

BIBLIOGRAFIA RECOMANADA GENER 2021

RCP I COVID-19

1. Rheumatol Int. 2021 Jan 1:1-17. doi: 10.1007/s00296-020-04759-2. Online ahead of print.
COVID-19, hydroxychloroquine and sudden cardiac death: implications for clinical practice in patients with rheumatic diseases.

Raza HA(1), Tariq J(1), Agarwal V(2), Gupta L(3).

ABSTRACT

Sudden cardiac death is commonly seen due to arrhythmias, which is a common cardiac manifestation seen in COVID-19 patients, especially those with underlying cardiovascular disease (CVD). Administration of hydroxychloroquine (HCQ) as a potential treatment option during SARS-CoV-2, initially gained popularity, but later, its safe usage became questionable due to its cardiovascular safety, largely stemming from instances of cardiac arrhythmias in COVID-19. Moreover, in the setting of rheumatic diseases, in which patients are usually on HCQ for their primary disease, there is a need to scale the merits and demerits of HCQ usage for the treatment of COVID-19. In this narrative review, we aim to address the association between usage of HCQ and sudden cardiac death in COVID-19 patients. MEDLINE, EMBASE, ClinicalTrials.gov and SCOPUS databases were used to review articles in English ranging from case reports, case series, letter to editors, systematic reviews, narrative reviews, observational studies and randomized control trials. HCQ is a potential cause of sudden cardiac death in COVID-19 patients. As opposed to the reduction in CVD with HCQ in treatment of systemic lupus erythematosus, rheumatoid arthritis, and other rheumatic diseases, safe usage of HCQ in COVID-19 patients is unclear; whereby, it is observed to result in QTc prolongation and Torsades de pointes even in patients with no underlying cardiovascular comorbidity. This is occasionally associated with sudden cardiac death or cardiac arrest; hence, its clinical efficacy needs further investigation by large-scale clinical trials.

2. Resuscitation. 2020 Dec;157:121-122. doi: 10.1016/j.resuscitation.2020.10.034. Epub 2020 Nov 2.

Out-of-hospital cardiac arrest incidence during COVID-19 pandemic in Southern Germany.

Huber BC(1), Brunner S(2), Schlichtiger J(2), Kanz KG(3), Bogner-Flatz V(4).

NO ABSTRACT AVAILABLE

3. Resuscitation. 2020 Dec;157:230-240. doi: 10.1016/j.resuscitation.2020.09.037. Epub 2020 Oct 10.

Influence of the Covid-19 pandemic on out-of-hospital cardiac arrest. A Spanish nationwide prospective cohort study.

Rosell Ortiz F(1), Fernández Del Valle P(2), Knox EC(3), Jiménez Fábrega X(4), Navalpotro Pascual JM(5), Mateo Rodríguez I(6), Ruiz Azpiazu JI(7), Iglesias Vázquez JA(8), Echarri Sucunza A(9), Alonso Moreno DF(10), Forner Canos AB(11), García-Ochoa Blanco MJ(12), López Cabeza N(13), Mainar Gómez B(14), Batres Gómez S(15), Cortés Ramas JA(16), Ceniceros Rozalén MI(17), Guirao Salas FA(18), Fernández Martínez B(19), Daponte Codina A(20); OHSCAR investigators.

ABSTRACT

AIMS: The influence of the COVID-19 pandemic on attendance to out-of-hospital cardiac arrest (OHCA) has only been described in city or regional settings. The impact of COVID-19 across an entire country with a high infection rate is yet to be explored. METHODS: The study uses data from 8629 cases recorded in two time-series (2017/2018 and 2020) of the Spanish national registry. Data from a non-COVID-19 period and the COVID-19 period (February 1st-April 30th 2020) were compared. During the COVID-19 period, data a further analysis comparing non-pandemic and pandemic weeks (defined according to the WHO declaration on March 11th, 2020) was conducted. The chi-squared analysis examined differences in OHCA attendance and

other patient and resuscitation characteristics. Multivariate logistic regression examined survival likelihood to hospital admission and discharge. The multilevel analysis examined the differential effects of regional COVID-19

incidence on these same outcomes. **RESULTS:** During the COVID-19 period, the incidence of resuscitation attempts declined and survival to hospital admission (OR = 1.72; 95%CI = 1.46-2.04; $p < 0.001$) and discharge (OR = 1.38; 95%CI = 1.07-1.78; $p = 0.013$) fell compared to the non-COVID period. This pattern was also observed when comparing non-pandemic weeks and pandemic weeks. COVID-19 incidence impinged significantly upon outcomes regardless of regional variation, with low, medium, and high incidence regions equally affected.

CONCLUSIONS: The pandemic, irrespective of its incidence, seems to have particularly impeded the pre-hospital phase of OHCA care. Present findings call for the need to adapt out-of-hospital care for periods of serious infection risk.

4. Resuscitation. 2020 Dec;157:1-2. doi: 10.1016/j.resuscitation.2020.09.032. Epub 2020 Oct 6.

Out-of-hospital cardiac arrest during the COVID-19 era in Bologna: System response to preserve performances.

Semeraro F(1), Gamberini L(2), Tartaglione M(2), Iarussi B(2), Descovich C(3), Picoco C(2), Gordini G(2).

NO ABSTRACT AVAILABLE

5. Resusc Plus. 2021 Mar;5:100075. doi: 10.1016/j.resplu.2020.100075. Epub 2021 Jan 2.

Management of first responder programmes for out-of-hospital cardiac arrest during the COVID-19 pandemic in Europe.

Andelius L(1), Oving I(2), Folke F(1)(3), de Graaf C(2), Stieglis R(2), Kjoelbye JS(1), Hansen CM(1)(3), Koster RW(2), L Tan H(2)(4), Blom MT(2); ESCAPE-NET investigators.

ABSTRACT

AIM: First responder (FR) programmes dispatch professional FRs (police and/or firefighters) or citizen responders to perform cardiopulmonary resuscitation (CPR) and use automated external defibrillators (AED) in out-of-hospital cardiac arrest (OHCA). We aimed to describe management of FR-programmes across Europe in response to the Coronavirus Disease 2019 (COVID-19) pandemic.

METHODS: In June 2020, we conducted a cross-sectional survey sent to OHCA registry representatives in 18 European countries with active FR-programmes. The survey was administered by e-mail and included questions regarding management of both citizen responder and FR-programmes. A follow-up question was conducted in October 2020 assessing management during a potential "second wave" of COVID-19. **RESULTS:** All representatives responded (response rate = 100%). Fourteen regions dispatched citizen responders and 17 regions dispatched professional FRs (9 regions dispatched both). Responses were post-hoc divided into three categories: FR activation continued unchanged, FR activation continued with restrictions, or FR activation temporarily paused. For citizen responders, regions either temporarily paused activation ($n = 7$, 50.0%) or continued activation with restrictions ($n = 7$, 50.0%). The most common restriction was to omit rescue breaths and perform compression-only CPR. For professional FRs, nine regions continued activation with restrictions (52.9%) and five regions (29.4%) continued activation unchanged, but with personal protective equipment available for the professional FRs. In three regions (17.6%), activation of professional FRs temporarily paused. **CONCLUSION:** Most regions changed management of FR-programmes in response to the COVID-19 pandemic. Studies are needed to investigate the consequences of pausing or restricting FR-programmes for bystander CPR and AED use, and how this may impact patient outcome.

6. Resusc Plus. 2020 Dec;4:100054. doi: 10.1016/j.resplu.2020.100054. Epub 2020 Nov 21.

Clinical characteristics and outcomes of in-hospital cardiac arrest among patients with and without COVID-19.

Yuriditsky E(1), Mitchell OJL(2), Brosnahan SB(3), Smilowitz NR(1), Drus KW(3), Gonzales AM(3), Xia Y(4), Parnia S(3), Horowitz JM(1).

ABSTRACT

AIMS: To define outcomes of patients with COVID-19 compared to patients without COVID-19 suffering in-hospital cardiac arrest (IHCA). MATERIALS AND METHODS: We performed a single-center retrospective study of IHCA cases. Patients with COVID-19 were compared to consecutive patients without COVID-19 from the prior year. Return of spontaneous circulation (ROSC), 30-day survival, and cerebral performance category (CPC) at 30-days were assessed. RESULTS: Fifty-five patients with COVID-19 suffering IHCA were identified and compared to 55 consecutive IHCA patients in 2019. The COVID-19 cohort was more likely to require vasoactive agents (67.3% v 32.7%, $p = 0.001$), invasive mechanical ventilation (76.4% v 23.6%, $p < 0.001$), renal replacement therapy (18.2% v 3.6%, $p = 0.029$) and intensive care unit care (83.6% v 50.9%, $p = 0.001$) prior to IHCA. Patients with COVID-19 had shorter CPR duration (10 min v 22 min, $p = 0.002$). ROSC (38.2% v 49.1%, $p = 0.336$) and 30-day survival (20% v 32.7%, $p = 0.194$) did not differ. A 30-day cerebral performance category of 1 or 2 was more common among non-COVID patients (27.3% v 9.1%, $p = 0.048$). CONCLUSIONS: Return of spontaneous circulation and 30-day survival were similar between IHCA patients with and without COVID-19. Compared to previously published data, we report greater ROSC and 30-day survival after IHCA in COVID-19.

7. Resusc Plus. 2020 Dec;4:100034. doi: 10.1016/j.resplu.2020.100034. Epub 2020 Oct 5.

Bystanders are less willing to resuscitate out-of-hospital cardiac arrest victims during the COVID-19 pandemic.

Grunau B(1)(2)(3)(4), Bal J(1), Scheuermeyer F(1)(2)(3), Guh D(3), Dainty KN(5), Helmer J(1)(4), Saini S(6), Chakrabarti A(6), Brar N(6), Sidhu N(6), Barbic D(1)(2)(3), Christenson J(1)(2)(3), Chakrabarti S(1)(7).

ABSTRACT

AIM: The COVID-19 pandemic may influence the willingness of bystanders to engage in resuscitation for out-of-hospital cardiac arrest. We sought to determine if and how the pandemic has changed willingness to intervene, and the impact of personal protective equipment (PPE). METHODS: We distributed a 12-item survey to the general public through social media channels from June 4 to 23, 2020. We used 100-point scales to inquire about participants' willingness to perform interventions on "strangers or unfamiliar persons" and "family members or familiar persons", and compared mean willingness during time periods prior to and during the COVID-19 pandemic using paired t-tests. RESULTS: Survey participants ($n = 1360$) were from 26 countries; the median age was 38 years (IQR 24-50) and 45% were female. Compared to prior to the pandemic, there were significant decreases in willingness to check for breathing or a pulse (mean difference -10.7% [95%CI -11.8, -9.6] for stranger/unfamiliar persons, -1.2% [95%CI -1.6, -0.8] for family/familiar persons), perform chest compressions (-14.3% [95%CI -15.6, -13.0], -1.6% [95%CI -2.1, -1.1]), provide rescue breaths (-19.5% [95%CI -20.9, -18.1], -5.5% [95%CI -6.4, -4.6]), and apply an automated external defibrillator (-4.8% [95%CI -5.7, -4.0], -0.9% [95%CI -1.3, -0.5]) during the COVID-19 pandemic. Willingness to intervene increased significantly if PPE was available (+8.3% [95%CI 7.2, 9.5] for stranger/unfamiliar, and +1.4% [95%CI 0.8, 1.9] for family/familiar persons). CONCLUSION: Willingness to perform bystander resuscitation during the pandemic decreased, however this was ameliorated if simple PPE were available.

8. Resusc Plus. 2020 Dec;4:100027. doi: 10.1016/j.resplu.2020.100027. Epub 2020 Sep 14.

Clinical considerations for out-of-hospital cardiac arrest management during COVID-19.

Leong YC(1)(2), Cheskes S(1)(2)(3)(4), Drennan IR(5)(6), Buick JE(1)(7), Latchmansingh RG(1), Verbeek PR(1)(2)(8).

ABSTRACT

Managing out-of-hospital cardiac arrest requires paramedics to perform multiple aerosol generating medical procedures in an uncontrolled setting. This increases the risk of cross infection during the COVID-19 pandemic. Modifications to conventional protocols are required to balance paramedic safety with optimal patient care and potential stresses on the capacity of critical care resources.

Despite this, little specific advice has been published to guide paramedic practice. In this commentary, we highlight challenges and controversies regarding critical decision making around initiation of resuscitation, airway management, mechanical chest compression, and termination of resuscitation. We also discuss suggested triggers for implementation and revocation of recommended protocol changes and present an accompanying paramedic-specific algorithm.

9. Cardiol Res. 2021 Feb;12(1):47-50. doi: 10.14740/cr1149. Epub 2020 Dec 11.

Trajectory of Cardiac Catheterization for Acute Coronary Syndrome and Out-of-Hospital Cardiac Arrest During the COVID-19 Pandemic.

Desai PS(1), Fanous EJ(1), Tan W(2)(3), Lee J(4), Trinh T(4), Rafique AM(2), Parikh RV(2), Press MC(2).

ABSTRACT

BACKGROUND: We sought to investigate the trajectory of cardiac catheterizations for acute coronary syndrome (ACS) and out-of-hospital cardiac arrest (OHCA) during the pre-isolation (PI), strict-isolation (SI), and relaxed-isolation (RI) periods of the coronavirus disease 2019 (COVID-19) pandemic at three hospitals in Los Angeles, CA, USA. **METHODS:** A retrospective analysis was conducted on adult patients undergoing urgent or emergent cardiac catheterization for suspected ACS or OHCA between January 1, 2020 and June 2, 2020 at three hospitals in Los Angeles, CA, USA. We designated January 1, 2020 to March 17, 2020 as the PI COVID-19 period, March 18, 2020 to May 5, 2020 as the SI COVID-19 period, and May 6, 2020 to June 2, 2020 as the RI COVID-19 period.

RESULTS: From PI to SI, there was a significant reduction in mean weekly cases of catheterizations for non-ST elevation myocardial infarction/unstable angina (NSTEMI/UA) (8.29 vs. 12.5, $P = 0.019$), with all other clinical categories trending downwards. From SI to RI, mean weekly cases of catheterizations for total ACS increased by 17%, NSTEMI/UA increased by 27%, and OHCA increased by 32%, demonstrating a "rebound effect". **CONCLUSIONS:** Cardiac catheterizations for ACS and NSTEMI/UA exhibited a "rebound effect" once social isolation was relaxed.

10. ASAIO J. 2020 Dec 28; Publish Ahead of Print. doi: 10.1097/MAT.0000000000001377. Online ahead of print.

Extracorporeal Membrane Oxygenation and Extracorporeal Cardiopulmonary Resuscitation for a COVID-19 Paediatric Patient: A Successful Outcome.

Alfoudri H(1), Shamsah M, Yousuf B, AlQuraini N.

