

BIBLIOGRAFIA RECOMANADA 23/04/2020

FELIÇ SANT JORDI I CUIDEU-VOS MOLT!

COVID-19 AND CPR

1. Am J Respir Crit Care Med. 2020 Apr 16. doi: 10.1164/rccm.202004-1037CP. [Epub ahead of print]

Hospital Preparedness for COVID-19: A Practical Guide from a Critical Care Perspective.

Griffin KM(1), Karas MG(1), Ivascu NS(1), Lief L(2).

Abstract

In response to the estimated potential impact of COVID-19 on New York City hospitals, our institution prepared for an influx of critically ill patients. Multiple areas of surge planning progressed simultaneously focused on infection control, clinical operational challenges, intensive care unit surge capacity, staffing, ethics and maintenance of staff wellness. Protocols developed focused on clinical decisions around intubation, the use of high-flow oxygen, infectious disease consultation and cardiac arrest. Mechanisms to increase bed capacity as well as increase efficiency in intensive care units by outsourcing procedures were implemented. Novel uses of technology to minimize staff exposure to COVID-19, as well as to facilitate family engagement and end of life discussions were encouraged. Education and communication remained key in attempting to standardize care, stay apprized on emerging data as well as to review seminal literature on respiratory failure. Challenges were encountered and overcome through interdisciplinary collaboration and iterative surge planning as intensive care unit admissions rose. Support was provided for both clinical and nonclinical staff affected by the profound impact COVID-19 had on our city. We describe in granular detail, the procedures and processes developed during a one-month period while surge planning was ongoing and the need for intensive care unit capacity rose exponentially. The approaches described provide a potential roadmap for centers that must rapidly adapt to the tremendous challenge introduced by this and potential future pandemics. This article is open access and distributed under the terms of the Creative Commons Attribution Non-Commercial No Derivatives License 4.0 (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2. Resuscitation. 2020 Apr 10. pii: S0300-9572(20)30142-8.

doi:10.1016/j.resuscitation.2020.04.005. [Epub ahead of print]

In-hospital cardiac arrest outcomes among patients with COVID-19 pneumonia in Wuhan, China.

Shao F(1), Xu S(2), Ma X(3), Xu Z(3), Lyu J(3), Ng M(4), Cui H(5), Yu C(5), Zhang Q(6), Sun P(7), Tang Z(8).

Abstract

OBJECTIVE: To describe the characteristics and outcomes of patients with severe COVID-19 and in-hospital cardiac arrest (IHCA) in Wuhan, China. **METHODS:** The outcomes of patients with severe COVID-19 pneumonia after IHCA over a 40-day period were retrospectively evaluated. Between January 15 and February 25, 2020, data for all cardiopulmonary resuscitation (CPR) attempts for IHCA that occurred in a tertiary teaching hospital in Wuhan, China were collected according to the Utstein style. The primary outcome was restoration of spontaneous circulation (ROSC), and the secondary outcomes were 30-day survival, and neurological outcome. **RESULTS:** Data from 136 patients showed 119 (87.5%) patients had a respiratory cause for their cardiac arrest, and 113 (83.1%) were resuscitated in a general ward. The initial rhythm was asystole in 89.7%, pulseless electrical activity (PEA) in 4.4%, and shockable in 5.9%. Most patients with IHCA were monitored (93.4%) and in most resuscitation (89%) was initiated <1min. The average length of hospital stay was 7 days and the time from

illness onset to hospital admission was 10 days. The most frequent comorbidity was hypertension (30.2%), and the most frequent symptom was shortness of breath (75%). Of the patients receiving CPR, ROSC was achieved in 18 (13.2%) patients, 4 (2.9%) patients survived for at least 30 days, and one patient achieved a favourable neurological outcome at 30 days. Cardiac arrest location and initial rhythm were associated with better outcomes. **CONCLUSION:** Survival of patients with severe COVID-19 pneumonia who had an in-hospital cardiac arrest was poor in Wuhan.

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RCP / COMPRESSIONS TORÀCIQUES MECÀNIQUES

1. Pediatrics. 2020 Apr 16. pii: e20192908. doi: 10.1542/peds.2019-2908. [Epub ahead of print] **Enhancing CPR During Transition From Prehospital to Emergency Department: A QI Initiative.** Hoehn EF(1)(2)(3), Cabrera-Thurman MK(4), Oehler J(4)(5), Vukovic A(4)(2), Frey M(4), Helton M(4), Geis G(4)(2), Kerrey B(4)(2).

Abstract

BACKGROUND AND OBJECTIVES: High-quality cardiopulmonary resuscitation (CPR) increases the likelihood of survival of pediatric out-of-hospital cardiac arrest (OHCA). Maintenance of high-quality CPR during transition of care between prehospital and pediatric emergency department (PED) providers is challenging. Our objective for this initiative was to minimize pauses in compressions, in alignment with American Heart Association recommendations, for patients with OHCA during the handoffs from prehospital to PED providers. We aimed to decrease interruptions in compressions during the first 2 minutes of PED care from 17 seconds (baseline data) to 10 seconds over 12 months. Our secondary aims were to decrease the length of the longest pause in compressions to <10 seconds and eliminate encounters in which time to defibrillator pad placement was >120 seconds. **METHODS:** Our multidisciplinary team outlined our theory for improvement and designed interventions aimed at key drivers. Interventions included specific roles and responsibilities, CPR handoff choreography, and empowerment of frontline providers. Data were abstracted from video recordings of patients with OHCA receiving manual CPR on arrival. **RESULTS:** We analyzed 33 encounters between March 2018 and July 2019. We decreased total interruptions from 17 to 12 seconds during the first 2 minutes and decreased the time of the longest single pause from 14 to 7 seconds. We saw a decrease in variability of time to defibrillator pad placement.

CONCLUSIONS: Implementation of a quality improvement initiative involving CPR transition choreography resulted in decreased interruptions in compressions and decreased variability of time to defibrillator pad placement.

3. Prehosp Emerg Care. 2020 Apr 17:1-10. doi: 10.1080/10903127.2020.1754977. [Epub ahead of print]

Comparison of Chest Compression Quality Between Transfer Sheet and Stretcher Use for Transporting Out-Of-Hospital Cardiac Arrest Patients in a High-Rise Building - A Randomized and Open-label Cross-over Design.

Chi CY(1), Renhao DM(2), Yang CW(3), Yang MF(1), Lee HJ(3), Lee CH(4), Shih FF(1), Ong MEH(5), Ko PC(1).

Abstract

OBJECTIVES: Stretchers are commonly used for transporting cardiac arrest patients, but their use may be limited in confined spaces, like elevators. Use of transfer sheet as an alternative has not been explored. We aimed to compare manual chest compression quality between these two methods. **METHODS:** In this prospective, open-label, randomized cross-over manikin study, the subjects included emergency medical technicians who were assigned to 12 three-person crews. Scenarios included transport of a cardiac arrest in a high-rise building and

elevator using transfer sheet (TS) and stretchers adjusted to 45° (S45) and 90° (S90). Chest compression quality was measured using a recording manikin and that before (on-scene phase) and after (transport phase) the manikin moved via transfer sheet or stretcher were compared. RESULTS: The final analysis included 72 simulation runs. Chest compression quality did not differ among the groups in the on-scene phase. In the transport phase, the transfer sheet group provided greater mean compression depth (54.4 ± 4.2 vs 39.6 ± 7.2 mm, $p < 0.01$ and 54.4 ± 4.2 vs 40.6 ± 8.3 mm, $p < 0.01$, respectively) than stretchers of S45 and S90, and higher percentage of deep-enough compression (TS: 51.0 [23.8-74.8]% vs S45: 19.5 [5.8-29.5]%, $p < 0.01$) than the S45 group. Transfer sheet use showed a trend of lower percentages of full recoil (TS: 40.0 [12.8-64.5]% vs S45: 70.5 [47.0-79.8]% vs S90: 52.5 [25.3-76.0]%, $p = 0.09$). Chest compression fraction, compressions with correct hand position, and mean compression rates did not differ between groups in the transport phase. The TS group showed shorter time intervals of simulation start-to-first-compression (TS: 13.9 [12.4-15.1] sec vs S90: 15.9 [13.3-16.4] sec, $p = 0.04$) and total run time (TS: 145.7 [135.1-151.4] sec vs S90: 160.0 [151.9-175.4] sec, $p < 0.01$) than the S90 group. CONCLUSION: In this simulation, using transfer sheet outperform using stretcher for transporting cardiac arrest patients from high-rise buildings. Rescuers need to be aware of full chest recoil.

