

REGISTRES REVISIONS

1. Semin Neurol. 2017 Feb;37(1):5-12. doi: 10.1055/s-0036-1597832. Epub 2017 Feb 1.

Cardiac Arrest and Cardiopulmonary Resuscitation.

Nolan JP1.

Abstract

In this review, the author summarizes the incidence, causes, and survival associated with out-of-hospital cardiac arrest (OHCA) and in-hospital cardiac arrest (IHCA). The resuscitation guideline process is outlined, and the impact of resuscitation interventions is discussed. The incidence of OHCA treated by emergency medical services varies throughout the world, but is in the range of 30 to 50 per 100,000 of the population. Survival-to-hospital-discharge rates also vary, but are in the range of 8 to 10% for many countries. Cardiac disease accounts for the vast majority of OHCA; however, although it is a common cause of IHCA, many other diseases are also common causes of IHCA. Five yearly reviews of resuscitation science have been facilitated in recent years by the International Liaison Committee on Resuscitation; these have been followed by the publication of regional resuscitation guidelines. There is good evidence that increasing rates of bystander cardiopulmonary resuscitation and earlier defibrillation are both contributing to improving the survival rate after an OHCA.

2. Scand J Trauma Resusc Emerg Med. 2017 Feb 1;25(1):9. doi: 10.1186/s13049-017-0350-8.

Recognition of out-of-hospital cardiac arrest during emergency calls - a systematic review of observational studies.

Viereck S1, Møller TP2, Rothman JP3, Folke F2, Lippert FK2.

Abstract

BACKGROUND: The medical dispatcher plays an essential role as part of the first link in the Chain of Survival, by recognising the out-of-hospital cardiac arrest (OHCA) during the emergency call, dispatching the appropriate first responder or emergency medical services response, performing dispatcher assisted cardiopulmonary resuscitation, and referring to the nearest automated external defibrillator. The objective of this systematic review was to evaluate and compare studies reporting recognition of OHCA patients during emergency calls.

METHODS: This systematic review was reported in compliance with the PRISMA guidelines. We systematically searched MEDLINE, Embase and the Cochrane Library on 4 November 2015. Observational studies, reporting the proportion of clinically confirmed OHCA that was recognised during the emergency call, were included. Two authors independently screened abstracts and full-text articles for inclusion. Data were extracted and the risk of bias within studies was assessed using the QUADAS-2 tool for quality assessment of diagnostic accuracy studies.

RESULTS: A total of 3,180 abstracts were screened for eligibility and 53 publications were assessed in full-text. We identified 16 studies including 6,955 patients that fulfilled the criteria for inclusion in the systematic review. The studies reported recognition of OHCA with a median sensitivity of 73.9% (range: 14.1-96.9%). The selection of study population and the definition of "recognised OHCA" (threshold for positive test) varied greatly between the studies, resulting in high risk of bias. Heterogeneity in the studies precluded meta-analysis.

CONCLUSION: Among the 16 included studies, we found a median sensitivity for OHCA recognition of 73.9% (range: 14.1-96.9%). However, great heterogeneity between study populations and in the definition of "recognised OHCA", lead to insufficient comparability of results. Uniform and transparent reporting is required to ensure comparability and development towards best practice.

3. Am J Med. 2017 Jan 29. pii: S0002-9343(17)30089-X. doi: 10.1016/j.amjmed.2016.12.030. [Epub ahead of print]

Syncope: Outcomes and Conditions Associated with Hospitalization.

Joy PS1, Kumar G2, Olshansky B3.

Abstract

PURPOSE: Syncope is a perplexing problem for which hospital admission and readmission are contemplated but outcomes remain uncertain. Our purpose was to determine the incidence of admissions and readmissions for syncope and compare associated conditions, in-hospital outcomes and resource utilization.

METHODS: The 2005-2011 California Statewide Inpatient Database was utilized. Patients of age ≥ 18 admitted under ICD-9-CM code 780.2 ("syncope or collapse") were selected. Records with a primary discharge diagnosis of syncope were classified as primary syncope. Primary outcome was mortality and secondary outcome measures were cardiopulmonary resuscitation, mechanical ventilation, discharge disposition, length-of-stay, frequency of readmission and hospital charges.

RESULTS: An estimated $1.52 \pm 0.02\%$ admissions every year are related to syncope. Among admissions for syncope, in 42.1%, the cause remained unknown; Twenty-three percent syncope admissions were for recurrent episodes. Top 5 associated new diagnoses were hypokalemia (0.24%), ventricular tachycardia (0.17%), atrial fibrillation (0.16%), dehydration (0.12%) and hyponatremia (0.12%). Mortality rates are lower for primary vs. secondary syncope (0.2% vs. 1.4%; $p < 0.0001$). Greatest risk factors for mortality in primary syncope were pulmonary hypertension (OR=12.3; 95% CI:3.34-45.04) and metastatic cancer (OR=7.22; 95% CI:4.50-11.58). Major adverse events showed a decreasing trend for patients with multiple syncope admissions. Older patients and defibrillators or pacemaker recipients are admitted more often but experience negligible adverse events. Over a decade, median hospital charge for a single syncope admission has increased by 1.5 times.

CONCLUSIONS: Despite a good prognosis, syncope is a frequent cause for hospitalization particularly in the elderly. Present evaluation strategies are expensive and lack diagnostic value.

FORMACIÓ

1. Nurs Stand. 2017 Feb 1;31(23):54-63. doi: 10.7748/ns.2017.e10461.

An overview of adult cardiopulmonary resuscitation equipment.

Bowden T1, Smith D1,2.

Abstract

Nurses have many roles and responsibilities in relation to cardiopulmonary resuscitation (CPR), including: recognising that a patient is deteriorating; recognising cardiac arrest and commencing CPR while waiting for the resuscitation team to arrive; ensuring the contents of the resuscitation trolley are present, in date and in full working order; and completing documentation for the National Cardiac Arrest Audit in participating healthcare organisations. Many patient safety incidents involving resuscitation trolley equipment and resuscitation have been reported, and predominantly relate to a lack of equipment, missing equipment and inadequately stocked trolleys. This article provides an overview of the contents of the standard resuscitation trolley and a rationale for the use of each item. It discusses the importance of checking and restocking the resuscitation trolley, as well as the documentation of CPR efforts.

TRAUMA

1. Ann Burns Fire Disasters. 2016 Jun 30;29(2):103-107.

Factors at scene and in transfer related to the development of hypothermia in major burns.

Steele JE1, Atkins JL2, Vizcaychipi MP3.