ABSTRACT

Paediatric population have been affected by the Coronavirus disease 2019 (COVID-19) to a much smaller scale compared to the adult population. The severity of the disease is variable ranging from mild form of pneumonia to severe Acute Respiratory Distress Syndrome (ARDS) that necessitates admission to the Intensive Care Unit (ICU) requiring maximal level of organ support. Failure of the maximum support through mechanical ventilation can lead to the consideration of a higher level of organ support through extracorporeal membrane oxygenation

(ECMO). We present a case of an 8 years old girl, who presented with severe ARDS secondary to COVID-19 pneumonia for which a venovenous-extracorporeal membrane oxygenation (VV ECMO) was initiated. This was followed by the patient developing cardiac arrest which was managed with extracorporeal cardiopulmonary resuscitation (ECPR). The patient was also given thrombolytic therapy during the ECPR due to high clinical suspicion for pulmonary embolism. VV-A ECMO was then continued and the patient was successfully weaned off both VA and VV ECMO and discharged home with full neurological recovery. This encouraging result will hopefully lead to more consideration of this lifesaving therapy for severe cardiac and respiratory failure secondary to COVID-19 in paediatric patients.

RCP - COMPRESSORS TORÀCICS MECÀNICS

1. J Am Heart Assoc. 2021 Jan 14:e017367. doi: 10.1161/JAHA.120.017367. Online ahead of print.

Optimal Combination of Chest Compression Depth and Rate in Virtual Reality Resuscitation Training: A Post Hoc Analysis of the Randomized Lowlands Saves Lives Trial.

Nas J(1), Thannhauser J(1), van Geuns RM(1), van Royen N(1), Bonnes JL(1), Brouwer MA(1).

ABSTRACT

Background Dissemination of cardiopulmonary resuscitation (CPR) skills is essential for cardiac arrest survival. Virtual reality (VR)-training methods are low cost and easily available, but to meet depth requirements adaptations are required, as confirmed in a recent randomized study on currently prevailing CPR quality criteria. Recently, the promising clinical performance of new CPR quality criteria was demonstrated, based on the optimal combination of compression depth and rate. We now study compliance with these newly proposed CPR quality criteria. Methods and Results Post hoc analysis of a randomized trial compared standardized 20-minute face-to-face CPR training with VR training using the Lifesaver VR smartphone application. During a posttraining test, compression depth and rate were measured using CPR mannequins. We assessed compliance with the newly proposed CPR criteria, that is, compression rate within $\pm 20\%$ of 107/minute and depth within $\pm 20\%$ of 47 mm. We studied 352 participants, age 26 (22-31) years, 56% female, and 15% with CPR training ≤ 2 years. Among VR-trained participants, there was a statistically significant difference between the proportions complying with newly proposed versus the currently prevailing quality criteria (52% versus 23%, $P < 0.001$). The difference in proportions complying with rate requirements was statistically significant (96% for the new versus 50% for current criteria, $P < 0.001$), whereas there was no significant difference with regard to the depth requirements (55% versus 51%, $P = 0.45$). Conclusions Lifesaver VR training, although previously found to be inferior to face-to-face training, may lead to CPR quality compliant with recently proposed, new quality criteria. If the prognostic importance of these new criteria is confirmed in additional studies, Lifesaver VR in its current form would be an easily available vector to disseminate CPR skills.

REGISTRES, REVISIONS I EDITORIALS

1. Resuscitation. 2021 Jan 11:S0300-9572(21)00008-3. doi: 10.1016/j.resuscitation.2021.01.002. Online ahead of print.

Cardiac arrest reported in newspapers: A new, yet missed, opportunity to increase cardiopulmonary resuscitation awareness.

Scquizzato T(1), Gazzato A(2), Semeraro F(3), Landoni G(1), Ristagno G(4), Scapigliati A(5).

NO ABSTRACT AVAILABLE

2. Pediatr Crit Care Med. 2021 Jan 1;22(1):130-132. doi: 10.1097/PCC.0000000000002617.

Out-of-Hospital Cardiac Arrest-Is International Agreement on Guidelines for Limits of Treatment Possible?

Butt W(1)(2)(3)(4), Butlinski A(1)(4).

NO ABSTRACT AVAILABLE

3. Med Klin Intensivmed Notfmed. 2021 Jan 14. doi: 10.1007/s00063-020-00771-3. Online ahead of print.

Extracorporeal cardiopulmonary resuscitation (eCPR) for all patients with out-of-hospital cardiac arrest?.

Adler C(1)(2), Michels G(3).

NO ABSTRACT AVAILABLE

ARTICLE IN GERMAN

4. Eur Heart J. 2021 Jan 7:ehaa1052. doi: 10.1093/eurheartj/ehaa1052. Online ahead of print.

Prognostication after out-of-hospital cardiac arrest: biases and caveats.

Williams A(1), Vlachos S(2), Maharaj R(3).

NO ABSTRACT AVAILABLE

5. Curr Opin Anaesthesiol. 2021 Feb 1;34(1):40-47. doi: 10.1097/ACO.0000000000000942.

Cardiac arrest in older adult patients.

Einav S(1), Cortegiani A(2), Marcus EL(3).

ABSTRACT

PURPOSE OF REVIEW: To describe the epidemiology, prognostication, and treatment of out- and in-hospital cardiac arrest (OHCA and IHCA) in elderly patients. RECENT FINDINGS: Elderly patients undergoing cardiac arrest (CA) challenge the appropriateness of attempting cardiopulmonary resuscitation (CPR). Current literature suggests that factors traditionally associated with survival to hospital discharge and neurologically intact survival after CA cardiac arrest in general (e.g. presenting rhythm, bystander CPR, targeted temperature management) may not be similarly favorable in elderly patients. Alternative factors meaningful for outcome in this special population include prearrest functional status, comorbidity load, the specific age subset within the elderly population, and CA location (i.e., nursing versus private home). Age should therefore not be a standalone criterion for withholding CPR. Attempts to perform CPR in an elderly patient should instead stem from a shared decision-making process. SUMMARY: An appropriate CPR attempt is an attempt resulting in neurologically intact survival. Appropriate CPR in elderly patients requires better risk classification. Future research should therefore focus on the associations of specific within-elderly age subgroups, comorbidities, and functional status with neurologically intact survival. Reporting must be standardized to enable such evaluation.

ACR INTRAHOSPITALÀRIA

1. Saudi Med J. 2021 Jan;42(1):75-81. doi: 10.15537/smj.2021.1.25607.

Cardiopulmonary resuscitation is more effective for in-hospital cardiac arrest when performed on a stretcher. A manikin study.

Tezel O(1), Bilge S, Özkan G.

ABSTRACT

OBJECTIVES: To compare the efficacies of various chest compression procedures performed on a stretcher during dynamic transport of patients with in-hospital cardiac arrest. Methods: This prospective and randomized cross-over study used manikins. Practitioners were asked to perform chest compressions on a manikin placed on a moving stretcher for 2 minutes. Cardiopulmonary resuscitation (CPR) procedures were included the following 3 types: i) CPR-walking (CPR-W) ii)

CPR-straddling (CPR-S), and iii) CPR-mechanical chest compression device (CPR-MCCD). Demographic data of the participants, CPR quality indicators, the time between the start command and first compression, level of difficulty, and the distance covered by the stretcher for the duration of each application were recorded. RESULTS: Thirty-two physicians (9 female, 23 male), participated in this study. The CPR-MCCD procedure was the most effective for all parameters, except the time between the start command and first compression. On the other hand, the compression rate at optimal depth, CPR success score, distance covered, and level of difficulty parameters were significantly favored in the CPR-S group, when compared to the CPR-W group (p less than 0.001, all comparisons). CONCLUSIONS: It is possible to perform high-quality chest compressions during patient transport using the CPR-MCCD method. The CPR-S method allowed practitioners to perform higher-quality chest compressions compared to CPR-W.

LESIONS PER RCP

Sense articles en aquesta revisió

ETIOLOGIA DE L'ACR

1. Occup Environ Med. 2021 Jan 12:oemed-2020-107018. doi: 10.1136/oemed-2020-107018. Online ahead of print.

Ambient temperatures, heatwaves and out-of-hospital cardiac arrest in Brisbane, Australia. Doan TN(1)(2), Wilson D(3)(4), Rashford S(3)(5), Bosley E(3)(6).

ABSTRACT

BACKGROUND: The health impacts of temperatures are gaining attention in Australia and worldwide. While a number of studies have investigated the association of temperatures with the risk of cardiovascular diseases, few examined out-of-hospital cardiac arrest (OHCA) and none have done so in Australia. This study examined the exposure-response relationship between temperatures, including heatwaves and OHCA in Brisbane, Australia. METHODS: A quasi-Poisson regression model coupled with a distributed lag non-linear model was employed, using OHCA and meteorological data between 1 January 2007 and 31 December 2019. Reference temperature was chosen to be the temperature of minimum risk (21.4°C). Heatwaves were defined as daily average temperatures at or above a heat threshold (90th, 95th, 98th, 99th percentile of the yearly temperature distribution) for at least two consecutive days. RESULTS: The effect of any temperature above the reference temperature was not statistically significant; whereas low temperatures (below reference temperature) increased OHCA risk. The effect of low temperatures was delayed for 1 day, sustained up to 3 days, peaking at 2 days following exposures. Heatwaves significantly increased OHCA risk across the operational definitions. When a threshold of 95th percentile of yearly temperature distribution was used to define heatwaves, OHCA risk increased 1.25 (95% CI 1.04 to 1.50) times. When the heat threshold for defining heatwaves increased to 99th percentile, the relative risk increased to 1.48 (1.11 to 1.96). CONCLUSIONS: Low temperatures and defined heatwaves increase OHCA risk. The findings of this study have important public health implications for mitigating strategies aimed at minimising temperature-related OHCA.

2. Am Heart J. 2020 Dec 30:S0002-8703(20)30413-0. doi: 10.1016/j.ahj.2020.12.011. Online ahead of print.

Out-of-hospital Cardiac Arrest: A Systematic Review of Current Risk Scores to Predict Survival.

Gue YX(1), Adatia K(2), Kanji R(3), Potpara T(4), Yh G(5), Gorog DA(6).

ABSTRACT

IMPORTANCE: The arrest and the post-arrest period are an incredibly emotionally traumatic time for family and friends of the affected individual. There is a need to assess prognosis early in the patient pathway to offer objective, realistic and non-emotive information to the next-of-kin regarding the likelihood of survival. **OBJECTIVE:** To present a systematic review of the clinical risk scores available

to assess patients on admission following out-of-hospital cardiac arrest (OHCA) which can predict in-hospital mortality. **EVIDENCE REVIEW:** A systematic search of online databases Embase, MEDLINE and Cochrane Central Register of Controlled Trials was conducted up until 20th November 2020.

FINDINGS: Out of 1,817 initial articles, we identified a total of 28 scoring systems, with 11 of the scores predicting mortality following OHCA included in this review. The majority of the scores included arrest characteristics (initial rhythm and time to return of spontaneous circulation) as prognostic indicators. Out of these, the three most clinically-useful scores, namely those which are

easy-to-use, comprise of commonly available parameters and measurements, and which have high predictive value are the OHCA, NULL-PLEASE and rCAST scores, which appear to perform similarly. Of these, the NULL-PLEASE score is the easiest to calculate and has also been externally validated.

CONCLUSION: Clinicians should be aware of these risk scores, which can be used to provide objective, non-emotive and reproducible information to the next-of-kin on the likely prognosis following OHCA. However, in isolation, these Scores should not form the basis for clinical decision-making.

END-TIDAL CO₂

Sense articles en aquesta revisió

DONACIÓ D'ÒRGANS

Sense articles en aquesta revisió

FEEDBACK

Sense articles en aquesta revisió

FÀRMACS

1. JAMA. 2021 Jan 12;325(2):138-145. doi: 10.1001/jama.2020.24326.

Effect of Out-of-Hospital Sodium Nitrite on Survival to Hospital Admission After Cardiac Arrest: A Randomized Clinical Trial.

Kim F(1), Maynard C(2), Dezfulian C(3), Sayre M(4), Kudenchuk P(1), Rea T(1), Sampson D(1), Olsufka M(1), May S(5), Nichol G(1)(4).

ABSTRACT

IMPORTANCE: Therapeutic delivery of sodium nitrite during resuscitation improved survival in animal models of cardiac arrest, but efficacy has not been evaluated in clinical trials in humans. **OBJECTIVE:** To determine whether parenteral administration of sodium nitrite given by paramedics during resuscitation for out-of-hospital cardiac arrest improved survival to hospital admission.

DESIGN, SETTING, AND PARTICIPANTS: Double-blind, placebo-controlled, phase 2 randomized clinical trial including 1502 adults in King County, Washington, with out-of-hospital cardiac arrest from ventricular fibrillation or nonventricular fibrillation. Patients underwent resuscitation by paramedics and were enrolled between February 8, 2018, and August 19, 2019; follow-up and data abstraction were completed by December 31, 2019. INTERVENTIONS: Eligible patients with out-of-hospital cardiac arrest were randomized (1:1:1) to receive 45 mg of sodium nitrite (n = 500), 60 mg of sodium nitrite (n = 498), or placebo (n = 499), which was given via bolus injection by the paramedics as soon as possible during active resuscitation. MAIN OUTCOMES AND MEASURES: The primary outcome was survival to hospital admission and was evaluated with 1-sided hypothesis testing. The secondary outcomes included out-of-hospital variables (rate of return of spontaneous circulation, rate of rearrest, and use of norepinephrine to support blood pressure) and in-hospital variables (survival to hospital discharge; neurological outcomes at hospital discharge; cumulative survival to 24 hours, 48 hours, and 72 hours; and number of days in the intensive care unit). RESULTS: Among 1502 patients with out-of-hospital cardiac arrest who were randomized (mean age, 64 years [SD, 17 years]; 34% were women), 99% completed the trial. Overall, 205 patients (41%) in the 45 mg of sodium nitrite group and 212 patients (43%) in the 60 mg of sodium nitrite group compared with 218 patients (44%) in the placebo group survived to hospital admission; the mean difference for the 45-mg dose vs placebo was -2.9% (1-sided 95% CI, -8.0% to ∞; P = .82) and the mean difference for the 60-mg dose vs placebo was -1.3% (1-sided 95% CI, -6.5% to ∞; P = .66). None of the 7 prespecified secondary outcomes were significantly different, including survival to hospital discharge for 66 patients (13.2%) in the 45 mg of sodium nitrite group and 72 patients (14.5%) in the 60 mg of sodium nitrite group compared with 74 patients (14.9%) in the placebo group; the mean difference for the 45-mg dose vs placebo was -1.7% (2-sided 95% CI, -6.0% to 2.6%; P = .44) and the mean difference for the 60-mg dose vs placebo was -0.4% (2-sided 95% CI, -4.9% to 4.0%; P = .85). CONCLUSIONS AND RELEVANCE: Among patients with out-of-hospital cardiac arrest, administration of sodium nitrite, compared with placebo, did not significantly improve survival to hospital admission. These findings do not support the use of sodium nitrite during resuscitation from out-of-hospital cardiac arrest.

TRAUMA

Sense articles en aquesta revisió

VENTILACIÓ

1. Unfallchirurg. 2021 Jan 12. doi: 10.1007/s00113-020-00950-z. Online ahead of print.

Improvement in breathing mechanics by plate osteosynthesis of the ribs after cardiac massage : Case report and review of the literature.

Abshagen KF(1), Stolberg-Stolberg J(2), Loyen JP(2), Riesenbeck O(2), Everding J(2), Freise H(3), Raschke MJ(2).