REGISTRES, REVISIONS I EDITORIALS

1. J Cardiothorac Surg. 2020 Mar 23;15(1):50. doi: 10.1186/s13019-020-1086-5.

History of cardiopulmonary resuscitation in ancient China: a narrative review.

Yu Y(1), Liu X(1), Wang LJ(1), Wang S(1), Ao H(2).

Abstract

Modern cardiopulmonary resuscitation (CPR) comprises an open airway, artificial ventilation, chest compressions and, if necessary, defibrillation. CPR has been intensively studied and tested to perfect an integrated and effective resuscitation system in the West. However, CPR efforts in China has been understudied and underreported. CPR has been performed for more than 2000 years in China. As early as the third century BC, a Chinese doctor named Zhongjing Zhang presented a detailed program to save patients from suicide by hanging in the book entitled "Synopsis of the Golden Chamber". Dr. Zhang proposed "not only to save the body, but also to save the spirit", which remains a guiding principle in modern resuscitation: to not only ensure cardiopulmonary recovery but also preserve the brain function. We aim to review and summarize efforts of CPR in China from a historic point of view.

FREE FULL TEXT

2. Prehosp Emerg Care. 2020 Apr 14:1-7. doi: 10.1080/10903127.2020.1754979. [Epub ahead of print]

Prehospital Protocols for Post-Return of Spontaneous Circulation are Highly Variable.

Spigner MF(1), Benoit JL(1), McMullan JT(1), Menegazzi JJ(2).

Abstract

BACKGROUND: Up to 44% of out-of-hospital cardiac arrest (OHCA) patients will rearrest in the immediate post-return of spontaneous circulation (post-ROSC) period, and rearrest is associated with decreased survival. Cardiac arrest guidelines are often equivocal regarding what post-ROSC care should be provided in the prehospital setting and when hospital transport should be initiated. Prehospital protocols must balance the benefit of time-dependent hospital-based care with the risk of early rearrest. We sought to describe current prehospital protocols for post-ROSC care in the treatment of OHCA. METHODS: A single trained abstractor systematically reviewed a purposeful sample of prehospital protocols for adult non-traumatic cardiac arrest from the United States using an *a priori* standardized data abstraction form. Protocols were either stand-alone or integrated into intra-arrest care.

Exclusion criteria were non-911 ground transport agencies and protocols not revised since the 2015 American Heart Association guideline update. All protocols were publicly available via the Internet. Data abstraction was conducted in May 2019. Measures of interest were counted and summarized. Proportions and 95% confidence intervals were calculated. RESULTS: We identified and reviewed 82 prehospital protocols from 46 states and the District of Columbia. Seven protocols were excluded due to the revision date, leaving 75 protocols included in the study. Six protocols (8%; CI 3.7%-16%) provide no guidance on prehospital post-ROSC care. 12-lead electrocardiogram (ECG) acquisition (63/75 [84%; CI 73%-91%]) and transport to percutaneous coronary intervention-capable hospitals (55/75 [73%; CI 62%-83%]) are common, although not ubiquitous. Of those that do require a 12-lead ECG, 40% [CI 27-54%] required the presence of an ST-elevation myocardial infarction to inform their transport decision. Only 9 (12%; CI 6.4%-22%) provide any guidance on when to initiate transport post-ROSC, with 4 (5%; CI 2%-13%) requiring a post-ROSC stabilization period prior to transport. CONCLUSION: Prehospital treatment and transport protocols for post-ROSC care are highly variable across the United States.

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1. Prehosp Emerg Care. 2020 Apr 14:1-7. doi: 10.1080/10903127.2020.1743800. [Epub ahead of print]

Tension Hemopneumothorax in the Setting of Mechanical CPR during Prehospital Cardiac Arrest.

Rowland D, Vryhof N, Overton D, Mastenbrook J.

Abstract

INTRODUCTION: There are several complications associated with automated mechanical CPR (AM-CPR), including tension pneumothoraces. The incidence of these complications and the risk factors for their development remain poorly characterized. Tension hemopneumothorax is a previously unreported complication of AM-CPR. The authors present a case of a suspected tension hemopneumothorax that developed during the use of an automated mechanical CPR device. CASE DESCRIPTION: A 67 year-old woman with a history of COPD and CABG was observed by an off-duty firefighter to be slumped behind the wheel of an ice cream truck that drifted off the road at a low rate of speed and was stopped by a wooden fence, resulting in only minor paint scratches. The patient was found to be in cardiac arrest with a shockable rhythm. No signs of trauma were noted, and equal bilateral breath sounds were present with BVM ventilation. After 13 minutes of manual CPR, fire department personnel applied their Defibtech LifeLine ARM mechanical CPR device to the patient. During resuscitation, the device had to be repositioned twice due to rightward piston migration off of the sternum. Seven minutes after AM-CPR application, the patient had absent right-sided breath sounds and ventilations were more difficult. Needle decompression was performed with an audible release of air. A chest tube was placed by an EMS physician and roughly 400 mL of blood were immediately returned. At the next 2-minute pulse check, ROSC was noted, and the patient was transported to the hospital. She had an ischemic EKG and elevated troponin. Chest CT showed emphysematous lungs, bilateral rib fractures, and a small right-sided pneumothorax. Despite aggressive measures, the patient's condition gradually worsened, and she died 48 hours after presentation. DISCUSSION/CONCLUSION: Migration of AM-CPR device pistons may contribute

to the development of iatrogenic injuries such as hemopneumothoraces. Patients with underlying lung disease may be at a higher risk of developing pneumothoraces or hemopneumothoraces during the course of AM-CPR. Awareness of these potential complications may aid first responders by improving vigilance of piston location and by providing quicker recognition of iatrogenic injuries that need immediate attention to improve the opportunity for ROSC.

CAUSA DE L'ACR

1. *Angiology*. 2020 May;71(5):389-396. doi: 10.1177/0003319719896475. Epub 2019 Dec 26.

Sudden Arrhythmic Death at the Higher End of the Heart Failure Spectrum.

Dimos A(1), Xanthopoulos A(1), Papamichalis M(1), Bourazana A(1), Tavoularis D(1), Skoularigis J(1), Triposkiadis F(1).

Abstract

The risk of sudden cardiac death (SCD) is high in heart failure (HF) patients. Sudden arrhythmic death (SAD) is a frequent cause of exit in HF patients at the lower end of the HF spectrum, and implantable cardioverter-defibrillators have been recommended to prevent these life-threatening rhythm disturbances in select patients. However, less is known regarding the cause of SCD in patients at the upper end of the HF spectrum, despite the fact that the majority of out-of-hospital SCD victims have unknown or near-normal/normal left ventricular ejection fraction (LVEF). In this review, we report the epidemiology, summarize the mechanisms, discuss the diagnostic challenges, and propose a stepwise approach for the prevention of SAD in HF with near-normal/normal LVEF.