Abstract

There is a paucity of evidence regarding incidence and causes of hypothermia in patients with major burns and its impact on outcomes. This paper identifies contributing factors to hypothermia and its relationship with the severity of physiological scoring systems on admission to a tertiary centre. Patients with burns $>20\%$ TBSA admitted between March 2010 and July 2013 comprised this retrospective survey. Data relating to causative factors at time of burn, during transfer, physiological outcome scores (BOBI, SOFA, RTS and APACHE II), length of hospital stay and mortality were collected. SPSS statistical software was used for analysis. The study included 31 patients (medians: age 32 years, burn size 30% TBSA). 13% ($n=4$) of patients died during

hospital admission. 42% (n=13) of patients had a temperature <36.0C on arrival. Temperature on arrival at the burns centre was related to the severity of all physiological scores (p=<0.001). There was no difference between groups in terms of mortality in hospital (p=0.151) or length of hospital stay (p=0.547). Our results show that hypothermia is related to burn severity and patient physiological status. They do not show a relationship between hypothermia and external factors at the time of the burn. This paper prompts further investigation into the prevention of hypothermia in patients with major burns.

2. Scand J Trauma Resusc Emerg Med. 2017 Feb 2;25(1):10. doi: 10.1186/s13049-017-0354-4.

Severity-dependent differences in early management of thoracic trauma in severely injured patients - Analysis based on the TraumaRegister DGU®.

Bayer J1, Lefering R2, Reinhardt S3, Kühle J3, Südkamp NP3, Hammer T3; TraumaRegister DGU.

Abstract

BACKGROUND:

Major trauma is associated with chest injuries in nearly 50% of multiple injuries. Thoracic trauma is a relevant source of comorbidity throughout the period of multiply-injured patient care and may require swift and well-thought-out interventions in order to avert a deleterious outcome. In this epidemiological study we seek to characterize groups of different thoracic trauma severity in severely injured patients and identify related differences in prehospital and early clinical management. This may help to anticipate necessary treatment for chest injuries.

METHODS: Patients documented between 2002 and 2012 in the TraumaRegister DGU®, aged ≥ 16 years, determined Injury Severity Score ≥ 16, and documentation from European trauma centers were analyzed. Isolated brain injury and severe head injury (Abbreviated Injury ScaleHead ≥ 4) led to patient exclusion. Patient subgroups were formed according to the Abbreviated Injury ScaleThorax as Controls, AIS-2, AIS-3, AIS-4, and AIS-5/6. Demographic and clinical characteristics comparing the aforementioned groups were evaluated using descriptive statistics.

RESULTS: Twenty two thousand five hundred sixty five predominantly male (74%) patients, mean age 45.7 years (SD 19.3), suffering from blunt trauma (95%), and presenting a mean Injury Severity Score of 25.6 (SD 9.6) were analyzed. Higher thoracic injury severity was associated with more different thoracic injuries. The highest rate of prehospital intubation (58%) occurred in AISThorax-5/6. The worse the chest trauma, the more chest tubes were placed prehospitally, peaking at 22% in AISThorax-5/6. Out-of-hospital cardiopulmonary resuscitation was successfully performed in 11% in AISThorax-5/6 compared to 1%-3% in lesser thoracic trauma severity. Massive transfusion and emergency surgery was highest in AISThorax-5/6 compared to lesser thoracic injury (12% vs. 5%-7% and 17% vs. 3%-7%) and both were independently associated with thoracic injuries in patients with AISThorax ≥ 4.

CONCLUSIONS: We provide epidemiological data on trauma mechanism, concomitant injuries, frequencies of emergency interventions and outcome associated with different thoracic trauma severity. Prehospital and early clinical management is more complex when AISThorax is ≥ 4. Severely injured patients with critical thoracic trauma are most challenging to take care of with highest rates in prehospital intubation, cardiopulmonary resuscitation, chest tube placements, blood transfusions as well as emergency surgery.

TARGET TEMPERATURE MANAGEMENT

1. Cardiol J. 2017 Feb 2. doi: 10.5603/CJ.a2017.0016. [Epub ahead of print]

A review of the utility of a hypothermia protocol in cardiac arrests due to non-shockable rhythms.

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Abstract

BACKGROUND: Therapeutic hypothermia and targeted temperature management are considered standard of care in the management of patients following out-of-hospital cardiac

arrests due to shockable rhythms to improve neurological outcomes. In those presenting out-of-hospital cardiac arrests associated with non-shockable rhythms, the benefit of hypothermia is less clear. In this review we try to clarify the utility of implementing a hypothermia protocol after cardiac arrests due to non-shockable rhythms.

METHODS: PUBMED, Ovid, MEDLINE, EMBASE, and clinicaltrials.gov websites were searched through during October, 2016 using the terms "non shockable", "hypothermia," and "cardiac arrest." Studies were excluded if they solely evaluated in-hospital cardiac arrests, shockable rhythms, and/or pediatric patients. Data was extracted by two authors.

RESULTS: 40 studies were included in this review, most of which were not randomized or controlled, nor were they powered to make significant conclusions about the efficacy of hypothermia in this population. Some did evaluate specific factors that may portend to a better outcome in patients presenting with out-of-hospital cardiac arrest due to non-shockable rhythms undergoing hypothermia. Shortcomings included incorporating in-hospital cardiac arrest patients in analyses, comparing results of hypothermia in shockable versus non-shockable rhythm patients as an outcome measure, lacking standardization in cooling protocols, and short-term measures of outcomes.

CONCLUSIONS: It was concluded that further study is needed to characterize patients presenting non-shockable rhythms who would benefit from hypothermia to better guide its use in this population given the costs and implications of treatment and long-term care in those who survive with poor outcomes.

2. Adv Emerg Nurs J. 2017 Jan/Mar;39(1):52-58. doi: 10.1097/TME.000000000000131.

Initiation of Therapeutic Hypothermia in the Emergency Department: A Quality Improvement Project.

Yochum C1, Utley R.

Abstract

Therapeutic hypothermia (TH) postresuscitation has been recommended by the American Heart Association (AHA) since 2005. Early initiation of TH and fast achievement of goal temperatures have been associated with better neurological outcomes. The objective of this study was to evaluate the effectiveness of a specific TH protocol for the emergency department (ED) in increasing ED use of TH and decreasing the time from return of spontaneous circulation (ROSC) to initiation of cooling measures. An ED protocol for TH as recommended by the AHA was implemented. A random sample of 10 patients who received TH prior to the implementation of an ED protocol were analyzed and compared with the first 10 patients who received TH after the ED protocol was implemented. The time from ROSC to initiation of cooling measures and survival to discharge rates were analyzed. After implementation of the ED protocol, 7 of the 10 patients were treated with the ED protocol. The mean time to initiation of TH for the preimplementation group was 127.8 min (SD = 52.9) compared with 15.71 min (SD = 9.552) for the postimplementation group. The difference in initiation time between the pre- and postimplementation study groups was statistically significant, $t(9.826) = 6.55$, $p < 0.05$. Survival to discharge rates were 30% for the preimplementation group and 20% for the postimplementation group. The difference was not statistically significant, $\chi(1, N = 20) = 0.73$, $p = 0.78$. Implementation of an ED protocol for TH reduced mean time to initiation of therapy. Additional study is warranted to determine whether differences in survival and functional recovery for ED patients receiving TH were influenced by age, comorbidities, and total resuscitation time.