ABSTRACT

This article reports the case of a 69-year-old patient with multiple rib fractures and sternal fracture after repetitive cardiopulmonary resuscitation (CPR). Because of secondary respiratory failure due to an unstable thorax, rib fixation was performed 10 days after CPR. Subsequently, ventilation improved resulting in successful extubation 4 days after rib plating. A review of the literature revealed only five documented cases of rib osteosynthesis after CPR. Although flail chest occurs in up to 15% of patients after CPR, there is little evidence of the effect of rib

fixation. The benefit of this procedure after chest trauma is reduced pain, shortened intensive care unit stay, lower rates of ventilation-associated pneumonia and lower costs for the healthcare system. Further clinical research is needed and interdisciplinary treatment should be kept in mind when dealing with patients resuscitated with prolonged mechanical ventilation.

ARTICLE EN ALEMANY

MONITORATGE CEREBRAL

1. Sci Rep. 2021 Jan 12;11(1):690. doi: 10.1038/s41598-020-80086-7.

Serum fibroblast growth factor 21 levels after out of hospital cardiac arrest are associated with neurological outcome.

Pekkarinen PT(1), Skrifvars MB(2), Lievonen V(2), Jakkula P(3), Albrecht L(2), Loisa P(4), Tiainen M(5), Pettilä V(3), Reinikainen M(6), Hästbacka J(3).

ABSTRACT

Fibroblast growth factor (FGF) 21 is a marker associated with mitochondrial and cellular stress. Cardiac arrest causes mitochondrial stress, and we tested if FGF 21 would reflect the severity of hypoxia-reperfusion injury after cardiac arrest. We measured serum concentrations of FGF 21 in 112 patients on ICU admission and 24, 48 and 72 h after out-of-hospital cardiac arrest with shockable initial rhythm included in the COMACARE study (NCT02698917). All patients received targeted temperature management for 24 h. We defined 6-month cerebral performance category 1-2 as good and 3-5 as poor neurological outcome. We used samples from 40 non-critically ill emergency room patients as controls. We assessed group differences with the Mann Whitney U test and temporal differences with linear modeling with restricted maximum likelihood estimation. We used multivariate logistic regression to assess the independent predictive value of FGF 21 concentration for neurologic outcome. The median (inter-quartile range, IQR) FGF 21 concentration was 0.25 (0.094-0.91) ng/ml in controls, 0.79 (0.37-1.6) ng/ml in patients at ICU admission ($P < 0.001$ compared to controls) and peaked at 48 h [1.2 (0.46-2.5) ng/ml]. We found no association between arterial blood oxygen partial pressure and FGF 21 concentrations. We observed with linear modeling an effect of sample timepoint ($F 5.6$, $P < 0.01$), poor neurological outcome ($F 6.1$, $P = 0.01$), and their interaction ($F 3.0$, $P = 0.03$), on FGF 21 concentration. In multivariate logistic regression analysis, adjusting for relevant clinical covariates, higher average FGF 21 concentration during the first 72 h was independently associated with poor neurological outcome (odds ratio 1.60, 95% confidence interval 1.10-2.32). We conclude that post cardiac arrest patients experience cellular and mitochondrial stress, reflected as a systemic FGF 21 response. This response is higher with a more severe hypoxic injury but it is not exacerbated by hyperoxia.

2. PLoS One. 2021 Jan 7;16(1):e0245210. doi: 10.1371/journal.pone.0245210. eCollection 2021.

Neuromarkers and neurological outcome in out-of-hospital cardiac arrest patients treated with therapeutic hypothermia-experience from the HAnnover COoling REgistry (HACORE).

Akin M(1), Garcheva V(1), Sieweke JT(1), Adel J(1), Flierl U(1), Bauersachs J(1), Schäfer A(1).

ABSTRACT

BACKGROUND: Neuron-specific enolase (NSE) and S-100b have been used to assess neurological damage following out-of-hospital cardiac arrest (OHCA). Cut-offs were derived from small normothermic cohorts. Whether similar cut-offs apply to patients treated with hypothermia remained undetermined. **METHODS:** We investigated 251 patients with OHCA treated with hypothermia but without routine prognostication. Neuromarkers were determined at day 3, neurological outcome was assessed after hospital discharge by cerebral performance category (CPC).

RESULTS: Good neurological outcome (CPC \leq 2) was achieved in 41%. Elevated neuromarkers, older age and absence of ST-segment elevation after ROSC were associated with increased mortality. Poor neurological outcome in survivors was additionally associated with history of cerebrovascular events, sepsis and higher admission lactate. Mean NSE was 33 μ g/l [16-94] vs. 119 μ g/l [25-406]; p<0.001, for survivors vs. non-survivors, and 21 μ g/l [16-29] vs. 40 μ g/l [23-98], p<0.001 for good vs. poor neurological outcome. S-100b was 0.127 μ g/l [0.063-0.360] vs. 0.772 μ g/l [0.121-2.710], p<0.001 and 0.086 μ g/l [0.061-0.122] vs. 0.138 μ g/l [0.090-0.271], p = 0.009, respectively. For mortality, thresholds of 36 μ g/l for NSE and 0.128 μ g/l for S-100b could be determined; for poor neurological outcome 33 μ g/l (NSE) and 0.123 μ g/l (S-100b), respectively. Positive predictive value for NSE was 81% (74-88) and 79% (71-85) for S-100b. CONCLUSIONS: Thresholds for NSE and S-100b predicting mortality and poor neurological outcome are similar in OHCA patients receiving therapeutic hypothermia as in those reported before the era of hypothermia. However, both biomarkers do not have enough specificity to predict mortality or poor neurological outcome on their own and should only be additively used in clinical decision making.

ECOGRAFIA I RCP

Sense articles en aquesta revisió

ORGANITZACIÓ I ENTRENAMENT

1. Simul Healthc. 2021 Jan 8; Publish Ahead of Print. doi: 10.1097/SIH.0000000000000540. Online ahead of print.

Life-Saving Procedures Performed While Wearing CBRNe Personal Protective Equipment: A Mannequin Randomized Trial.

Mormando G(1), Paganini M, Alexopoulos C, Savino S, Bortoli N, Pomiatto D, Graziano A, Navalesi P, Fabris F.

ABSTRACT

INTRODUCTION: Chemical-biological-radiological-nuclear-explosive (CBRNe) are complex events. Decontamination is mandatory to avoid harm and contain hazardous materials, but can delay care. Therefore, the stabilization of patients in the warm zone seems reasonable, but research is limited. Moreover, subjects involved in biological events are considered infectious even after decontamination and need to be managed while wearing personal protective equipment (PPE), as seen with Ebola and COVID-19 pandemic. With this simulation mannequin trial, we assessed the impact of CBRNe PPE on cardiopulmonary resuscitation and combat casualty care procedures.

METHODS: We compared procedures performed by emergency medicine and anesthesiology senior residents, randomized in 2 groups (CBRNe PPE vs. no PPE). Chest compression (CC) depth was defined as the primary outcome. Time to completion was calculated for the following: tourniquet application; tension pneumothorax needle decompression; peripheral venous access (PVA) and

intraosseous access positioning; and drug preparation and administration. A questionnaire was delivered to evaluate participants' perception. RESULTS: Thirty-six residents participated. No significant difference between the groups in CC depth (mean difference = 0.26 cm [95% confidence interval = -0.26 to 0.77 cm, P = 0.318]), as well as for CC rate, CC complete release, and time for drugs preparation and administration was detected. The PPE contributed to significantly higher times for tourniquet application, tension pneumothorax decompression, peripheral venous access, and intraosseous access positioning. The residents found simulation relevant to the residencies' core curriculum. CONCLUSIONS: This study suggests that

cardiopulmonary resuscitation can be performed while wearing PPE without impacting quality, whereas other tasks requiring higher dexterity can be significantly impaired by PPE. Trial Registration Number: NCT04367454, April 29, 2020 (retrospectively registered).

2. Sci Rep. 2021 Jan 13;11(1):991. doi: 10.1038/s41598-020-79626-y.

A non-inferiority randomised controlled trial comparing self-instruction with instructor-led method in training of layperson cardiopulmonary resuscitation.

Ko YC(1), Yang CW(1)(2)(3), Lin HY(1), Chiang WC(4), Hsieh MJ(5), Ma MH(6)(7).

ABSTRACT

Our study aimed to compare the effect of self-instruction with manikin feedback to that of instructor-led method on cardiopulmonary resuscitation (CPR) and automated external defibrillator (AED) skill performance. In our randomized non-inferiority trial, 64 non-healthcare providers were randomly allocated into self-instruction and instructor-led groups. Both groups watched a 27-min standardized teaching video. Participants in the self-instruction group then performed hands-on practice on the Resusci Anne QCPR with a device-driven feedback, while those in the instructor-led group practiced manikins; feedback was provided and student's questions were answered by instructors. Outcomes were measured by blinded evaluators and SkillReporter software. The primary outcome was the pass rate. Secondary outcomes were scores of the knowledge test and items of individual skill performance. The baseline characteristics of the two groups were similar. The pass rates were 93.8% in both group (absolute difference 0%, $p = 0.049$ for noninferiority). The knowledge test scores were not significantly different. However, the self-instruction group performed better in some chest compression and ventilation skills, but performed worse in confirming environmental safety and checking normal breathing. There was no difference in AED skills between the two groups. Our results showed the self-instruction method is not inferior to the instructor-led method.

3. Scand J Trauma Resusc Emerg Med. 2021 Jan 6;29(1):7. doi: 10.1186/s13049-020-00823-9.

Predictors of recognition of out of hospital cardiac arrest by emergency medical services call handlers in England: a mixed methods diagnostic accuracy study.

Watkins CL(1), Jones SP(1), Hurley MA(1), Benedetto V(1), Price CI(2), Sutton CJ(3), Quinn T(4), Bangee M(1), Chesworth B(1), Miller C(1), Doran D(1), Siriwardena AN(5), Gibson JME(6).

ABSTRACT

BACKGROUND: The aim of this study was to identify key indicator symptoms and patient factors associated with correct out of hospital cardiac arrest (OHCA) dispatch allocation. In previous studies, from 3% to 62% of OHCA are not recognised by Emergency Medical Service call handlers, resulting in delayed arrival at scene. **METHODS:** Retrospective, mixed methods study including all suspected or confirmed OHCA patients transferred to one acute hospital from its associated regional Emergency Medical Service in England from 1/7/2013 to 30/6/2014. Emergency Medical Service and hospital data, including voice recordings of EMS calls, were analysed to identify predictors of recognition of OHCA by call handlers. Logistic regression was used to explore the role of the most frequently occurring (key) indicator symptoms and characteristics in predicting a correct dispatch for patients with OHCA. **RESULTS:** A total of 39,136 dispatches were made which resulted in transfer to the hospital within the study period, including 184 patients with OHCA. The use of the term 'Unconscious' plus one or more of symptoms 'Not breathing/Ineffective breathing/Noisy breathing' occurred in 79.8% of all OHCA, but only 72.8% of OHCA were correctly dispatched as such. 'Not breathing' was associated with recognition of OHCA by call handlers (Odds Ratio (OR) 3.76). The

presence of key indicator symptoms 'Breathing' (OR 0.29), 'Reduced or fluctuating level of consciousness' (OR 0.24), abnormal pulse/heart rate (OR 0.26) and the characteristic 'Female patient' (OR 0.40) were associated with lack of recognition of OHCA by call handlers (p-values < 0.05). CONCLUSIONS: There is a small proportion of calls in which cardiac arrest indicators are described but the call is not dispatched as such. Stricter adherence to dispatch protocols may improve call handlers' OHCA recognition. The existing dispatch protocol would not be improved by the addition of further terms as this would be at the expense of dispatch specificity.

4. Resuscitation. 2021 Jan 11;160:1-6. doi: 10.1016/j.resuscitation.2021.01.001. Online ahead of print.

'I think he's dead': A cohort study of the impact of caller declarations of death during the emergency call on bystander CPR.

Riou M(1), Ball S(2), Morgan A(3), Gallant S(3), Perera N(3), Whiteside A(4), Bray J(5), Bailey P(2), Finn J(6).

ABSTRACT

BACKGROUND: In emergency calls for out-of-hospital cardiac arrest (OHCA), dispatchers are instrumental in the provision of bystander cardiopulmonary resuscitation (CPR) through the recruitment of the caller. We explored the impact of caller perception of patient viability on initial recognition of OHCA by the dispatcher, rates of bystander CPR and early patient survival outcomes.

METHODS: We conducted a retrospective cohort study of 422 emergency calls where OHCA was recognised by the dispatcher and resuscitation was attempted by paramedics. We used the call recordings, dispatch data, and electronic patient care records to identify caller statements that the patient was dead, initial versus delayed recognition of OHCA by the dispatcher, caller acceptance to

perform CPR, provision of bystander-CPR, prehospital return of spontaneous circulation (ROSC), and ROSC on arrival at the Emergency Department. **RESULTS:** Initial recognition of OHCA by the dispatcher was more frequent in cases with a declaration of death by the caller than in cases without (92%, 73/79 vs. 66%, 227/343, $p < 0.001$). Callers who expressed such a view (19% of cases) were more likely to decline CPR (38% vs. 10%, adjusted odds ratio 4.59, 95% confidence interval 2.49-8.52, $p < 0.001$). Yet, 15% (12/79) of patients described as non-viable by callers achieved ROSC.

CONCLUSION: Caller statements that the patient is dead are helpful for dispatchers to recognise OHCA early, but potentially detrimental when recruiting the caller to perform CPR. There is an opportunity to improve the rate of bystander-CPR and patient outcomes if dispatchers are attentive to caller statements about viability.

5. Resuscitation. 2020 Dec 31;159:60-68. doi: 10.1016/j.resuscitation.2020.12.022. Online ahead of print.

PROLOGUE (PROgnostication using LOGistic regression model for Unselected adult cardiac arrest patients in the Early stages): Development and validation of a scoring system for early prognostication in unselected adult cardiac arrest patients.

Bae DH(1), Lee HY(1), Jung YH(2), Jeung KW(3), Lee BK(2), Youn CS(4), Kang BS(5), Heo T(2), Min YI(2).

ABSTRACT

BACKGROUND: Early prognostication after cardiac arrest would be useful. We aimed to develop a scoring model for early prognostication in unselected adult cardiac arrest patients. **METHODS:** We retrospectively analysed data of adult non-traumatic cardiac arrest patients treated at a tertiary hospital between 2014 and 2018. The primary outcome was poor outcome at hospital discharge (cerebral performance category, 3-5). Using multivariable logistic regression analysis, independent predictors were identified among known outcome predictors, that were available at intensive

care unit admission, in patients admitted in the first 3 years (derivation set, N = 671), and a scoring system was developed with the variables that were retained in the final model. The scoring model was validated in patients admitted in the last 2 years (validation set, N = 311). RESULTS: The poor outcome rates at hospital discharge were similar between the derivation (66.0%) and validation sets (64.3%). Age <59 years, witnessed collapse, shockable rhythm, adrenaline dose <2 mg, low-flow duration <18 min, reactive pupillary light reflex, Glasgow Coma Scale motor score ≥ 2 , and levels of creatinine <1.21 mg dl⁻¹, potassium <4.4 mEq l⁻¹, phosphate <5.8 mg dl⁻¹, haemoglobin ≥ 13.2 g dl⁻¹, and lactate <8 mmol l⁻¹ were retained in the final multivariable model and used to develop the scoring system. Our model demonstrated excellent discrimination in the validation set (area under the curve of 0.942, 95% confidence interval 0.917-0.968). CONCLUSIONS: We developed a scoring model for early prognostication in unselected adult cardiac arrest patients. Further validations in various cohorts are needed.

