, cardiac arrest, cardiogenic shock and/or pulmonary failure until further management options are explored. Data base searches were done using key words such as ECLS, VT, cardiac arrest, VT ablation, venoarterial extra-corporeal membrane oxygenation (VA-ECMO). The use of ECLS has been described in a few case reports to facilitate VT ablation for incessant VT refractory to medical therapy. For patients with, out-of- hospital ventricular fibrillation (VF) and VT, Minnesota Resuscitation Consortium has implemented emergent advanced perfusion and reperfusion strategy, followed by coronary angiography and primary coronary intervention to improve outcome. The major indications for ECLS are cardiogenic shock related to acute myocardial infarction, myocarditis, post embolic acute cor pulmonale, drug intoxication and post cardiac arrest syndrome with the threat of multi-organ failure. ECLS permits the use of negative inotropic antiarrhythmic drug therapy, facilitates the weaning of catecholamine administration, thereby ending the vicious cycle of catecholamine driven electric storm. ECLS provides hemodynamic support during ablation procedure, while mapping and induction of VT is undertaken. ECLS provides early access to cardiac

catheterization laboratory in patients with cardiac arrest due to shockable rhythm. The current evidence from literature, supports the use of ECLS to ensure adequate vital organ perfusion in patients with refractory VT. ECLS is a safe, feasible and effective therapeutic option when conventional therapies are insufficient to support cardiopulmonary function. A highly driven multidisciplinary team approach is essential to accomplish this task.

PEDIATRIA

Pediatric Cardiac Arrest due to Drowning and Other Respiratory Etiologies: Neurobehavioral Outcomes in Initially Comatose Children.

Slomine BS1, Nadkarni VM2, Christensen JR1, Silverstein FS3, Telford R4, Topjian A2, Koch JD5, Sweney J4, Fink EL6, Mathur M7, Holubkov R4, Dean JM4, Moler FW3; Therapeutic Hypothermia after Pediatric Cardiac Arrest THAPCA Trial Investigators.

Abstract

AIM: To describe the 1-year neurobehavioral outcome of survivors of cardiac arrest secondary to drowning, compared with other respiratory etiologies, in children enrolled in the Therapeutic Hypothermia after Pediatric Cardiac Arrest Out-of-Hospital (THAPCA-OH) trial.

METHODS: Exploratory analysis of survivors (ages 1-18 years) who received chest compressions for ≥2minutes, were comatose, and required mechanical ventilation after return of circulation (ROC). Participants recruited from 27 pediatric intensive care units in North America received targeted temperature management [therapeutic hypothermia (33°C) or therapeutic normothermia (36.8°C)] within 6hours of ROC. Neurobehavioral outcomes included 1-year Vineland Adaptive Behavior Scales, Second Edition (VABS-II) total and domain scores and age-appropriate cognitive performance measures (Mullen Scales of Early Learning or Wechsler Abbreviated Scale of Intelligence).

RESULTS: Sixty-six children with a respiratory etiology of cardiac arrest survived for 1-year; 60/66 had broadly normal premorbid functioning (VABS-II ≥ 70). Follow up was obtained on 59/60 (30 with drowning etiology). VABS-II composite and domain scores declined significantly from premorbid scores in drowning and non-drowning groups (p <0.001), although declines were less pronounced for the drowning group. Seventy-two percent of children had well below average cognitive functioning at 1-year. Younger age, fewer doses of epinephrine, and drowning etiology were associated with better VABS-II composite scores. Demographic variables and treatment with hypothermia did not influence neurobehavioral outcomes.

CONCLUSIONS: Risks for poor neurobehavioral outcomes were high for children who were comatose after out-of-hospital cardiac arrest due to respiratory etiologies; survivors of drowning had better outcomes than those with other respiratory etiologies.

Effect of prehospital advanced airway management for pediatric out-of-hospital cardiac arrest.

Ohashi-Fukuda N1, Fukuda T2, Doi K3, Morimura N 3.

Abstract

BACKGROUND: Respiratory care may be important in pediatric out-of-hospital cardiac arrest (OHCA) due to the asphyxial nature of the majority of events. However, evidence of the effect of prehospital advanced airway management (AAM) for pediatric OHCA is scarce.

METHODS: This was a nationwide population-based study of pediatric OHCA in Japan from 2011 to 2012 based on data from the All-Japan Utstein Registry. We included pediatric OHCA patients aged between 1 and 17 years old. The primary outcome was one-month neurologically favorable survival defined as a Glasgow-Pittsburgh cerebral performance category (CPC) score of 1-2 (corresponding to a Pediatric CPC score of 1-3).

RESULTS: A total of 2,157 patients were included in the final cohort; 365 received AAM and 1,792 received bag-valve-mask (BVM) ventilation only. Among the 2,157 patients, 213 (9.9%) survived with favorable neurological outcomes (CPC of 1-2) one month after OHCA. There were no significant differences in

neurologically favorable survival between the AAM and BVM groups after adjusting for potential confounders, although there was a tendency favoring BVM ventilation: propensity score matching, OR 0.74 (95%CI 0.35-1.59), and multivariable logistic regression modeling, ORadjusted 0.55 (95% CI 0.24-1.14). Subgroup analyses demonstrated that there were no subgroups in which AAM was associated with neurologically favorable survival, including the non-cardiac (primarily asphyxial) etiology group.

CONCLUSIONS: In pediatric OHCA, prehospital AAM was not associated with an increased chance of neurologically favorable survival compared with BVM-only ventilation. However, careful consideration is required to interpret the findings, as there may be unmeasured residual confounders and selection bias.

Accuracy of Postresuscitation Team Debriefings in a Pediatric Emergency Department.

Mullan PC1, Cochrane NH2, Chamberlain JM3, Burd RS4, Brown FD5, Zinns LE6, Crandall KM5, O'Connell KJ3.

Abstract

STUDY OBJECTIVE: Guideline committees recommend postresuscitation debriefings to improve performance. "Hot" postresuscitation debriefings occur immediately after the event and rely on team recall. We assessed the ability of resuscitation teams to recall their performance in team-based, hot debriefings in a pediatric emergency department (ED), using video review as the criterion standard. We hypothesized that debriefing accuracy will improve during the course of the study.

METHODS: Resuscitation physician and nurse leaders cofacilitated debriefings after ED resuscitations involving cardiopulmonary resuscitation (CPR) or intubation. Debriefing teams recorded their self-assessments of clinical performance measures with standardized debriefing forms. The debriefing form data were compared with actual performance measured by video review at 2 pediatric EDs over 22 months. CPR performance measures included time to automated external defibrillator pad placement, epinephrine administration timing, and compression pause timing. Intubation measures included occurrences of oxygen desaturation, number of intubation attempts, and use of end-tidal carbon dioxide monitoring.

RESULTS: We analyzed 100 resuscitations (14 cardiac arrests, 22 cardiac arrests with intubation, and 64 intubations). The accuracy of debriefing answers was 87%, increasing from 83% to 91% between the first and second halves of the study period (7.7% difference; 95% confidence interval 0.2% to 15%). Debriefings that acknowledged an error in certain performance measures (ie, automated external defibrillator pad placement delay, multiple intubation attempts, and occurrence of oxygen desaturation) had significantly worse performance in those specific measures on video review.

CONCLUSION: Teams in postresuscitation debriefings had a higher degree of debriefing answer accuracy in the final 50 debriefings than in the first 50. Teams also distinguished various degrees of resuscitation performance.

Pediatric extracorporeal cardiopulmonary resuscitation during nights and weekends.

Burke CR1, Chan T2, Brogan TV2, McMullan DM3.