2. *J Am Heart Assoc*. 2020 Apr 15:e014125. doi: 10.1161/JAHA.119.014125. [Epub ahead of print]

Out-of-Hospital Cardiac Arrests and Wildfire-Related Particulate Matter During 2015-2017 California Wildfires.

Jones CG(1)(2), Rappold AG(3), Vargo J(4), Cascio WE(3), Kharrazi M(1), McNally B(5), Hoshiko S(1); with the CARES Surveillance Group.

Abstract

Background The natural cycle of large-scale wildfires is accelerating, increasingly exposing both rural and populous urban areas to wildfire emissions. While respiratory health effects associated with wildfire smoke are well established, cardiovascular effects have been less clear. **Methods and Results** We examined the association between out-of-hospital cardiac arrest and wildfire smoke density (light, medium, heavy smoke) from the National Oceanic Atmospheric Association's Hazard Mapping System. Out-of-hospital cardiac arrest data were provided by the Cardiac Arrest Registry to Enhance Survival for 14 California counties, 2015-2017 (N=5336). We applied conditional logistic regression in a case-crossover design using control days from 1, 2, 3, and 4 weeks before case date, at lag days 0 to 3. We stratified by pathogenesis, sex, age (19-34, 35-64, and ≥65 years), and socioeconomic status (census tract percent below poverty). Out-of-hospital cardiac arrest risk increased in association with heavy smoke across multiple lag days, strongest on lag day 2 (odds ratio, 1.70; 95% CI, 1.18-2.13). Risk in the lower socioeconomic status strata was elevated on medium and heavy days, although not statistically significant. Higher socioeconomic status strata had elevated odds ratios with heavy smoke but null results with light and medium smoke. Both sexes and age groups 35 years and older were impacted on days with heavy smoke. **Conclusions** Out-of-hospital cardiac arrests increased with wildfire smoke exposure, and lower socioeconomic status appeared to increase the risk. The future trajectory of wildfire, along with increasing vulnerability of the aging population, underscores the importance of formulating public health and clinical strategies to protect those most vulnerable.

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1. BMC Emerg Med. 2020 Mar 23;20(1):22. doi: 10.1186/s12873-020-00316-z.

Comparison of videolaryngoscopy and direct laryngoscopy by German paramedics during out-of-hospital cardiopulmonary resuscitation; an observational prospective study.

Risse J(1), Volberg C(2), Kratz T(3), Plöger B(4), Jerrentrup A(4), Pabst D(5), Kill C(5).

Abstract

BACKGROUND: Videolaryngoscopy (VL) has become a popular method of intubation (ETI). Although VL may facilitate ETI in less-experienced rescuers there are limited data available concerning ETI performed by paramedics during CPR. The goal was to evaluate the impact VL compared with DL on intubation success and glottic view during CPR performed by German paramedics. We investigated in an observational prospective study the superiority of VL by paramedics during CPR compared with direct laryngoscopy (DL). **METHODS:** In a single Emergency Medical Service (EMS) in Germany with in total 32 ambulances paramedics underwent an initial instruction from in endotracheal intubation (ETI) with GlideScope® (GVL) during resuscitation. The primary endpoint was good visibility of the glottis (Cormack-Lehane grading 1/2), and the secondary endpoint was successful intubation comparing GVL and DL. **RESULTS:** In total n = 97 patients were included, n = 69 with DL (n = 85 intubation attempts) and n = 28 VL (n = 37 intubation attempts). Videolaryngoscopy resulted in a significantly improved visualization of the larynx compared with DL. In the group using GVL, 82% rated visualization of the glottis as CL 1&2 versus 55% in the DL group (p = 0.02). Despite better visualization of the larynx, there was no statistically significant difference in successful ETI between GVL and DL (GVL 75% vs. DL 68.1%, p = 0.63). **CONCLUSIONS:** We found no difference in Overall and First Pass Success (FPS) between GVL and DL during CPR by German paramedics despite better glottic visualization with GVL. Therefore, we conclude that education in VL should also focus on insertion of the endotracheal tube, considering the different procedures

of GVL. TRIAL REGISTRATION: German Clinical Trial Register DRKS00020976, 27. February 2020 retrospectively registered.

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2. Int J Emerg Med. 2020 Apr 16;13(1):18. doi: 10.1186/s12245-020-00276-y.

Manual ventilation quality is improved with a real-time visual feedback system during simulated resuscitation.

Gould JR(1), Campana L(1), Rabickow D(2), Raymond R(2), Partridge R(3).

Abstract

INTRODUCTION: Manual ventilations during cardiac arrest are frequently performed outside of recommended guidelines. Real-time feedback has been shown to improve chest compression quality, but the use of feedback to guide ventilation volume and rate has not been studied. The purpose of this study was to determine whether the use of a real-time visual feedback system for ventilation volume and rate improves manual ventilation quality during simulated cardiac arrest. METHODS: Teams of 2 emergency medical technicians (EMTs) performed two 8-min rounds of cardiopulmonary resuscitation (CPR) on a manikin during a simulated cardiac arrest scenario with one EMT performing ventilations while the other performed compressions. The EMTs switched roles every 2 min. During the first round of CPR, ventilation and chest compression feedback was disabled on a monitor/defibrillator. Following a 20-min rest period and a brief session to familiarize the EMTs with the feedback technology, the trial was repeated with feedback enabled. The primary outcome variables for the study were ventilations and chest compressions within target. Ventilation rate (target, 8-10 breaths/minute) and tidal volume (target, 425-575 ml) were measured using a novel differential pressure-based flow sensor. Data were analyzed using paired t tests. RESULTS: Ten teams of 2 EMTs completed the study. Mean percentages of ventilations performed in target for rate (41% vs. 71%, $p < 0.01$), for volume (31% vs. 79%, $p < 0.01$), and for rate and volume together (10% vs. 63%, $p < 0.01$) were significantly greater with feedback. CONCLUSION: The use of a novel visual feedback system for ventilation quality increased the percentage of ventilations in target for rate and volume during simulated CPR. Real-time feedback to perform ventilations within recommended guidelines during cardiac arrest should be further investigated in human resuscitation.

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MONITORATGE CEREBRAL

1. J Clin Med. 2020 Apr 13;9(4). pii: E1113. doi: 10.3390/jcm9041113.

Background Frequency Patterns in Standard Electroencephalography as an Early Prognostic Tool in Out-of-Hospital Cardiac Arrest Survivors Treated with Targeted Temperature Management.

Kim YJ(1), Kim MJ(2), Koo YS(3), Kim WY(1).

Abstract

We investigated the prognostic value of standard electroencephalography, a 30-min recording using 21 electrodes on the scalp, during the early post-cardiac arrest period, and evaluated the performance of electroencephalography findings combined with other clinical features for predicting favourable outcomes in comatose out-of-hospital cardiac arrest (OHCA) survivors treated with targeted temperature management (TTM). This observational registry-based study was conducted at a tertiary care hospital in Korea using the data of all consecutive adult

non-traumatic comatose OHCA survivors who underwent standard electroencephalography during TTM between 2010 and 2018. The primary outcome was a 6-month favourable neurological outcome (Cerebral Performance Category score of 1 or 2). Among 170 comatose OHCA survivors with median electroencephalography time of 22 hours, a 6-month favourable neurologic outcome was observed in 34.1% (58/170). After adjusting other clinical characteristics, an electroencephalography background with dominant alpha and theta waves had the highest odds ratio of 13.03 (95% confidence interval, 4.69-36.22) in multivariable logistic analysis. A combination of other clinical features (age < 65 years, initial shockable rhythm, resuscitation duration < 20 min) with an electroencephalography background with dominant alpha and theta waves increased predictive performance for favourable neurologic outcomes with a high specificity of up to 100%. A background with dominant alpha and theta waves in standard electroencephalography during TTM could be a simple and early favourable prognostic finding in comatose OHCA survivors.

