1. Indian J Pediatr. 2020 Sep 27:1-7. doi: 10.1007/s12098-020-03483-w. Online ahead of print.
IAP ALS Update on Resuscitation Guidelines During COVID-19 Pandemic.
Tiwari L(1)(2), Taneja LN(3)(4), Gupta S(5); Other Expert Committee Members.
Abstract
Corona virus disease 2019 (COVID-19) pandemic has posed significant risk for health care workers. Various steps of cardiopulmonary resuscitation involve aerosol-generating procedures and have significant risk of spread of corona virus. Indian Academy of Pediatrics Advanced Life Support Basic Life Support (IAP ALS BLS) group had constituted a guideline update team to suggest modifications in existing resuscitation guidelines in view of COVID-19 pandemic. The GRADE approach was used to develop recommendations on shortlisted clinical practice questions on resuscitation during COVID pandemic as modifications.
FREE FULL TEXT

2. BMJ. 2020 Sep 30;371:m3513. doi: 10.1136/bmj.m3513.
In-hospital cardiac arrest in critically ill patients with covid-19: multicenter cohort study.
Hayek SS(1), Brenner SK(2)(3), Azam TU(4), Shadid HR(5), Anderson E(4), Berlin H(5), Pan M(5), Meloche C(5), Feroz R(5), O'Hayer P(5), Kaakati R(5), Bitar A(4), Padalia K(5), Perry D(4), Blakely P(4), Gupta S(6), Shaefi S(7), Srivastava A(8), Charytan DM(9), Bansal A(10), Mallappallil M(11), Melamed
ML(12), Shehata AM(13), Sunderram J(14), Mathews KS(15), Sutherland AK(16), Nallamothu BK(4), Leaf DE(6); STOP-COVID Investigators.
Abstract
OBJECTIVES: To estimate the incidence, risk factors, and outcomes associated with in-hospital cardiac arrest and cardiopulmonary resuscitation in critically ill adults with coronavirus disease 2019 (covid-19). DESIGN: Multicenter cohort study. SETTING: Intensive care units at 68 geographically diverse hospitals across the United States. PARTICIPANTS: Critically ill adults (age ≥18 years) with laboratory confirmed covid-19. MAIN OUTCOME MEASURES: In-hospital cardiac arrest within 14 days of admission to an intensive care unit and in-hospital mortality. RESULTS: Among 5019 critically ill patients with covid-19, 14.0% (701/5019) had in-hospital cardiac arrest, 57.1% (400/701) of whom received cardiopulmonary resuscitation. Patients who had in-hospital cardiac arrest were older (mean age 63 (standard deviation 14) v 60 (15) years), had more comorbidities, and were more likely to be admitted to a hospital with a smaller number of intensive care unit beds compared with those who did not have in-hospital cardiac arrest. Patients who received cardiopulmonary resuscitation were younger than those who did not (mean age 61 (standard deviation 14) v 67 (14) years). The most common rhythms at the time of cardiopulmonary resuscitation were pulseless electrical activity (49.8%, 199/400) and asystole (23.8%, 95/400). 48 of the 400 patients (12.0%) who received cardiopulmonary resuscitation survived to hospital discharge, and only 7.0% (28/400) survived to hospital discharge with normal or mildly impaired neurological status. Survival to hospital discharge differed by age, with 21.2% (11/52) of patients younger than 45 years surviving compared with 2.9% (1/34) of those aged 80 or older. CONCLUSIONS: Cardiac arrest is common in critically ill patients with covid-19 and is associated with poor survival, particularly among older patients.

RCP/COMPRESSIONS TORÀCIQUES MECÀNIQUES

Monitoring chest compression rate in automated external defibrillators using the autocorrelation of the transthoracic impedance.
Ruiz de Gauna S(1), Ruiz JM(1), Gutiérrez JJ(1), González-Otero DM(1)(2), Alonso D(3), Corcuera C(3), Urtusagasti JF(3).
Abstract
Aim: High-quality chest compressions is challenging for bystanders and first responders to out-of-hospital cardiac arrest (OHCA). Long compression pauses and compression rates higher than recommended are common and detrimental to survival. Our aim was to design a simple and low computational cost algorithm for feedback on compression rate using the transthoracic impedance (TI) acquired by automated external defibrillators (AEDs).
Methods: ECG and TI signals from AED recordings of 242 OHCA patients treated by basic life support (BLS) ambulances were retrospectively analyzed. Beginning and end of chest compression series and each individual compression were annotated. The algorithm computed a biased estimate of the autocorrelation of the TI signal in consecutive non-overlapping 2-s analysis windows to detect the presence of chest compressions and estimate compression rate.
Results: A total of 237 episodes were included in the study, with a median (IQR) duration of 10 (6-16) min. The algorithm performed with a global sensitivity in the detection of chest compressions of 98.7%, positive predictive value of 98.7%, specificity of 97.1%, and negative predictive value of 97.1% (validation subset including 207 episodes). The unsigned error in the estimation of compression rate was 1.7 (1.3-2.9) compressions per minute.
Conclusion: Our algorithm is accurate and robust for real-time guidance on chest compression rate using AEDs. The algorithm is simple and easy to implement with minimal software modifications. Deployment of AEDs with this capability could potentially contribute to enhancing the quality of chest compressions in the first minutes from collapse.

Mechanical versus manual chest compressions for cardiac arrest.
Wang PL(1), Brooks SC(2).
ABSTRACT NO DISPONIBLE

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Predictive Utility of End-Tidal Carbon Dioxide on Defibrillation Success in Out-of-Hospital Cardiac Arrest.
Hubble MW(1), Van Vleet L(2), Taylor S(3), Bachman M(4), Williams JG(4), Vipperman R(5), Renkiewicz GK(1).
Abstract
Introduction: The likelihood of survival from ventricular fibrillation (VF) declines 7%-10% per minute until successful defibrillation. When VF duration is prolonged, immediate defibrillation of the ischemic myocardium is less likely to result in ROSC, and repeated unsuccessful defibrillations are associated with post-resuscitation myocardial dysfunction. Thus, the timing of defibrillation should be based upon the probability of shock success-a function of VF duration. Unfortunately, VF duration is often unknown in out-of-hospital cardiac arrest (OHCA) and a better predictor of shock success is needed. Objective: To assess the ability of end-tidal carbon dioxide (EtCO$_2$) to predict successful defibrillation in OHCA. Methods: This retrospective study included adult patients among four EMS systems who experienced non-traumatic OHCA from August, 2015-July, 2017 and received one or more defibrillations. First and succedent shocks were analyzed separately. First shocks represented EMS-attempted defibrillation of patients who had not received a prior AED shock, whereas succedent shocks included all shocks subsequent to the first. Logistic regression provided odds ratios (OR) for first shocks resulting in ROSC, while a generalized estimating equation was used to analyze succedent shocks. Results: Among 324 patients, 869 shocks were delivered by EMS (153 first and 716 succedent shocks). Layperson CPR was performed in 48.1% of cases and 21.6% received an AED shock before EMS arrival. First defibrillation ROSC was more likely with layperson CPR (OR =4.41;p = 0.01) and increasing EtCO$_2$ (OR =1.03/mmHg;p = 0.01). No other variables were statistically significant. Notably, only one patient with EtCO$_2$<20 mmHg was successfully defibrillated on the first shock. The probability of ROSC was higher with increasing values of EtCO$_2$ when layperson CPR was provided, yet remained relatively unchanged across all values of EtCO$_2$≥20 mmHg without layperson CPR. The optimal threshold first shock EtCO$_2$ was 27 and 32 mmHg for those with/without layperson CPR, respectively. EtCO$_2$ was not a predictor of ROSC for succedent shocks. Conclusions: An optimal defibrillation threshold EtCO2 of 27 and 32 mmHg was observed for patients with and without layperson CPR, respectively. Further studies are warranted to verify these results and to evaluate the clinical effect of delaying defibrillation in favor of chest compressions until these values are attained.