Abstract

AIM: Extracorporeal cardiopulmonary resuscitation (ECPR) is a lifesaving rescue therapy for patients with refractory cardiac arrest. Previous studies suggest that maintaining a 24/7 in-house surgical team may reduce ECPR initiation time and improve survival in adult patients. However, an association between cardiac arrest occurring during off-hours and ECPR outcome has not been established in children.

METHODS: This is a single institution, retrospective review of all pediatric patients who received ECPR from December 2008 to August 2015.

RESULTS: During the study period, ECPR was performed 54 times in 53 patients (20 Weekday, 34 Night/Weekend). Interval from ECPR activation to initiation of extracorporeal life support was significantly longer during night/weekends (49 mins Night/Weekend vs. 33 mins Weekday, p<0.001) as was the interval from ECPR activation to incision for cannulation (26 mins Night/Weekend vs. 14 mins Weekday, p <0.001). Rate of central nervous system (CNS) injury was higher in the night/weekend group (43% Night/Weekend vs. 15% Weekday, p=0.04), with associated 75% mortality prior to hospital discharge. Time of arrest did not impact survival to hospital discharge (44% Night/Weekend vs. 55% Weekday, p=0.57), one-year survival (33%

Night/Weekend vs. 44% Weekday, p=0.44), or neurologic outcome (Pediatric Cerebral Performance Score at 1-year post-ECPR, 1.45 Weekday vs. 1.50 Night/Weekend, p=0.82).

CONCLUSIONS: Cardiac arrest occurring at night or during weekend hours is associated with a longer ECPR initiation time and higher rates of CNS injury. However, prolonged pre-ECPR support associated with off-hours cardiac arrest does not appear to impact survival or functional outcome in pediatric patients.

RECERCA EXPERIMENTAL

Combination Treatment with Methylene Blue and Hypothermia in Global Cerebral Ischemia.
Li L1, Yang R1, Li P1, Lu H1, Hao J1, Li L1, Tucker D2, Zhang Q3.
Abstract
Therapeutic hypothermia (TH) is the most potent therapeutic strategy for global cerebral ischemia (GCI), usually induced by cardiac arrest. TH has been shown both to suppress the delayed neuronal cell death in the vulnerable hippocampal CA1 subregion and to improve neurological outcomes in experimental animals after GCI. However, given the multiple adverse effects resulting from TH, application of such a therapy is typically limited. In recent years, methylene blue (MB) has emerged as a potential therapeutic drug for the treatment of neurodegenerative diseases. In this study, we investigated the beneficial effects of mild TH combined with MB treatment after GCI. We report that both the neuronal survival in the hippocampal CA1 region and the hippocampus-dependent spatial learning and memory in the combined treatment animals were enhanced compared to those in the single treatment animals. Mechanistic studies revealed that combined TH and MB treatment significantly attenuated mitochondrial dysfunction induced by GCI in the hippocampus CA1 region. The combined treatment also markedly suppressed GCI-induced reactive gliosis and inflammation and reduced oxidative stress while enhancing the antioxidant capacity of hippocampal CA1 neurons. Finally, combining TH and MB synergistically attenuated the intrinsic cytochrome c/caspase-3 apoptotic pathway induced by GCI. Our results suggest that TH and MB act synergistically to protect the ischemic brain and suppress cognitive impairment caused by GCI.

Dihydrocapsaicin-induced hypothermia after asphyxiai cardiac arrest in rats.
Junyun He, Young L, Xiaofeng Jia.
Abstract
Cardiac arrest (CA) is one of the leading causes of mortality and morbidity in the world. Fast, reversible and controllable pharmaceutical-induced hypothermia (PIH) is strongly desired to treat ischemia-reperfusion brain injury. Dihydrocapsaicin (DHC), an agonist of transient receptor potential vanilloid type 1 cation channel (TRPV1), is an emerging candidate for PIH. Its capability to lower body temperature has been validated in both healthy and stroke animal models. However, DHC has shown cardiovascular effects and its safety and feasibility in a CA model has not been tested. Additionally, activated TRPV1 has multiple functions in addition to regulating body temperature and its effect on neurological recovery needs to be evaluated. In this study, we compared two methods of DHC administration, bolus injection and infusion via the femoral vein. We found that cardiovascular effects were only seen with a large dose DHC bolus injection. Then, we applied DHC-induced hypothermia in an asphyxial-CA rat model. We showed that DHC-treated rats were viable. Four-hour infusion of DHC at a rate of 0.75 mg/kg/h after CA maintained a body temperature of about 34 °C for at least 8 hours. DHC-treated rats had higher electrical activity during the first 4 hours after CA and had better neurological recovery during the 3 days after CA compared with normothermia rats. Additional pathway investigation of DHC administration following CA will further uncover the benefits of DHC-induced hypothermia.

Multimodel quantitative analysis of somatosensory evoked potentials after cardiac arrest with graded hypothermia.
Leanne Moon Young, Choudhary R, Xiaofeng Jia.
Abstract

Cardiac arrest (CA) is one of the most prominent causes of morbidity and mortality in adults. Therapeutic hypothermia (TH) is a recommended treatment to improve survival and functional outcome following CA, however, it is unclear what degree of TH is most beneficial. It has been suggested that TH of 33°C provides no survival or outcome benefits over TH of 36°C. Additionally, there is a lack of verified objective quantitative prognostic tools for comatose CA patients under TH. In this study, we calculated three quantitative markers of somatosensory evoked potentials (SSEP) to examine their potential to track recovery in the early period following CA under graded TH. A total of 16 rats were randomly divided among 4 temperature groups (n=4/group): normothermia (N0, 36.5-37.5°C), hypothermia 1 (H1, 30-32°C), hypothermia 2 (H2, 32-34°C) and hypothermia 3 (H3, 34-36°C). All rats underwent a 15min baseline SSEP recording followed by 9min asphyxial-CA, resulting in severe cerebral injury, and immediate temperature management following resuscitation for 6 hours. SSEP recordings were maintained in 15 min intervals from 30min-4hrs after resuscitation. The N10 amplitude, N10 latency and quantitative SSEP phase space area (qSSEP-PSA) were calculated for the early recovery period and normalized to their respective baselines. Functional recovery was determined by the neurological deficit scale (NDS). N10 amplitude was significantly larger in H1, H2 and H3 compared to N0. N10 latency was significantly longer in H1 than all temperature groups and all hypothermia groups had significantly longer latencies than N0. qSSEP-PSA had significantly better recovery in H1 and H2 than N0. Animals with good outcome (72hr NDS>50) had better recovery of all markers. N10 amplitude was significantly correlated with N10 latency and qSSEP-PSA. The results importantly demonstrate that quantified SSEPs have the potential to objectively track recovery following CA with graded TH.