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ORGANITZACIÓ I ENTRENAMENT

1. JAMA Netw Open. 2020 Apr 1;3(4):e203043. doi: 10.1001/jamanetworkopen.2020.3043.

Association of Fine Particulate Matter Exposure With Bystander-Witnessed Out-of-Hospital Cardiac Arrest of Cardiac Origin in Japan.

Kojima S(1), Michikawa T(2), Matsui K(3), Ogawa H(4), Yamazaki S(5), Nitta H(5), Takami A(6), Ueda K(7), Tahara Y(8), Yonemoto N(9), Nonogi H(10), Nagao K(11), Ikeda T(12), Sato N(13), Tsutsui H(14); Japanese Circulation Society With Resuscitation Science Study (JCS-ReSS) Group.

Abstract

Importance:

Out-of-hospital cardiac arrests (OHCAs) are a major public health concern and a leading cause of death worldwide. Exposure to ambient air pollution is associated with increases in morbidity and mortality and has been recognized as a leading contributor to global disease burden.

OBJECTIVE: To examine the association between short-term exposure to particulate matter with a diameter of 2.5 µm or smaller (PM_{2.5}) and the incidence of OHCAs of cardiac origin and with the development of initial cardiac arrest rhythm. **DESIGN, SETTING, AND**

PARTICIPANTS: This case-control study used data from cases registered between January 1, 2005, and December 31, 2016, in the All-Japan Utstein Registry, a prospective, nationwide, population-based database for OHCAs across all 47 Japanese prefectures. These OHCA cases included patients who had bystander-witnessed OHCAs and for whom emergency medical services responders initiated resuscitation before hospital transfer. A case-crossover design was employed for the study analyses. A prefecture-specific, conditional logistic regression model to estimate odds ratios was applied, and a random-effects meta-analysis was used to obtain prefecture-specific pooled estimates. All analyses were performed from May 7, 2019, to January 23, 2020. **MAIN OUTCOMES AND MEASURES:** The main outcome was the association of short-term PM_{2.5} exposure with the incidence of bystander-witnessed OHCAs of cardiac origin. The differences in the distribution of initial cardiac arrest rhythm in OHCAs among those with exposure to PM_{2.5} were also examined. **RESULTS:** In total, 103 189 OHCAs witnessed by bystanders were included in the final analysis. Among the patients who experienced such OHCAs, the mean (SD) age was 75 (15.5) years, and 62 795 (60.9%) were men. Point estimates of the percentage increase for a 10-µg/m³ increase in PM_{2.5} at lag0-1 (difference in mean PM_{2.5} concentrations measured on the case day and 1 day before) demonstrated a statistically significantly higher incidence of OHCA across most of the 47 prefectures, without significant heterogeneity (I² = 20.1%; P = .12). A stratified analysis found an association between PM_{2.5} exposure and OHCAs (% increase, 1.6; 95% CI, 0.1%-3.1%). An initial shockable rhythm, such as ventricular fibrillation or pulseless ventricular tachycardia (% increase, 0.6;

95% CI, -2.0% to 3.2%), was not associated with PM2.5 exposure. However, an initial nonshockable rhythm, such as pulseless electrical activity and asystole, was associated with PM2.5 exposure (% increase, 1.4; 95% CI, 0.1%-2.7%). **CONCLUSIONS AND RELEVANCE:** Findings from this study suggest that increased PM2.5 concentration is associated with bystander-witnessed OHCA of cardiac origin that commonly presents with nonshockable rhythm. The results support measures to reduce PM2.5 exposure to prevent OHCAs of cardiac origin.

FREE FULL TEXT

2. Prehosp Emerg Care. 2020 Apr 17:1-13. doi: 10.1080/10903127.2020.1757181. [Epub ahead of print]

Verbal Motivation vs. Digital Real-Time Feedback During Cardiopulmonary Resuscitation: Comparing Bystander CPR Quality in a Randomized and Controlled Manikin Study of Simulated Cardiac Arrest.

Plata C(1), Nowack M(1), Loeser J(2), Drinhaus H(1), Steinhäuser S(3), Hinkelbein J(1), Wetsch WA(1), Böttiger BW(1), Spelten O(4).

Abstract

PURPOSE OF THE STUDY: The use of smartphone applications increases bystander CPR quality as well as the use of telephone CPR protocols. The present prospective, randomized, controlled manikin trial analyses the effects of a smartphone application (PocketCPR®) on CPR quality in a bystander CPR scenario compared to a dispatcher-assisted telephone CPR with the additional use of a metronome and verbal motivation. **METHODS:** 150 laypersons were included to perform 8-minute CPR on a manikin. Volunteers were randomly assigned to one of three groups: (1) dispatcher-assisted telephone CPR (telephone-group), (2) dispatcher-assisted telephone CPR combined with the smartphone-application (telephone + app-group) and (3) dispatcher-assisted telephone CPR with additional verbal motivation ("push harder, release completely", every 20 seconds, starting after 60 seconds) and a metronome with 100 min⁻¹ (telephone + motivation-group). **RESULTS:** Median compression depth did not differ significantly between the study groups ($p = 0.051$). However, in the post hoc analysis median compression depth in the telephone + motivation-group was significantly elevated compared to the telephone + app-group (59mm [IQR 47-67mm] vs. 51mm [IQR 46-57mm]; $p = 0.025$). The median number of superficial compressions was significantly reduced in the telephone + motivation-group compared to the telephone + app-group (70 [IQR 3-362] vs. 349 [IQR 88-538]; $p = 0.004$), but not compared to the telephone-group (91 [IQR 4-449]; $p = 0.707$). In contrast to the other study groups, median compression depth of the telephone + motivation-group increased over time. Chest compressions with correct depth were found significantly more often in the telephone + app-group compared to the other study groups ($p = 0.011$). Median compression rate in the telephone + app-group was significantly elevated (108 min⁻¹ [IQR 96-119 min⁻¹]) compared to the telephone-group (78 min⁻¹ [IQR 56-106 min⁻¹]; $p < 0.001$) and the telephone + motivation-group (99 min⁻¹ [IQR 91-101 min⁻¹]; $p < 0.001$). **CONCLUSIONS:** The use of a smartphone application as well as verbal motivation by a dispatcher during telephone CPR leads to higher CPR quality levels compared to standard telephone CPR. Thereby, the use of the smartphone application mainly shows an increase in compression rate, while increased compression rate with simultaneously increased compression depth was only apparent in the telephone + motivation-group.

3. Prehosp Emerg Care. 2020 Apr 14:1-13. doi: 10.1080/10903127.2020.1752868. [Epub ahead of print]

Time to return of spontaneous circulation and survival: when to transport in out-of-hospital cardiac arrest?

de Graaf C(1), Donders DNV(1), Beesems SG(1), Henriques JPS(1), Koster RW(1).