ECMO

1. Ann Emerg Med. 2017 Jan 27. pii: S0196-0644(16)31213-6. doi: 10.1016/j.annemergmed.2016.10.001. [Epub ahead of print]

Development and Implementation of a Comprehensive, Multidisciplinary Emergency Department Extracorporeal Membrane Oxygenation Program.

Tonna JE1, Selzman CH2, Mallin MP3, Smith BR4, Youngquist ST3, Koliopoulou A2, Welt F4, Stoddard KD5, Nirula R6, Barton R6, Fair JF 3rd3, Fang JC7, McKellar S2.

Abstract

Despite advances in the medical and surgical management of cardiovascular disease, greater than 350,000 patients experience out-of-hospital cardiac arrest in the United States annually, with only a 12% neurologically favorable survival rate. Of these patients, 23% have an initial shockable rhythm of ventricular fibrillation/pulseless ventricular tachycardia (VF/VT), a marker of high probability of acute coronary ischemia (80%) as the precipitating factor. However, few patients (22%) will experience return of spontaneous circulation and sufficient hemodynamic stability to undergo cardiac catheterization and revascularization. Previous case series and observational studies have demonstrated the successful application of intra-arrest extracorporeal life support, including to out-of-hospital cardiac arrest victims, with a neurologically favorable survival rate of up to 53%. For patients with refractory cardiac arrest, strategies are needed to bridge them from out-of-hospital cardiac arrest to the catheterization laboratory and revascularization. To address this gap, we expanded our ICU and perioperative extracorporeal membrane oxygenation (ECMO) program to the emergency department (ED) to reach this cohort of patients to improve survival. In this report, we illustrate our process and initial experience of developing a multidisciplinary team for rapid deployment of ED ECMO as a template for institutions interested in building their own ED ECMO programs.

2. *Minerva Anesthesiol.* 2016 Jan;82(1):36-43. Epub 2015 Apr 24.

Early vascular complications after percutaneous cannulation for extracorporeal membrane oxygenation for cardiac assist.

Avalli L1, Sangalli F, Migliari M, Maggioni E, Gallieri S, Segramora V, Camesasca V, Formica F, Paolini G, Pesenti A.

Comment in: *Dealing with complications of extracorporeal life support.* [*Minerva Anesthesiol.* 2016]

Abstract

BACKGROUND: Extracorporeal membrane oxygenation (VA ECMO) demonstrated an advantage in survival and neurological outcome in patients with cardiogenic shock and, in selected population, in victims of refractory cardiac arrest. The incidence of vascular complications ranges in recent series from 10 to 70% including both early and late complications. The aim of the present study was to determine the incidence of early vascular complications and the effectiveness of the prevention of limb ischemia by the insertion of a catheter for distal perfusion.

METHODS: Data from our registry of 100 patients treated with VA ECMO implanted via percutaneous femoral approach for cardiogenic shock or refractory cardiac arrest were analyzed. If the leg perfusion was inadequate, an additional 7-9 Fr percutaneous catheter distal to the ECMO arterial cannula was placed into the femoral artery to prevent limb ischemia.

RESULTS: Thirty-five patients had early vascular complications. Thirty patients with early ischemia were cannulated with a small reperfusion cannula to obtain antegrade perfusion of the limb. Twenty-six had an effective reperfusion. Seven patients developed a compartment syndrome of the leg requiring urgent fasciotomy that led to clinical improvement and recovery in five, while the other two patients progressed to irreversible ischemia requiring amputation of the limb.

CONCLUSION: The majority of ischemic episodes were resolved with the insertion of a distal perfusion catheter. We did not observe any mortal vascular complication, nor any of the observed complications was related to increased mortality.

PEDIATRIA

1. *Kardiol Pol.* 2017 Feb 2. doi: 10.5603/KP.a2017.0015. [Epub ahead of print]

The quality of a newly developed infant chest compression method applied by paramedics: a randomized crossover manikin trial.

Smereka J, Kasinski M, Smereka A, Ładny JR, Szarpak Ł1.

Abstract

BACKGROUND: The etiology of sudden cardiac arrest in infants is different from that in adults, with respiratory failure, sudden infant death syndrome, and drowning being the primary causes in the former. According to the European Resuscitation Council (ERC) and American Heart Association (AHA) recommendations, the quality of chest compressions (CC) is a key element affecting the effectiveness of cardiopulmonary resuscitation (CPR). The current ERC and AHA guidelines recommend the 'two-finger technique' (TFT) or 'two-thumb encircling hands technique' (TTHT) for external CCs during infant CPR.

AIM: The aim of the randomized crossover manikin trial was to assess the CC quality during simulated resuscitation in infants performed by paramedics.

METHODS: The prospective, randomized, crossover, single-centre study was conducted between June and August 2016. The study material consisted of 120 fully trained and licensed paramedics (39 females, 32.5%) with a minimum of 5 years of professional experience (7.5 ± 4.8 years) in emergency medicine (mean age, 30.5 ± 5.5 years). The participants performed CCs using three techniques: the TFT (the rescuer compresses the sternum with the tips of two fingers); the TTHT; and the 'new two-thumb technique' (nTTT). The novel method of CCs in an infant consists in using two thumbs directed at the angle of 90 degrees to the chest while closing the fingers of both hands in a fist.

RESULTS: The median CC rate when using the TFT, the TTHT, and nTTT methods varied and amounted to 134 min⁻¹ vs. 126 min⁻¹ vs. 114 min⁻¹, respectively. There was a statistically significant difference in the median CC frequency between TFT and TTHT ($p < 0.001$), TFT and nTTT ($p < 0.001$), and between TTHT and the nTTT ($p < 0.001$). The highest percentage of compressions with the frequency recommended by the ERC guidelines, 100-120 min⁻¹, was achieved by the study participants only with the nTTT. The median CC depth during the TFT was 28 (interquartile range [IQR], 27-30) mm and was significantly lower than in the static TTHT (40.5 [IQR, 39-41] mm; $p < 0.001$) and nTTT (40 [IQR, 39-41] mm; $p < 0.001$). The percentage of adequate depth CCs was correctly obtained with TTHT and nTTT. The largest proportion of total decompression of the chest was observed with the nTTT technique (96 [IQR, 96-98]%), followed by TFT (95.5 [IQR, 85.5-99]%) and TTHT (5 [IQR, 3-7]%). In all scenarios, the correct placement of the CC point was achieved in more than 90% of cases.

CONCLUSIONS: Our novel infant CC method provides the highest percentage of CCs with the frequency recommended by the ERC guidelines as compared with standard techniques. It also allows to obtain optimal CC depth.

FV | ELECTROFISIOLOGIA

1. Open Access Emerg Med. 2017 Jan 13;9:9-17. doi: 10.2147/OAEM.S109339. eCollection 2017. A multicenter prospective randomized study comparing the efficacy of escalating higher biphasic versus low biphasic energy defibrillations in patients presenting with cardiac arrest in the in-hospital environment.

Anantharaman V1, Tay SY2, Manning PG3, Lim SH1, Chua TS4, Tiru M5, Charles RA1, Sudarshan V1.