The Resuscitative and Pharmacokinetic Effects of Humeral Intraosseous Vasopressin in a Swine Model of Ventricular Fibrillation.
Burgert JM1, Johnson AD1, Garcia-Blanco J1, Fulton LV2, Loughren MJ3.
Abstract
Introduction: The American Heart Association (AHA; Dallas, Texas USA) and European Resuscitation Council (Niel, Belgium) cardiac arrest (CA) guidelines recommend the intraosseous (IO) route when intravenous (IV) access cannot be obtained. Vasopressin has been used as an alternative to epinephrine to treat ventricular fibrillation (VF). Hypothesis/Problem Limited data exist on the pharmacokinetics and resuscitative effects of vasopressin administered by the humeral IO (HIO) route for treatment of VF. The purpose of this study was to evaluate the effects of HIO and IV vasopressin, on the occurrence, odds, and time of return of spontaneous circulation (ROSC) and pharmacokinetic measures in a swine model of VF.
METHODS: Twenty-seven Yorkshire-cross swine (60 to 80 kg) were assigned randomly to three groups: HIO (n=9), IV (n=9), and a control group (n=9). Ventricular fibrillation was induced and untreated for two minutes. Chest compressions began at two minutes post-arrest and vasopressin (40 U) administered at four minutes post-arrest. Serial blood specimens were collected for four minutes, then the swine were resuscitated until ROSC or 29 post-arrest minutes elapsed.
RESULTS: Fisher's Exact test determined ROSC was significantly higher in the HIO 5/7 (71.5%) and IV 8/11 (72.7%) groups compared to the control 0/9 (0.0%; P=.001). Odds ratios of ROSC indicated no significant difference between the treatment groups (P=.68) but significant differences between the HIO and control, and the IV and control groups (P=.03 and .01, respectively). Analysis of Variance (ANOVA) indicated the mean time to ROSC for HIO and IV was 621.20 seconds (SD=204.21 seconds) and 554.50 seconds (SD=213.96 seconds), respectively, with no significant difference between the groups (U=11; P=.22). Multivariate Analysis of Variance (MANOVA) revealed the maximum plasma concentration (Cmax) and time to maximum concentration (Tmax) of vasopressin in the HIO and IV groups was 71753.9 pg/mL (SD=26744.58 pg/mL) and 61853.7 pg/mL (SD=22745.04 pg/mL); 111.42 seconds (SD=51.3 seconds) and 114.55 seconds (SD=55.02 seconds), respectively. Repeated measures ANOVA indicated no significant difference in plasma vasopressin concentrations between the treatment groups over four minutes (P=.48).
CONCLUSIONS: The HIO route delivered vasopressin effectively in a swine model of VF. Occurrence, time, and odds of ROSC, as well as pharmacokinetic measurements of HIO vasopressin, were comparable to IV.

Effects of Shenfu Injection () on cerebral metabolism in a porcine model of cardiac arrest.
Yin Q1, Wu CJ2, Yang J2, Hang CC2, Li CS3.

Abstract
OBJECTIVE: To investigate the effects of Shenfu Injection (, SFI) on cerebral metabolism in a porcine model of cardiac arrest (CA).
METHODS: Thirty Wuzhishan minipigs were randomly assigned to the control group (n=6), epinephrine group (EP group, n=12) and Sfigroup (n=12). After 8 min of untreated ventricular fifibrillation (VF), pigs in the EP group or Sfigroup were administered with either EP (0.02 mg/kg) or Sfi(1.0 mL/kg), respectively. After successful resuscitation, cerebrospinal fluid (CSF) levels of glucose, pyruvate, lactate, glutamate and glycerol were measured at 1, 6, 12 and 24 h after recover from spontaneous circulation (ROSC). In addition, neurologic defificit score (NDS) was calculated at 24 h after ROSC. Surviving pigs were killed at 24 h after ROSC, and the brain tissue was obtained for ultra-microstructure examination.
RESULTS: Compared with the EP group, CSF glucose and pyruvate levels were higher (all P<0.01), and lactate levels were lower in the Sfigroup (P<0.01). Meanwhile, CSF glutamate and glycerol levels in the Sfigroup were lower in comparison to the EP group (all P<0.05). In addition, Sfidecreased NDS at 24 h after ROSC (P<0.01), and alleviated the histopathological damage of the brain.
CONCLUSIONS: Sficould alleviate brain injury after CA, which may be associated with improving cerebral metabolism.

CASE REPORTS

Anomalous origin of the circumflex coronary artery presenting with ventricular fibrillation cardiac arrest.
Harky A1, Bashir M1, Garner M1, Hsia T2.
Abstract
We report a case of an incidental finding of an anomalous left circumflex coronary artery arising from the right pulmonary artery that effectuated a ventricular fibrillation cardiac arrest in a woman aged 34 years. This rarity was detected during routine work-up to delineate the cause of this arrhythmia. Our patient had a background of double-outlet right ventricle and a ventricular septal defect, which was repaired with a Dacron patch and a left ventricle patch over to the aorta at age 14 months. Angiographic study at the time of her presentation showed anomalous origin of the left circumflex artery originating from the right pulmonary artery; this was discussed in multispecialty team meeting and surgical intervention was recommended; eventually, surgery was performed with reimplantation of the anomalous circumflex artery into the ascending aorta. We highlight the importance of early angiographic studies in patients with known congenital heart defects and emphasise the optimal strategy of treatment

Novel approach for independent control of brain hypothermia and systemic normothermia: cerebral selective deep hypothermia for refractory cardiac arrest.
Wang CH1, Lin YT1, Chou HW1, Wang YC 1, Hwang JJ1, Gilbert JR2, Chen YS1.
Abstract
A 38-year-old man was found unconscious, alone in the driver's seat of his car. The emergency medical team identified his condition as pulseless ventricular tachycardia. Defibrillation was attempted but failed. Extracorporeal membrane oxygenation (ECMO) was started in the emergency room 52 min after the estimated arrest following the extracorporeal cardiopulmonary resuscitation (ECPR) protocol in our center. The initial prognosis under the standard protocol was <25% chance of survival. A novel adjunctive to our ECPR protocol, cerebral selective deep (<30°C) hypothermia (CSDH), was applied. CSDH adds a second independent femoral access extracorporeal circuit, perfusing cold blood into the patient's common carotid artery. The ECMO and CSDH circuits demonstrated independent control of cerebral and core temperatures. Nasal temperature was lowered to below 30°C for 12 hours while core was maintained at normothermia. The patient was discharged without significant neurological deficit 32 days after the initial arrest.

RCP

Disparities in telephone CPR access and timing during out-of-hospital cardiac arrest.

Nuño T1, Bobrow BJ2, Rogge-Miller KA3, Panczyk M 4, Mullins T4, Tormala W4, Estrada A5, Keim SM6, Spaite DW6.

Abstract

AIM: Spanish-only speaking residents in the United States face barriers to receiving potentially life-saving 911 interventions such as Telephone -cardiopulmonary resuscitation (TCPR) instructions. Since 2015, 911 dispatchers have placed an increased emphasis on rapid identification of potential cardiac arrest. The purpose of this study was to describe the utilization and timing of the 911 system during suspected OHCA by Spanish-speaking callers in Metropolitan Phoenix, Arizona.

METHODS: The dataset consisted of suspected OHCA from 911 centers from October 10, 2010 through December 31, 2013. Review of audio TCPR process data included whether the need for CPR was recognized by telecommunicators, whether CPR instructions were provided, and the time elements from call receipt to initiation of compressions.

RESULTS: A total of 3398 calls were made to 911 for suspected OHCA where CPR was indicated. A total of 39 (1.2%) were determined to have a Spanish language barrier. This averages to 18 calls per year with a Spanish language barrier during the study period, compared with 286 OHCAs expected per year among this population. The average time until telecommunicators recognized CPR need was 87.4s for the no language barrier group compared to 160.6s for the Spanish-language barrier group (p<0.001).Time to CPR instructions started was significantly different between these groups (144.4s vs 231.3s, respectively) (p<0.001), as was time to first compression, (174.4s vs. 290.9s, respectively) (p<0.001).

CONCLUSIONS: Our study suggests that Hispanic callers under-utilize the 911 system, and when they do call 911, there are significant delays in initiating CPR.

REGISTRES I REVISIONS

External validation of the ROSC after cardiac arrest (RACA) score in a physician staffed emergency medical service system.

Kupari P1, Skrifvars M2,3, Kuisma M4.

Abstract

BACKGROUND: The return of spontaneous circulation (ROSC) after cardiac arrest (RACA) score may have implications as a quality indicator for the emergency medical services (EMS) system. We aimed to validate this score externally in a physician staffed urban EMS system.