Uses and pitfalls of measurement of end-tidal carbon dioxide during cardiac arrest.
Nicholson TC(1), Pavia EF(2).
Abstract
Purpose of review: To discuss recent studies relevant to the utility of measuring end-tidal carbon dioxide (ETCO2) during cardiopulmonary resuscitation (CPR) and its correlation with outcome in adults experiencing cardiac arrest.
Recent findings: Over the past couple of years, at least five studies have included measurement of ETCO2 in their methods. Two of these studies were prospective and two retrospective. All considered ETCO2 measurements after out-of-hospital cardiac arrest, either in the prehospital setting, or after arrival in the emergency department. All assessed for an association between ETCO2 measurement and return of spontaneous circulation (ROSC).

However, the timing of measurement, whether a one-off value or a trend and the cut-off values used to determine whether or not there was an association were different in all cases.
Summary: Higher values of ETCO2 during resuscitation from cardiac arrest are generally associated with a greater likelihood of ROSC. However, timing of measurements and cut-off values used show significant variability across different studies, making it hard to draw any conclusions about the utility of any particular reading for prognostication. Future studies might aim to develop an accepted standard for the timing and cut-off value of ETCO2 used, to enable comparison of the parameter across different studies.

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FEEDBACK

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FÀRMACS

Epinephrine's effects on cerebrovascular and systemic hemodynamics during cardiopulmonary resuscitation.
Mavroudis CD(1)(2), Ko TS(3), Morgan RW(4), Volk LE(5), Landis WP(4), Smood B(6), Xiao R(7), Hefti M(8), Boorady TW(3), Marquez A(4), Karlsson M(9), Licht DJ(3), Nadkarni VM(4), Berg RA(4), Sutton RM(4), Kilbaugh TJ(4).
Abstract
Background: Despite controversies, epinephrine remains a mainstay of cardiopulmonary resuscitation (CPR). Recent animal studies have suggested that epinephrine may decrease cerebral blood flow (CBF) and cerebral oxygenation, possibly potentiating neurological injury during CPR. We investigated the cerebrovascular effects of intravenous epinephrine in a swine model of pediatric in-hospital cardiac arrest. The primary objectives of this study were to determine if (1) epinephrine doses have a significant acute effect on CBF and cerebral tissue oxygenation during CPR and (2) if the effect of each subsequent dose of epinephrine differs significantly from that of the first.
Methods: One-month-old piglets (n = 20) underwent asphyxia for 7 min, ventricular fibrillation, and CPR for 10-20 min. Epinephrine (20 mcg/kg) was administered at 2, 6, 10, 14, and 18 min of CPR. Invasive (laser Doppler, brain tissue oxygen tension [$PbtO_2$]) and noninvasive (diffuse correlation spectroscopy and diffuse optical spectroscopy) measurements of CBF and cerebral tissue oxygenation were simultaneously recorded. Effects of subsequent epinephrine doses were compared to the first.
Results: With the first epinephrine dose during CPR, CBF and cerebral tissue oxygenation increased by > 10%, as measured by each of the invasive and noninvasive measures (p < 0.001). The effects of epinephrine on CBF and cerebral tissue oxygenation decreased with subsequent doses. By the fifth dose of epinephrine, there were no demonstrable increases in CBF of cerebral tissue oxygenation. Invasive and noninvasive CBF measurements were highly correlated during asphyxia (slope effect 1.3, p < 0.001) and CPR (slope effect 0.20, p < 0.001).
Conclusions: This model suggests that epinephrine increases CBF and cerebral tissue oxygenation, but that effects wane following the third dose. Noninvasive measurements of neurological health parameters hold promise for developing and directing resuscitation strategies.

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Cost-effectiveness of adrenaline for out-of-hospital cardiac arrest.
Achana F(1)(2), Petrou S(1)(2), Madan J(1), Khan K(1), Ji C(1), Hossain A(3), Lall R(1), Slowther AM(1), Deakin CD(4), Quinn T(5), Nolan JP(1)(6), Pocock H(1)(7), Rees N(8), Smyth M(1)(9), Gates S(10), Gardiner D(11), Perkins GD(12); PARAMEDIC2 Collaborators.
Abstract
Background: The 'Prehospital Assessment of the Role of Adrenaline: Measuring the Effectiveness of Drug Administration In Cardiac Arrest' (PARAMEDIC2) trial showed that adrenaline improves overall survival, but not neurological outcomes. We sought to determine the within-trial and lifetime health and social care costs and benefits associated with adrenaline, including secondary benefits from organ donation.
Methods: We estimated the costs, benefits (quality-adjusted life years (QALYs)) and incremental cost-effectiveness ratios (ICERs) associated with adrenaline during the 6-month trial follow-up. Model-based analyses explored how results altered when the time horizon was extended beyond 6 months and the scope extended to include recipients of donated organs.
Results: The within-trial (6 months) and lifetime horizon economic evaluations focussed on the trial population produced ICERs of £1,693,003 (€1,946,953) and £81,070 (€93,231) per QALY gained in 2017 prices, respectively, reflecting significantly higher mean costs and only marginally higher mean QALYs in the adrenaline group. The probability that adrenaline is cost-effective was less than 1% across a range of cost-effectiveness thresholds. Combined direct economic effects over the lifetimes of survivors and indirect economic effects in organ recipients produced an ICER of £16,086 (€18,499) per QALY gained for adrenaline with the probability that adrenaline is cost-effective increasing to 90% at a £30,000 (€34,500) per QALY cost-effectiveness threshold.
Conclusions: Adrenaline was not cost-effective when only directly related costs and consequences are considered. However, incorporating the indirect economic effects associated with transplanted organs substantially alters cost-effectiveness, suggesting decision-makers should consider the complexity of direct and indirect economic impacts of adrenaline.
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TRAUMA

First Experience with The Abdominal Aortic and Junctional Tourniquet in Prehospital Traumatic Cardiac Arrest.
Balian F(1), Garner AA(2), Weatherall A(3), Lee A(4).
Abstract
Introduction: The Abdominal Aortic and Junctional Tourniquet (AAJT) increased systemic vascular resistance, mean arterial pressure, carotid blood flow and rate of return of spontaneous circulation (ROSC) in animals with hypovolaemic traumatic cardiac arrest (TCA). The objective of this study was to report the first experience of the use of the AAJT as part of a pre-hospital TCA algorithm.
Methods: This is a descriptive case series of the use of the AAJT in patients with TCA in a civilian physician-led pre-hospital trauma service in Sydney, Australia between June 2015 to August 2019. Cases were identified and data sourced from routinely collected data sets within the retrieval service.