Abstract

BACKGROUND: Biphasic defibrillation has been practiced worldwide for >15 years. Yet, consensus does not exist on the best energy levels for optimal outcomes when used in patients with ventricular fibrillation (VF)/pulseless ventricular tachycardia (VT).

METHODS: This prospective, randomized, controlled trial of 235 adult cardiac arrest patients with VF/VT was conducted in the emergency and cardiology departments. One group received low-energy (LE) shocks at 150-150-150 J and the other escalating higher-energy (HE) shocks at 200-300-360 J. If return of spontaneous circulation (ROSC) was not achieved by the third shock, LE patients crossed over to the HE arm and HE patients continued at 360 J. Primary end point was ROSC. Secondary end points were 24-hour, 7-day, and 30-day survival.

RESULTS: Both groups were comparable for age, sex, cardiac risk factors, and duration of collapse and VF/VT. Of the 118 patients randomized to the LE group, 48 crossed over to the HE protocol, 24 for persistent VF, and 24 for recurrent VF. First-shock termination rates for HE and LE patients were 66.67% and 64.41%, respectively ($P=0.78$, confidence interval: 0.65-1.89). First-

shock ROSC rates were 25.64% and 29.66%, respectively (P=0.56, confidence interval: 0.46-1.45). The 24-hour, 7-day, and 30-day survival rates were 85.71%, 74.29%, and 62.86% for first-shock ROSC LE patients and 70.00%, 50.00%, and 46.67% for first-shock ROSC HE patients, respectively. Conversion rates for further shocks at 200 J and 300 J were low, but increased to 38.95% at 360 J.

CONCLUSION: First-shock termination and ROSC rates were not significantly different between LE and HE biphasic defibrillation for cardiac arrest patients. Patients responded best at 150/200 J and at 360 J energy levels. For patients with VF/pulseless VT, consideration is needed to escalate quickly to HE shocks at 360 J if not successfully defibrillated with 150 or 200 J initially.

RECERCA EXPERIMENTAL

1. Am J Emerg Med. 2017 Jan 23. pii: S0735-6757(17)30057-8. doi: 10.1016/j.ajem.2017.01.040. [Epub ahead of print]

Correlation of Impedance Threshold Device use during cardiopulmonary resuscitation with post-cardiac arrest Acute Kidney Injury.

Niforopoulou P1, Iacovidou N2, Lelovas P3, Karlis G4, Papalois A5, Siakavellas S6, Spapis V7, Kaparos G8, Siafaka I9, Xanthos T10.

Abstract

PURPOSE: To assess whether use of Impedance Threshold Device (ITD) during cardiopulmonary resuscitation (CPR) reduces the degree of post-cardiac arrest Acute Kidney Injury (AKI), as a result of improved hemodynamics, in a porcine model of ventricular fibrillation (VF) cardiac arrest.

METHODS: After 8 min of untreated cardiac arrest, the animals were resuscitated either with active compression-decompression (ACD) CPR plus a sham ITD (control group, n=8) or with ACD-CPR plus an active ITD (ITD group, n=8). Adrenaline was administered every 4 min and electrical defibrillation was attempted every 2 min until return of spontaneous circulation (ROSC) or asystole. After ROSC the animals were monitored for 6 h under general anesthesia and then returned to their cages for a 48 h observation, before euthanasia. Two novel biomarkers, Neutrophil Gelatinase-Associated Lipocalin (NGAL) in plasma and Interleukin-18 (IL-18) in urine, were measured at 2 h, 4 h, 6 h, 24 h and 48 h post-ROSC, in order to assess the degree of AKI.

RESULTS: ROSC was observed in 7 (87.5%) animals treated with the sham valve and 8 (100%) animals treated with the active valve (P=NS). However, more than twice as many animals survived at 48 h in the ITD group (n=8, 100%) compared to the control group (n=3, 37.5%). Urine IL-18 and plasma NGAL levels were augmented post-ROSC in both groups, but they were significantly higher in the control group compared with the ITD group, at all measured time points.

CONCLUSION: Use of ITD during ACD-CPR improved hemodynamic parameters, increased 48 h survival and decreased the degree of post-cardiac arrest AKI in the resuscitated animals.

2. Cell Rep. 2017 Jan 31;18(5):1109-1117. doi: 10.1016/j.celrep.2017.01.011.

Autonomous CaMKII Activity as a Drug Target for Histological and Functional Neuroprotection after Resuscitation from Cardiac Arrest.

Deng G1, Orfila JE1, Dietz RM2, Moreno-Garcia M1, Rodgers KM3, Coultrap SJ4, Quillinan N1, Traystman RJ5, Bayer KU6, Herson PS7.

Abstract

The Ca²⁺/calmodulin-dependent protein kinase II (CaMKII) is a major mediator of physiological glutamate signaling, but its role in pathological glutamate signaling (excitotoxicity) remains less clear, with indications for both neuro-toxic and neuro-protective functions. Here, the role of CaMKII in ischemic injury is assessed utilizing our mouse model of cardiac arrest and cardiopulmonary resuscitation (CA/CPR). CaMKII inhibition (with tatCN21 or tatCN19o) at clinically relevant time points (30 min after resuscitation) greatly reduces neuronal injury. Importantly, CaMKII inhibition also works in combination with mild hypothermia, the current standard of care. The relevant drug target is specifically Ca²⁺-independent "autonomous" CaMKII activity generated by T286 autophosphorylation, as indicated by substantial reduction

in injury in autonomy-incompetent T286A mutant mice. In addition to reducing cell death, tatCN19o also protects the surviving neurons from functional plasticity impairments and prevents behavioral learning deficits, even at extremely low doses (0.01 mg/kg), further highlighting the clinical potential of our findings.

FÀRMACS

1. J Med Internet Res. 2017 Feb 1;19(2):e31. doi: 10.2196/jmir.7005.

A Mobile Device App to Reduce Time to Drug Delivery and Medication Errors During Simulated Pediatric Cardiopulmonary Resuscitation: A Randomized Controlled Trial.

Siebert JN1, Ehrler F2, Combescure C3, Lacroix L1, Haddad K1, Sanchez O4, Gervais A1, Lovis C2, Manzano S1.

Abstract

BACKGROUND: During pediatric cardiopulmonary resuscitation (CPR), vasoactive drug preparation for continuous infusion is both complex and time-consuming, placing children at higher risk than adults for medication errors. Following an evidence-based ergonomic-driven approach, we developed a mobile device app called Pediatric Accurate Medication in Emergency Situations (PedAMINES), intended to guide caregivers step-by-step from preparation to delivery of drugs requiring continuous infusion.

OBJECTIVE: The aim of our study was to determine whether the use of PedAMINES reduces drug preparation time (TDP) and time to delivery (TDD; primary outcome), as well as medication errors (secondary outcomes) when compared with conventional preparation methods.