6. Prehosp Emerg Care. 2021 Jan 11:1-14. doi: 10.1080/10903127.2021.1873471. Online ahead of print.

Comparison of out-of-hospital cardiac arrests occurring in schools and other public locations: a 12-year retrospective study.

Haskins B(1)(2)(3), Nehme Z(3)(4), Ball J(2)(4), Mahony E(4), Parker-Stebbing L(4), Cameron P(1)(2)(5), Bernard S(1)(2)(4)(5), Smith K(1)(2)(3)(4).

ABSTRACT

Objective: Out-of-hospital cardiac arrests (OHCA) in schools and universities are uncommon. However, these institutions must plan and prepare for such events to ensure the best outcomes. To evaluate their preparedness we assessed baseline characteristics, survival outcomes and 12-year trends for OHCA in schools/universities compared to other public locations. Methods: We conducted a retrospective analysis of OHCA in schools/universities and public locations between 2008 and 2019 using Victorian Ambulance Cardiac Arrest Registry data. Results: We included 9,037 EMS attended cases, 131 occurred in schools/universities and 8,906 in public locations. Compared to public locations, a significantly higher proportion of EMS treated cases in schools/universities received bystander cardiopulmonary resuscitation (CPR) (95.5% vs. 78.5%, $p < 0.001$), public access defibrillation (PAD) (26.1% vs. 9.9%, $p < 0.001$) and presented in shockable rhythms (69.4% vs. 50.9%, $p < 0.001$). Unadjusted survival to hospital discharge rates were also significantly higher in schools/universities (39.6% vs. 24.2%, $p < 0.001$). The long-term unadjusted trends for bystander CPR in schools/universities increased from 91.7% (2008-10) to 100% (2017-19) (p -trend = 0.025), for PAD from 4.2% (2008-10) to 47.5% (2017-19) (p -trend < 0.001) and for survival to hospital discharge from 16.7% (2008-10) to 57.5% (2017-19) (p -trend = 0.004). However, after adjustment for favorable cardiac arrest factors, such as younger age, bystander CPR and PAD, survival was similar between schools/universities and public locations. Conclusion - The majority of OHCA in schools and universities were witnessed and received bystander CPR, however less than half received PAD. Developing site-specific cardiac emergency response plans and providing age appropriate CPR training to primary, secondary and university students would help improve PAD rates.

7. JMIR Mhealth Uhealth. 2021 Jan 5;9(1):e16114. doi: 10.2196/16114.

Mobile App Support for Cardiopulmonary Resuscitation: Development and Usability Study.

Müller SD(#)(1), Lauridsen KG(2)(3)(4), Palic AH(1), Frederiksen LN(1), Mathiasen M(5), Løfgren B(2)(3)(6).

ABSTRACT

BACKGROUND: The user requirements for in-hospital cardiopulmonary resuscitation (CPR) support apps are understudied. To study usability, functionality, and design based on user requirements, we applied a mixed methods research design using interviews, observations, and

a Kano questionnaire to survey perspectives of both physicians and nurses. **OBJECTIVE:** This study aims to identify what an in-hospital CPR support app should include to meet the requirements and expectations of health care professionals by evaluating the CprPrototype app. **METHODS:** We used a mixed methods research design. The qualitative methods consisted of semistructured interviews and observations from an advanced life support (ALS) course; both provided input to the subsequent questionnaire development. The quantitative method is a questionnaire based on the Kano model classifying user requirements as must-be, one-dimensional (attributes causing satisfaction when present and dissatisfaction when absent), attractive, indifferent, and reverse (attributes causing dissatisfaction when present and satisfaction when absent). The questionnaire was supplemented with comment fields. All respondents were physicians and nurses providing ALS at hospitals in the Central Denmark Region. **RESULTS:** A total of 83 physicians and nurses responded to the questionnaire, 15 physicians and nurses were observed during ALS training, and 5 physicians were interviewed. On the basis of the Kano questionnaire, 53% (9/17) of requirements were classified as indifferent, 29% (5/17) as attractive, and 18% (3/17) as one-dimensional. The comments revealed 7 different categories of user requirements with noticeable differences between those of physicians and nurses: technological challenges, keep track of time, documentation and history, disturbing element, improvement areas: functions, improvement areas: design, and better guidance. **CONCLUSIONS:** The study provides recommendations to developers on the user requirements that need to be addressed when developing CPR support apps. Three features (one-dimensional attributes) must be incorporated in an in-hospital CPR support app: reminder of rhythm check, reminder of resuscitation drugs, and differentiate between adults and children. In addition, 5 features (attractive attributes) would result in higher user satisfaction: all functions on one side, access to the patient journal in the app, automatic time recording when cardiac arrest is called, sound to guide the chest compression rate (metronome), and send CPR history to the DANARREST (Danish in-hospital cardiac arrest registry) database.

8. JAMA Netw Open. 2021 Jan 4;4(1):e2032320. doi: 10.1001/jamanetworkopen.2020.32320. **Effect of Machine Learning on Dispatcher Recognition of Out-of-Hospital Cardiac Arrest During Calls to Emergency Medical Services: A Randomized Clinical Trial.** Blomberg SN(1)(2), Christensen HC(1)(2)(3), Lippert F(1)(2), Ersbøll AK(4), Torp-Petersen C(5), Sayre MR(6), Kudenchuk PJ(7), Folke F(1)(2)(8).

ABSTRACT

IMPORTANCE: Emergency medical dispatchers fail to identify approximately 25% of cases of out-of-hospital cardiac arrest (OHCA), resulting in lost opportunities to save lives by initiating cardiopulmonary resuscitation. **OBJECTIVE:** To examine how a machine learning model trained to identify OHCA and alert dispatchers during emergency calls affected OHCA recognition and response. **DESIGN, SETTING, AND PARTICIPANTS:** This double-masked, 2-group, randomized clinical trial analyzed all calls to emergency number 112 (equivalent to 911) in Denmark. Calls were processed by a machine learning model using speech recognition software. The machine learning model assessed ongoing calls, and calls in which the model identified OHCA were randomized. The trial was performed at Copenhagen Emergency Medical Services, Denmark, between September 1, 2018, and December 31, 2019. **INTERVENTION:** Dispatchers in the intervention group were alerted when the machine learning model identified out-of-hospital cardiac arrest, and those in the control group followed normal protocols without alert. **MAIN OUTCOMES AND MEASURES:** The primary end point was the rate of dispatcher recognition of subsequently confirmed OHCA. **RESULTS:** A total of 169 049 emergency calls were examined, of which the machine learning model identified 5242 as suspected OHCA. Calls were randomized to control (2661 [50.8%]) or

intervention (2581 [49.2%]) groups. Of these, 336 (12.6%) and 318 (12.3%), respectively, had confirmed OHCA. The mean (SD) age among of these 654 patients was 70 (16.1) years, and 419 of 627 patients (67.8%)

with known gender were men. Dispatchers in the intervention group recognized 296 confirmed OHCA cases (93.1%) with machine learning assistance compared with 304 confirmed OHCA cases (90.5%) using standard protocols without machine learning assistance ($P = .15$). Machine learning alerts alone had a significantly higher sensitivity than dispatchers without alerts for confirmed OHCA (85.0% vs 77.5%; $P < .001$) but lower specificity (97.4% vs 99.6%; $P < .001$) and positive predictive value (17.8% vs 55.8%; $P < .001$). **CONCLUSIONS AND RELEVANCE:** This randomized clinical trial did not find any significant improvement in dispatchers' ability to recognize cardiac arrest when supported by machine learning even though artificial intelligence did surpass human recognition.

9. Int J Environ Res Public Health. 2021 Jan 9;18(2):E496. doi: 10.3390/ijerph18020496.

Association between Survival and Time of On-Scene Resuscitation in Refractory Out-of-Hospital Cardiac Arrest: A Cross-Sectional Retrospective Study.

Park HA(1)(2), Ahn KO(3), Lee EJ(4), Park JO(1), On Behalf Of The Korean Cardiac Arrest Research Consortium KoCARC Investigators.

ABSTRACT

It is estimated that over 60% of out-of-hospital cardiac arrest (OHCA) patients with a shockable rhythm are refractory to current treatment, never achieve return of spontaneous circulation, or die before they reach the hospital. Therefore, we aimed to identify whether field resuscitation time is associated with survival rate in refractory OHCA (rOHCA) with a shockable initial rhythm. This cross-sectional retrospective study extracted data of emergency medical service (EMS)-treated patients aged ≥ 15 years with OHCA of suspected cardiac etiology and shockable initial rhythm confirmed by EMS providers from the OHCA registry database of Korea. A multivariable logistic regression analysis was conducted for survival to discharge and good neurological outcomes in the scene time interval groups. The median scene time interval for the non-survival and survival to discharge patients were 16 (interquartile range (IQR) 13-21) minutes and 14 (IQR 12-16) minutes, respectively. In this study, for rOHCA patients with a shockable rhythm, continuing CPR for more than 15 min on the scene was associated with a decreased chance of survival and good neurological outcome. In particular, we found that in the patients whose transport time interval was >10 min, the longer scene time interval was negatively associated with the neurological outcome.

10. Heart. 2021 Jan 8;heartjnl-2020-317761. doi: 10.1136/heartjnl-2020-317761. Online ahead of print.

Socioeconomic disparities in prehospital factors and survival after out-of-hospital cardiac arrest.

Møller S(1), Wissenberg M(2), Starkopf L(3), Kragholm K(4), Hansen SM(5), Ringgren KB(4), Folke F(2)(6), Andersen J(7), Malta Hansen C(2)(6), Lippert F(6), Koeber L(8), Gislason GH(2), Torp-Pedersen C(9), Gerds TA(10).

ABSTRACT

OBJECTIVE: It remains unknown whether patient socioeconomic factors affect interventions and survival after out-of-hospital cardiac arrest (OHCA), and whether a socioeconomic effect on bystander interventions affects survival. Therefore, this study examined patient socioeconomic disparities in prehospital factors and survival. **METHODS:** From the Danish Cardiac Arrest Registry, patients with OHCA ≥ 30 years were identified, 2001-2014, and divided into quartiles of household income (highest, high, low, lowest). Associations between income and bystander cardiopulmonary resuscitation (CPR) and 30-day survival with bystander CPR as mediator were analysed by logistic regression and mediation analysis in private witnessed, public witnessed, private unwitnessed and public unwitnessed arrests, adjusted for confounders. **RESULTS:** We

included 21 480 patients. Highest income patients were younger, had higher education and were less comorbid relative to lowest income patients. They had higher odds for bystander CPR with the biggest difference in private unwitnessed arrests (OR 1.74, 95% CI 1.47 to 2.05). For 30-day survival, the biggest differences were in public witnessed arrests with 26.0% (95% CI 22.4% to 29.7%) higher survival in highest income compared with lowest income patients. Had bystander CPR been the same for lowest income as for highest income patients, then survival would be 25.3% (95% CI 21.5% to 29.0%) higher in highest income compared with lowest income patients, resulting in elimination of 0.79% (95% CI 0.08% to 1.50%) of the income disparity in survival. Similar trends but smaller were observed in low and high-income patients, the other three subgroups and with education instead of income. From 2002 to 2014, increases were observed in both CPR and survival in all income groups. CONCLUSION: Overall, lower socioeconomic status was associated with poorer prehospital factors and survival after OHCA that was not explained by patient or cardiac arrest-related factors.

11. Healthcare (Basel). 2021 Jan 2;9(1):E34. doi: 10.3390/healthcare9010034.

Comparison of Long-Term Effects between Chest Compression-Only CPR Training and Conventional CPR Training on CPR Skills among Police Officers.

Cho BJ(1), Kim SR(2).

ABSTRACT

Despite of the changes of out-of-hospital cardiac arrest (OHCA) survival rise when bystander CPR is provided, this was only conducted in about 23% of OHCA patients in Korea in 2018. Police officers acting as first responders have a high chance of witnessing situations requiring CPR. We investigated long-term effects on CPR quality between chest compression-only CPR training and conventional CPR training in police officers to find an efficient CPR training method in a prospective, randomized, controlled trial. Police officers underwent randomization and received different CPR training. With the Brayden Pro application, we compared the accuracy of CPR skills immediately after training and the one after 3 months. Right after training, the conventional CPR group presented the accuracy of the CPR skills (compression rate: 74.6%, compression depth: 66.0%, recoil: 78.0%, compression position: 96.1%) and chest compression-only CPR group presented the accuracy of the CPR skills (compression rate: 74.5%, compression depth: 71.6%, recoil: 79.2%, compression position: 99.0%). Overall, both groups showed the good quality of CPR skills and had no meaningful difference right after the training. However, three months after training, overall accuracy of CPR skills decreased, a significant difference between two groups was observed for compression position (conventional CPR: 80.0%, chest compression only CPR: 95.0%). In multiple linear regression analysis, three months after CPR training, chest compression-only CPR training made CPR skills accuracy 28.5% higher. In conclusion, police officers showed good-quality CPR right after CPR training in both groups. But three months later, chest compression-only CPR training group had better retention of CPR skills. Therefore, chest compression-only CPR training is better to be a standard training method for police officers as first responders.

12. BMC Emerg Med. 2021 Jan 7;21(1):3. doi: 10.1186/s12873-020-00400-4.

Association between prehospital prognostic factors on out-of-hospital cardiac arrest in different age groups.

Huang JB(1), Lee KH(2)(3), Ho YN(1), Tsai MT(1), Wu WT(1), Cheng FJ(4).

ABSTRACT

BACKGROUND: The prognosis of out-of-hospital cardiac arrest (OHCA) is very poor. While several prehospital factors are known to be associated with improved survival, the impact of prehospital factors on different age groups is unclear. The objective of the study was to access

the impact of prehospital factors and pre-existing comorbidities on OHCA outcomes in different age groups.

METHODS: A retrospective observational analysis was conducted using the emergency medical service (EMS) database from January 2015 to December 2019. We collected information on prehospital factors, underlying diseases, and outcome of OHCA in different age groups. Kaplan-Meier type survival curves and multivariable logistic regression were used to analyze the association between modifiable pre-hospital factors and outcomes. **RESULTS:** A total of 4188 witnessed adult OHCA were analyzed. For the age group 1 (age \leq 75 years old), after adjustment for confounding factors, EMS response time (odds ratio [OR] = 0.860, 95% confidence interval [CI]: 0.811-0.909, $p < 0.001$), public location (OR = 1.843, 95% CI: 1.179-1.761, $p < 0.001$), bystander CPR (OR = 1.329, 95% CI: 1.007-1.750, $p = 0.045$), attendance by an EMT-Paramedic (OR = 1.666, 95% CI: 1.277-2.168, $p < 0.001$), and prehospital defibrillation by automated external defibrillator (AED)(OR = 1.666, 95% CI: 1.277-2.168, $p < 0.001$) were prognostic factors for survival to hospital discharge in OHCA patients. For the age group 2 (age $>$ 75 years old), age (OR = 0.924, CI:0.880-0.966, $p = 0.001$), EMS response time (OR = 0.833, 95% CI: 0.742-0.928, $p = 0.001$), public location (OR = 4.290, 95% CI: 2.450-7.343, $p < 0.001$), and attendance by an EMT-Paramedic (OR = 2.702, 95% CI: 1.704-4.279, $p < 0.001$) were independent prognostic factors for survival to hospital discharge in OHCA patients.