Results: During the study, 44 TCAs were attended, 22 with AAJT application. Mean time (standard deviation) to AAJT application since last signs of life was 16 (9) minutes. Eighteen (16 males, 2 females) patients, with median age (interquartile range) of 40 (25-58) years, were included for analysis. Seventeen patients (94%) had blunt trauma. Sixteen patients (89%) were in TCA at the time of service contact, 11 (61%) had a change in electrical activity, 4 (22%) had ROSC, and of the 6 with documented end-tidal carbon dioxide, the mean rise was 24.0mmHg (95% CI 12.6-35.4) (P=0.003). Three patients (17%) had sustained ROSC on arrival to the Emergency Department. No patients survived to hospital discharge.

Conclusion: Physiological changes were demonstrated but there were no survivors. Further research focusing on faster application times may be associated with improved outcomes.

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1. Am J Cardiol. 2020 Sep 29:S0002-9149(20)31007-9. doi: 10.1016/j.amjcard.2020.09.032. Online ahead of print.

Effectiveness of the 40-Minute Handmade Manikin Program to Teach Hands-on Cardiopulmonary Resuscitation at School Communities.

Nakagawa NK(1), Oliveira KMG(2), Lockey A(3), Semeraro F(4), Aikawa P(5), Macchione M(6), Carvalho-Oliveira R(6), Gouvêa GB(2), Boaventura AP(7), Maiworm AI(8), Calderaro M(9), Hajjar LA(10), Motta EV(11), Souza HP(12), Saldiva de André CD(13), Silva LFF(6), Polastri TF(14), Timerman S(14), Carmona MC(15), Böttiger BW(16).

Abstract

Bystander training in cardiopulmonary resuscitation (CPR) is crucial to improve the victims' survival and quality of life after sudden cardiac arrest. This quasi-experimental study aimed to determine the success rate of two different programs of CPR-training for children, adolescents, and adults in school communities. We assessed the development and acquisition of the following CPR-skills: checking local safety, assessing victim's responsiveness, calling for help, assessing victim's breathing, and performing chest compression (hands and straight arms placement on the chest, compression velocity, depth, and chest release) using a 40-minute program with handmade manikins or the 120-minute program using intermediate-fidelity manikins. There were 1,630 learners (mean age 16 years, 38% male) in the 40-minute program, and 347 learners (mean age 27 years, 32% male) in the 120-minute program. The lowest successful pass rate of learners that developed CPR-skills was 89.4% in the 40-minute program and 84.5% in the 120-minute program. The chances of success increased with age in the same program (compression rate and depth). The success rate also increased with the more extended and intermediate-cost program at the same age (assessing victim's responsiveness, calling for help, and assessing the victim's respiration). In conclusion, a forty-

minute and cheaper (low-cost handmade manikin) CPR program was adequate to develop and acquire the overall CPR skills for ≥ 89 % at school communities, independently of gender. However, some individual CPR skills can be further improved with increasing age and using the longer and intermediate-cost program.

Quality of cardiopulmonary resuscitation: Degree of agreement between instructor and a feedback device during a simulation exercise.
Arrogante O(1), González-Romero GM(2), Caperos JM(3), Samith S(4), Carrión-García L(5), Ríos-Díaz J(6).
Abstract
Background: High-quality cardiopulmonary resuscitation (CPR) saves lives after a cardiorespiratory arrest. Currently used feedback devices (FD) provide accurate information on CPR quality during training. However, there is no consensus in previous studies that have compared FD to the feedback provided by an instructor and most show methodological limitations. This study aimed to analyse the degree of agreement between an FD and an instructor in the assessment of high-quality CPR.
Method: 60 undergraduate nursing students participated in a descriptive observational study. Variables related to the quality of chest compressions (CC) and ventilation were recorded. Students were evaluated during 2-minute compression/ventilation cycles by an expert instructor and using the CPR training torso, Little Anne™ QCPR (Laerdal Medical) with its associated QCPR Instructor App software for iOS.
Results: The degree of agreement between instructor and FD assessments was moderate-good: CC rate per minute (Intracass correlation coeficiente [ICC] = 0.791), complete chest recoil (ICC = 0.437); CC depth (k = 0.804); CC with correct depth (ICC = 0.557); correct ventilations (k = 0.510); ventilations per cycle (ICC = 0.635); CC per cycle (ICC = 0.215); overall quality of CPR (ICC = 0.602). However, the degree of agreement should be considered poor since the limits were broad.
Conclusions: Although there were discrepancies between the FD and the instructor, it would be advisable to follow a combined approach in CPR training, whereby the quantitative feedback supplied by the FD is complemented by the qualitative assessment of an instructor.

When dispatcher assistance is not saving lives: assessment of process compliance, barriers and outcomes in out-of-hospital cardiac arrest in a metropolitan city in China.
Zhang L(1), Luo M(2), Myklebust H(3), Pan C(2), Wang L(2), Zhou Z(2), Yang Q(2), Lin Q(2), Zheng ZJ(4).
Abstract
Background: Several Chinese cities have implemented dispatcher-assisted cardiopulmonary resuscitation (DA-CPR), although out-of-hospital cardiac arrest (OHCA) survival rates remain low. We aimed to assess the process compliance, barriers and outcomes of OHCA in one of the earliest implemented (DA-CPR) programmes in China.
Methods: We retrospectively reviewed OHCA emergency dispatch records of Suzhou emergency medical service from 2014 to 2015 and included adult OHCA victims (>18 years) with a bystander-witnessed atraumatic OHCA that was subsequently confirmed by on-site emergency physician. The circumstances and DA-CPR process related to the OHCA event were analysed. Dispatch audio records were reviewed to identify potential barriers to implementation during the DA-CPR process.
Results: Of the 151 OHCA victims, none survived. The median time from patient collapse to call for emergency services and that from call to provision of cardiopulmonary resuscitation

instructions was 30 (IQR 20-60) min and 115 (IQR 90-153) s, respectively. Only 110 (80.3%) bystanders/rescuers followed the dispatcher instructions; of these, 51 (46.3%) undertook persistent chest compressions. Major barriers to following the DA-CPR instructions were present in 104 (68.9%) cases, including caller disconnection of the call, distraught mood or refusal to carry out either compressions or ventilations.

Conclusions: The OHCA survival rate and the DA-CPR process were far from optimal. The zero survival rate is disproportionally low compared with survival statistics in high-income countries. The prolonged delay in calling the emergency services negated and rendered futile any DA-CPR efforts. Thus, efforts targeted at developing public awareness of OHCA, calling for help and competency in DA-CPR should be increased.

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Factors associated with knowledge and attitude towards adult cardiopulmonary resuscitation among healthcare professionals at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia: an institutional-based cross-sectional study.

Mersha AT(1), Gebre Egzi AHK(2), Tawuye HY(2), Endalew NS(2).