METHODS: We conducted a retrospective cohort study. Data on resuscitation attempts from the Helsinki EMS cardiac arrest registry from 1.1.2008 to 31.12.2010 were collected and analyzed. For each attempted resuscitation the RACA score variables were collected and the score calculated. The endpoint was ROSC defined as palpable pulse over 30 s. Calibration was assessed by comparing predicted and observed ROSC

rates in the whole sample, separately for shockable and non-shockable rhythm, and separately for resuscitations lead by a specialist, registrar or medical supervisor (i.e., senior paramedic). Data are presented as medians and interquartile ranges. Statistical testing included chi-square test, the Mann-Whitney U test, Hosmer-Lemeshow goodness of fit test and calculation of 95% confidence intervals (CI) for proportions.

RESULTS: A total of 680 patients were included of whom 340 attained ROSC. The RACA score was higher in patients with ROSC (0.62 [0.46-0.69] than in those without (0.46 [0.36-0.57]) (p < 0.001). Observed against predicted ROSC indicated reasonable calibration overall (p = 0.30), with better calibration in patients with a shockable initial rhythm (p = 0.75) than in patients with a non-shockable rhythm (p = 0.04). There was no statistical difference between observed and predicted ROSC rates in resuscitations attended by a specialist (50% vs 53%, 95% CI 45-55) or registrar (55% vs 53%, 95% CI 48-62), but rates were lower than predicted in resuscitations lead by a medical supervisor (36% vs 49%, 95% CI 25-47).

DISCUSSION: Developing a practical severity-of-illness scoring system for out-of-hospital cardiac arrest patients would allow patient heterogeneity adjustment and measurement of quality of care in analogy to commoly used severity-of-illness- scores developed for the similar purposes for the general intensive care unit population. However, transferring RACA score to another country with different population and EMS system might affect the performance and generalizability of the score.

CONCLUSIONS: This study found a good overall calibration and moderate discrimination of the RACA score in a physician staffed urban EMS system which suggests external validity of the score. Calibration was suboptimal in patients with a non-shockable rhythm which may due to a local do-not-attempt-resuscitation policy. The lower than expected overall ROSC rate in resuscitations attended by medical supervisors requires further study.

Continuous chest compression versus interrupted chest compression for cardiopulmonary resuscitation of non-asphyxial out-of-hospital cardiac arrest.

Zhan L1, Yang LJ2, Huang Y3,4, He Q3,4, Liu GJ5.

China, 610041.

Abstract

BACKGROUND: Out-of-hospital cardiac arrest (OHCA) is a major cause of death worldwide. Cardiac arrest can be subdivided into asphyxial and non asphyxial etiologies. An asphyxia arrest is caused by lack of oxygen in the blood and occurs in drowning and choking victims and in other circumstances. A non asphyxial arrest is usually a loss of functioning cardiac electrical activity. Cardiopulmonary resuscitation (CPR) is a well-established treatment for cardiac arrest. Conventional CPR includes both chest compressions and 'rescue breathing' such as mouth-to-mouth breathing. Rescue breathing is delivered between chest compressions using a fixed ratio, such as two breaths to 30 compressions or can be delivered asynchronously without interrupting chest compression. Studies show that applying continuous chest compressions is critical for survival and interrupting them for rescue breathing might increase risk of death. Continuous chest compression CPR may be performed with or without rescue breathing.

OBJECTIVES: To assess the effects of continuous chest compression CPR (with or without rescue breathing) versus conventional CPR plus rescue breathing (interrupted chest compression with pauses for breaths) of non-asphyxial OHCA.

SEARCH METHODS: We searched the Cochrane Central Register of Controlled Trials (CENTRAL; Issue 1 2017); MEDLINE (Ovid) (from 1985 to February 2017); Embase (1985 to February 2017); Web of Science (1985 to February 2017). We searched ongoing trials databases including controlledtrials.com and clinicaltrials.gov. We did not impose any language or publication restrictions.

SELECTION CRITERIA: We included randomized and quasi-randomized studies in adults and children suffering non-asphyxial OHCA due to any cause. Studies compared the effects of continuous chest compression CPR (with or without rescue breathing) with interrupted CPR plus rescue breathing provided by rescuers (bystanders or professional CPR providers).

DATA COLLECTION AND ANALYSIS:

Two authors extracted the data and summarized the effects as risk ratios (RRs), adjusted risk differences (ARDs) or mean differences (MDs). We assessed the quality of evidence using GRADE.

MAIN RESULTS: We included three randomized controlled trials (RCTs) and one cluster-RCT (with a total of 26,742 participants analysed). We identified one ongoing study. While predominantly adult patients, one study included children. Untrained bystander-administered CPRThree studies assessed CPR provided by untrained bystanders in urban areas of the USA, Sweden and the UK. Bystanders administered CPR under telephone instruction from emergency services. There was an unclear risk of selection bias in two trials and low risk of detection, attrition, and reporting bias in all three trials. Survival outcomes were unlikely to be affected by the unblinded design of the studies.We found high-quality evidence that continuous chest compression CPR without rescue breathing improved participants' survival to hospital discharge compared with interrupted chest compression with pauses for rescue breathing (ratio 15:2) by 2.4% (14% versus 11.6%; RR 1.21, 95% confidence interval (CI) 1.01 to 1.46; 3 studies, 3031 participants).One trial reported survival to hospital admission, but the number of participants was too low to be certain about the effects of the different treatment strategies on survival to admission(RR 1.18, 95% CI 0.94 to 1.48; 1 study, 520 participants; moderate-quality evidence).There were no data available for survival at one year, quality of life, return of spontaneous circulation or adverse effects.There was insufficient evidence to determine the effect of the different strategies on neurological outcomes at hospital discharge (RR 1.25, 95% CI 0.94 to 1.66; 1 study, 1286 participants; moderate-quality evidence). The proportion of participants categorized as having good or moderate cerebral performance was 11% following treatment with interrupted chest compression plus rescue breathing compared with 10% to 18% for those treated with continuous chest compression CPR without rescue breathing. CPR administered by a trained professional In one trial that assessed OHCA CPR administered by emergency medical service professionals (EMS) 23,711 participants received either continuous chest compression CPR (100/minute) with asynchronous rescue breathing (10/minute) or interrupted chest compression with pauses for rescue breathing (ratio 30:2). The study was at low risk of bias overall.After OHCA, risk of survival to hospital discharge is probably slightly lower for continuous chest compression CPR with asynchronous rescue breathing compared with interrupted chest compression plus rescue breathing (9.0% versus 9.7%) with an adjusted risk difference (ARD) of -0.7%; 95% CI (-1.5% to 0.1%); moderate-quality evidence.There is high-quality evidence that survival to hospital admission is 1.3% lower with continuous chest compression CPR with asynchronous rescue breathing compared with interrupted chest compression plus rescue breathing (24.6% versus 25.9%; ARD -1.3% 95% CI (-2.4% to -0.2%)).Survival at one year and quality of life were not reported.Return of spontaneous circulation is likely to be slightly lower in people treated with continuous chest compression CPR plus asynchronous rescue breathing (24.2% versus 25.3%; -1.1% (95% CI -2.4 to 0.1)), high-quality evidence.There is high-quality evidence of little or no difference in neurological outcome at discharge between these two interventions (7.0% versus 7.7%; ARD -0.6% (95% CI -1.4 to 0.1).Rates of adverse events were 54.4% in those treated with continuous chest compressions plus asynchronous rescue breathing versus 55.4% in people treated with interrupted chest compression plus rescue breathing compared with the ARD being -1% (-2.3 to 0.4), moderate-quality evidence).