CONCLUSIONS: There were variations between younger and older OHCA patients. We found that bystander CPR and prehospital defibrillation by AED were independent prognostic factors for younger OHCA patients but not for the older group.

13. Australas Emerg Care. 2021 Jan 5:S2588-994X(20)30115-9. doi: 10.1016/j.auec.2020.12.002. Online ahead of print.

Effects of vibration-guided cardiopulmonary resuscitation with a smartwatch versus metronome guidance cardiopulmonary resuscitation during adult cardiac arrest: a randomized controlled simulation study.

Choi S(1), Han S(1), Chae MK(2), Lee YH(3).

ABSTRACT

BACKGROUND: Smartwatches could be used as a cardiopulmonary resuscitation (CPR) guidance system through its vibration function. This study was conducted to determine whether vibration guidance by a smartwatch application influences CPR performance compared to metronome guided CPR in a simulated noisy setting. **METHODS:** This study was randomised controlled trial. A total of 130 university students were enrolled. The experiment was conducted using a cardiac arrest

model with hands-only CPR. Participants were randomly divided into two groups 1:1 ratio and performed 2-min metronome guidance or vibration guidance compression at the rate of 110/min. Basic life support quality data were compared in simulated noisy environments.

RESULTS: There were significant differences between the audio and vibration guidance groups in the mean compression rate (MCR). However, there were no significant differences in correct or mean compression depth, correct hand position, and correctly released compression. The vibration guidance group resulted in 109 MCR (Interquartile range [IQR] 108-110), whereas the metronome

guidance group resulted in 115 MCR (IQR 112-117) ($p < 0.001$). **CONCLUSION:** In a simulated noisy environment, vibration guided CPR showed to be particularly advantageous in maintaining a desired MCR during hands-only CPR compared to metronome guided CPR.

14. Am J Emerg Med. 2020 Dec 23;41:60-65. doi: 10.1016/j.ajem.2020.12.024. Online ahead of print.

Delay to initiation of out-of-hospital cardiac arrest EMS treatments.

Ornato JP(1), Peberdy MA(2), Siegel CR(3), Lindfors R(4), Ludin T(4), Garrison D(4).

ABSTRACT

BACKGROUND: Time to initial treatment is important in any response to out-of-hospital cardiac arrest (OHCA). The purpose of this paper was to quantify the time delay for providing initial EMS treatments supplemented by comparison with those of other EMS systems conducting clinical trials.

METHODS: Data were collected between 1/1/16-2/15/19. Dispatched, EMS-worked, adult OHCA cases occurring before EMS arrival were included and compared with published treatment time data. Response time and time-to-treatment intervals were profiled in both groups. Time intervals were calculated by subtracting the following timepoints from 9-1-1 call receipt: ambulance in route; at curb; patient contact; first defibrillation; first epinephrine; and first antiarrhythmic.

RESULTS: 342 subjects met study inclusion/exclusion. Mean time intervals (min [95%CI]) from 9-1-1 call receipt to the following EMS endpoints were: dispatch 0.1 [0.05-0.2]; at curb 5.0 [4.5, 5.5]; at patient 6.7 [6.1, 7.2];, first defibrillation initially shockable 11.7 [10.1, 13.3]; first epinephrine (initially shockable 15.0 [12.8, 17.2], initially non-shockable 14.8 [13.5, 15.9]), first antiarrhythmic 25.1 [22.0, 28.2]. These findings were similar to data in 5 published clinical trials involving 12,954 subjects. **CONCLUSIONS:** Delay to EMS treatments are common and may affect clinical outcomes. Neither Utstein out-of-hospital guidelines [1] nor U.S. Cardiac Arrest Registry to Enhance Survival (CARES) databases require capture of these elements. EMS is often not providing treatments quickly enough to optimize

clinical outcomes. Further regulatory change/research are needed to determine whether OHCA outcome can be improved by novel changes such as enhancing bystander effectiveness through drone-delivered drugs/devices & real-time dispatcher direction on their use.

CURES POST-RCE

1. Resuscitation. 2021 Jan 12:S0300-9572(21)00001-0. doi: 10.1016/j.resuscitation.2020.12.023. Online ahead of print.

Acute kidney injury after in-hospital cardiac arrest.

Mah KE(1), Alten JA(2), Cornell TT(3), Selewski DT(4), Askenazi D(5), Fitzgerald JC(6), Topjian A(6), Page K(7), Holubkov R(7), Slomine BS(8), Christensen JR(8), Dean JM(7), Moler FW(9).

ABSTRACT

AIM: Determine 1) frequency and risk factors for acute kidney injury (AKI) after in-hospital cardiac arrest (IHCA) in the Therapeutic Hypothermia after Pediatric Cardiac Arrest In-Hospital (THAPCA-IH) trial and associated outcomes; 2) impact of temperature management on post-IHCA AKI. **METHODS:** Secondary analysis of THAPCA-IH; a randomized controlled multi-national trial at 37 children's hospitals. **ELIGIBILITY:** Serum creatinine (Cr) within 24 h of randomization. **OUTCOMES:** Prevalence of severe AKI defined by Stage 2 or 3 Kidney Disease Improving Global Outcomes Cr criteria. 12-month survival with favorable neurobehavioral outcome. Analyses stratified by entire cohort and cardiac

subgroup. Risk factors and outcomes compared among cohorts with and without severe AKI.

RESULTS: Subject randomization: 159 to hypothermia, 154 to normothermia. Overall, 80% (249) developed AKI (any stage), and 66% (207) developed severe AKI. Cardiac patients (204, 65%) were more likely to develop severe AKI (72% vs 56%, $p = 0.006$). Preexisting cardiac or renal conditions, baseline lactate, vasoactive support, and systolic blood pressure were associated with severe AKI.

Comparing hypothermia versus normothermia, there were no differences in severe AKI rate (63% vs 70%, $p = 0.23$), peak Cr, time to peak Cr, or freedom from mortality or severe AKI ($p = 0.14$). Severe AKI was associated with decreased hospital survival (48% vs 65%, $p = 0.006$) and decreased 12-month survival with favorable neurobehavioral outcome (30% vs 53%, $p < 0.001$). **CONCLUSION:** Severe post-IHCA AKI occurred frequently especially in those with preexisting cardiac or renal conditions and peri-arrest hemodynamic instability. Severe AKI

was associated with decreased survival with favorable neurobehavioral outcome. Hypothermia did not decrease incidence of severe AKI post-IHCA.

2. Resuscitation. 2021 Jan 2;159:117-125. doi: 10.1016/j.resuscitation.2020.12.018. Online ahead of print.

Racial disparities in survival outcomes following pediatric in-hospital cardiac arrest.

Haskell SE(1), Girotra S(2), Zhou Y(3), Zimmerman MB(4), Del Rios M(5), Merchant RM(6), Atkins DL(7).

ABSTRACT

BACKGROUND: Among adults with in-hospital cardiac arrest (IHCA), overall survival is lower in black patients compared to white patients. Data regarding racial differences in survival for pediatric IHCA are unknown. **METHODS:** Using 2000-2017 data from the American Heart Association Get With the Guidelines-Resuscitation® registry, we identified children >24 h and <18 years of age with IHCA due to an initial pulseless rhythm. We used generalized estimation equation to examine the association of black race with survival to hospital discharge, return of spontaneous circulation (ROSC), and favorable neurologic outcome at discharge. **RESULTS:** Overall, 2940 pediatric patients (898 black, 2042 white) at 224 hospitals with IHCA were included. The mean age was 3.0 years, 57% were male and 16% had an initial shockable rhythm. Age, sex, interventions in place at the time of arrest and cardiac arrest characteristics did not differ significantly by race. The overall survival to discharge was 36.9%, return of spontaneous circulation (ROSC) was 73%, and favorable neurologic survival was 20.8%. Although black race was associated with lower rates of ROSC compared to white patients (69.5% in blacks vs. 74.6% in whites; risk-adjusted OR 0.79, 95% CI 0.67-0.94, P = 0.016), black race was not associated with survival to discharge (34.7% in blacks vs. 37.8% in whites; risk-adjusted OR 0.96, 95% CI 0.80-1.15, P = 0.68) or favorable neurologic outcome (18.7% in blacks vs. 21.8% in whites, risk-adjusted OR 0.98, 95% CI 0.80-1.20, p = 0.85). **CONCLUSIONS:** In contrast to adults, we did not find evidence for racial differences in survival outcomes following IHCA among children.

3. Prehosp Emerg Care. 2021 Jan 5:1-8. doi: 10.1080/10903127.2020.1869873. Online ahead of print.

Utility of Glucose Testing and Treatment of Hypoglycemia in Patients with Out-of-Hospital Cardiac Arrest.

Abramson TM(1), Bosson N(2)(3)(4), Loza-Gomez A(1), Eckstein M(1)(5), Gausche-Hill M(2)(3)(4).

ABSTRACT

Objective Many emergency medical services (EMS) protocols for out-of-hospital cardiac arrests (OHCA) include point-of-care (POC) glucose measurement and administration of dextrose, despite limited knowledge of benefit. The objective of this study was to describe the incidence of hypoglycemia and dextrose administration by EMS in OHCA and subsequent patient outcomes. **Methods** This was a retrospective analysis of OHCA in a large, regional EMS system from 2011-2017.

Patients ≥18 years old with non-traumatic OHCA and attempted field resuscitation by paramedics were included. The primary outcomes were frequency of POC glucose measurement, hypoglycemia (glucose <60 mg/dl), and dextrose/glucagon administration (treatment group). The secondary outcomes included field return of spontaneous circulation (ROSC), survival to hospital discharge (SHD), and survival with good neurologic outcome. **Results** There were 46,211 OHCA during

the study period of which 33,851 (73%) had a POC glucose test performed. Glucose levels were documented in 32,780 (97%), of whom 2,335 (7%) were hypoglycemic. Among hypoglycemic patients, 41% (959) received dextrose and/or glucagon. Field ROSC was achieved in 30% (286) of hypoglycemic patients who received treatment. Final outcome was determined for 1,714

(73%) of the hypoglycemic cases, of whom 120 (7%) had SHD and 66 (55%) had a good neurologic outcome. 27 of 32,780 (0.08%) patients with a documented POC glucose result who were identified as hypoglycemic, received field treatment, and survived to discharge with good neurologic outcome. 48 (6%) of patients in the treatment group had SHD vs. 72 (8%) without treatment, risk difference -2.0% (95%CI -4.4%, 0.4%), $p = 0.1$. Conclusion In this EMS system, POC glucose testing was common in adult OHCA, yet survival to hospital discharge with good neurologic outcome did not differ between patients treated and untreated for hypoglycemia. These results question the common practice of measuring and treating hypoglycemia in OHCA patients.

4. Orv Hetil. 2021 Jan 10;162(2):52-60. doi: 10.1556/650.2021.31949.

Pilot analysis of the usefulness of mortality risk score systems at resuscitated patients.

Kiss B(1), Fekete-Győr A(2), Szakál-Tóth Z(1), Párkányi A(1), Jenei Z(3), Nyéki P(1), Becker D(1), Molnár L(1), Ruzsa Z(1), Dér G(1), Kovács E(4), Pilecky D(5), Gellér L(1), Veli-Pekka H(6), Merkely B(1), Zima E(1).

ABSTRACT

INTRODUCTION: Sudden cardiac death is one of the most significant cardiovascular causes of death worldwide. Although there have been immense methodological and technical advances in the field of cardiopulmonary resuscitation and following intensive care in the last decade, currently there are only a few validated risk-stratification scoring systems for the quick and reliable estimation of the mortality risk of these patients at the time of admission to the intensive care unit. **OBJECTIVE:** Our aim was to correlate the mortality prediction risk points calculated by CardShock Risk Score (CSRS) and modified (m) CSRS based on the admission data of the post-cardiac arrest syndrome (PCAS) patients. **METHODS:** The medical records of 172 out-of-hospital resuscitated cardiac arrest patients, who were admitted at the Heart and Vascular Centre of Semmelweis University, were screened retrospectively. Out of the 172 selected patients, 123 were eligible for inclusion to calculate CSRS and mCSRS. Based on CSRS score, we generated three different groups of patients, with scores 1 to 3, 4 to 6, and 7+, respectively. Mortality data of the groups were compared by log-rank test. **RESULTS:** Mean age of the patients was 63.6 years (69% male), the cause of sudden cardiac death was acute coronary syndrome in 80% of the cases. The early and late mortality was predicted by neurological status, serum lactate level, renal function, initial rhythm, and the need of catecholamines. Using mCSRS, a significant survival difference was proven in between the groups "1-3" vs "4-6" ($p \leq 0.001$), "4-6" vs "7+" ($p = 0.006$). **CONCLUSION:** Compared to the CSRS, the mCSRS expanded with the 2 additional weighting points differentiates more specifically the low-moderate and high survival groups in the PCAS patient population treated in our institute.

ARTICLE EN HUNGARÉS

5. Neurocrit Care. 2021 Jan 11. doi: 10.1007/s12028-020-01181-1. Online ahead of print.

Cerebrospinal Fluid Lactate Levels, Brain Lactate Metabolism and Neurologic Outcome in Patients with Out-of-Hospital Cardiac Arrest.

Son SH(1), In YN, Md(2), Park JS(3)(4), You Y(1), Min JH(2)(5), Yoo I(1)(5), Cho YC(1), Jeong W(1), Ahn HJ(1), Kang C(1), Lee BK(6).

ABSTRACT

BACKGROUND/OBJECTIVE: Cerebrospinal fluid (CSF) and serum lactate levels were assessed to predict poor neurologic outcome 3 months after return of spontaneous circulation (ROSC). We compared arterio-CSF differences in the lactate (ACDL) levels between two neurologic outcome groups. **METHODS:** This retrospective observational study involved out-of-hospital cardiac arrest (OHCA) survivors who had undergone target temperature management. CSF and serum samples were obtained immediately (lactate0), and at 24 (lactate24), 48 (lactate48), and 72 (lactate72) h

after ROSC, and ACDL was calculated at each time point. The primary outcome was poor 3-month neurologic outcome (cerebral performance categories 3-5). RESULTS: Of 45 patients, 27 (60.0%) showed poor neurologic outcome. At each time point, CSF lactate levels were significantly higher in the poor neurologic outcome group than in the good neurologic outcome group (6.97 vs. 3.37, 4.20 vs. 2.10, 3.50 vs. 2.00, and 2.79 vs. 2.06, respectively; all $P < 0.05$). CSF lactate's prognostic performance was higher than serum lactate at each time point, and lactate₂₄ showed the highest AUC values (0.89, 95% confidence interval, 0.75-0.97). Over time, ACDL decreased from -1.30 (-2.70-0.77) to -1.70 (-3.2 to -0.57) in the poor neurologic outcome group and increased from -1.22 (-2.42-0.32) to -0.64 (-2.31-0.15) in the good neurologic outcome group. CONCLUSIONS: At each time point, CSF lactate showed better prognostic performance than serum lactate. CSF lactate₂₄ showed the highest prognostic performance for 3-month poor neurologic outcome. Over time, ACDL decreased in the poor neurologic outcome group and increased in the good neurologic outcome group.