Abstract

OBJECTIVE: This study was conducted to assess the factors associated with knowledge and attitude towards adult cardiopulmonary resuscitation (CPR) among health professionals at the University of Gondar Hospital, Northwest Ethiopia.STUDY DESIGN: An institutional-based cross-sectional study was conducted from 15 February to 15 March 2018. Both bivariable and multivariable logistic regression analyses were used to identify factors associated with knowledge and attitude level of health professionals towards CPR. Variables with a p value less than <0.2 in the bivariable analysis were fitted into the multivariable analysis. In the multivariable analysis, variables with a p value <0.05 were considered statistically significant.SETTING: University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia. PARTICIPANTS: A total of 406 health professionals (physicians, nurses, anaesthetists, health officers and midwives) were included. RESULTS: Among the study participants, 25.1% (95% CI 21.2 to 29.3) had good knowledge and 60.8% (95% CI 55.9 to 65.5) had good attitude towards adult CPR. Work experience (adjusted OR (AOR): 5.02, 95% CI 1.25 to 20.20), number of work settings (AOR: 6.52, 95% CI 2.76 to 15.41), taking CPR training (AOR: 2.76, 95% CI 1.40 to 5.42), exposure to cardiac arrest case (AOR: 2.16, 95% CI 1.14 to 4.07) and reading CPR guidelines (AOR: 5.57, 95% CI 2.76 to 11.20) were positively associated with good knowledge. Similarly, taking CPR training (AOR: 1.74, 95% CI 1.42 to 1.53) and reading CPR guidelines (AOR: 2.74, 95% CI 1.55 to 4.85) were positively associated with good attitude. CONCLUSIONS: The level of knowledge and attitude of health professionals towards adult CPR was suboptimal. Health professionals who were taking CPR training and reading CPR guidelines had good knowledge and attitude towards CPR. In addition, work experience, number of work settings and exposure to cardiac arrest case had a positive association with CPR knowledge. Thus, providing regular CPR training and work setting rotations is highly crucial.

CURES POST-RCE

Copeptin as a Prognostic Marker in Prolonged Targeted Temperature Management After Out-of-Hospital Cardiac Arrest.

Paramanathan S(1), Grejs AM(1), Jeppesen AN(2), Søreide E(3)(4), Kirkegaard H(2), Duez CHV(2).

Abstract

The aim was to investigate blood concentrations of copeptin and the prognostication in 24 versus 48 hours of targeted temperature management (TTM) in patients resuscitated after out-of-hospital cardiac arrest. This is an exploratory biomarker substudy of the trial entitled; "Targeted temperature management for 48 vs 24 hours and neurologic outcome after out-of-hospital-cardiac-arrest: A randomized clinical trial." Patients were randomized to target temperature of 33°C ± 1°C for 24 (TTM24) or 48 (TTM48) hours. The primary outcome was copeptin concentrations compared with TTM at admission, 24, 48, and 72 hours (t24, t48, and t72) after reaching target temperature. Secondary outcomes were the association between copeptin and cerebral performance category (CPC) score after 6 months, and copeptin level between cerebral or noncerebral causes of death. Blood samples from 117 patients were analyzed from two Scandinavian sites. No significant differences in copeptin concentrations were found between TTM24 versus TTM48 at admission 211.3 µg/L (148-276.6) versus 179.8 µg/L (127-232.6) ($p = 0.45$), t24: 23.3 µg/L (16.5-30.2) versus 18.6 µg/L (13.3-23.9) ($p = 0.25$), t48: 28.8 µg/L (20.6-36.9) versus 19.7 µg/L (14.3-25.1) ($p = 0.06$), and t72: 23.3 µg/L (13.8-26.8) versus 31.6 µg/L (22-41.2) ($p = 0.05$). Copeptin concentrations were significantly higher in poor neurological outcome group at t24, t48, and t72 ($p < 0.01$), but not at admission ($p = 0.19$). The prognostic ability of copeptin (area under the receiver operating characteristic curve) was at admission: 0.59 (95% confidence intervals: 0.46-0.72), t24: 0.74 (0.63-0.86), t48: 0.8 (0.7-0.9), and t72: 0.76 (0.65-0.87). Copeptin levels were not significantly different in noncerebral compared with cerebral causes at admission: $p = 0.41$, t24: $p = 0.52$, t48: $p = 0.15$, and t72: $p = 0.38$. There were no differences in the level of copeptin in TTM24 versus TTM48. Blood concentrations of copeptin were associated with CPC at 6 months, and no association between levels of copeptin and cerebral versus noncerebral causes of death was observed.

Effectiveness of Sodium Bicarbonate Administration on Mortality in Cardiac Arrest Patients: A Systematic Review and Meta-analysis.

Wu KH(1), Chang CY(1), Chen YC(2), Chang CP(1), Hsiao CT(3), Weng HH(4).

Abstract
Background: The 2010 Advanced Cardiac Life Support guidelines stated that routine sodium bicarbonate (SB) use for cardiac arrest patients was not recommended. However, SB administration during resuscitation is still common.
Objectives: To evaluate the effect of SB on return of spontaneous circulation (ROSC) and survival-to-discharge rates in adult cardiac arrest patients.
Methods: We searched Medline, Scopus, and Cochrane Central Register of Controlled Trials (CENTRAL) from inception to December 2019. We included trials on nontraumatic adult patients after cardiac resuscitation and SB treatment vs. controls.
Results: A meta-analysis was performed with six observational studies, including 18,406 adult cardiac arrest patients. There were no significant differences in the ROSC rate (odds ratio [OR] 1.185; 95% confidence interval [CI] 0.680-2.065) and survival-to-discharge rate (OR 0.296; 95% CI 0.066-1.323) between the SB and no-SB groups. In the subgroup analysis based on the year factor, there were no significant differences in the mortality rate in the After-2010 group. In the subgroup analysis based on the continent, the ROSC rate (OR 0.521; 95% CI 0.432-0.628) and survival-to-discharge rate (OR 0.102; 95% CI 0.066-0.156) were significantly lower in the North American group.
Conclusions: SB use was not associated with improvement in ROSC or survival-to-discharge rates in cardiac resuscitation. In addition, mortality was significantly increased in the North American group with SB administration.

Metformin prevents brain injury after cardiopulmonary resuscitation by inhibiting the endoplasmic reticulum stress response and activating AMPK-mediated autophagy.

Chuan L(1), Zhang L(2), Fu H(3), Yang Y(3), Wang Q(3), Jiang X(4), Li Z(5), Ni K(5), Ding L(6).

Abstract

Background and aims: The neurological damage caused by cardiac arrest (CA) can seriously affect quality of life. We investigated the effect of metformin pretreatment on brain injury and survival in a rat CA/cardiopulmonary resuscitation (CPR) model.

Methods and results: After 14 days of pretreatment with metformin, rats underwent 9 minutes of asphyxia CA/CPR. Survival was evaluated 7 days after restoration of spontaneous circulation; neurological deficit scale (NDS) score was evaluated at days 1, 3, and 7. Proteins related to the endoplasmic reticulum (ER) stress response and autophagy were measured using immunoblotting. Seven-day survival was significantly improved and NDS score was significantly improved in rats pretreated with metformin. Metformin enhanced AMPK-induced autophagy activation. AMPK and autophagy inhibitors removed the metformin neuroprotective effect. Although metformin inhibited the ER stress response, its inhibitory effect was weaker than 4-PBA.