METHODS: The study was a randomized controlled crossover trial with 2 parallel groups comparing PedAMINES with a conventional and internationally used drugs infusion rate table in the preparation of continuous drug infusion. We used a simulation-based pediatric CPR cardiac arrest scenario with a high-fidelity manikin in the shock room of a tertiary care pediatric emergency department. After epinephrine-induced return of spontaneous circulation, pediatric emergency nurses were first asked to prepare a continuous infusion of dopamine, using either PedAMINES (intervention group) or the infusion table (control group), and second, a continuous infusion of norepinephrine by crossing the procedure. The primary outcome was the elapsed time in seconds, in each allocation group, from the oral prescription by the physician to TDD by the nurse. TDD included TDP. The secondary outcome was the medication dosage error rate during the sequence from drug preparation to drug injection.

RESULTS: A total of 20 nurses were randomized into 2 groups. During the first study period, mean TDP while using PedAMINES and conventional preparation methods was 128.1 s (95% CI 102-154) and 308.1 s (95% CI 216-400), respectively (180 s reduction, $P=.002$). Mean TDD was 214 s (95% CI 171-256) and 391 s (95% CI 298-483), respectively (177.3 s reduction, $P=.002$). Medication errors were reduced from 70% to 0% ($P<.001$) by using PedAMINES when compared with conventional methods.

CONCLUSIONS: In this simulation-based study, PedAMINES dramatically reduced TDP, to delivery and the rate of medication errors.

2. BMC Anesthesiol. 2017 Feb 2;17(1):18. doi: 10.1186/s12871-017-0309-3.

Supplement of levosimendan to epinephrine improves initial resuscitation outcomes from asphyxial cardiac arrest.

Wu B1, Peng YG2, Zhao S1, Bao N1, Pan L1, Dong J1, Xu X3,4, Wang Q5,6.

Abstract

BACKGROUND: Levosimendan exerted favorable effects on the initial outcome in the treatment of ventricular fibrillation cardiac arrest. This study investigated the efficacy of levosimendan in the treatment of asphyxia-induced cardiac arrest in rats.

METHODS: Animals underwent asphyxial cardiac arrest/cardiopulmonary resuscitation, randomized to three treatment groups: epinephrine (10 $\mu\text{g}/\text{kg}$) supplemented with levosimendan (bolus 12 $\mu\text{g}/\text{kg}$ and infusion for 1 h, EL group); epinephrine only (10 $\mu\text{g}/\text{kg}$, E group), or levosimendan only (bolus 12 $\mu\text{g}/\text{kg}$ and infusion for 1 h, L group). The resuscitation success rate, wet-to-dry ratio of lung, and rate of alveolar and blood gas analysis were recorded.

RESULTS: 10 rats in the EL group, 8 in the E group, and 2 in the L group showed an initial return of spontaneous circulation ($P < 0.001$); among them, 10, 4, and 2 rats survived at the end of a 60-min observation period from each group, respectively ($P = 0.001$). The coronary perfusion pressure in the EL group was higher than that of either the E or L group ($P < 0.05$). The lung wet-to-dry weight ratio and rate of damaged alveoli were lower in the EL group than the E group ($P < 0.05$).

CONCLUSIONS: In the early stage of resuscitation for asphyxia-induced cardiac arrest in rats, levosimendan supplemented with epinephrine can significantly increase coronary perfusion pressure, reduce lung injury, and ultimately enhance the survival rate.

REGISTRES I REVISIONS

1. Resuscitation. 2017 Feb 12. pii: S0300-9572(17)30053-9. doi: 10.1016/j.resuscitation.2017.01.029. [Epub ahead of print]

Out-of-hospital cardiac arrest (OHCA) attended by mobile emergency teams with a physician on board. Results of the Spanish OHCA Registry (OSHCAR).

Rosell-Ortiz F1, Navalpotro-Pascual JM2, Del Valle PF3, Sánchez-Santos L4, Escalada-Roig X5, Echarri-Sucunza A6, Adsuar-Quesada JM7, Cenicerros-Rozalén I8, Ruiz-Azpiazu JI9, Iburguren-Olalde K10, López-Cabeza N11, Mier-Ruiz MV12, Martín-Sánchez E13, Del Valle MM14, Inza-Muñoz G15, Cordero Torres JA16, García-Ochoa MJ17, Cortés-Ramas JA18, Canabal-Berlanga R19, López-Navarro RZ20, López-Messa JB21, Del Águila JG22, Alonso-Moreno D10, Pozo-Pérez C11, Bravo-Castello J16, Ramos-García N19, Gómez-Larrosa I20, Mellado-Vergel FJ23.

Abstract

Most survival outcomes in out-of-hospital cardiac arrest (OHCA) are provided by emergency medical services (EMS) without a doctor on board. Our objective was to determine such outcomes in a whole country with public physician-led EMS.

METHODS: We analyzed data from a nationwide prospective registry of OHCA cases attended by emergency medical teams (EMS) of 19 Public EMS in Spain, covering the period from 1 October 2013 to 30-October 2014 (13 months).

RESULTS: Advanced life support (ALS) was initiated in 9347 cases (incidence of 18.6 cases per 105 inhabitants per year). Resuscitation was considered futile in 558 cases (5.9%), and ALS was continued in 8789 cases (94.1%); mean age 63.5 ± 17 years, 72.1% men. Initial rhythm was shockable in 22.1% of cases. Basic life support (BLS) was provided by bystanders in 1602 (24%) cases (635 of them with telephone assistance from the dispatch center). Of 8789 patients receiving ALS, 72.1% men, 2669 (30.4%) patients had return of spontaneous circulation (ROSC) on hospital arrival, a figure that reached 50.6% when the initial rhythm was shockable. Hospital discharge with good neurological status (CPC1-2) was found in 11.1% of the study population. Survival at discharge was 27.6% in the Utstein comparator group of patients. A total of 216 (2.5%) patients arrived at the hospital with ongoing resuscitation, of whom only one survived with CPC1-2, and 165 (1.9%) patients were included in non-heart-beating donation programs.

CONCLUSIONS: In Spain with physician-led EMS, OHCA survival with good neurologic status reached 11.1%, and 27.65% in the case of our Utstein comparator group, despite only a modest contribution of bystander BLS. In these services, the ongoing resuscitation strategy seems to be of little use except when considering non-heart beating donation programs.

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2. J Community Health. 2017 Feb 13. doi: 10.1007/s10900-016-0308-1. [Epub ahead of print]

Parental Knowledge of Cardiovascular Screening and Prevention of Sudden Cardiac Arrest in Youth Athletes.

Wagener MA1, Diamond AB2,3, Karpinos AR2,3,4.

Abstract

Sudden cardiac arrest (SCA) is the leading cause of death in youth athletes. Survival from out-of-hospital SCA depends on prompt initiation of cardiopulmonary resuscitation (CPR) and use of an automated external defibrillator (AED). This study evaluated parental knowledge, experience, and attitudes related to cardiovascular screening, SCA, and CPR/AED use in youth athletes and made comparisons between parents who are employed in healthcare and parents who are not employed in healthcare. We conducted a cross-sectional survey to evaluate knowledge, experiences, and attitudes of 91 parents of youth athletes who attended a community-based cardiovascular screening event. Although cardiovascular screening can reduce the risk of SCA, we found that 36% of parents incorrectly thought cardiovascular screening could prevent SCA and there was no difference in knowledge between the two groups of parents. This initial evaluation of parental knowledge of cardiovascular screening issues in youth athletes should guide educational efforts to prevent and respond to SCA in youth athletes.