AUTHORS' CONCLUSIONS: Following OHCA, we have found that bystander-administered chest compression-only CPR, supported by telephone instruction, increases the proportion of people who survive to hospital

discharge compared with conventional interrupted chest compression CPR plus rescue breathing. Some uncertainty remains about how well neurological function is preserved in this population and there is no information available regarding adverse effects.When CPR was performed by EMS providers, continuous chest compressions plus asynchronous rescue breathing did not result in higher rates for survival to hospital discharge compared to interrupted chest compression plus rescue breathing. The results indicate slightly lower rates of survival to admission or discharge, favourable neurological outcome and return of spontaneous circulation observed following continuous chest compression. Adverse effects are probably slightly lower with continuous chest compression.Increased availability of automated external defibrillators (AEDs), and AED use in CPR need to be examined, and also whether continuous chest compression CPR is appropriate for paediatric cardiac arrest.

Long-Term Mortality of Emergency Medical Services Patients.

Bøtker MT1, Terkelsen CJ2, Sørensen JN3, Jepsen SB4, Johnsen SP5, Christensen EF6, Andersen MS7.

Abstract

STUDY OBJECTIVE: Emergency medical services (EMS) provides out-of-hospital care to patients with life-threatening conditions, but the long-term outcomes of EMS patients are unknown. We seek to determine the long-term mortality of EMS patients in Denmark.

METHODS: We analyzed linked EMS, hospital, and vital status data from 3 of 5 geographic regions in Denmark. We included events from July 1, 2011, to December 31, 2012. We classified EMS events according to primary dispatch category (unconsciousness/cardiac arrest, accidents/trauma, chest pain, dyspnea, neurologic symptoms, and other EMS patients). The primary outcome was 1-year mortality adjusted for age, sex, and Charlson comorbidity index.

RESULTS: Among 142,125 EMS events, primary dispatch categories were unconsciousness or cardiac arrest 5,563 (3.9%), accidents or trauma 40,784 (28.7%), chest pain 20,945 (14.7%), dyspnea 9,607 (6.8%), neurologic symptoms 17,804 (12.5%), and other EMS patients 47,422 (33.4%). One-year mortality rates were unconscious or cardiac arrest 54.7% (95% confidence interval [CI] 53.4% to 56.1%), accidents or trauma 7.8 (95% CI 7.5% to 8.1%), chest pain 8.5% (95% CI 8.1% to 9.0%), dyspnea 27.7% (95% CI 26.7% to 28.7%), neurologic symptoms 14.1% (95% CI 13.6% to 14.7%), and other EMS patients 11.1% (95% CI 10.8% to 11.4%). Compared with other EMS conditions, adjusted 1-year mortality was higher in unconsciousness or cardiac arrest (risk ratio [RR] 2.6; 95% CI 2.5 to 2.7), dyspnea (RR 1.5; 95% CI 1.4 to 1.5), and in neurologic symptoms (RR 1.1; 95% CI 1.0 to 1.1), but lower in chest pain (RR 0.6; 95% CI 0.6 to 0.7) and accidents or trauma (RR 0.8; 95% CI 0.8 to 0.8).

CONCLUSION: EMS patients with unconsciousness or cardiac arrest, dyspnea, and neurologic symptoms are at highest risk of long-term mortality. Our results suggest a potential for outcome improvement in these patients.

Adult Out-of-Hospital Cardiac Arrest in Philadelphia from 2008-2012: An Epidemiological Study.

Gaieski DF1, Agarwal AK2, Abella BS2, Neumar RW 3, Mechem C4, Cater SW5, Shofer FS2, Leary M2, Pajerowski WP6, Becker LB2, Carr B7, Merchant R2, Band RA7.

Abstract

BACKGROUND: Wide variation in out-of-hospital cardiac arrest (OHCA) survival has been reported, with low survival in urban settings. We sought to describe the epidemiology of OHCA in Philadelphia, Pennsylvania, the fifth largest U.S. city, and identify potential areas for targeted interventions to improve survival.

METHODS AND RESULTS: Retrospective chart review of adult, non-traumatic, OHCA occurring in Philadelphia between 2008 and 2012. We determined incidence and epidemiological factors including: demographics, initial cardiac rhythm, bystander cardiopulmonary resuscitation, automated external defibrillator use, return of spontaneous circulation and 30-day survival. 5,198 cases of adult, non-traumatic OHCA were identified. The incidence was 81.5/100,000. The majority of cases occurred in a residence (76.2%); 30.4% were witnessed events; the initial cardiac rhythm was pulseless ventricular tachycardia or ventricular fibrillation in 6.2% of cases, pulseless electrical activity in 21.0%, asystole in 38.3% and was unknown or undocumented in the remaining 34.5%. Multivariate logistic regression analysis demonstrated increased 30-day survival with younger age, shockable cardiac rhythms, and daytime arrest. 30-day survival was 8.1% for EMS-assessed patients and 8.6% for EMS-transported patients.

CONCLUSIONS: Philadelphia's reported incidence is consistent with urban settings although the survival rate is higher than other urban centers.

The future is now: neuroprotection during cardiopulmonary resuscitation.

Moore JC1, Bartos JA, Matsuura TR, Yannopoulos D.

Abstract

PURPOSE OF REVIEW: Survival with favorable neurological function after cardiac arrest remains low. The purpose of this review is to identify recent advances that focus on neuroprotection during cardiopulmonary resuscitation (CPR).

RECENT FINDINGS: Multiple strategies have been shown to enhance neuroprotection during CPR. Brain perfusion during CPR is increased with therapies such as active compression decompression CPR and intrathoracic pressure regulation that improve cardiac preload and decrease intracranial pressure. Head Up CPR has been shown to decrease intracranial pressure thereby increasing cerebral perfusion pressure and cerebral blood flow. Sodium nitroprusside enhanced CPR increases cerebral perfusion, facilitates heat exchange, and improves neurologic survival in swine after cardiac arrest. Postconditioning has been administered during CPR in laboratory settings. Poloxamer 188, a membrane stabilizer, and ischemic postconditioning have been shown to improve cardiac and neural function after cardiac arrest in animal models. Postconditioning with inhaled gases protects the myocardium, with more evidence mounting for the potential for neural protection.

SUMMARY: Multiple promising neuroprotective therapies are being developed in animal models of cardiac arrest, and are in early stages of human trials. These therapies have the potential to be bundled together to improve rates of favorable neurological survival after cardiac arrest.

Sudden Cardiac Death: Autopsy Findings in 7200 Cases Between 2001 and 2015.

Ifteni P1, Barabas B, Gavris C, Moga M, Burtea V, Dracea L.

Abstract

BACKGROUND: Sudden cardiac death (SCD) is a sudden unexpected event, from a cardiac cause, that occurs in less than 1 hour after the symptom onset in a person without any previous condition that would seem fatal or who was seen without any symptoms 24 hours before being found dead.

OBJECTIVE: The aims of the study were to describe the features of SCD in Brasov County, Romania (400,000 inhabitants) according to local forensic department autopsy files.

METHODS: We retrospectively chart reviewed a number of 7200 autopsy reports between 2001 and 2015 to identify cases of SCD. Data included cause of death, demographics, location of the event, prior known illnesses, as well as psychiatric comorbidities.

RESULTS:

Of 7200 autopsies effectuated during the 15-year period, we excluded 276 cases with incomplete data. The rest of the 6924 cases included 3000 autopsies (43.3%) of individuals with a violent death: accidents, suicides, and homicides. In 3924 cases (56.7%), the death was nonviolent. Of 3924 nonviolent deaths, based on the registry of Forensic department, we identified 1085 cases of SCD (749 males [69%]; mean age, 56 ± 17.4 years).