Conclusion: In a CA/CPR rat model, 14-day pretreatment with metformin has a neuroprotective effect. This effect is closely related to the activation of AMPK-induced autophagy and inhibition of the ER stress response. Long-term use of metformin can reduce brain damage following CA/CPR.

Neuron-specific enolase and neuroimaging for prognostication after cardiac arrest treated with targeted temperature management.

Kim SH(1), Kim HJ(2), Park KN(2), Choi SP(1), Lee BK(3), Oh SH(2), Jeung KW(3), Cho IS(4), Youn CS(2).

Abstract

Background: Prognostication after cardiac arrest (CA) needs a multimodal approach, but the optimal method is not known. We tested the hypothesis that the combination of neuron-specific enolase (NSE) and neuroimaging could improve outcome prediction after CA treated with targeted temperature management (TTM).

Methods: A retrospective observational cohort study was performed on patients who underwent at least one NSE measurement between 48 and 72 hr; received both a brain computed tomography (CT) scan within 24 hr and diffusion-weighted magnetic resonance imaging (DW-MRI) within 7 days after return of spontaneous circulation (ROSC); and were treated with TTM after out-of-hospital CA between 2009 and 2017 at the Seoul St. Mary's Hospital in Korea. The primary outcome was a poor neurological outcome at 6 months after CA, defined as a cerebral performance category of 3-5.

Results: A total of 109 subjects underwent all three tests and were ultimately included in this study. Thirty-four subjects (31.2%) experienced good neurological outcomes at 6 months after CA. The gray matter to white matter attenuation ratio (GWR) was weakly correlated with the mean apparent diffusion coefficient (ADC), PV400 and NSE (Spearman's rho: 0.359, -0.362 and -0.263, respectively). NSE was strongly correlated with the mean ADC and PV400 (Spearman's rho: -0.623 and 0.666, respectively). Serum NSE had the highest predictive value among the single parameters (area under the curve (AUC) 0.912, sensitivity 70.7% for maintaining 100% specificity). The combination of a DWI parameter (mean ADC or PV400) and NSE had better prognostic performance than the combination of the CT parameter (GWR) and NSE. The addition of the GWR to a DWI parameter and NSE did not improve the prediction of neurological outcomes.

Conclusion: The GWR (≤ 24 hr) is weakly correlated with the mean ADC (≤ 7 days) and NSE (highest between 48 and 72 hr). The combination of a DWI parameter and NSE has better

prognostic performance than the combination of the GWR and NSE. The addition of the GWR to a DWI parameter and NSE does not improve the prediction of neurological outcomes after CA treatment with TTM.

A Randomized Pilot Clinical Trial of Early Coronary Angiography Versus No Early Coronary Angiography for Post-Cardiac Arrest Patients Without ST-Segment Elevation: The PEARL Study.
Kern KB(1), Radsel P(2), Jentzer JC(3), Seder DB(4), Lee KS(1), Lotun K(1), Janardhanan R(1), Stub D(5), Hsu CH(6), Noc M(2).
Abstract
Background: The benefit of emergent coronary angiography after resuscitation from out-of-hospital cardiac arrest (OHCA) is uncertain for patients without ST-segment elevation (STE). The aim of this randomized trial was to evaluate the efficacy and safety of early coronary angiography and to determine the prevalence of acute coronary occlusion in resuscitated OHCA patients without STE. Methods: Adult (>18 years) comatose survivors without STE after resuscitation from OHCA were prospectively randomized in a 1:1 fashion under exception to informed consent regulations to early coronary angiography versus no early coronary angiography in this multi-center study. Early angiography was defined as ≤ 120 minutes from arrival at the percutaneous coronary intervention capable facility. The primary endpoint was a composite of efficacy and safety measures, including efficacy parameters of survival to discharge, favorable neurological status at discharge (Cerebral Performance Category ≤ 2), echocardiographic measures of left ventricular ejection fraction >50% and a normal regional wall motion score of 16 within 24 hours of admission. Adverse events included re-arrest, pulmonary edema on chest x-ray, acute renal dysfunction, bleeding requiring transfusion or intervention, hypotension (systolic arterial pressure ≤90 mmHg), and pneumonia. Secondary endpoints included the incidence of culprit vessels with acute occlusion. Results: The study was prematurely terminated before enrolling the target number of patients. A total of 99 patients were enrolled from 2015-2018, including 75 with initially shockable rhythms. Forty-nine patients were randomized to early coronary angiography. The primary endpoint of efficacy and safety was not different between the two groups (55.1% vs 46.0%; p=0.64). Early coronary angiography was not associated with any significant increase in survival (55.1% vs 48.0%; p=0.55 or adverse events (26.5% vs 26.0%; p=1.00). Early coronary angiography revealed a culprit vessel in 47%, with a total of 14% of patients undergoing early coronary angiography having an acutely occluded culprit coronary artery. Conclusions: This underpowered study, when considered together with previous clinical trials, does not support early coronary angiography for comatose survivors of cardiac arrest without ST elevation. Whether early detection of occluded potential culprit arteries leads to interventions that improve outcomes requires additional study. **Clinical Trial Registration:** URL: https://www.clinicaltrials.gov. Unique identifier: NCT02387398.

Cognitive impairment and psychopathology in out-of-hospital cardiac arrest survivors in Denmark: The REVIVAL cohort study protocol.
Wagner MK(1), Berg SK(2)(3), Hassager C(2)(3), Armand S(4), Møller JE(5), Ekholm O(6), Rasmussen TB(7), Fisher PM(4)(8), Knudsen GM(4)(8), Stenbæk DS(4).
Abstract
INTRODUCTION: Cognitive impairment and psychopathology caused by brain hypoxia and the traumatic impact of critical illness are common in cardiac arrest survivors and can lead to negative consequences of everyday life functioning, and further impact mental health in relatives. Most studies have dealt with the mere survival rate after cardiac arrest and not with long-term consequences to mental health in cardiac arrest survivors. Importantly, we face a

gap in our knowledge about suitable screening tools in the early post-arrest phase for long-term risk prediction of mental health problems. This study aims to evaluate the efficacy of a novel screening procedure to predict risk of disabling cognitive impairment and psychopathology 3 months after cardiac arrest.

Furthermore, the study aims to evaluate long-term prevalence of psychopathology in relatives. METHODS AND ANALYSES: In this multicentre prospective cohort study, out-of-hospital cardiac arrest survivors and their relatives will be recruited. The post-arrest screening includes the Montreal Cognitive Assessment (MoCA), the Hospital Anxiety and Depression Scale (HADS), the Impact of Event Scale-Revised (IES-R) and the Acute Stress Disorder Interview (ASDI) and is conducted during

hospitalisation. In a subsample of the patients, functional MRI is done, and cortisol determination collected. At 3-month follow-up, the primary study outcomes for 200 survivors include the Danish Affective Verbal Learning Test-26 (VAMT-26), Delis-Kaplan Executive Function System tests (trail making, colour-word interference, word and design fluency), Rey's Complex Figure and Letter-number sequencing subtest of Wechsler Adult Intelligence Scale-IV, HADS and IES-R. For the relatives, they include HADS and IES-R. ETHICS AND DISSEMINATION: The study is approved by the local regional Research Ethics Committee (H-18046155) and the Danish Data Protection Agency

(RH-2017-325, j.no.05961) and follows the latest version of the Declaration of Helsinki. The results will be published in peer-reviewed journals and may impact the follow-up of cardiac arrest survivors.