6. Heart Vessels. 2021 Jan 2. doi: 10.1007/s00380-020-01745-3. Online ahead of print.

Relationship between D-dimer level upon emergency room arrival and the duration of cardiac arrest in patients with witnessed out-of-hospital cardiac arrest.

Asano M(1)(2), Kurabayashi M(3), Yamauchi Y(1), Sasano T(2).

ABSTRACT

In patients with out-of-hospital cardiac arrest (OHCA), the probability of resuscitation is strongly influenced by the duration of cardiac arrest, which activates the blood coagulation-fibrinolysis system. Because plasma D-dimer levels reflect activity of blood coagulation and fibrinolysis, they should increase with the duration of cardiac arrest. We evaluated 222 consecutive non-traumatic witnessed OHCA patients who underwent measurement of plasma D-dimer levels on arrival in the emergency room. Return of spontaneous circulation was achieved in 138 patients (62%), but only 42 (19%) were alive 30 days post-OHCA. D-dimer levels were elevated in 217 patients (97.7%). There

was a positive correlation between plasma D-dimer levels and duration of cardiac arrest in the 222 patients ($r = 0.623$, $p < 0.001$). When the cause of OHCA was limited to cardiovascular disease, the positive correlation between level of D-dimer and the duration of cardiac arrest ($r = 0.776$, $p < 0.001$)

increased. D-dimer levels were significantly lower in survivors than in non-survivors [9.5 (1.4-17.5) vs 54.2 (34.2-74.3) $\mu\text{g/mL}$, $p = 0.024$]. Receiver operating characteristic curve analysis showed that a cutoff value of D-dimer $\leq 10 \mu\text{g/L}$ led to sensitivity (69.0%) and specificity (72.8%) for 30 day survival (area under curve 0.75). Multivariate logistic regression analysis showed that D-dimer $\leq 10 \mu\text{g/ml}$ was an independent predictor for 30 day survival (odds ratio 4.39, 95% confidence interval 1.41-13.70; $p = 0.01$). D-dimer level correlates with duration of cardiac arrest, especially in OHCA patients due to cardiovascular causes, and may help physicians assess the probability of survival in OHCA patients.

7. Blood Purif. 2021 Jan 13:1-8. doi: 10.1159/000510127. Online ahead of print.

Rationale of Blood Purification in the Post-Resuscitation Syndrome following Out-of-Hospital Cardiac Arrest: A Narrative Review.

Redant S(1), De Bels D(2), Honoré PM(2).

ABSTRACT

Even today, little is known about the pathophysiology of the post-resuscitation syndrome. Our narrative review is one of the first summarizing all the knowledge about this phenomenon. We have focused our review upon the potential role of blood purification in attenuating the consequences of the post-resuscitation syndrome. Blood purification can decrease the cytokine storm particularly when using a CytoSorb absorber. Acrylonitrile 69-based oXiris membranes can remove endotoxin and high-mobility group box 1 protein. Blood purification techniques can quickly induce hypothermia. Blood purification can be used with veno-arterial extracorporeal

membrane oxygenation to remove excess water. Further trials are needed to provide more concrete data about the use of blood purification in the post-resuscitation syndrome.

8. Am J Emerg Med. 2020 Dec 30;41:70-72. doi: 10.1016/j.ajem.2020.12.015. Online ahead of print.

A prospective study of the incidence of intracranial hemorrhage in survivors of out of hospital cardiac arrest.

Gelber J(1), Montgomery ME(2), Singh A(2).

ABSTRACT

AIM: Intracranial Hemorrhage (ICH) is an important cause of out-of-hospital cardiac arrest (OHCA), yet there are no United States (US), European, or Australian prospective studies examining its incidence in patients who sustained OHCA. This study aims to identify the incidence of ICH in US patients with OHCA who obtain return of spontaneous circulation (ROSC). **METHODS:** We prospectively analyzed consecutive patients with OHCA who achieved ROSC at a single US hospital over a 15-month period. Before beginning patient enrollment, we implemented a standardized emergency department order-set for the initial management for all patients with ROSC after OHCA. This order-set included a non-contrast head computed-tomography (NCH-CT) scan. Patient and cardiac arrest variables were recorded, as were NCH-CT findings. **RESULTS:** During the study period, 85 patients sustained an OHCA, achieved ROSC, survived to hospital admission, and underwent a NCH-CT. Three of these 85 patients had ICH (3.5%). Survival to discharge was seen in 23/82 (28.0%)

patients without ICH and in 1/3 patients with ICH. Survival with good neurologic outcome was seen in 14/82 (17.1%) patients without ICH and in 0/3 patients with ICH. Patients with ICH tended to be older than patients without ICH. **CONCLUSIONS:** In our US cohort, ICH was an uncommon finding in patients who sustained OHCA and survived to hospital admission, and no patients with ICH survived to discharge with good neurologic outcome. Additionally, the incidence of ICH was lower than reported in previous studies.

TARGETED TEMPERATURE MANAGEMENT

1. Neurocrit Care. 2021 Jan 5:1-10. doi: 10.1007/s12028-020-01166-0. Online ahead of print.

Targeted Temperature Management Suppresses Hypoxia-Inducible Factor-1 α and Vascular Endothelial Growth Factor Expression in a Pig Model of Cardiac Arrest.

Li J(1), Li C(2), Yuan W(3), Wu J(3), Li J(4), Li Z(5), Zhao Y(3).

ABSTRACT

BACKGROUND: The hypoxia-inducible factor-1 α (HIF-1 α)/vascular endothelial growth factor (VEGF)/VEGF receptor subtype 2 (VEGFR-2) pathway has been implicated in ischemia/reperfusion injury. The aim of this study was to clarify whether whole-body hypothermic targeted temperature management (HTTM) inhibits the HIF-1 α /VEGF/VEGFR-2 pathway in a swine model of cardiac arrest (CA) and cardiopulmonary resuscitation (CPR). **METHODS:** Twenty-four domestic male Beijing Landrace pigs were used in this study. CA was electrically induced with ventricular fibrillation and left untreated for 8 min. Return of spontaneous circulation (ROSC) was achieved in 16 pigs, which were randomly assigned either to normothermia at 38 °C or to HTTM at 33 °C (each group: n = 8). HTTM was intravascularly induced immediately after ROSC. The core temperature was reduced to 33 °C and maintained for 12 h after ROSC. The serum levels of HIF-1 α , VEGF, VEGFR-2, and neuron-specific enolase (NSE) were measured with enzyme immunoassay kits 0.5, 6, 12, and 24 h after ROSC. The expression of HIF-1 α , VEGF, and VEGFR-2 in cerebral cortical tissue was measured by RT-PCR and Western blot analysis 24 h after ROSC. Neurological deficit scores and brain cortical tissue water content were evaluated 24 h after ROSC. **RESULTS:** The serum levels of HIF-1 α , VEGF,

and VEGFR-2 were significantly increased under normothermia within 24 h after ROSC. However, these increases were significantly reduced by HTTM. HTTM also decreased cerebral cortical HIF-1 α , VEGF, and VEGFR-2 mRNA and protein expression 24 h after ROSC (all $p < 0.05$). HTTM pigs had better neurological outcomes and less brain edema than normothermic pigs. CONCLUSION: The HIF-1 α /VEGF/VEGFR-2 system is activated following CA and CPR. HTTM protects against cerebral injury after ROSC, which may be part of the mechanism by which it inhibits the expression of components of the HIF-1 α /VEGF/VEGFR-2 signaling pathway.

2. *J Cereb Blood Flow Metab.* 2021 Jan 14;271678X20970059. doi: 10.1177/0271678X20970059. Online ahead of print.

Targeted temperature management and early neuro-prognostication after cardiac arrest.

Chen S(1)(2), Lachance BB(3), Gao L(2), Jia X(1)(4)(5)(6)(7).

ABSTRACT

Targeted temperature management (TTM) is a recommended neuroprotective intervention for coma after out-of-hospital cardiac arrest (OHCA). However, controversies exist concerning the proper implementation and overall efficacy of post-CA TTM, particularly related to optimal timing and depth of TTM and cooling methods. A review of the literature finds that optimizing and individualizing TTM remains an open question requiring further clinical investigation. This paper will summarize the preclinical and clinical trial data to-date, current recommendations, and future directions of this therapy, including new cooling methods under investigation. For now, early induction, maintenance for at least 24 hours, and slow rewarming utilizing endovascular methods may be preferred. Moreover, timely and accurate neuro-prognostication is valuable for guiding ethical and cost-effective management of post-CA coma. Current evidence for early neuro-prognostication after TTM suggests that a combination of initial prediction models, biomarkers, neuroimaging, and electrophysiological methods is the optimal strategy in predicting neurological functional outcomes.

ELECTROFISIOLOGIA I DESFIBRIL·LACIÓ

1. *Resuscitation.* 2020 Dec 31;160:7-13. doi: 10.1016/j.resuscitation.2020.12.019. Online ahead of print.

Software annotation of defibrillator files: Ready for prime time?

Gupta V(1), Schmicker RH(2), Owens P(3), Pierce AE(3), Idris AH(4).

ABSTRACT

BACKGROUND: High-quality chest compressions are associated with improved outcomes after cardiac arrest. Defibrillators record important information about chest compressions during cardiopulmonary resuscitation (CPR) and can be used in quality-improvement programs. Defibrillator review software can automatically annotate files and measure chest compression metrics. However, evidence is limited regarding the accuracy of such measurements. **OBJECTIVE:** To compare chest compression fraction (CCF) and rate measurements made with software annotation vs. manual annotation vs. limited manual annotation of defibrillator files recorded during out-of-hospital cardiac arrest (OHCA) CPR. **METHODS:** This was a retrospective, observational study of 100 patients who had CPR for OHCA. We assessed chest compression bioimpedance waveforms from the time of initial CPR until defibrillator removal. A reviewer revised software annotations in two ways: completely manual annotations and limited manual annotations, which marked the beginning and end of CPR and ROSC, but not chest compressions. Measurements were compared for CCF and rate using intraclass correlation coefficient (ICC) analysis. **RESULTS:** Case mean rate showed no significant difference between the methods (108.1-108.6 compressions per minute) and ICC was excellent (>0.90). The case mean (\pm SD) CCF for software, manual, and limited manual annotation was 0.64 ± 0.19 , 0.86 ± 0.07 , and 0.81 ± 0.10 , respectively. The ICC for manual vs. limited manual annotation of

CCF was 0.69 while for individual minute epochs it was 0.83. CONCLUSION: Software annotation performed very well for chest compression rate. For CCF, the difference between manual and software annotation measurements was clinically important, while manual vs. limited manual annotation were similar with an ICC that was good-to-excellent.

2. Prehosp Disaster Med. 2021 Jan 13:1-6. doi: 10.1017/S1049023X20001508. Online ahead of print.

Mismatches Between the Number of Installed Automated External Defibrillators and the Annual Rate of Automated External Defibrillator Use Among Places.

Oh JH(1), Cho GC(2), Ryoo SM(3), Han SH(4), Woo SH(5), Jang YS(6), Cho Y(2), Sim M(7), Kim OH(8).

ABSTRACT

AIM: In South Korea, the law concerning automated external defibrillators (AEDs) states that they should be installed in specific places including apartment complexes. This study was conducted to investigate the current status and effectiveness of installation and usage of AEDs in South Korea.

METHODS: Installation and usage of AEDs in South Korea is registered in the National Emergency Medical Center (NEMC) database. Compared were the installed number, usage, and annual rate of AED use according to places of installation. All data were obtained from the NEMC database. RESULTS: After excluding AEDs installed in ambulances or fire engines (n = 2,003), 36,498 AEDs were registered in South Korea from 1998 through 2018. A higher number of AEDs were installed in places required by the law compared with those not required by the law (20,678 [56.7%] vs. 15,820 [43.3%]; P <.001). Among them, 11,318 (31.0%) AEDs were installed in apartment complexes. The

overall annual rate of AED use was 0.38% (95% CI, 0.33-0.44). The annual rate of AED use was significantly higher in places not required by the law (0.62% [95% CI, 0.52-0.72] versus 0.21% [95% CI, 0.16-0.25]; P <.001). The annual rate of AED use in apartment complexes was 0.13% (95% CI, 0.08-0.17). CONCLUSION: There were significant mismatches between the number of installed

AEDs and the annual rate of AED use among places. To optimize the benefit of AEDs in South Korea, changes in the policy for selecting AED placement are needed.

3. JAMA Netw Open. 2021 Jan 4;4(1):e2032875. doi: 10.1001/jamanetworkopen.2020.32875.

Association of Timing of Electrocardiogram Acquisition After Return of Spontaneous Circulation With Coronary Angiography Findings in Patients With Out-of-Hospital Cardiac Arrest.

Baldi E(1)(2), Schnaubelt S(3), Caputo ML(1)(4), Klersy C(5), Clodi C(3), Bruno J(4), Compagnoni S(1)(2), Benvenuti C(6), Domanovits H(3), Burkart R(6), Fracchia R(1), Primi R(7), Ruzicka G(3), Holzer M(3), Auricchio A(4), Savastano S(7).