CONCLUSION: Sudden death with a cardiac etiology remained a major cause of unexpected end of life in the vast majority of cases autopsied during the study period.

ACR INTRAHOSPITALÀRIA

Perioperative cardiac arrest in the operating room environment: a review of the literature.

Hinkelbein J1, Andres J2, Thies KC3, De Robertis E4.

Abstract

Cardiac arrest in the operating room (OR) environment is a rare but potentially catastrophic event with mortality rates of more than 50%. Cardiac arrest during anaesthesia and the immediate postoperative period is distinct from non-operative settings or other in-hospital cardiac arrests since it is almost always witnessed and often anticipated. Contributing factors are known, and the event is generally rapidly recognized, as patients are usually under full monitoring. The nature of the cardiac arrest in the OR environment is also different as it is not only related to the patient's conditions but likewise to the anaesthetic and the surgical

procedure. Several recent retrospective registry studies have investigated the incidence of perioperative cardiac arrest; in non-cardiac surgery patients, the incidence is reported to range from 0.2 to 1.1 per 10,000 adults and from 1.4 to 4.6 per 10,000 children. Successful management of cardiac arrest during surgery and beyond requires not only individual technical skills and a well-organized team response, but also an institutional safety culture embedded in everyday practice through continuous education, training and multidisciplinary cooperation. Evidence based guidelines and standardized treatment algorithms addressing the particularities of peri-operative cardiac arrest would be helpful to facilitate training and to strengthen our response. Existing guidelines are not comprehensive enough to cover specific aspects in depth; for the future, more detailed and more explicit guidelines are required. The aim of this article is to review recent literature on cardiac arrest in the perioperative operating environment with a focus on incidence, causes and therapeutic approaches.

TARGET TEMEPERATURE MANAGEMENT

Cold Blooded: Evaluating Brain Temperature by MRI During Surface Cooling of Human Subjects.

Curran EJ1,2, Wolfson DL1, Watts R3,4, Freeman K5.

Abstract

BACKGROUND:

Targeted temperature management (TTM) confers neurological and survival benefits for post-cardiac arrest patients with return of spontaneous circulation (ROSC) who remain comatose. Specialized equipment for induction of hypothermia is not available in the prehospital setting, and there are no reliable methods for emergency medical services personnel to initiate TTM. We hypothesized that the application of surface cooling elements to the neck will decrease brain temperature and act as initiators of TTM.

METHODS: Magnetic resonance (MR) spectroscopy was used to evaluate the effect of a carotid surface cooling element on brain temperature in healthy adults.

RESULTS: Six individuals completed this study. We measured a temperature drop of 0.69 ± 0.38 °C (95% CI) in the cortex of the brain following the application of the cooling element. Application of a room temperature element also caused a measurable decrease in brain temperature of 0.66 ± 0.41 °C (95% CI) which may be attributable to baroreceptor activation.

CONCLUSION: The application of surface cooling elements to the neck decreased brain temperature and may serve as a method to initiate TTM in the prehospital setting.

CURES POST

Features of hospital and emergency medical service in out-of-hospital cardiac arrest patients with shockable rhythm.

Tsai SL1, Chaou CH2, Huang CH3, Tzeng IS 4, Kuo CW1, Weng YM1, Chien CY5.

Abstract

OBJECTIVE: Predicting the outcome of out-of-hospital cardiac arrest (OHCA) patients is crucial. We examined hospital characteristics and parameters of emergency medical service (including scene time interval and direct ambulance delivery to intensive heart hospitals) as survival or outcome predictors.

STUDY DESIGN: Data from 546 consecutive OHCA shockable patients treated between January 2012 and December 2015 in Taoyuan City (Taiwan, ROC) were collected. In addition to demographic data, location of arrest, initial rhythm, availability of a hospital with or without 24/7 percutaneous coronary intervention (PCI), emergency medical service (EMS) time, provision of cardiopulmonary resuscitation by a bystander, presence of a witness at collapse, and level of life support were analysed.

RESULTS: Multivariate analysis showed that hospitalisation with immediate PCI availability was an independent predictor (OR: 4.32; 95% CI: 1.27-14.70) solely for the outcome of survival until discharge. The presence of a witness while collapsing (OR: 3.52; 95% CI: 1.03-11.98), EMS response time (OR: 0.83; 95% CI: 0.70-0.98), and scene time interval (STI; OR: 0.89; 95% CI: 0.81-0.99) were valuable for predicting the neurological outcome.

CONCLUSIONS: Direct ambulance delivery to intensive heart hospitals that had 24/7 PCI availability was associated with a higher probability of surviving until discharge in OHCA patients with shockable rhythms. Similarly, a witnessed collapse was correlated with being discharged alive from hospital and recovering with good cerebral performance. In addition, longer response time and scene time interval indicated poorer survival and neurological outcome.

ECMO

Life-threatening massive pulmonary embolism rescued by venoarterial-extracorporeal membrane oxygenation.

Corsi F1,2, Lebreton G3, Bréchot N2, Hekimian G2, Nieszkowska A2, Trouillet JL2, Luyt CE2, Leprince P3, Chastre J2, Combes A2, Schmidt M4,5.

Abstract

BACKGROUND: Despite quick implementation of reperfusion therapies, a few patients with high-risk, acute, massive, pulmonary embolism (PE) remain highly hemodynamically unstable. Others have absolute contraindication to receive reperfusion therapies. Venoarterial-extracorporeal membrane oxygenation (VA-ECMO) might lower their right ventricular overload, improve hemodynamic status, and restore tissue oxygenation.

METHODS: ECMO-related complications and 90-day mortality were analyzed for 17 highly unstable, ECMO-treated, massive PE patients admitted to a tertiary-care center (2006-2015). Hospital- discharge survivors were assessed for long-term health-related quality of life. A systematic review of this topic was also conducted.

RESULTS: Seventeen high-risk PE patients [median age 51 (range 18-70) years, Simplified Acute Physiology Score II (SAPS II) 78 (45-95)] were placed on VA-ECMO for 4 (1-12) days. Among 15 (82%) patients with pre-

ECMO cardiac arrest, seven (41%) were cannulated during cardiopulmonary resuscitation, and eight (47%) underwent pre-ECMO thrombolysis. Pre-ECMO median blood pressure, pH, and blood lactate were, respectively: 42 (0-106) mmHg, 6.99 (6.54-7.37) and 13 (4-19) mmol/L. Ninety-day survival was 47%. Fifteen (88%) patients suffered in-ICU severe hemorrhages with no impact on survival. Like other ECMO-treated patients, ours reported limitations of all physical domains but preserved mental health 19 (4-69) months post-ICU discharge.

CONCLUSIONS: VA-ECMO could be a lifesaving rescue therapy for patients with high-risk, acute, massive PE when thrombolytic therapy fails or the patient is too sick to benefit from surgical thrombectomy. Because heparin-induced clot dissolution and spontaneous fibrinolysis allows ECMO weaning within several days, future studies should investigate whether VA-ECMO should be the sole therapy or completed by additional mechanical clot-removal therapies in this setting.

[Effect and related factors of extracorporeal cardiopulmonary resuscitation combined with emergent percutaneous coronary intervention on cardiac arrest patients due to acute myocardial infarction].

[Article in Chinese]

Huang L1, Liu YW, Li T, Hu XM, Duan DW, Wu P, Peng WJ, Lang YH.

Abstract

OBJECTIVE: To evaluate the effect of extracorporeal membrane oxygenation (ECMO) combined with primary percutaneous coronary intervention (PPCI) on cardiac arrest in patients with acute myocardial infarction (AMI).