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PEDIATRIA

1. Pediatrics. 2020 Oct;146(Suppl 2):S155-S164. doi: 10.1542/peds.2020-016915H.
Innovations in Cardiorespiratory Monitoring to Improve Resuscitation With Helping Babies Breathe.
Patterson JK(1), Girnary S(2), North K(1), Data S(3), Ishoso D(4), Eilevstjønn J(2), Bose CL(1).
Abstract
Ninety percent of intrapartum-related neonatal deaths are attributable to respiratory depression, with the vast majority of these deaths occurring in low- and lower-middle-income countries. Neonatal resuscitation training with Helping Babies Breathe (HBB) decreases mortality from respiratory depression. Cardiorespiratory monitoring in conjunction with HBB can provide valuable resuscitation feedback for both training and bedside purposes. In this article, we discuss 3 innovations that couple cardiorespiratory monitoring with HBB: NeoNatalie Live, the Augmented Infant Resuscitator, and NeoBeat. NeoNatalie Live is a high-fidelity manikin that facilitates bag mask ventilation training through case scenarios of varying difficulty. The Augmented Infant Resuscitator is added in-line between a face mask and ventilation bag during bag mask ventilation training to provide users with real-time feedback on ventilation quality. NeoBeat is a battery-operated heart rate meter that digitally displays the newborn heart rate during bedside resuscitations. For each innovation, we review details of the device, implementation in the field, and areas for further research. Using early

experience implementing these devices, we suggest building blocks for effective translation of training into improved care. We also highlight general challenges in implementation of devices in facilities in low- and lower-middle-income countries including considerations for training, adaptations to existing workflow, and integration into the ecosystem. Although the devices highlighted in this article hold promise, more data are needed to understand their impact on newborn outcomes.

NEUROlogical Prognosis After Cardiac Arrest in Kids (NEUROPACK) study: protocol for a prospective multicentre clinical prediction model derivation and validation study in children after cardiac arrest.
Scholefield BR(1)(2), Martin J(3), Penny-Thomas K(2), Evans S(2), Kool M(4)(2), Parslow R(5), Feltbower R(5), Draper ES(6), Hiley V(5), Sitch AJ(3)(7), Kanthimathinathan HK(4)(2), Morris KP(2)(3), Smith F(4); NEUROPACK Investigators for the Paediatric Intensive Care Society-Study Group (PICS-SG).
Abstract
INTRODUCTION: Currently, we are unable to accurately predict mortality or neurological morbidity following resuscitation after paediatric out of hospital (OHCA) or in-hospital (IHCA) cardiac arrest. A clinical prediction model may improve communication with parents and families and risk stratification of patients for appropriate postcardiac arrest care. This study aims to the derive and validate a clinical prediction model to predict, within 1 hour of admission to the paediatric intensive care unit (PICU), neurodevelopmental outcome at 3 months after paediatric cardiac arrest. METHODS AND ANALYSIS: A prospective study of children (age: >24 hours and <16 years), admitted to 1 of the 24 participating PICUs in the UK and Ireland, following an OHCA or IHCA. Patients are included if requiring more than 1 min of cardiopulmonary resuscitation and mechanical ventilation at PICU admission Children who had cardiac arrests in PICU or neonatal intensive care unit will be excluded. Candidate variables will be identified from data submitted to the Paediatric Intensive Care Audit Network registry. Primary outcome is neurodevelopmental status, assessed at 3 months by telephone interview using the Vineland Adaptive Behavioural Score II questionnaire. A clinical prediction model will be derived using logistic regression with model performance and accuracy assessment. External validation will be performed using the Therapeutic Hypothermia After Paediatric Cardiac Arrest trial dataset. We aim to identify 370 patients, with successful consent and follow-up of 150 patients. Patient inclusion started 1 January 2018 and inclusion will continue over 18 months. ETHICS AND DISSEMINATION: Ethical review of this protocol was completed by 27 September 2017 at the Wales Research Ethics Committee 5, 17/WA/0306. The results of this study will be published in peer-reviewed journals and presented in conferences.

ECMO

USE OF EXTRACORPOREAL MEMBRANE OXYGENATION FOR eCPR IN THE EMERGENCY ROOM IN PATIENTS WITH REFRACTORY OUT-OF-HOSPITAL CARDIAC ARREST.
NAPP LC(1), SANCHEZ MARTINEZ C(1), AKIN M(1), GARCHEVA V(1), KÜHN C(2), BAUERSACHS J(1), SCHÄFER A(1).
Abstract
Background: Out-of-hospital cardiac arrest (OHCA) refractory to conventional high-quality cardiopulmonary resuscitation (CPR) may be rescued by extracorporeal CPR (eCPR) using veno-arterial extracorporeal membrane oxygenation (V-A ECMO). Even when trying to identify eCPR

candidates based on criteria assumed to be associated with a favourable neurological outcome, reported survival rates are frequently below 10%.

Methods: All patients undergoing implantation of V-A ECMO for eCPR between January 2018 and December 2019 (N = 40) were analysed (age 53±13 years; 75% male). Patients with refractory OHCA and potentially favourable circumstances (initial shockable rhythm, witnessed arrest, bystander CPR, absence of limiting comorbidities, age <75 years) were transported under mechanical chest compression. Candidates for eCPR should have a pH ≥6.9, arterial lactate ≤15 mmol/L and time-to-ECMO should be ≤60 minutes.

Results: Overall 30-day survival was 12.5%, with 3 of 5 survivors having a favourable neurological outcome (cerebral performance category (CPC) 1 or 2), representing 7.5% of the total eCPR population. No patient selected for eCPR met all pre-defined criteria (median of unfavourable criteria: 3). Importantly, time-to-ECMO most often (39/40) exceeded 60 minutes (mean 102 ±32 min.), and lactate was >15mmol/L in 30 out of 40 patients. Moreover, 22 out of 40 patients had a non-shockable rhythm on the first ECG.

Conclusions: Despite our intention to select patients with potentially advantageous circumstances to achieve acceptable eCPR outcomes, the imminent deadly consequence of withholding eCPR obviously prompted individual physicians to perform the procedure also in presumably more unfavourable settings, resulting in similar mortality rates of eCPR as reported before.

FREE FULL TEXT

RECERCA EXPERIMENTAL

Protective effect and mechanism of mild hypothermia on liver injury after cardiopulmonary resuscitation in pigs.
Li YQ(1), Wang Y(2), Song J(3), Xie DY(4), Tang ZR(5), Li CS(5), Hao JY(2), Jing ML(6), Hu XM(6), Zhai JL(6), Liu ZX(2).