ABSTRACT

IMPORTANCE: Electrocardiography (ECG) is an important tool to triage patients with out-of-hospital cardiac arrest (OHCA) after return of spontaneous circulation (ROSC). An immediate coronary angiography after ROSC is recommended only in patients with an ECG that is diagnostic of ST-segment elevation myocardial infarction (STEMI). To date, the benefit of this approach has not been demonstrated in patients with a post-ROSC ECG that is not diagnostic of STEMI. OBJECTIVE: To assess whether the time from ROSC to ECG acquisition is associated with the diagnostic accuracy of ECG for STEMI. DESIGN, SETTING, AND PARTICIPANTS: This retrospective, multicenter cohort study

(the Post-ROSC Electrocardiogram After Cardiac Arrest study) analyzed consecutive patients older than 18 years who were resuscitated from OHCA between January 1, 2015, and December 31, 2018, and were admitted to 1 of the 3 participating centers in Europe (Pavia, Italy; Lugano,

Switzerland; and Vienna, Austria). EXPOSURE: Only patients who underwent coronary angiography during hospitalization and who acquired a post-ROSC ECG before the angiography were enrolled. Patients with a nonmedical cause of OHCA were excluded. MAIN OUTCOMES AND MEASURES: The primary end point was false-positive ECG findings, defined as the percentage of patients with post-ROSC ECG findings that met STEMI criteria but who did not show obstructive coronary artery disease on angiography that was worthy of percutaneous coronary angioplasty. RESULTS: Of 586 consecutive patients who were admitted to the 3 participating centers, 370 were included in the analysis (287 men [77.6%]; median age, 62 years [interquartile range, 53-70 years]); 121 (32.7%) were enrolled in the participating center in Pavia, Italy; 38 (10.3%) in Lugano, Switzerland; and 211 (57.0%) in Vienna, Austria. The percentage of false-positive ECG findings in the first tertile of ROSC to ECG time (≤ 7 minutes) was significantly higher than that in the second (8-33 minutes) and third (>33 minutes) tertiles: 18.5% in the first tertile vs 7.2% in the second (odds ratio [OR], 0.34; 95% CI, 0.13-0.87; $P = .02$) and 5.8% in the third (OR, 0.27; 95% CI, 0.15-0.47; $P < .001$). These differences remained significant when adjusting for sex (≤ 7 minutes: reference; 8-33 minutes: OR, 0.32; 95% CI, 0.12-0.85; $P = .02$; >33 minutes: OR, 0.26; 95% CI, 0.14-0.47; $P < .001$), age (≤ 7 minutes: reference; 8-33 minutes: OR, 0.34; 95% CI, 0.13-0.89; $P = .03$; >33 minutes: OR, 0.27; 95% CI, 0.15-0.46; $P < .001$), number of segments with ST-elevation (≤ 7 minutes: reference; 8-33 minutes: OR, 0.35; 95% CI, 0.15-0.81; $P = .01$; >33 minutes: OR, 0.28; 95% CI, 0.15-0.52; $P < .001$), QRS duration (≤ 7 minutes: reference; 8-33 minutes: OR, 0.35; 95% CI, 0.14-0.87; $P = .02$; >33 minutes: OR, 0.27; 95% CI, 0.15-0.48; $P < .001$), heart rate (≤ 7 minutes: reference; 8-33 minutes: OR, 0.35; 95% CI, 0.13-0.93; $P = .04$; >33 minutes: OR, 0.29; 95% CI, 0.15-0.55; $P < .001$), epinephrine administered (≤ 7 minutes: reference; 8-33 minutes: OR, 0.35; 95% CI, 0.13-0.98; $P = .045$; >33 minutes: OR, 0.27; 95% CI, 0.16-0.48; $P < .001$), shockable initial rhythm (≤ 7 minutes: reference; 8-33 minutes: OR, 0.35; 95% CI, 0.13-0.96; $P = .04$; >33 minutes: OR, 0.26; 95% CI, 0.15-0.46; $P < .001$), and 3 or more shocks administered (≤ 7 minutes: reference; 8-33 minutes: OR, 0.36; 95% CI, 0.13-1.00; $P = .05$; >33 minutes: OR, 0.27; 95% CI, 0.16-0.48; $P < .001$) in bivariable analyses. CONCLUSIONS AND RELEVANCE: This study suggests that early ECG acquisition after ROSC in patients with OHCA is associated with a higher percentage of false-positive ECG findings for STEMI. It may be reasonable to delay post-ROSC ECG by at least 8 minutes after ROSC or repeat the acquisition if the first ECG is diagnostic of STEMI and is acquired early after ROSC.

4. Cureus. 2020 Dec 10;12(12):e12019. doi: 10.7759/cureus.12019.

Can We Predict Good Survival Outcomes by Classifying Initial and Re-Arrest Rhythm Change Patterns in Out-of-Hospital Cardiac Arrest Settings?

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ABSTRACT

Objective The purpose of this study was to investigate whether a change in prehospital arrest rhythms could allow medical personnel to predict survival outcomes in patients who achieved a return of spontaneous circulation (ROSC) in the setting of out-of-hospital cardiac arrest (OHCA). **Methods** The design of this study was retrospective, multi-regional, observational, and cross-sectional with a determining period between August 2015 and July 2016. Cardiac arrest rhythms were defined as a shockable rhythm (S), which refers to ventricular fibrillation (VF) or pulseless ventricular tachycardia (pVT), and non-shockable rhythm (NS), which refers to pulseless electrical activity or asystole. Survival to admission, survival to discharge, and good cerebral

performance category (CPC) (CPC 1 or 2) were defined as good survival outcomes. Results A total of 163 subjects were classified into four groups according to the rhythm change pattern: NS→NS (98), S→S (27), S→NS (23), and NS→S (15). NS→NS pattern was used as the reference in logistic regression analysis. In the case of survival to hospital admission, the odds ratio (OR) (95% CI) of the S→S pattern was the highest [12.63 (3.56-44.85), p: <0.001 by no correction] and [7.29 (1.96-27.10), p = 0.003 with adjusting]. In the case of survival to hospital discharge, the OR (95% CI) of the S→S pattern was the highest [37.14 (11.71-117.78), p: <0.001 by no correction] and [13.85 (3.69-51.97), p: <0.001 with adjusting]. In the case of good CPC (CPC 1 or 2) at discharge, the OR (95% CI) of the S→S pattern was the highest [96 (19.14-481.60), p: <0.001 by no correction] and [149.69 (19.51-1148.48), p: <0.001 with adjusting]. Conclusions The S→S group showed the highest correlation with survival to hospital admission, survival to hospital discharge, and good CPC (CPC 1 or 2) at discharge compared to the NS→NS group. Verifying changes in initial cardiac arrest rhythm and prehospital re-arrest (RA) rhythm patterns after prehospital ROSC can help us predict good survival outcomes in the OHCA setting.

5. Am J Emerg Med. 2020 Dec 30;41:73-79. doi: 10.1016/j.ajem.2020.12.031. Online ahead of print.

Double external defibrillation for shock-refractory ventricular fibrillation cardiac arrest: A step towards standardization.

Miraglia D(1), Ramzy M(2).

ABSTRACT

Double (or dual) external defibrillation (DED) has increasingly been used in the last few years by a number of emergency medical services (EMS) as a last resort to terminate ventricular fibrillation and pulseless ventricular tachycardia in adult patients who remain refractory to standard defibrillation. However, no randomized controlled trials comparing DED with standard defibrillation focusing

on patient-oriented outcomes as the primary objective have been published to date. Selection criteria, procedure techniques, and protocol are not clearly defined and vary across observational studies. The terms and/or nomenclature used to describe DED are confusing and vary throughout the literature. Despite increased use of DED, many questions remain as to which patients will derive the most benefit from DED, when to implement DED, and the optimal form of delivering DED. The present paper provides a brief overview of the background, procedure techniques, pad placement, and factors affecting how DED is delivered. A further objective of this paper is to offer a proposal for a uniform nomenclature and a standardized protocol in the form of a flowchart for EMS agencies to guide further clinical trials and best practices. This paper should not only help give background on novel definitions and clarify nomenclature for this practice, but more importantly should help institutions lay the groundwork for performing EMS-based large trials to further investigate the effectiveness of DED.

PEDIATRIA

1. Pediatr Qual Saf. 2020 Dec 28;6(1):e374. doi: 10.1097/pq9.0000000000000374. eCollection 2021 Jan-Feb.

CPR during COVID-19: Use of Expert-driven Rapid Cycle Deliberate Practice to Implement PALS Guidelines.

Nichols BE(1), McMichael ABV(1), Volk APD(1), Bhaskar P(1), Bowens CD(1).

ABSTRACT

The American Heart Association (AHA) and other national institutions have endorsed modifications to resuscitation guidelines given the risk of healthcare workers' (HCWs) exposure to COVID-19. Institutional implementation of the COVID-19-focused guidelines requires both

proof of feasibility and education of HCW. Pediatric critical care medical directors at The University of Texas Southwestern/Children's Health System of Texas (UTSW/CHST) created a guideline for the resuscitation of COVID-19 patients. The simulation team used in situ simulation to demonstrate guideline feasibility and to create educational materials. METHODS: A UTSW/CHST guideline incorporated COVID-19-focused AHA and other national organizational recommendations to fit the institutional needs. A high-fidelity in situ simulation helped test the feasibility and optimize the UTSW/CHST guideline. We developed a novel form of rapid cycle deliberate practice (RCDP), expert-driven RCDP, in which all simulation participants are experts, to debrief the simulation. RESULTS: In situ simulation with expert-driven RCDP demonstrated guideline feasibility in the resuscitation of a COVID-19 patient while balancing the protection of HCW. Expert-driven RCDP allowed for real-time alterations to the guideline during the simulation event. Video recording and dissemination of the simulation allowed for the education of over 300 staff on the new recommendations. CONCLUSIONS: High-fidelity in situ simulation with expert-driven RCDP created a rapid consensus among expert critical care providers to develop the UTSW/CHST guideline and quickly adopt the new AHA recommendations. This debriefing method helped minimize the risk of HCW exposure by minimizing the number of required participants and time for simulation. We recommend using this distinctive, expert-driven RCDP debriefing method for expeditious testing of COVID-19-focused processes at other institutions.

2. *Pediatr Crit Care Med.* 2021 Jan 11; Publish Ahead of Print. doi: 10.1097/PCC.0000000000002659. Online ahead of print.

Intraosseous or Peripheral Intravenous Access in Pediatric Cardiac Arrest? Results From the French National Cardiac Arrest Registry.

Recher M(1), Baert V, Escutnaire J, Le Bastard Q, Javaudin F, Hubert H, Leteurtre S.

ABSTRACT

OBJECTIVES: Despite the evolving recommendations that favor the use of intraosseous access in pediatric resuscitation, the impact of vascular access type on survival in young children has not been demonstrated. The aim of this study was to assess the impact of the intravascular injection route on the return on spontaneous circulation, survival to hospital admission (0 day), and 30 days or survival to hospital discharge, by comparing survival rates in young children having intraosseous and peripheral IV access. The second aim was to compare the rates of favorable neurologic outcome after 30 days or survival to hospital discharge. **DESIGN:** This was a multicenter retrospective comparative study between July 2011 and October 2018. **SETTING:** Based on the French cardiac arrest registry data. **PATIENTS:** All prepubescent (males < 12 yr old, females < 10 yr old) victims of an out-of-hospital cardiac arrest. **INTERVENTIONS:** Patients with adrenaline administration by intraosseous versus peripheral venous technique were compared, using propensity score matching.

MEASUREMENTS AND MAIN RESULTS: The analysis included 603 prepubescent patients, 351 (58%) in the intraosseous group and 252 (42%) in the peripheral IV group. Intraosseous group patients were younger, lighter, with more medical cause for arrest. The intraosseous group had lower survival rates at 30 days or hospital discharge (n = 6; 1.7%) than the peripheral IV group (n = 12; 4.8%) (p = 0.030). After matching, 101 pairs of patients were created. No difference was observed on return of spontaneous circulation or 0-day survival rates (odds ratio = 1.000 [95% CI, 0.518-1.930]; odds ratio = 0.946 [95% CI, 0.492-1.817], respectively) and on 30 days or hospital discharge survival (n = 3 in both groups) (odds ratio = 1.000 [95% CI, 0.197-5.076]). Meaningful

statistical evaluation of neurologic status among survivors was precluded by inadequate numbers.

CONCLUSIONS: The type of injection route (intraosseous or peripheral venous access) does not appear to have an impact on survival of out-of-hospital cardiac arrest in a prepubescent population, but limitations of propensity matching limit a definitive conclusion.

3. *Circ Arrhythm Electrophysiol.* 2021 Jan 5. doi: 10.1161/CIRCEP.120.008517. Online ahead of print.

Outcomes of Pediatric Patients with Defibrillators Following Initial Presentation with Sudden Cardiac Arrest.

Robinson JA(1), LaPage MJ(2), Atallah J(3), Webster G(4), Miyake CY(5), Ratnasamy C(6), Ollberding NJ(7), Mohan S(8), Von Bergen NH(9), Johnsrude CL(10), Garnreiter JM(11), Spar DS(12), Czosek RJ(12).

ABSTRACT

Background - Implantable cardioverter defibrillators (ICD) are recommended for secondary prevention after sudden cardiac arrest (SCA). The outcomes of pediatric patients receiving an ICD after SCA remain unclear. The objective of this study is to evaluate outcomes, future risk for appropriate shocks, and identify characteristics associated with appropriate ICD therapy during follow-up. **Methods** - Multi-center retrospective analysis of patients (≤ 21 yrs) without prior cardiac disease who received an ICD following SCA. Patient/device characteristics, cardiac function, and underlying diagnoses were collected, along with SCA event characteristics. Patient outcomes including complications and device therapies were analyzed. **Results** - In total, 106 patients were

included, median age 14.7 yrs. Twenty (19%) received appropriate shocks and 16 (15%) received inappropriate shocks (median follow up 3 yrs). First-degree relative with SCA was associated with appropriate shocks ($p < 0.05$). In total, 40% patients were considered idiopathic. Channelopathy was the most frequent late diagnosis not made at time of presentation. Neither underlying diagnosis nor

idiopathic status was associated with increased incidence of appropriate shock. Monomorphic ventricular tachycardia (HR 4.6 [1.2; 17.3]) and family history of sudden death (HR 6.5 [1.4; 29.8]) were associated with freedom from appropriate shock in a multivariable model (AUC=0.8). Time from diagnoses to evaluation demonstrated a non-linear association with freedom from appropriate shock ($p = 0.015$). In patients > 2 yrs from implantation, younger age ($p = 0.02$) and positive exercise test ($p = 0.04$) were associated with appropriate shock. **Conclusions** - The risk of future device therapy is high in pediatric patients receiving an ICD after SCA, irrelevant of underlying disease. Lack of a definitive diagnosis after SCA was not associated with lower risk of subsequent events and does not obviate the need for secondary prophylaxis.

ECMO

1. *Resusc Plus.* 2020 Dec;4:100029. doi: 10.1016/j.resplu.2020.100029. Epub 2020 Oct 8.

Sub30: Protocol for the Sub30 feasibility study of a pre-hospital Extracorporeal membrane oxygenation (ECMO) capable advanced resuscitation team at achieving blood flow within 30 min in patients with refractory out-of-hospital cardiac arrest.

Singer B(1)(2), Reynolds JC(3), Davies GE(2), Wrigley F(4), Whitbread M(5), Faulkner M(4), O'Brien B(1), Proudfoot AG(1), Mathur A(1), Evens T(2), Field J(6), Monk V(6), Finney SJ(1); International ECMO Network (ECMONet).

ABSTRACT

BACKGROUND: Out-of-hospital cardiac arrest carries a poor prognosis with survival less than 10% in many patient cohorts. Survival is inversely associated with duration of resuscitation as external chest compressions do not provide sufficient blood flow to prevent irreversible organ

damage during a prolonged resuscitation. Extracorporeal membrane oxygenation (ECMO) instituted during cardiac arrest can provide normal physiological blood flows and is termed Extracorporeal Cardio-Pulmonary Resuscitation (ECPR). ECPR may improve survival when used with in-hospital cardiac arrests. This possible survival benefit has not been replicated in trials of out-of-hospital cardiac arrests, possibly because of the additional time it takes to transport the patient to hospital and initiate ECPR. Pre-hospital ECPR may shorten the time between cardiac arrest and physiological blood flows, potentially improving survival. It may also mitigate some of the neurological injury that many survivors suffer. METHODS: Sub30 is a prospective six patient feasibility study. The primary aim is to test whether it is possible to institute ECPR within 30 min of collapse in adult patients with refractory out of hospital cardiac arrest (OHCA). The secondary aims are to gather preliminary data on clinical outcomes, resource utilisation, and health economics associated with rapid ECPR delivery in order to plan any subsequent clinical investigation or clinical service. On study days a dedicated fast-response vehicle with ECPR capability will be tasked to out-of-hospital cardiac arrests in an area of London served by Barts Heart Centre. If patients suffer a cardiac arrest refractory to standard advanced resuscitation and meet eligibility criteria, ECPR will be started in the pre-hospital environment. DISCUSSION: Delivering pre-hospital ECPR within 30 min of an out-of-hospital cardiac arrest presents significant ethical, clinical, governance and logistical challenges. Prior to conducting an efficacy study of ECPR the feasibility of timely and safe application must be demonstrated first. Extensive planning, multiple high-fidelity multiagency simulations and a unique collaboration between pre-hospital and in-hospital institutions will allow us to test the feasibility of this intervention in London. The study has been reviewed, refined and endorsed by the International ECMO Network (ECMONet).