3. *Circ J*. 2017 Feb 11. doi: 10.1253/circj.CJ-16-1251. [Epub ahead of print]

Age-Specific Differences in the Duration of Prehospital Cardiopulmonary Resuscitation Administered by Emergency Medical Service Providers Necessary to Achieve Favorable Neurological Outcome After Out-of-Hospital Cardiac Arrest.

Funada A1, Goto Y, Tada H, Teramoto R, Shimojima M, Hayashi K, Yamagishi M.

Abstract

BACKGROUND:

The appropriate duration of prehospital cardiopulmonary resuscitation (CPR) administered by emergency medical service (EMS) providers for patients with out-of-hospital cardiac arrest (OHCA) necessary to achieve 1-month survival with favorable neurological outcome (Cerebral Performance Category 1 or 2, CPC 1-2) is unclear and could differ by age.

Methods and Results: We analyzed the records of 35,709 adult OHCA patients with return of spontaneous circulation (ROSC) before hospital arrival in a prospectively recorded Japanese registry between 2011 and 2014. The CPR duration was defined as the time from CPR initiation by EMS providers to prehospital ROSC. The rate of 1-month CPC 1-2 was 21.4% (7,650/35,709). The CPR duration was independently and inversely associated with 1-month CPC 1-2 (adjusted odds ratio, 0.93 per 1-min increment; 95% confidence interval, 0.93-0.94). The CPR duration increased with age ($P < 0.001$). However, the CPR duration beyond which the proportion of OHCA patients with 1-month CPC 1-2 decreased to $< 1\%$ declined with age: 28 min for patients aged 18-64 years, 25 min for 65-74 years, 23 min for 75-84 years, 20 min for 85-94 years, and 18 min for ≥ 95 years.

CONCLUSIONS: In patients who achieved prehospital ROSC after OHCA, the duration of CPR administered by EMS providers necessary to achieve 1-month CPC 1-2 varied by age.

4. *Circ Cardiovasc Qual Outcomes*. 2017 Feb;10(2). pii: e003194. doi: 10.1161/CIRCOUTCOMES.116.003194.

Incidence and Survival After In-Hospital Cardiopulmonary Resuscitation in Nonelderly Adults: US Experience, 2007 to 2012.

Mallikethi-Reddy S1, Briasoulis A2, Akintoye E2, Jagadeesh K2, Brook RD2, Rubenfire M2, Afonso L2, Grines CL2.

Abstract

BACKGROUND: Survival trends after in-hospital cardiopulmonary resuscitation (ICPR) for cardiac arrest in nonelderly adults is not well known. Influence of cardiopulmonary resuscitation guidelines on nationwide survival after ICPR is yet to be well elucidated.

METHODS AND RESULTS: We examined survival trends and factors associated with survival after ICPR in nonelderly adults aged 18 to 64 years, using Healthcare Utilization Project Nationwide Inpatient Sample Database from 2007 through 2012 in the United States. Furthermore, we studied the impact of 2010 American Heart Association cardiopulmonary resuscitation guidelines on survival. We identified 235 959 patients who underwent ICPR after cardiac arrest. Overall, 30.4% patients survived to hospital discharge. Survival improved from 27.4% in 2007 to 32.8% in 2012 ($P_{\text{trend}} < 0.001$). Shockable arrest rhythms were noted in 23.3% of patients. Incidence of ICPR increased from 1.81 per 1000 hospitalizations in 2007 to 2.37 per 1000

hospitalizations in 2012 ($P_{trend} < 0.001$). There was no statistically significant change in survival trends before and after 2010 cardiopulmonary resuscitation guidelines. Female sex and shockable rhythms were associated with higher adjusted odds of survival, whereas black race, lack of health insurance, age, and weekend admission were associated with lower adjusted odds of survival.

CONCLUSIONS: Among nonelderly adults, survival after ICPR improved significantly from 2007 through 2012, with an overall survival rate of 30.4%. Incidence of ICPR increased significantly during the study period. There was no statistically significant change in survival before and after 2010 cardiopulmonary resuscitation guidelines. Female sex and black race were associated with higher and lower odds of survival, respectively.

5. *Handb Clin Neurol.* 2017;141:593-617. doi: 10.1016/B978-0-444-63599-0.00032-6.

Neurology of cardiopulmonary resuscitation.

Mulder M1, Geocadin RG2.

Abstract

This chapter aims to provide an up-to-date review of the science and clinical practice pertaining to neurologic injury after successful cardiopulmonary resuscitation. The past two decades have seen a major shift in the science and practice of cardiopulmonary resuscitation, with a major emphasis on postresuscitation neurologic care. This chapter provides a nuanced and thoughtful historic and bench-to bedside overview of the neurologic aspects of cardiopulmonary resuscitation. A particular emphasis is made on the anatomy and pathophysiology of hypoxic-ischemic encephalopathy, up-to-date management of survivors of cardiopulmonary resuscitation, and a careful discussion on neurologic outcome prediction. Guidance to practice evidence-based clinical care when able and thoughtful, pragmatic suggestions for care where evidence is lacking are also provided. This chapter serves as both a useful clinical guide and an updated, thorough, and state-of-the-art reference on the topic for advanced students and experienced practitioners in the field.

6. *Semin Respir Crit Care Med.* 2017 Feb;38(1):66-72. doi: 10.1055/s-0036-1597559. Epub 2017 Feb 16.

Massive Pulmonary Embolism: Extracorporeal Membrane Oxygenation and Surgical Pulmonary Embolectomy.

Weinberg A1, Tapson VF2, Ramzy D3.

Abstract

Massive pulmonary embolism (PE) refers to large emboli that cause hemodynamic instability, right ventricular failure, and circulatory collapse. According to the 2016 ACCP Antithrombotic Guidelines, therapy for massive PE should include systemic thrombolytic therapy in conjunction with anticoagulation and supportive care. However, in patients with a contraindication to systemic thrombolytics or in those who fail the above interventions, extracorporeal membrane oxygenation (ECMO) and/or surgical embolectomy may be used to improve oxygenation, achieve hemodynamic stability, and successfully treat massive PE. Randomized controlled human trials evaluating ECMO in this context have not been done, and its role has not been well-defined. The European Society of Cardiology 2014 acute PE guidelines briefly mention that ECMO can be used for massive PE as a method for hemodynamic support and as an adjunct to surgical embolectomy. The 2016 CHEST Antithrombotic Therapy for venous thromboembolism Disease guidelines do not mention ECMO in the management of massive PE. However, multiple case reports and small series cited benefit with ECMO for massive PE. Further, ECMO may facilitate stabilization for surgical embolectomy. Unfortunately, ECMO requires full anticoagulation to maintain the functionality of the system; hence, significant bleeding complicates its use in 35% of patients. Contraindications to ECMO include high bleeding risk, recent surgery or hemorrhagic stroke, poor baseline functional status, advanced age, neurologic dysfunction, morbid obesity, unrecoverable condition, renal failure, and prolonged cardiopulmonary resuscitation without adequate perfusion of end organs. In this review, we discuss management of massive PE, with an emphasis on the potential role for ECMO and/or surgical embolectomy.