Abstract

BACKGROUND: In out-of-hospital cardiac arrest (OHCA), 10-50% of patients have return of spontaneous circulation (ROSC) before hospital arrival. It is important to investigate the relation between time-to-ROSC and survival to determine the optimal timing of transport to the hospital in patients without ROSC. **METHODS:** We analyzed data of OHCA patients with a presumed cardiac cause (excluding traumatic and other obvious non-cardiac causes) and ROSC before hospital arrival from the Amsterdam Resuscitation Study (ARREST) database. ROSC included those patients whose ROSC was persistent or transient before or during transport, lasting ≥ 1 minute. Of these data, we analyzed the association between the time of emergency medical services (EMS) arrival until ROSC (time-to-ROSC) and 30-day survival. **RESULTS:** Of 3632 OHCA patients with attempted resuscitation, 810 patients with prehospital ROSC were included. Of these, 332 (41%) survived 30 days. Survivors had a significant shorter time-to-ROSC compared to non-survivors of median 5 min (IQR 2,10) vs. median 12 min (IQR 9,17) ($p < 0.001$). Of the survivors, 90% achieved ROSC within 15 minutes compared to 22 minutes of non-survivors. In a multivariable model adjusted for known system determinants time-to-ROSC per minute was significantly associated with 30-day survival (OR 0.89; 95%CI 0.86 - 0.91). A ROC curve showed 8 minutes as the time-to-ROSC with the best test performance (sensitivity of 0.72 and specificity of 0.77). **CONCLUSION:** In OHCA patients with prehospital ROSC survival significantly decreases with increasing time-to-ROSC. Of all patients, 90% of survivors had achieved ROSC within the first 15 minutes of EMS resuscitation. The optimal time for the decision to transport is between 8 and 15 minutes after EMS arrival.

CURES POST-RCE

1. BMC Cardiovasc Disord. 2020 Apr 15;20(1):170. doi: 10.1186/s12872-020-01451-y.

High plasma levels of pro-inflammatory factors interleukin-17 and interleukin-23 are associated with poor outcome of cardiac-arrest patients: a single center experience.

Zhuang YG(1), Chen YZ(1), Zhou SQ(1), Peng H(1), Chen YQ(1), Li DJ(2)(3)(4).

Abstract

BACKGROUND: Systemic inflammation is an important feature of post-cardiac arrest syndrome (PCAS). This study was designed to determine whether the plasma concentrations of some circulating pro-inflammatory cytokines (interleukin-17 [IL-17], IL-22, IL-23 and IL-33) are of value in predicting the outcome of patients after return of spontaneous circulation (ROSC) during the post-cardiac arrest period. **METHODS:** This was a prospective observational clinical study. In total, 21 patients (survivors, $n = 10$; non-survivors, $n = 11$) who experienced cardiac arrest and successful ROSC with expected survival of at least 7 days were consecutively enrolled from January 2016 to December 2017. Of the 21 enrolled patients, ten survived were designated "survivors". The other eleven patients died between 2 days and 1 months post ROSC. Venous blood was drawn at three time-points: baseline (< 1 h post ROSC), 2 days post ROSC and 7 days post ROSC. Plasma IL-17, IL-22, IL-23 and IL-33 were determined using commercial enzyme-linked immunosorbent assays. **RESULTS:** Plasma creatinine levels, but aspartate aminotransferase (AST) and alanine aminotransferase (ALT) levels, were elevated in non-survivors compared with survivors. Plasma levels of IL-17, IL-22, IL-23 and IL-33 of the 21 total patients did not change at 2 or 7 days post ROSC compared to baseline. In survivors, the plasma levels of IL-17 and IL-23 at 2 or 7 days post ROSC were lower than baseline. In non-survivors, plasma levels of IL-17 increased compared with baseline. Receiver operating characteristic curve analysis showed that the plasma levels of IL-17 and IL-23 at 2 or 7 days post ROSC were able to predict the mortality of PCAS patients, and positively correlated with Acute Physiology and Chronic Health Evaluation (APACHE)-II score and time to ROSC. **CONCLUSION:** These results provide the first evidence that the elevated plasma IL-17 and IL-23

levels are associated with poor outcome in PCAS patients. The role of IL-17/IL-23 axis post ROSC is worth paying attention to in PCAS patients.

FREE FULL TEXT

2. J Formos Med Assoc. 2020 Apr 13. pii: S0929-6646(20)30109-1.
doi:10.1016/j.jfma.2020.03.017. [Epub ahead of print]

Targeted temperature management and emergent coronary angiography are associated with improved outcomes in patients with prehospital return of spontaneous circulation.

Lin JJ(1), Huang CH(2), Chen WJ(3), Chuang PY(4), Chang WT(1), Chen WT(1), Tsai MS(5).

Abstract

BACKGROUND/PURPOSE: Whether targeted temperature management (TTM) and emergent coronary angiography (CAG) remain associated with better outcomes in patients with prehospital return of spontaneous circulation (ROSC) was unknown. **METHODS:** This retrospective cohort study enrolled 81 adult, nontraumatic out-of-hospital cardiac arrest patients who had good pre-arrest neurological function and achieved prehospital ROSC during 2012 to August 2017. The outcomes were survival-to-discharge and neurological recovery at discharge. **RESULTS:** Fifty-five patients (67.9%) survived to hospital discharge (the survivor group) and twenty-six (32.1%) failed (the non-survivor group). A total of 47 patients (58.0%) presented favorable neurological outcomes [Cerebral Performance Category (CPC) score = 1-2, the favorable group], and 34 patients (42.0%) presented unfavorable neurological outcomes (CPC score = 3-5, the poor group). The survivor group had more patients with TTM (45.5% vs. 19.2%, $p = 0.023$) and emergent CAG (76.4% vs. 19.2%, $p < 0.001$) than the non-survivor group, and similar findings were noted in the neurological outcomes (TTM: 44.7% vs. 26.5%, $p = 0.094$; CAG: 80.9% vs. 26.5%, $p < 0.001$). TTM remained associated with increased survival-to-discharge [odds ratio (OR) = 14.635, 95% confidence interval (CI) = 1.296-165.305, $p = 0.030$] and a trend toward good neurological recovery (OR = 4.551, 95%CI = 0.963-21.517, $p = 0.056$). After excluding patients with rapid neurological recovery after ROSC ($n = 70$), TTM was associated with good neurological outcomes (OR = 4.534, 95% CI = 1.075-19.127, $p = 0.040$). Emergent CAG had the trend associated with survival-to-discharge (OR = 9.599, 95%CI = 0.764-120.634, $p = 0.080$) and was significantly associated with good neurological outcomes (OR = 21.785, 95%CI = 2.004-236.836, $p = 0.011$). **CONCLUSION:** In patients with prehospital ROSC, both TTM and emergent CAG were associated to improved survival and neurological outcomes.

3. Resuscitation. 2020 Apr 12. pii: S0300-9572(20)30138-6.
doi:10.1016/j.resuscitation.2020.04.002. [Epub ahead of print]

Health-related quality of life after surviving an out-of-hospital compared to an in-hospital cardiac arrest: A Swedish population-based registry study.

Djärv T(1), Bremer A(2), Herlitz J(3), Israelsson J(4), Cronberg T(5), Lilja G(5), Rawshani A(6), Årestedt K(7).

Abstract

BACKGROUND: Health-related quality of life (HRQoL) has been reported for out-hospital (OHCA) and in-hospital cardiac arrest (IHCA) separately, but potential differences between the two groups are unknown. The aim of this study is therefore to describe and compare HRQoL in patients surviving OHCA and IHCA. **METHODS:** Patients ≥ 18 years with Cerebral Performance Category 1-3 included in the Swedish Registry for Cardiopulmonary Resuscitation between 2014-2017 were included. A telephone interview was performed based on a questionnaire sent 3-6 months post cardiac arrest, including EQ-5D-5L and the Hospital Anxiety and Depression Scale. Mann-Whitney U test and multiple linear- and ordinal logistic regression analyses were used to describe and compare HRQoL in OHCA and IHCA survivors. Adjustments were made for sex, age and initial rhythm. **RESULTS:** In all, 1369 IHCA and 772 OHCA survivors were included. Most OHCA and IHCA survivors reported no symptoms of with anxiety (88%

and 84%) or depression (87% and 85%). IHCA survivors reported significantly more problems in the health domains mobility, self-care, usual activities and pain/discomfort ($p < 0.001$ for all) and scored lower general health measured by EQ-VAS (median 70 vs. 80 respectively, $p < 0.001$) compared with the OHCA survivors. CONCLUSION: Survivors of IHCA reported significantly worse HRQoL compared to survivors of OHCA. Consequently, research data gathered from one of these populations may not be generalizable to the other.