Abstract
Objective: To investigate the effect of mild hypothermia therapy on liver after cardiopulmonary resuscitation. Methods: Thirty-three inbred Chinese Wuzhishan (WZS) minipigs, weighted (28±2) kg, were used to establish a ventricular fibrillation model. And 30 animals survived after cardiopulmonary resuscitation reached basic life support. The surviving animals were randomly divided into two groups: mild hypothermia group (group M, n=15) and conventional treatment group (group C, n=15). All the animals were observed for 24 hours. Blood samples were extracted at baseline, 0.5, 1, 2, 4, 6, 12 and 24 h after successful resuscitation. The concentrations of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were detected at the time points. The enzyme-linked immunosorbent assay (ELISA) was used to detect the concentrations of interleukin-6 (IL-6) and tumour necrosis factor-alpha (TNF-α). The data were compared between the two groups, LSD test was used when the variance was homogeneous, and Tamhane T2 test was used when the variance was uneven. Results: Eleven pigs (73.3%) in the group M and 8(53.3%) in the group C survived at 24 h after successful resuscitation, with no statistically significant difference between the two groups ($\chi(2)$=1.229, P=0.225). After successful resuscitation, the AST, ALT increased in both group but less in M group (all P<0.05). After successful resuscitation, the concentrations of TFN-α and IL-6 in the blood increased in both groups, reached the peak at 4h, and then decreased gradually. The concentrations of TFN-α in group M were lower than those in group C at 0.5, 2, 4 and 6 h after successful resuscitation (t=0.01, 0.01, 0.87, 0.86, all P<0.05). The concentrations of IL-6 in the group M were lower than those in group C at 0.5, 1, 2 and 4 h after successful resuscitation (t=0.23, 0.78, 0.11, 0.80, all P<0.05). Conclusions: After successful

resuscitation, the release of inflammatory mediators, such as TNF-α and IL-6, and cell apoptosis may involve in liver ischemia reperfusion injury. After successful resuscitation, the liver undergoes ischemia-reperfusion injury, which may be related to the release of inflammatory mediators such as TNF-α and IL-6. Mild hypothermia therapy can prevent the release of TNF-α, IL-6 to reduce the degree of liver damage after resuscitation.
ARTICLE IN CHINESE

The Effect of Chest Compression Location and Aortic Perfusion in a Traumatic Arrest Model.
Barringer BJ(1), Castaneda MG(2), Rall J(2), Maddry JK(3), Anderson KL(4).
Abstract
Background: Recent evidence demonstrates that closed chest compressions directly over the left ventricle (LV) in a traumatic cardiac arrest (TCA) model improve hemodynamics and return of spontaneous circulation (ROSC) when compared to traditional compressions. Selective aortic arch perfusion (SAAP) also improves hemodynamics and controls hemorrhage in TCA. We hypothesized that chest compressions located over the LV would result in improved hemodynamics and ROSC in a swine model of TCA using SAAP.
Materials and methods: Transthoracic echo was used to mark the location of the aortic root (Traditional location) and the center of the LV on animals (n = 24), which were randomized to receive chest compressions in one of the two locations. After hemorrhage, ventricular fibrillation (VF) was induced to simulate TCA. After a period of 10 min of VF, basic life support (BLS) with mechanical CPR was initiated and performed for 10 min, followed by advanced life support (ALS) for an additional 10 min. SAAP balloons were inflated at min 6 of BLS. Hemodynamic variables were averaged over the final 2 min of the BLS and ALS periods. Survival was compared between this SAAP cohort and a control group without SAAP (No-SAAP) (n = 26).
Results: There was no significant difference in ROSC between the two SAAP groups (P = 0.67). There was no ROSC difference between SAAP and No-SAAP (P = 0.74).
Conclusions: There was no difference in ROSC between LV and Traditional compressions when SAAP was used in this swine model of TCA. SAAP did not confer a survival benefit compared to historical controls.

Pretreatment with human urine-derived stem cells protects neurological function in rats following cardiopulmonary resuscitation after cardiac arrest.
Pan C(1), Zheng X(2), Wang L(1), Chen Q(3), Lin Q(4).
Abstract
Cardiopulmonary resuscitation (CPR) after cardiac arrest (CA) often leads to neurological deficits in the absence of effective treatment. The aim of the present basic research study was to investigate the effects of human urine-derived stem cells (hUSCs) on the recovery of neurological function in rats after CA/CPR. hUSCs were isolated *in vitro* and identified using flow cytometry. A rat model of CA was established, and CPR was performed. Animals were scored for neurofunctional deficits following hUSC transplantation. The expression levels of brain-derived neurotrophic factor (BDNF) and vascular endothelial growth factor (VEGF) in the hippocampus and temporal cortex were detected via immunofluorescence. Moreover, brain water content and serum S100 calcium binding protein B (S100B) levels were measured 7 days following hUSC transplantation. The results demonstrated that hUSCs had upregulated expression levels of CD29, CD90, CD44, CD105, CD73, CD224 and CD146, and expressed low levels of CD34 and human leukocyte antigen-DR isotype. In addition, hUSCs were able to differentiate into neuronal cells *in vitro*. The SPSS 19.0 statistical package was used for statistical analysis, and it was found that the neurological function of the rats after CA/CPR was significantly improved following hUSC transplantation. Furthermore, hUSCs aggregated in the

hippocampus and temporal cortex, and secreted large amounts of BDNF and VEGF. hUSC transplantation also effectively inhibited brain edema and serum S100B levels after CPR. Therefore, the results suggested that hUSC transplantation significantly improved the neurological function of rats after CA/CPR, possibly by promoting the expression levels of BDNF and VEGF, as well as inhibiting brain edema.
FREE FULL TEXT

The Effect of Prophylactic Anticoagulation with Heparin on the Brain Cells of Sprague-Dawley Rats in a Cardiopulmonary-Cerebral Resuscitation Model.
Liu W(1)(2), Wang Y(2), Zhou X(2), Hai K(2), Jia D(1), Ye Q(1)(2).
Abstract
After a cardiac arrest (CA) of 5 to 10 min, a marked activation of blood coagulation occurs and microthrombi are found in the cerebral vessels. These microcirculatory disturbances directly affect the outcome on cardiopulmonary resuscitation (CPR). The purpose of this study was to investigate the effects and potential mechanisms of prophylactic anticoagulation on rat brain cells after cerebral CPR. After setting up an asphyxial CA model, we monitored the basic parameters such as the vitals and survival rate of the rats and assessed the respective neurological deficit (ND) and histological damage (HD) scores of their brain tissues. We, furthermore, investigated the influence of heparin on the expressions of TNF-α, IL-1β, CD40, NF-κB, and HIF-1α after asphyxial CA. The results showed that anticoagulation with heparin could obviously improve the outcome and prognosis of brain ischemia, including improvement of neurological function recovery and prevention of morphological and immunohistochemical injury on the brain, while significantly increasing the success rate of CPR. Treatment with heparin significantly inhibited the upregulation of CD40, NF-κB, and HIF-1α induced by asphyxial CA. Thrombolysis treatment may improve the outcome and prognosis of CPR, and future clinical studies need to evaluate the efficacy of early heparin therapy after CA.