METHODS: We retrospectively analyzed the clinical data from twenty cardiac arrest patients due to AMI from January 2010 to January 2015, who received both ECMO and PPCI after failed conventional cardiopulmonary resuscitation (CCPR) procedure in our center. The mean age was (58.8±13.9) years old and seventeen cases were male. The patients were divided into weaned (8 cases) and non-weaned group (12 cases) according to the outcome of ECMO removal, or survivor (6 cases) and non-survivor group (14 cases) according to the in-hospital outcome. The risk factors that affected weaning from ECMO and survival to discharge were analyzed via Spearman rank correlation test.

RESULTS: (1) The mean duration of CCPR and ECMO support was (46.7±22.2)min and (102.3±66.6)h, respectively. The rate of return of simultaneous beating was 100%(20/20). (2) CCPR duration was significantly shorter ((35.1±11.8)min vs. (54.4± 24.5) min, $P<0.05$) and cardiac care unit(CCU) stay time was significantly longer ((20.5±12.3)d vs. (4.3±4.0)d, $P<0.05$) in weaned group than in non-weaned group. Moreover, a significant difference was identified in culprit vessel distribution between the two groups ($P<0.05$). Culprit vessel distribution (left anterior descending artery r=-0.612, $P<0.01$; right coronary artery r=0.612, $P<0.01$) and length of cardiac care unit stay (r=0.784, $P<0.01$) were associated with weaned patients. (3) CCPR duration was significantly shorter ((29.2±4.9)min vs. (51.0±24.5)min, $P<0.01$). CCU stay time was significantly longer(16.0(9.5, 37.8)d vs. 3.0(2.0, 11.0) d, $P<0.01$). Weaning rate (6/6 vs. 2/14, $P<0.01$) and mean blood pressure ((87.9±19.4)mmHg(1 mmHg=0.133 kPa) vs. (63.7±18.6)mmHg, $P<0.05$) were significantly higher, while lactic acid level in arterial blood((1.74±0.85)mmol/L vs. (6.41±5.65) mmol/L, $P<0.05$) 48 hours after ECMO support was significantly lower in survivor group compared with non-survivor group. Culprit vessel of right coronary artery (r=0.491, $P<0.05$), length of CCU stay (r=0.609, $P<0.01$), successful weaning rate (r=0.802, $P<0.01$), and mean blood pressure at 48 hours after ECMO establishment (r=0.558, $P<0.05$) were positively associated with survival.

CONCLUSION: ECMO combined with PPCI is an effective therapeutic option to rescue AMI patients complicating with cardiac arrest.

DESFIBRIL·LACIÓ

Public health surveillance of automated external defibrillators in the USA: protocol for the dynamic automated external defibrillator registry study.

Elrod JB1, Merchant R2,3, Daya M4, Youngquist S5, Salcido D6,7, Valenzuela T8,9, Nichol G1.

Abstract

INTRODUCTION: Lay use of automated external defibrillators (AEDs) before the arrival of emergency medical services (EMS) providers on scene increases survival after out-of-hospital cardiac arrest (OHCA). AEDs have been placed in public locations may be not ready for use when needed. We describe a protocol for AED surveillance that tracks these devices through time and space to improve public health, and survival as well as facilitate research.

METHODS AND ANALYSIS: Included AEDs are installed in public locations for use by laypersons to treat patients with OHCA before the arrival of EMS providers on scene. Included cases of OHCA are patients evaluated by organised EMS personnel and treated for OHCA. Enrolment of 10 000 AEDs annually will yield precision of 0.4% in the estimate of readiness for use. Enrolment of 2500 patients annually will yield precision of 1.9% in the estimate of survival to hospital discharge. Recruitment began on 21 Mar 2014 and is ongoing. AEDs are found by using multiple methods. Each AED is then tagged with a label which is a unique two-dimensional (2D) matrix code; the 2D matrix code is recorded and the location and status of the AED tracked using a smartphone; these elements are automatically passed via the internet to a secure and confidential database in real time. Whenever the 2D matrix code is rescanned for any non-clinical or clinical use of an AED, the user is queried to answer a finite set of questions about the device status. The primary outcome of any clinical use of an AED is survival to hospital discharge. Results are summarised descriptively.

ETHICS AND DISSEMINATION: These activities are conducted under a grant of authority for public health surveillance from the Food and Drug Administration. Results are provided periodically to participating sites and sponsors to improve public health and quality of care.

State Requirements for Automated External Defibrillators in American Schools: Framing the Debate About Legislative Action.

Sherrid MV1, Aagaard P2, Serrato S3, Arabadjian ME3 , Lium JM4, Lium JD4, Greenberg HM5.

Abstract

Installation of automated external defibrillators (AEDs) in schools has been associated with increased survival after sudden cardiac arrest. An authoritative academic research database was interrogated to identify all current state statutes pertaining to AEDs in schools. As of February 2016, 17 of 50 U.S. states (34%) require AED installation in at least some of their schools; the remaining states have no legislation. However,

requirements are far from comprehensive in these 17 states. Only 5 states offer unequivocal funding to schools for purchasing AEDs. A minority of U.S. states have legislation requiring AED placement in schools, and even fewer provide funding. State legislatures that have not yet enacted legislation requiring AEDs in schools may look to neighboring states for examples of child and adult lifesaving law. Placement of an AED in schools should be implemented with an emergency response plan that trains staff in the recognition and response to cardiac arrest.

FORMACIÓ

Effect of dyad training on medical students' cardiopulmonary resuscitation performance.

Wang C1, Huang CC, Lin SJ, Chen JW.

Abstract

We investigated the effects of dyadic training on medical students' resuscitation performance during cardiopulmonary resuscitation (CPR) training.We provided students with a 2-hour training session on CPR for simulated cardiac arrest. Student teams were split into double groups (Dyad training groups: Groups A and B) or Single Groups. All groups received 2 CPR simulation rounds. CPR simulation training began with peer demonstration for Group A, and peer observation for Group B. Then the 2 groups switched roles. Single Groups completed CPR simulation without peer observation or demonstration. Teams were then evaluated based on leadership, teamwork, and team member skills.Group B had the highest first simulation round scores overall (P=0.004) and in teamwork (P=0.001) and team member skills (P=0.031). Group B also had the highest second simulation round scores overall (P<0.001) and in leadership (P=0.033), teamwork (P<0.001), and team member skills (P<0.001). In the first simulation, there were no differences between Dyad training groups with those of Single Groups in overall scores, leadership scores, teamwork scores, and team member scores. In the second simulation, Dyad training groups scored higher in overall scores (P=0.002), leadership scores (P=0.044), teamwork scores (P=0.005), and team member scores (P=0.008). Dyad training groups also displayed higher improvement in overall scores (P=0.010) and team member scores (P=0.022).Dyad training was effective for CPR training. Both peer observation and demonstration for peers in dyad training can improve student resuscitation performance.

VENTILACIÓ

Paramedic Intubation Experience Is Associated With Successful Tube Placement but Not Cardiac Arrest Survival.

Dyson K1, Bray JE2, Smith K3, Bernard S 4, Straney L5, Nair R6, Finn J7.

Abstract

STUDY OBJECTIVE: Paramedic experience with intubation may be an important factor in skill performance and patient outcomes. Our objective is to examine the association between previous intubation experience

and successful intubation. In a subcohort of out-of-hospital cardiac arrest cases, we also measure the association between patient survival and previous paramedic intubation experience.

METHODS: We analyzed data from Ambulance Victoria electronic patient care records and the Victorian Ambulance Cardiac Arrest Registry for January 1, 2008, to September 26, 2014. For each patient case, we defined intubation experience as the number of intubations attempted by each paramedic in the previous 3 years. Using logistic regression, we estimated the association between intubation experience and (1) successful intubation and (2) first-pass success. In the out-of-hospital cardiac arrest cohort, we determined the association between previous intubation experience and patient survival.