TARGETED TEMPERATURE MANAGEMENT

1. Ann Acad Med Singapore. 2020 Mar;49(3):127-136.

Mortality and Neurological Outcomes in Out-of-Hospital Cardiac Arrest Patients With and Without Targeted Temperature Management in a Multiethnic Asian Population.

Tay WJ(1), Li H, Ho AF, Sia CH, Kwek GG, Pothiwala S, Shahidah N, Tan KB, Wong AS, Sewa DW, Lim ET, Chin CT, Ong ME.

Abstract

INTRODUCTION: The use of targeted temperature management (TTM) is increasing although adoption is still variable. We describe our 6-year experience and compare the mortality and neurological outcomes of out-of-hospital cardiac arrest (OHCA) patients with and without the use of TTM in a multiethnic Asian population. **MATERIALS AND METHODS:** We performed a retrospective observational study at a tertiary academic medical centre. OHCA survivors admitted to our hospital between April 2010–December 2016 were included. Outcomes of interest were 30-day mortality postresuscitation, Cerebral Performance Category (CPC) and Overall Performance Category (OPC) scores. **RESULTS:** A total of 121 of 261 patients (46.3%) underwent TTM. TTM patients were younger (TTM 60.0 years old vs no TTM 63.7 years old, $P = 0.047$). There was no difference in the initial arrest rhythm of shockable origin between the 2 groups ($P = 0.289$). There was suggestion of lower 30-day mortality (TTM 24.3% vs no TTM 31.4%, $P = 0.214$), higher and good CPC/OPC scores (TTM 19.0% vs no TTM 15.7%, $P = 0.514$) with TTM although this did not reach statistical significance. On multivariable logistic regression analysis, TTM was not associated with 30-day mortality ($P = 0.07$). However, older age, initial non-shockable rhythm and increased duration from arrest to return of spontaneous circulation were associated with increased mortality. Malay ethnicity was associated with a poorer CPC/OPC score. **CONCLUSION:** Adoption and outcomes of TTM postresuscitation is variable and there is still a need to optimise management of the identified predictors of survival and good neurological outcomes while TTM is being used.

FREE FULL TEXT

2. Medicine (Baltimore). 2020 Apr;99(15):e19581. doi: 10.1097/MD.00000000000019581.

Prognostic factors for neurological outcomes in Korean targeted temperature management recipients with return of spontaneous circulation after out-of-hospital cardiac arrests: A nationwide observational study.

Kim JG(1)(2), Shin H(3), Choi HY(1), Kim W(1), Kim J(4), Moon S(5), Kim B(6), Ahn C(7), Lee J(8).

Abstract

Targeted temperature management (TTM) is recommended for comatose patients after out-of-hospital cardiac arrests (OHCAs). Even after successful TTM, several factors could influence the neuroprotective effect of TTM. The aim of this study is to identify prognostic factors associated with good neurological outcomes in TTM recipients. This study used nationwide data during 2012 to 2016 to investigate prognostic factors associated with good neurological outcomes in patients who received TTM after the return of spontaneous circulation (ROSC). Multivariate logistic regression analysis was conducted to analyse the factors that may affect the neurological outcomes in the TTM recipients. The study included 1578 eligible patients, comprising 767 with good and 811 with poor neurological outcomes. Multivariable analyses

showed that OHCA in public places (OR, 1.599; 95% CI, 1.100-2.323, P = .014), initial shockable rhythms (OR, 1.721; 95% CI, 1.191-2.486, P = .004), pre-hospital ROSCs (OR, 6.748; 95% CI, 4.703-9.682, P < .001), bystander cardiopulmonary resuscitation (CPR) (OR, 1.715; 95% CI, 1.200-2.450, P = .003), and primary coronary interventions (PCIs) (OR, 2.488; 95% CI, 1.639-3.778, P < .001) were statistically significantly associated with good neurological outcomes. Whereas, increase of age (OR, 0.962; 95% CI, 0.950-0.974, P < .001) and conventional cooling (OR, 0.478; 95% CI, 0.255-0.895, P = .021) were statistically significantly associated with poor neurological outcome. This study suggests that being younger, experiencing OHCA in public places, having initial shockable rhythm, pre-hospital ROSC, and bystander CPR, implementing PCIs and applying intravascular or surface cooling devices compared to conventional cooling method could predict good neurological outcomes in post-cardiac arrest patients who received TTM.

3. Resuscitation. 2020 Apr 12. pii: S0300-9572(20)30139-8.

doi:10.1016/j.resuscitation.2020.04.003. [Epub ahead of print]

Effects of moderate hypothermia versus normothermia on survival outcomes according to the initial body temperature in out-of-hospital cardiac patients: A nationwide observational study.

Kim JH(1), Park JH(2), Shin SD(3), Song KJ(4), Hong KJ(5), Kim TH(6), Kim KH(7).

Abstract

AIM: We aimed to investigate whether the effect of moderate hypothermia compared to normothermia on survival outcomes after out-of-hospital cardiac arrest (OHCA) patients who underwent targeted temperature management (TTM) differed between patients with and without initial spontaneous hypothermia. METHODS: We used data from a nationwide OHCA database collected between 2016 and 2017. Adult patients with OHCA of presumed cardiac aetiology who underwent TTM were included. Moderate hypothermia was defined as a target temperature of TTM < 35.5°C. Initial hypothermia was defined as the measured temperature before starting TTM < 35.5°C. Endpoints were survival to discharge and good neurological recovery (CPC 1 or 2). We compared outcomes between moderate hypothermia vs. normothermia using multivariable logistic regression with an interaction term between target temperature of TTM and initial spontaneous hypothermia. RESULTS: Of the 744 patients, 628 (84.4%) underwent moderate hypothermia. Initial spontaneous hypothermia was observed in 28.5% and 25.0% in the moderate hypothermia and normothermia groups, respectively. There was no significant difference in survival to discharge between moderate hypothermia and normothermia (57.2% vs 62.9%, p=0.248). The initial spontaneous hypothermia group showed poorer survival than the initial non-hypothermia group (41.8% vs 64.4%, p<0.001). In the interaction model, AOR (95% CI) for survival to discharge of moderate hypothermia was 3.51 (1.33-9.25) in patients with initial spontaneous hypothermia and 0.49 (0.27-0.89) in patients without initial spontaneous hypothermia. CONCLUSION: The effect of moderate hypothermia was modified by the initial temperature of OHCA survivors who underwent TTM. The positive effect of moderate hypothermia was increased in patients with initial spontaneous hypothermia.

ELECTROFISIOLOGIA I DESFIBRIL·LACIÓ

1. Cardiol Res Pract. 2020 Mar 28;2020:3786408. doi: 10.1155/2020/3786408. eCollection 2020.

Conversion from Nonshockable to Shockable Rhythms and Out-of-Hospital Cardiac Arrest Outcomes by Initial Heart Rhythm and Rhythm Conversion Time.