Mild hypercapnia improves brain tissue oxygen tension but not diffusion limitation in asphyxial cardiac arrest: an experimental study in pigs.
Zhou D(1), Li Z(1), Zhang S(1), Wu L(1), Li Y(1), Shi G(1), Zhou J(2).
Abstract
BACKGROUND: We sought to evaluate the effect of mild hypercapnia on brain tissue oxygen tension (Pbto2) and diffusion limitation (impaired ability of oxygen extraction) in a porcine post asphyxial cardiac arrest model. METHODS: In 16 Bama pigs, asphyxial cardiac arrest was induced by endotracheal tube clamping and remained untreated for another 4 min. After return of
spontaneous circulation (ROSC), animals were randomly assigned to mild hypercapnia (end-tidal carbon dioxide (EtCO2): 45 ~ 50 mmHg) and normocapnia (EtCO2: 35 ~ 40 mmHg) groups for 12 h. Intracranial pressure (ICP), Pbto2, and brain tissue temperature were invasively measured by multimodality monitors. Blood gas analysis, neuron specific enolase (NSE), and S100β were tested at
baseline, ROSC 1 h, 6 h, and 12 h. Generalized mixed model with a compound symmetry covariance matrix was used to compare the time-variables of the two groups. RESULTS: Twelve (75%) pigs had ROSC and 11 pigs survived for the study period, with 6 pigs in mild hypercapnia group and 5 in the normocapnia group. The mean EtCO2 in the mild hypercapnia was significantly higher than normocapnia group (48 vs 38 mmHg, p < 0.001). Compared with normocapnia, mild hypercapnia group had higher Pbto2 (p < 0.001), slightly higher mean arterial pressure (p = 0.012) and ICP (p = 0.009). There were no differences in cerebral perfusion pressure (p = 0.106), gradient of partial pressure of jugular venous bulb oxygen

(Pjvo2) and Pbto2 (p = 0.262), difference of partial pressure of jugular venous CO_2 and arterial CO_2 (p = 0.546), cardiac output (p = 0.712), NSE (p = 0.822), and S100β (p = 0.759) between the two groups. CONCLUSIONS: Short term mild hypercapnia post-resuscitation could improve Pbto2. However, no corresponding improvements in the gradient of Pjvo2 to Pbto2 and biomarkers of neurological recovery were observed in the porcine asphyxial
cardiac arrest model.

CASE REPORTS

Extracorporeal Cardiopulmonary Resuscitation During Cesarean Delivery in a Patient With D-Transposition of the Great Vessels, Years Following Mustard Operation.
Brozzi NA(1), Cifuentes RO(1), Ghodsizad A(1), Saab A(2), Yasin S(3), Loebe M(1).
Abstract
Patients with surgically repaired complex congenital cardiac anomalies present unique characteristics that can make the implementation of extracorporeal membrane oxygenation (ECMO) support especially challenging. Very few series have reported the outcomes of ECMO support during pregnancy and peripartum. We report a case of successful extracorporeal cardiopulmonary resuscitation during cesarean delivery in a patient with surgically repaired d-transposition of the great arteries, and we discuss particular aspects that contributed to successful implementation of ECMO support and hospital discharge.

Severe Apparent Life-threatening Event (ALTE) in an Infant with SARS-CoV 2 Infection.
Sano F(1), Yagasaki H(1), Kojika S(1), Toda T(1), Kono Y(1), Suzuki-Inoue K(2), Sasaki T(2), Ogihara S(3), Matsuno T(3), Inoue O(4), Moriguchi T(5), Harii N(6), Goto J(5), Shimizu T(7), Inukai T(1).
Abstract
The 2019 novel coronavirus (severe acute respiratory syndrome-coronavirus: SARS-CoV-2) has currently caused a global outbreak of infection. In general, children with the coronavirus disease-2019 have been reported to show milder respiratory symptoms as a respiratory infection than adult patients. Here, we describe SARS-CoV-2 infection in an infant who presented with a severe episode of apparent life-threatening event (ALTE). An 8-month-old otherwise healthy infant who was transported to our hospital because of a sudden cardiopulmonary arrest. Approximately one hour before this episode, she was almost fine but in a slightly worse humor than usual. On arrival at our hospital, sever acidosis but no clear sign of inflammatory response was denoted. A chest computed tomography scan showed weak consolidations in the upper right lung as well as atelectasis in the lower left lung. No sign of congenital heart disease or cardiomyopathy was observed in echocardiography, and no significant arrhythmia was observed in the later clinical course. Of note, the specific SARS-CoV-2 RNA was detected in both of her tracheal aspirate and urine sample by real-time RT-PCR. Although further accumulation of the cases is indispensable, our case suggests that SARS-CoV-2 infection may be one of the underlying factors in the pathophysiology of ALTE.
FREE FULL TEXT

A case of cardiac arrest due to a ruptured renal artery pseudoaneurysm, a complication of renal biopsy.

Satoh K(1), Kaga H(2), Okuyama M(3), Furuya T(3), Irie Y(3), Kameyama K(3), Kitamura T(3), Nakae H(3).

Abstract

Renal artery pseudoaneurysms (RAPs) are a rare complication of percutaneous kidney biopsies that generally present as hematuria and back pain and are treated with angioembolization. A 60-year-old man was admitted to our emergency department for sudden left back pain. He was taking an oral anticoagulant for atrial fibrillation. He had undergone an ultrasound-guided percutaneous renal biopsy 26 days prior. We diagnosed him with hemorrhagic shock from the renal artery. Although he received a massive rapid blood transfusion, he went into cardiac arrest. Resuscitative endovascular balloon occlusion of the aorta (REBOA) was performed and, within 10 min, the patient achieved return of spontaneous circulation and regained consciousness. Subsequently, angioembolization was successfully performed for a 12.5 mm × 5.9 mm pseudoaneurysm in the left renal inferior pole close to the site of the renal biopsy. A total of 1680 mL of red blood cells and fresh frozen plasma were administered respectively until hemostasis was completed. He was then treated with continuous hemodialysis in the intensive care unit (ICU) for 6 days. He stayed in the ICU for 9 days and was moved to the general ward with full neurological recovery and a sufficiently stable condition to be able to walk. In conclusion, clinicians should be aware of the possibility of severe hemorrhagic shock due to RAPs after renal biopsy. Moreover, even if the patient goes into cardiac arrest, there is a possibility of full recovery if REBOA is performed and angioembolization is completed.

FREE FULL TEXT

Surviving a Broken Heart: A Case of Intraoperative Cardiac Arrest and Takotsubo Cardiomyopathy.
Dan LD(1), Moore CC(2).

Abstract

Takotsubo cardiomyopathy manifests as global myocardial hypokinesis, a rare challenge for anesthesia practitioners. This report discusses a case in which a seemingly healthy patient presented for open abdominal hysterectomy and experienced intraoperative cardiac arrest requiring cardiopulmonary resuscitation. Takotsubo cardiomyopathy was diagnosed following resuscitation. This case examines risk factors and the intraoperative and postoperative management of a patient with Takotsubo cardiomyopathy.