VENTILACIÓ

1. Scand J Trauma Resusc Emerg Med. 2017 Feb 15;25(1):15. doi: 10.1186/s13049-017-0357-1.
Should capnography be used as a guide for choosing a ventilation strategy in circulatory shock caused by severe hypothermia? Observational case-series study.

Darocha T1,2,3, Kosiński S4,5, Jarosz A4,6, Podsiadło P4,7,8, Ziętkiewicz M4,6, Sanak T4,9,10, Gałązkowski R7,11, Piątek J4,12, Konstanty-Kalandyk J4,12, Drwiła R4,6.

Abstract

BACKGROUND: Severe accidental hypothermia can cause circulatory disturbances ranging from cardiac arrhythmias through circulatory shock to cardiac arrest. Severity of shock, pulmonary hypoperfusion and ventilation-perfusion mismatch are reflected by a discrepancy between measurements of CO₂ levels in end-tidal air (EtCO₂) and partial CO₂ pressure in arterial blood (PaCO₂). This disparity can pose a problem in the choice of an optimal ventilation strategy for accidental hypothermia victims, particularly in the prehospital period. We hypothesized that in severely hypothermic patients capnometry should not be used as a reliable guide to choose optimal ventilatory parameters.

METHODS: We undertook a pilot, observational case-series study, in which we included all consecutive patients admitted to the Severe Hypothermia Treatment Centre in Cracow, Poland for VA-ECMO in stage III hypothermia and with signs of circulatory shock. We performed serial measurements of arterial blood gases and EtCO₂, core temperature, and calculated a PaCO₂/EtCO₂ quotient.

RESULTS: The study population consisted of 13 consecutive patients (ten males, three females, median 60 years old). The core temperature measured in esophagus was 20.7-29.0 °C, median 25.7 °C. In extreme cases we have observed a Pa-EtCO₂ gradient of 35-36 mmHg. Median PaCO₂/EtCO₂ quotient was 2.15.

DISCUSSION AND CONCLUSION: Severe hypothermia seems to present an example of extremely large Pa-EtCO₂ gradient. EtCO₂ monitoring does not seem to be a reliable guide to ventilation parameters in severe hypothermia.

CURES POSTRCE

1. Medicine (Baltimore). 2017 Feb;96(7):e6123. doi: 10.1097/MD.00000000000006123.

Role of coronary angiography for out-of-hospital cardiac arrest survivors according to postreturn of spontaneous circulation on an electrocardiogram.

Lee TR1, Hwang SY, Cha WC, Shin TG, Sim MS, Jo IJ, Song KJ, Rhee JE, Jeong YK.

Abstract

Survivors of out-of-hospital cardiac arrest (OHCA) have high mortality and morbidity. An acute coronary event is the most common cause of sudden cardiac death. For this reason, coronary angiography is an important diagnostic and treatment strategy for patients with postcardiac arrest. This study aimed to identify the correlation between postreturn of spontaneous circulation (ROSC) on an electrocardiogram (ECG) and results of coronary angiography of OHCA survivors. We collected data from our OHCA registry from January 2010 to November 2014. We categorized OHCA survivors into 2 groups according to post-ROSC ECG results. Emergent coronary artery angiography (CAG) (CAG performed within 12 hours after cardiac arrest) was performed in patients who showed ST segment elevation or new onset of left bundle branch block (LBBB) in post-ROSC ECG. For other patients, the decision for performing CAG was made according to agreement between the emergency physician and the cardiologist. During the study period, 472 OHCA victims visited our emergency department and underwent cardiopulmonary resuscitation. Among 198 OHCA survivors, 82 patients underwent coronary artery intervention. Thirty-one (70.4%) patients in the ST segment elevation or LBBB group and 10 (24.4%) patients in the nonspecific ECG group had coronary artery lesions ($P < .01$). Seven (18.4%) patients in the nonspecific ECG group showed coronary spasm. OHCA survivors without ST segment elevation or new onset LBBB still have significant coronary lesions in CAG. If there is no other obvious

arrest cause in patients without significant changes in post ROSC ECG, CAG should be considered to rule out the possibility of coronary artery problems, including coronary spasm.

2. Anaesthesia. 2017 Feb 15. doi: 10.1111/anae.13809. [Epub ahead of print]

Haemodynamic changes to a midazolam-fentanyl-rocuronium protocol for pre-hospital anaesthesia following return of spontaneous circulation after cardiac arrest.

Miller M1, Groombridge C2, Lyon R1,3.

Abstract

Following the return of spontaneous circulation after out-of-hospital cardiac arrest, neurological dysfunction, airway or ventilatory compromise can impede transport to early percutaneous coronary intervention, necessitating pre-hospital or emergency department anaesthesia to facilitate this procedure. There are no published reports of the ideal induction agents in these patients. We sought to describe haemodynamic changes associated with induction of anaesthesia using a midazolam (0.1 mg.kg⁻¹), fentanyl (2 µg.kg⁻¹) and rocuronium (1 mg.kg⁻¹) regimen developed using expert opinion, and adherence to the protocol by our pre-hospital teams. We performed a retrospective review of haemodynamic data recorded during induction of anaesthesia in patients following return of spontaneous circulation, over a 30-month period. We analysed the changes in systolic blood pressure and heart rate using a repeated-measures design, as well as the rate of new hypotension or hypertension. Sixty-four patients had four consecutive measurements for analysis (one pre-induction and three post-induction). Systolic blood pressure at all three post-induction measurements was significantly lower than the pre-induction value. Heart rate did not differ between any time-points. New episodes of hypotension (systolic pressure <90 mmHg) occurred in four (6%) patients at the first measurement post-induction (95%CI 2-15%) and 10 (16%) at the third measurement (95%CI 8-27%). Three patients (5%; 95%CI 1-13%) had a hypertensive response. The median (IQR[range]) dose of midazolam given at induction was 0.04 (0.03-0.05 [0.01 to 0.10]) mg.kg⁻¹. Adherence to recommended fentanyl and rocuronium doses was high. Overall, systolic blood pressure was reduced following induction of anaesthesia, and systolic pressures < 90 mmHg occurred more often at measurements made later (up to 9 min) after induction. Changes in heart rate, and new hypertension were uncommon.

3. Resuscitation. 2017 Feb 12. pii: S0300-9572(17)30051-5. doi: 10.1016/j.resuscitation.2017.01.028. [Epub ahead of print]

Predictors of long-term functional outcome and health-related quality of life after out-of-hospital cardiac arrest.

Geri G1, Dumas F2, Bonnetain F3, Bougouin W1, Champigneulle B4, Arnaout M4, Carli P5, Marijon E6, Varenne O7, Mira JP4, Empana JP8, Cariou A9.