Zhang W(1), Luo S(2)(3)(4), Yang D(2), Zhang Y(1), Liao J(1), Gu L(1), Li W(1), Liu Z(1), Xiong Y(1), Idris A(5).

Abstract

BACKGROUND: The conversion from a nonshockable rhythm (asystole or pulseless electrical activity (PEA)) to a shockable rhythm (pulseless ventricular tachycardia or ventricular fibrillation) may be associated with better out-of-hospital cardiac arrest (OHCA) outcomes. There are insufficient data on the prognostic significance of such conversions by initial heart rhythm and different rhythm conversion time. **METHODS:** Among 24,849 adult OHCA patients of presumed cardiac etiology with initial asystole or PEA in the Resuscitation Outcomes Consortium Cardiac Epidemiologic Registry (version 3, 2011-2015), we examined the association of shockable rhythm conversion with prehospital return of spontaneous circulation (ROSC), survival, and favorable functional outcome (modified Rankin Scale score ≤ 3) at hospital discharge by initial rhythm and rhythm conversion time (time from cardiopulmonary resuscitation (CPR) initiation by emergency medical providers to first shock delivery), using logistic regression adjusting for key clinical characteristics. **RESULTS:** Of 16,516 patients with initial asystole and 8,333 patients with initial PEA, 16% and 20% underwent shockable rhythm conversions; the median rhythm conversion time was 12.0 (IQR: 6.7-18.7) and 13.2 (IQR: 7.0-20.5) min, respectively. No difference was found in odds of prehospital ROSC across rhythm conversion time, regardless of initial heart rhythm. Shockable rhythm conversion was associated with survival and favorable functional outcome at hospital discharge only when occurred during the first 15 min of CPR, for those with initial asystole, or the first 10 min of CPR, for those with initial PEA. The associations between shockable rhythm conversion and outcomes were stronger among those with initial asystole compared with those with initial PEA. **CONCLUSIONS:** The conversion from a nonshockable rhythm to a shockable rhythm was associated with better outcomes only when occurred early in initial nonshockable rhythm OHCA, and it has greater prognostic significance when the initial rhythm was asystole.

FREE FULL TEXT

2. Resuscitation. 2020 Apr 8. pii: S0300-9572(20)30125-8. doi: 10.1016/j.resuscitation.2020.03.014. [Epub ahead of print]

Occurrence of shockable rhythm in out-of-hospital cardiac arrest over time: a report from the COSTA group.

Oving I(1), de Graaf C(1), Karlsson L(2), Jonsson M(3), Kramer-Johansen J(4), Berglund E(3), Hulleman M(1), Beesems SG(1), Koster RW(1), Olasveengen TM(4), Ringh M(3), Claessen A(3), Lippert F(2), Hollenberg J(3), Folke F(2), Tan HL(5), Blom MT(6).

Abstract

BACKGROUND: Prior research suggests that the proportion of a shockable initial rhythm (SIR) in out-of-hospital cardiac arrest (OHCA) declined during the last decades. This study aims to investigate if this decline is still ongoing and explore the relationship between location of OHCA and proportion of a SIR as initial rhythm. **METHODS:** We calculated the proportion of patients with a SIR between 2006-2015 using pooled data from the COSTA-group (Copenhagen, Oslo, Stockholm, Amsterdam). Analyses were stratified according to location of OHCA (residential vs. public). **RESULTS:** A total of 19,054 OHCA cases were included. Overall, the total proportion of cases with a SIR decreased from 42% to 37% ($P < 0.01$) from 2006 to 2015. When stratified according to location, the proportion of cases with a SIR decreased for OHCA at a residential location (34% to 27%; $P = 0.03$), while the proportion of a SIR was stable among OHCA in public locations (59% to 57%; $P = 0.2$). During the last years of the study period (2011-2015), the overall proportion of a SIR remained stable (38% to 37%; $P = 0.45$); this was observed for both residential and public OHCA. **CONCLUSION:** We found a decline in the proportion of patients with a SIR in OHCA at a residential location; this decline levelled off during the second half of the study period (2011-2015). In public locations, we observed no decline in SIR over time.

PEDIATRIA

1. Crit Care Med. 2020 Apr 14. doi: 10.1097/CCM.0000000000004308. [Epub ahead of print]
Survival and Hemodynamics During Pediatric Cardiopulmonary Resuscitation for Bradycardia and Poor Perfusion Versus Pulseless Cardiac Arrest.

Morgan RW(1), Reeder RW(2), Meert KL(3), Telford R(2), Yates AR(4), Berger JT(5), Graham K(1), Landis WP(1), Kilbaugh TJ(1), Newth CJ(6), Carcillo JA(7), McQuillen PS(8), Harrison RE(9), Moler FW(10), Pollack MM(5), Carpenter TC(11), Notterman D(12), Holubkov R(2), Dean JM(2), Nadkarni VM(1), Berg RA(1), Sutton RM(1); Eunice Kennedy Shriver National Institute of Child Health and Human Development/Collaborative Pediatric Critical Care Research Network (CPCCRN) Pediatric Intensive Care Quality of Cardio-Pulmonary Resuscitation (PICqCPR) Investigators.

Abstract

OBJECTIVES: The objective of this study was to compare survival outcomes and intra-arrest arterial blood pressures between children receiving cardiopulmonary resuscitation for bradycardia and poor perfusion and those with pulseless cardiac arrests. **DESIGN:** Prospective, multicenter observational study. **SETTING:** PICUs and cardiac ICUs of the Collaborative Pediatric Critical Care Research Network. **PATIENTS:** Children (< 19 yr old) who received greater than or equal to 1 minute of cardiopulmonary resuscitation with invasive arterial blood pressure monitoring in place. **INTERVENTIONS:** None. **MEASUREMENTS AND MAIN RESULTS:** Of 164 patients, 96 (59%) had bradycardia and poor perfusion as the initial cardiopulmonary resuscitation rhythm. Compared to those with initial pulseless rhythms, these children were younger (0.4 vs 1.4 yr; $p = 0.005$) and more likely to have a respiratory etiology of arrest ($p < 0.001$). Children with bradycardia and poor perfusion were more likely to survive to hospital discharge (adjusted odds ratio, 2.31; 95% CI, 1.10-4.83; $p = 0.025$) and survive with favorable neurologic outcome (adjusted odds ratio, 2.21; 95% CI, 1.04-4.67; $p = 0.036$). There were no differences in diastolic or systolic blood pressures or event survival (return of spontaneous circulation or return of circulation via extracorporeal cardiopulmonary resuscitation). Among patients with bradycardia and poor perfusion, 49 of 96 (51%) had subsequent pulselessness during the cardiopulmonary resuscitation event. During cardiopulmonary resuscitation, these patients had lower diastolic blood pressure (point estimate, -6.68 mm Hg [-10.92 to -2.44 mm Hg]; $p = 0.003$) and systolic blood pressure (point estimate, -12.36 mm Hg [-23.52 to -1.21 mm Hg]; $p = 0.032$) and lower rates of return of spontaneous circulation (26/49 vs 42/47; $p < 0.001$) than those who were never pulseless. **CONCLUSIONS:** Most children receiving cardiopulmonary resuscitation in ICUs had an initial rhythm of bradycardia and poor perfusion. They were more likely to survive to hospital discharge and survive with favorable neurologic outcomes than patients with pulseless arrests, although there were no differences in immediate event outcomes or intra-arrest hemodynamics. Patients who progressed to pulselessness after cardiopulmonary resuscitation initiation had lower intra-arrest hemodynamics and worse event outcomes than those who were never pulseless.