RESULTS: During the 6.7-year study period, 769 paramedics attempted intubation in 14,857 patients. Paramedics typically performed 3 intubations per year (interquartile range 1 to 6). Most intubations were successful (95%), including 80% on the first attempt. Previous intubation experience was associated with intubation success (odds ratio 1.04; 95% confidence interval 1.03 to 1.05) and intubation first-pass success (odds ratio 1.02; 95% confidence interval 1.01 to 1.03). In the out-of-hospital cardiac arrest subcohort (n=9,751), paramedic intubation experience was not associated with patient survival.

CONCLUSION: Paramedics in this Australian cohort performed few intubations. Previous experience was associated with successful intubation. Among out-of-hospital cardiac arrest patients for whom intubation was attempted, previous paramedic intubation experience was not associated with patient survival.

FEEDBACK

Assessing practical skills in cardiopulmonary resuscitation: Discrepancy between standard visual evaluation and a mechanical feedback device.

González BS1, Martínez L, Cerdà M, Piacentini E, Trenado J, Quintana S.

Abstract

This paper aims to analyze agreement in the assessment of external chest compressions (ECC) by 3 human raters and dedicated feedback software.While 54 volunteer health workers (medical transport technicians), trained and experienced in cardiopulmonary resuscitation (CPR), performed a complete sequence of basic CPR maneuvers on a manikin incorporating feedback software (Laerdal PC v 4.2.1 Skill Reporting Software) (L), 3 expert CPR instructors (A, B, and C) visually assessed ECC, evaluating hand placement, compression depth, chest decompression, and rate. We analyzed the concordance among the raters (A, B, and C) and between the raters and L with Cohen's kappa coefficient (K), intraclass correlation coefficients (ICC), Bland-Altman plots, and survival-agreement plots. The agreement (expressed as Cohen's K and ICC) was ≥0.54 in only 3 instances and was ≤0.45 in more than half. Bland-Altman plots showed significant dispersion of the data. The survival-agreement plot showed a high degree of discordance between pairs of raters (A-L, B-L, and C-L) when the level of tolerance was set low. In visual assessment of ECC, there is a significant lack of agreement among accredited raters and significant dispersion and inconsistency in data, bringing into question the reliability and validity of this method of measurement

PEDIATRIA

Post-cardiotomy Rescue Extracorporeal Cardiopulmonary Resuscitation in Neonates with Single Ventricle After Intractable Cardiac Arrest: Attrition After Hospital Discharge and Predictors of Outcome.

Polimenakos AC1,2, Rizzo V3, El-Zein CF3, Ilbawi MN3.

Abstract

Extracorporeal cardiopulmonary resuscitation (ECPR) in children with cardiac arrest refractory to conventional cardiopulmonary resuscitation (CPR) has been reported with encouraging results. We reviewed outcomes of neonates with functional single ventricle (FSV) surviving post-cardiotomy ECPR after hospital discharge. Fifty-eight patients who required post-cardiotomy extracorporeal membrane oxygenation (ECMO) since the introduction of our ECPR protocol (January 2007-December 2011) were identified. Forty-one were neonates. Survival analysis was conducted. Of 41 neonates receiving post-cardiotomy ECMO, 32 had FSV. Twenty-one had ECPR. Fourteen underwent Norwood operation (NO) for hypoplastic left heart syndrome (HLHS). Seven had non-HLHS FSV. Four (of 7) underwent modified NO/DKS with systemic-to-pulmonary shunt (SPS), 2 SPS only and 1 SPS with anomalous pulmonary venous connection repair. Mean age was 6.8 ± 2.1 days. ECMO median duration was 7 days [interquartile range (IQR25-75: 4-18)]. Survival to ECMO discontinuation was 72% (15 of 21 patients) and at hospital discharge 62% (13 of 21 patients). The most common cause of late attrition was cardiac. At last follow-up (median: 22 months; IQR25-75: 3-36), 47% of patients were alive. Duration of ECMO and failure of lactate clearance within 24 h from ECMO deployment determined late survival after hospital discharge (p < 0.05). Rescue post-cardiotomy ECMO support in neonates with FSV carries significant late attrition. ECMO duration and failure in lactate clearance after deployment are associated with unfavorable outcome. Emphasis on CPR quality, refinement of management directives early during ECMO and aggressive early identification of patients requiring heart transplantation might improve late survival.

RECERCA EXPERIMENTAL

Mild hypothermia alleviates brain oedema and blood-brain barrier disruption by attenuating tight junction and adherens junction breakdown in a swine model of cardiopulmonary resuscitation.

Li J1, Li C1, Yuan W1, Wu J1, Li J2, Li Z3, Zhao Y1.

Abstract

Mild hypothermia improves survival and neurological recovery after cardiac arrest (CA) and cardiopulmonary resuscitation (CPR). However, the mechanism underlying this phenomenon is not fully elucidated. The aim of this study was to determine whether mild hypothermia alleviates early blood-brain barrier (BBB) disruption. We investigated the effects of mild hypothermia on neurologic outcome, survival rate, brain water content, BBB permeability and changes in tight junctions (TJs) and adherens junctions (AJs) after CA and CPR. Pigs were subjected to 8 min of untreated ventricular fibrillation followed by CPR. Mild hypothermia (33°C) was intravascularly induced and maintained at this temperature for 12 h, followed by active rewarming. Mild hypothermia significantly reduced cortical water content, decreased BBB permeability and attenuated TJ ultrastructural and basement membrane breakdown in brain cortical microvessels. Mild hypothermia also attenuated the CPR-induced decreases in TJ (occludin, claudin-5, ZO-1) and AJ (VE-cadherin) protein and mRNA expression. Furthermore, mild hypothermia decreased the CA- and CPR-induced increases in matrix metalloproteinase-9 (MMP-9) and vascular endothelial growth factor (VEGF) expression and increased angiogenin-1 (Ang-1) expression. Our findings suggest that mild hypothermia attenuates the CA- and resuscitation-induced early brain oedema and BBB disruption, and this improvement might be at

least partially associated with attenuation of the breakdown of TJ and AJ, suppression of MMP-9 and VEGF expression, and upregulation of Ang-1 expression.

CASE REPORTS

Massive Pulmonary Embolism Mimicking Acute Myocardial Infarction: Successful use of extracorporeal membrane oxygenation support as bridge to diagnosis.

Hsieh YK1, Siao FY2, Chiu CC2, Yen HH 3, Chen YL1.

Abstract

Prolonged cardiac arrest with pulseless electrical activity (PEA) results in death if its aetiology cannot be corrected immediately. We describe the case of a 75-year-old man with chest pain and his electrocardiogram (ECG) revealing ST-segment elevation in leads II, III, and aVf. Inferior wall myocardial infarction was subsequently diagnosed. Before performing emergency coronary angiography, however, a sudden cardiac arrest with PEA developed and the patient was placed on advanced cardiac life support. Oxygenation support for the extracorporeal membrane was initiated approximately 65min after prolonged cardiopulmonary resuscitation. Emergency coronary arteriogram showed no obstructive lesions in the right coronary artery. This result, however, was not consistent with the ECG findings, and thus, a massive pulmonary embolism was suspected. Subsequent pulmonary artery angiography showed severe emboli in bilateral branches of the pulmonary arteries. Catheter-directed thrombolysis with urokinase was administered, which ultimately failed, and surgical embolectomy was performed with extracorporeal membrane oxygenation support. After the above intervention, the patient was discharged on hospital day 60 without any sequelae or neurological deficits.