Abstract

BACKGROUND: Even if a large majority of out-of-hospital cardiac arrest (OHCA) survivors appear to have a good neurological recovery with no important sequelae, whether health-related quality of life (HRQOL) is altered is less explored.

PATIENTS AND METHODS: HRQOL was evaluated by telephone interview using SF-36 questionnaire. Each OHCA case was age and gender-matched with 4 controls from the French general population. Association between current condition of the survivors with the 8 dimensions of the SF-36 questionnaire was investigated using MANCOVA. Cluster analysis was performed to identify patterns of HRQOL among CPC1 survivors.

RESULTS: 255 patients discharged alive from our referral centre between 2000 and 2013 (median age of 55y [45,64], 73.7% males) were interviewed. Global physical and mental components did not differ between CPC 1 survivors and controls (47.0 vs. 47.1, p=0.88 and 46.4 vs. 46.9, p=0.45) but substantially differed between CPC2, CPC3 and the corresponding controls. Younger age, male gender, good neurological recovery and daily-life autonomy at telephone interview were significantly associated with better scores in each SF-36 dimensions. Cluster analysis individualized 4 distinct subgroups of CPC1 patients characterised by progressively increased score of SF-36. Return to work and daily-life autonomy were differently distributed across these 4 groups while pre-hospital Utstein variables were not.

CONCLUSION: HRQOL of CPC1 OHCA survivors appeared similar to that of the general population, but patients with CPC2 or 3 had altered HRQOL. Younger age, male gender, good neurological recovery and daily-life autonomy were independently associated with a better HRQOL.

RECERCA EXPERIMENTAL

1. Am J Emerg Med. 2017 Feb 6. pii: S0735-6757(17)30099-2. doi: 10.1016/j.ajem.2017.02.013. [Epub ahead of print]

Therapeutic hypothermia attenuates brain edema in a pig model of cardiac arrest: Possible role of the angiotensin-Tie-2 system.

Li J1, Li C2, Yuan W3, Wu J3, Li J4, Li Z5, Zhao Y3.

Abstract

OBJECTIVE: This study aimed to clarify whether therapeutic hypothermia protects against cerebral edema following cardiac arrest (CA) and cardiopulmonary resuscitation (CPR) in a porcine model via regulating the angiotensin-Tie-2 ligand-receptor system.

METHODS: Male pigs were randomized into the therapeutic hypothermia group, the normothermia group or the sham control group. CA was induced in pigs by untreated ventricular fibrillation for 8min. Brain edema was determined by measuring the cerebral cortical water content at 24h after the return of spontaneous circulation (ROSC). The serum levels of angiotensin-1 (Ang-1), angiotensin-2 (Ang-2), tyrosine kinase with immunoglobulin-like loop epidermal growth factor homology domain 2 (Tie-2), and S100B were measured using enzyme immunoassay kits at 0.5, 6, 12 and 24h after ROSC. The levels of the Ang-1, Ang-2, phosphorylated Tie-2 and Tie-2 proteins in the cerebral cortex at 24h after ROSC were determined by Western blotting.

RESULTS: Therapeutic hypothermia lessened brain cortex edema, alleviated histopathology injury, and improved neurologic outcomes at 24h after ROSC. Therapeutic hypothermia inhibited the CA- and CPR-induced increases in serum Ang-2 protein expression and the Ang-2/Ang-1 ratio and attenuated the decrease in serum Ang-1 expression. Therapeutic hypothermia also increased the protein expression of Ang-1 and the phosphorylated Tie-2/Tie-2 ratio and inhibited the expression of Ang-2 in the cerebral cortex at 24h after ROSC.

CONCLUSIONS: Based on our experiment, therapeutic hypothermia decreased cerebral edema after CA, which may be, at least in part, related to its ability to modulate the expression of components of the Ang-Tie-2 system.

2. J Neurosci Res. 2017 Feb 15. doi: 10.1002/jnr.24033. [Epub ahead of print]

Cortical spreading depolarizations in the postresuscitation period in a cardiac arrest male rat model.

Hansen FB1,2, Secher N1, Jensen MS3, Østergaard L4, Tønnesen E1, Granfeldt A1.

Abstract

Neurological injury develops over days following cardiac arrest (CA); however, the exact mechanisms remain unknown. After stroke or trauma, the progression of neurological injury is associated with cortical-spreading depolarizations (CSDs). The objective was to investigate whether CA and subsequent resuscitation in rats are associated with 1) the development of spontaneous negative direct current (DC) shifts indicative of CSDs, and 2) changes in artificially induced CSDs in the postresuscitation period. Male Sprague-Dawley rats were randomized into four groups: 1) CA 90, 2) Control 90, 3) CA 360, and 4) Control 360. Following 8 min of asphyxial CA, animals were resuscitated using adrenaline, ventilation, and chest compressions. Animals were observed for 90 or 360 min, respectively, before a 210-min data collection period. Cortical potentials were recorded through burr holes over the right hemisphere. Animals were intubated and monitored with invasive blood pressure, ECG, and arterial blood gas samples throughout the study. Spontaneous DC shifts occurred in only 1 of the 14 CA animals. In control animals, DC shifts were easy to induce, and their shape was highly uniform, consistent with that of classical CSDs. In CA animals, significantly fewer DC shifts could be induced, and their shape was profoundly altered compared with controls. We observed frequent epileptiform discharges and

temporal clusters of activity. Spontaneous CSDs were not a consistent finding in CA animals. Instead, spontaneous epileptiform discharges and temporal cluster of activity were observed, while the shapes of induced DC shifts were profoundly altered compared with controls.

CASE REPORTS

1. Int J Obstet Anesth. 2017 Jan 9. pii: S0959-289X(17)30009-2. doi: 10.1016/j.ijoa.2017.01.003. [Epub ahead of print]

Successful provision of inter-hospital extracorporeal cardiopulmonary resuscitation for acute post-partum pulmonary embolism.

McDonald C1, Laurie J2, Janssens S3, Zazulak C4, Kotze P5, Shekar K6.

Abstract

Mortality during pregnancy in a well-resourced setting is rare, but acute pulmonary embolism is one of the leading causes. We present the successful use of extracorporeal cardiopulmonary resuscitation (eCPR) in a 22-year old woman who experienced cardiopulmonary collapse following urgent caesarean section in the setting of a sub-massive pulmonary embolus. Resources and personnel to perform eCPR were not available at the maternity hospital and were recruited from an adjacent pediatric hospital. Initial care used low blood flow extracorporeal membrane oxygenation (ECMO) with pediatric ECMO circuitry, which was optimized when the team from a nearby adult cardiac hospital arrived. Following ECMO support, the patient experienced massive hemorrhage which was managed with uterotonic agents, targeted transfusion, bilateral uterine artery embolisation and abdominal re-exploration. The patient was transferred to an adult unit where she remained on ECMO for five days. She was discharged home with normal cognitive function. This case highlights the role ECMO plays in providing extracorporeal respiratory or mechanical circulatory support in a high risk obstetric patient.