2. Front Pediatr. 2020 Apr 2;8:133. doi: 10.3389/fped.2020.00133. eCollection 2020.

Rescuer Exertion and Fatigue Using Two-Thumb vs. Two-Finger Method During Simulated Neonatal Cardiopulmonary Resuscitation.

Reynolds C(1), Cox J(1), Livingstone V(2), Dempsey EM(1)(2).

Abstract

BACKGROUND: Rescuer fatigue during neonatal CPR can affect CPR quality leading to reduced cerebral and myocardial perfusion. **AIM:** To investigate rescuer fatigue during simulated neonatal CPR using both objective (heart rate and cardiac output) and subjective measures. **METHODS:** A randomized crossover manikin study performed. Nineteen doctors working in

neonatology were randomized to (a) two-thumb term, (b) two-finger term, (c) two-thumb preterm, or (d) two-finger preterm group. Cardiac output and heart rate were measured with a non-invasive cardiac output monitor. A Likert scale assessed participants' level of perceived exertion. RESULTS: In the preterm group, the mean change in HR from rest to 5 min in the TT group was 11.58 bpm (SD 6.22) vs. 9.94 bpm (SD 8.48), (p -value 0.36). There was no difference in change in CO, 2.10 (SD 1.15) in the TT group vs. 1.39 (SD 1.63) in TF group (p value 0.23). There was no difference in BORG RPE rating. In the term group, the mean change in HR from rest to 5 min was 15 bpm (SD 8.40) in TT group and 13 bpm (SD 7.86) in TF group, (p -value 0.416). The median change in CO from rest to 5 min was 1.50 (0.78 to 2.42 IQR) in TT group vs. 1.60 (0.65 to 3.0 IQR) in TF group. CONCLUSION: Providing chest compressions is associated with an increase in both heart rate and cardiac output. We did not identify difference between objective and subjective measures of fatigue between either technique in a preterm or term model.

FREE FULL TEXT

3. Pharmacoepidemiol Drug Saf. 2020 Apr 13. doi: 10.1002/pds.5001. [Epub ahead of print]

Validity of administrative claims-based algorithms for ventricular arrhythmia and cardiac arrest in the pediatric population.

Czaja AS(1)(2), Collins K(3), Valuck RJ(2), Anderson HD(2), Ghosh D(4), Davidson JA(3).

Abstract

PURPOSE: Identify administrative claims-based algorithms for capturing out-of-hospital ventricular arrhythmias (VA) and cardiac arrests (CA) due to cardiac causes in the pediatric population with high positive-predictive value (PPV). METHODS: Within a single pediatric center, a retrospective cohort of patients hospitalized or seen in the emergency room for VA or CA were identified from the electronic health records. Eligible encounters were blindly reviewed and linked to administrative data, including ICD-9/ICD-10 codes. Test characteristics, including PPV, for different diagnostic and procedure codes were generated using a 50% training sample. The gold standard was definite or suspected out-of-hospital VA or CA due to cardiac cause verified based on clinical criteria. Algorithms with the highest PPV were then applied to a 50% validation sample to validate performance. RESULTS: From 2004-2017, 598 encounters met eligibility criteria. 174 (29%) had an outcome of interest, with remainder being an inpatient event or CA due to other cause. Within the training sample ($n = 263$), VA codes in primary position had a PPV 94% (95%CI 81%-99%) with low sensitivity (44%, 95%CI 33%-56%). CA codes in any position or VA codes in nonprimary positions had low PPV (18%-19%, 31% respectively). Applying the top three performing algorithms to the validation sample ($n = 252$) yielded similar PPV values. CONCLUSIONS: Contrary to adults, algorithms including a CA code do not perform well for identifying out-of-hospital VA and CA due to cardiac cause in the pediatric populations. Researchers should be aware of the potential implications for future pediatric drug safety studies for these outcomes.

ECMO

1. World J Pediatr Congenit Heart Surg. 2020 May;11(3):265-274. doi: 10.1177/2150135120902102.

Factors Associated With Survival Following Extracorporeal Cardiopulmonary Resuscitation in Children.

Melvan JN(1), Davis J(2), Heard M(2), Trivedi JR(3), Wolf M(2), Kanter KR(1), Deshpande SR(2), Alsoufi B(3).

Abstract

OBJECTIVES: We examined a large single-institution experience in extracorporeal cardiopulmonary resuscitation (ECPR) in children having cardiac arrest refractory to conventional resuscitation measures with focus on factors affecting survival. **METHODS:** Between 2002 and 2017, 184 children underwent ECPR at our institution. We entered demographic, anatomic, clinical, surgical, and ECPR support details into a multivariable logistic regression models to determine factors associated with mortality. **RESULTS:** Median age was 54 days (interquartile range [IQR]: 11-272). In all, 157 (85%) patients had primary cardiac disease, including 136 (74%) with congenital heart disease (71 with single ventricle). Extracorporeal cardiopulmonary resuscitation occurred following cardiac surgery in 124 (67%) patients. Median cardiopulmonary resuscitation (CPR) duration was 27 minutes (IQR: 18-40) and median support duration was 3.0 days (IQR: 1.6-5.3). Overall, ECPR was weaned in 115 (63%), with 79 (43%) surviving to hospital discharge. Survival for patients with congenital heart disease, noncongenital cardiac, and noncardiac pathologies was 44%, 71%, and 15%, respectively. On multivariable regression analysis, risk factors associated with mortality were presupport pH <7.1 (odds ratio [OR] = 3.7, 95% confidence interval [CI]: 1.11-12.41, $P = .033$), mechanical complications (OR = 8.33, 95% CI: 1.91-36.25, $P = .005$), neurologic complications (OR = 6.27, 95% CI: 1.40-28.10, $P = .017$), and renal replacement therapy (OR = 3.31, 95% CI: 1.03-10.66, $P = .045$). **CONCLUSIONS:** Extracorporeal cardiopulmonary resuscitation plays a valuable role salvaging children with refractory cardiac arrest. Survival varies with underlying pathology and can be expected even with relatively longer CPR durations. Efforts to improve systemic output before and after institution of ECPR might mitigate some of the significant risk factors for mortality.

RECERCA EXPERIMENTAL

1. Scand J Trauma Resusc Emerg Med. 2020 Apr 10;28(1):27. doi:10.1186/s13049-020-00721-0.

A novel ECG-biomarker for cardiac arrest during hypothermia.

Dietrichs ES(1)(2), Tveita T(3)(4), Myles R(5), Smith G(5).

Abstract

BACKGROUND: Treatment of arrhythmias evoked by accidental or therapeutic hypothermia and rewarming remains challenging. We aim to find an ECG-biomarker that can predict ventricular arrhythmias at temperatures occurring in therapeutic and accidental hypothermia. **MAIN BODY:** Evaluation of ECG-data from accidental and therapeutic hypothermia patients and experimental data on ECG and ventricular fibrillation (VF) threshold in hypothermic New Zealand White Rabbits. VF threshold was measured in rabbit hearts cooled to moderate (31 °C) and severe (17 °C) hypothermia. QRS-interval divided by corrected QT-interval (QTc) was calculated at same temperatures. Clinical QRS/QTc data were obtained after a systematic literature review. Rabbit QRS/QTc values correlated with risk for VF (correlation coefficient: 0.97). Human QRS/QTc values from hypothermic patients, showed similar correlation with risk for ventricular fibrillation in the experimental data (correlation coefficient: 1.00). **CONCLUSIONS:** These calculations indicate that QRS/QTc has potential as novel biomarker for predicting risk of hypothermia-induced cardiac arrest. Our findings apply both to victims of accidental hypothermia and to patients undergoing therapeutic hypothermia during surgery or after e.g. cardiac arrest.

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CASE REPORTS

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