2. Indian J Thorac Cardiovasc Surg. 2021 Jan 7:1-9. doi: 10.1007/s12055-020-01072-2. Online ahead of print.

ECPR-extracorporeal cardiopulmonary resuscitation.

Kumar KM(1).

ABSTRACT

Extracorporeal cardiopulmonary resuscitation (ECPR) is a salvage procedure in which extracorporeal membrane oxygenation (ECMO) is initiated emergently on patients who have had cardiac arrest (CA) and on whom the conventional cardiopulmonary resuscitation (CCPR) has failed. Awareness and usage of ECPR are increasing all over the world. Significant advancements have taken place in the ECPR initiation techniques, in its device and in its post-procedure care. ECPR is a team work requiring multidisciplinary experts, highly skilled health care workers and adequate infrastructure with appropriate devices. Perfect coordination and communication among team members play a vital role in the outcome of the ECPR patients. Ethical, legal and financial issues need to be considered before initiation of ECPR and while withdrawing the support when the ECPR is futile. Numerous studies about ECPR are being published more frequently in the last few years. Hence, keeping updated about the ECPR is very important for proper selection of cases and its management. This article reviews various aspects of ECPR and relevant literature to date.

3. EClinicalMedicine. 2020 Nov 13;29-30:100632. doi: 10.1016/j.eclinm.2020.100632. eCollection 2020 Dec.

The Minnesota mobile extracorporeal cardiopulmonary resuscitation consortium for treatment of out-of-hospital refractory ventricular fibrillation: Program description, performance, and outcomes.

Bartos JA(1)(2), Frascione RJ(2)(3), Conterato M(2)(4), Wesley K(5), Lick C(6), Sipprell K(7), Vuljaj N(5), Burnett A(8), Peterson BK(9), Simpson N(10), Ham K(11), Bruen C(11), Woster

C(11), Haley KB(11), Moore J(10), Trigger B(12), Hodgson L(2), Harkins K(2), Kosmopoulos M(2), Aufderheide TP(13), Tolar J(14), Yannopoulos D(1)(2).

ABSTRACT

BACKGROUND: We describe implementation, evaluate performance, and report outcomes from the first program serving an entire metropolitan area designed to rapidly deliver extracorporeal membrane oxygenation (ECMO)-facilitated resuscitation to patients with refractory ventricular fibrillation/ventricular tachycardia (VF/VT) out-of-hospital cardiac arrest (OHCA). **METHODS:** This observational cohort study analyzed consecutive patients prospectively enrolled in the Minnesota Mobile Resuscitation Consortium's ECMO-facilitated resuscitation program. Entry criteria included: 1) adults (aged 18-75), 2) VF/VT OHCA, 3) no return of spontaneous circulation following 3

shocks, 4) automated cardiopulmonary resuscitation with a Lund University Cardiac Arrest System (LUCAS™), and 5) estimated transfer time of < 30 min. The primary endpoint was functionally favorable survival to hospital discharge with Cerebral Performance Category (CPC) 1 or 2. Secondary endpoints included 3-month functionally favorable survival, program benchmarks, ECMO cannulation rate, and safety. Essential program components included emergency medical services, 3

community ECMO Initiation Hospitals with emergency department ECMO cannulation sites and 24/7 cardiac catheterization laboratories, a 24/7 mobile ECMO cannulation team, and a single, centralized ECMO intensive care unit. **FINDINGS:** From December 1, 2019 to April 1, 2020, 63 consecutive patients were transported and 58 (97%) met criteria and were treated by the mobile ECMO service. Mean age was 57 ± 1.8 years; 46/58 (79%) were male. Program benchmarks were variably met, 100% of patients were successfully cannulated, and no safety issues were identified. Of the 58 patients, 25/58 (43% [CI:31-56%]) were both discharged from the hospital and alive at 3 months with CPC 1 or 2. **INTERPRETATION:** This first, community-wide ECMO-facilitated resuscitation program in the US demonstrated 100% successful cannulation, 43% functionally favorable survival rates at hospital discharge and 3 months, as well as safety. The program provides a potential model of this approach for other communities.

RECERCA EXPERIMENTAL

1. Sci Rep. 2021 Jan 12;11(1):629. doi: 10.1038/s41598-020-79780-3.

The evaluation of pituitary damage associated with cardiac arrest: An experimental rodent model.

Okuma Y(1), Aoki T(1), Miyara SJ(1)(2), Hayashida K(1), Nishikimi M(1), Takegawa R(1), Yin T(1), Kim J(1), Becker LB(1)(3), Shinozaki K(4)(5).

ABSTRACT

The pituitary gland plays an important endocrinal role, however its damage after cardiac arrest (CA) has not been well elucidated. The aim of this study was to determine a pituitary gland damage induced by CA. Rats were subjected to 10-min asphyxia and cardiopulmonary resuscitation (CPR). Immunohistochemistry and ELISA assays were used to evaluate the pituitary damage and endocrine function. Samples were collected at pre-CA, and 30 and 120 min after cardio pulmonary resuscitation. Triphenyltetrazolium chloride (TTC) staining demonstrated the expansion of the pituitary damage over time. There was phenotypic validity between the pars distalis and nervosa. Both CT-proAVP (pars nervosa hormone) and GH/IGF-1 (pars distalis hormone) decreased over time, and a different expression pattern corresponding to the damaged areas was noted (CT-proAVP, 30.2 ± 6.2, 31.5 ± 5.9, and 16.3 ± 7.6 pg/mg protein, p < 0.01; GH/IGF-1, 2.63 ± 0.61, 0.62 ± 0.36, and 2.01 ± 0.41 ng/mg protein, p < 0.01 respectively). Similarly, the expression pattern between these hormones in the end-organ systems showed phenotypic validity. Plasma CT-proAVP (r = 0.771, p = 0.025) and IGF-1 (r = -0.775, p = 0.024) demonstrated a strong correlation with TTC staining

area. Our data suggested that CA induces pathological and functional damage to the pituitary gland.

2. Scand J Trauma Resusc Emerg Med. 2021 Jan 6;29(1):2. doi: 10.1186/s13049-020-00819-5.

The protective effects of phosphodiesterase-5 inhibitor, sildenafil on post-resuscitation cardiac dysfunction of cardiac arrest: by regulating the miR-155-5p and miR-145-5p.

He Y(1), Wang G(1), Li C(2), Wang Y(2), Zhang Q(3).

ABSTRACT

BACKGROUND: MiRNA-155 and miRNA-145 have been demonstrated to function as a key regulator in the development of the cardiovascular system. Recent experimental and clinical studies have indicated the cardioprotective role of sildenafil during ischemia/reperfusion (I/R) injury. This study was designed to investigate if administration of sildenafil will attenuate post-resuscitation myocardial dysfunction by regulating miRNA-155 and miR-145 expressions. **METHODS:** Thirty-two male pigs (weighing 30 ± 2 kg) were randomly divided into 4 groups, sildenafil group (n = 8), sildenafil +NG-nitro-L-arginine methyl ester (L-NAME) (20 mg/kg L) group (n = 8), saline (SA group, n = 8); and sham operation group (sham group, n = 8). Eight minutes of untreated VF was followed by defibrillation in anesthetized, closed-chest pigs. Hemodynamic status and blood samples were obtained at 0 min, 0.5, 1, 2, 4 and 6 h after return of spontaneous circulation (ROSC), and the hearts were removed and analyzed under electron microscopy, quantitative real-time polymerase chain reaction and ultra structural analysis were performed to evaluate myocardial injury. **RESULTS:** Compared with the sildenafil + L-NAME and saline groups, the sildenafil group had better outcomes in terms of hemodynamic and oxygen metabolism parameters as well as 24-h survival rate, and attenuated myocardial injury; In this study, CA pigs showed evidently increased levels of miR-155-5p and miR-145-5p, while the sildenafil treatment decreased the levels of miR-155-5p and miR-145-5p in CA pigs. In addition, the levels of eNOS was decreased in CA pigs, validating sildenafil attenuating post-resuscitation myocardial dysfunction by regulating miRNA-155 and miR-145 expressions. **CONCLUSIONS:** Sildenafil group had better outcomes in terms of hemodynamic and oxygen metabolism parameters as well as 24-h survival rate, inhibited the increases in the miR-155-5p and miR-145-5p levels and attenuated myocardial injury in a porcine model of CA and resuscitation.

3. J Intensive Care. 2021 Jan 7;9(1):4. doi: 10.1186/s40560-020-00521-9.

Brain monitoring using near-infrared spectroscopy to predict outcome after cardiac arrest: a novel phenotype in a rat model of cardiac arrest.

Takegawa R(1)(2), Hayashida K(3)(4), Choudhary R(1)(2), Rolston DM(1)(2), Becker LB(1)(2).

ABSTRACT

Improving neurological outcomes after cardiac arrest (CA) is the most important patient-oriented outcome for CA research. Near-infrared spectroscopy (NIRS) enables a non-invasive, real-time measurement of regional cerebral oxygen saturation. Here, we demonstrate a novel, non-invasive measurement using NIRS, termed modified cerebral oximetry index (mCOx), to distinguish the severity of brain injury after CA. We aimed to test the feasibility of this method to predict neurological outcome after asphyxial CA in rats. Our results suggest that mCOx is feasible shortly after resuscitation and can provide a surrogate measure for the severity of brain injury in a rat asphyxia CA model.

4. Cryobiology. 2021 Jan 4:S0011-2240(21)00003-1. doi: 10.1016/j.cryobiol.2021.01.003. Online ahead of print.

Resistance to ventricular fibrillation predicted by the QRS/QTc - Ratio in an intact rat model of hypothermia/rewarming.

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ABSTRACT

Accidental hypothermia is associated with increased risk for arrhythmias. QRS/QTc is proposed as an ECG-marker, where decreasing values predict hypothermia-induced ventricular arrhythmias. If reliable it should also predict nonappearance of arrhythmias, observed in species like rat that regularly tolerate prolonged hypothermia. A rat model designed for studying cardiovascular

function during cooling, hypothermia and subsequent rewarming was chosen due to species-dependent resistance to ventricular arrhythmias. ECG was recorded throughout the protocol. No ventricular arrhythmias occurred during experiments. QRS/QTc increased throughout the cooling period and remained above normothermic baseline until rewarmed. Different from the high incidence of hypothermia-induced ventricular arrhythmias in accidental hypothermia patients, where QRS/QTc ratio is decreased in moderate hypothermia; hypothermia and rewarming of rats is not associated with increased risk for ventricular fibrillation. This resistance to lethal hypothermia-induced arrhythmias was predicted by QRS/QTc.

5. Chin J Integr Med. 2021 Jan 9:1-7. doi: 10.1007/s11655-021-2855-2. Online ahead of print.

Effects of Shenfu Injection () on Inflammatory Response during Post-Resuscitation Myocardial Dysfunction after Cardiac Arrest in Swine.

Gu W(1), Hou XM(2), Li CS(3).

ABSTRACT

OBJECTIVE: To investigate whether Shenfu Injection (SFI,) can alleviate post-resuscitation myocardial dysfunction by inhibiting the inflammatory response. **METHODS:** After 8 min of ventricular fibrillation and 2 min of basic life support, 24 pigs were randomly divided into 3 groups (n=8), which were given intravenous bolus injections of SFI (1.0 mL/kg), epinephrine (EP, 0.02 mg/kg) and normal saline (SA), respectively. The animals were sacrificed at 24 h after restoration of spontaneous circulation (ROSC), and serum interleukin-6 (IL-6) and tumor necrosis factor- α (TNF- α) levels were measured by enzyme-linked immunosorbent assay (ELISA); expressions of Toll-like receptor 4 (TLR4)/nuclear factor kappa B (NF- κ B) mRNAs and proteins were determined by RT-PCR and Western blot, respectively. **RESULTS:** Compared with the EP and the SA groups, the ultrastructure of myocardial cells were slightly damaged and the systolic function of the left ventricle was markedly improved in the SFI group at 24 h after ROSC ($P<0.05$). In addition, compared with the EP and SA groups, the SFI group also showed significantly reduced levels of serum IL-6 and TNF- α , protein and mRNA levels of myocardial NF- κ B and TLR4 ($P<0.05$). **CONCLUSIONS:** Activation of TLR4/NF- κ B signaling pathway may be involved in the pathological mechanisms of post-resuscitation myocardial dysfunction. SFI may block NF- κ B-mediated inflammatory response by reducing the activity of NF- κ B and the level of TNF- α , thus playing a protective role in post-resuscitation myocardial dysfunction.

6. Artif Organs. 2021 Jan 12. doi: 10.1111/aor.13910. Online ahead of print.

Differential Expression Profiles of Circular RNAs in the Rat Hippocampus after Deep Hypothermic Circulatory Arrest.

Li YA(1), Liu ZG(1), Zhang YP(1), Hou HT(1), He GW(1)(2)(3)(4), Xue LG(1), Yang Q(1), Liu XC(1).

ABSTRACT

Neurological dysfunction commonly occurs after cardiac surgery with deep hypothermic circulatory arrest (DHCA). The mechanisms underlying DHCA-associated brain injury remain poorly understood. This study determined the changes in expression profiles of circular RNAs (circRNAs) in the hippocampus in rats underwent DHCA, with an attempt to explore the potential role of circRNAs in the brain injury associated with DHCA. Adult male Sprague-Dawley rats were subjected to cardiopulmonary bypass with DHCA. Brain injury was evaluated by neurological severity scores and histological as well as transmission electron microscope examinations. The expression profiles of circRNAs in the hippocampal tissues were screened by microarray.

Quantitative real-time PCR (RT-qPCR) was used to validate the reliability of the microarray results. Bioinformatic algorithms were applied to construct a competing endogenous RNA (ceRNA) network, and Gene Ontology (GO) and Kyoto Encyclopedia of Genes and Genomes (KEGG) analyses were performed to explore the potential biological roles of the circRNAs. Out of 14,145 circRNAs screened, 56 were differentially expressed in the hippocampus between the DHCA and sham operated rats, including 30 up-regulated and 26 down-regulated circRNAs. The expression changes of six selected circRNAs (up-regulated: rno_circRNA_011190, rno_circRNA_012988, rno_circRNA_000544; down-regulated: rno_circRNA_010393, rno_circRNA_012043, rno_circRNA_015149) were further confirmed by RT-qPCR. Bioinformatics analysis showed the enrichment of these confirmed circRNAs and their potential target mRNAs in several KEGG pathways including histidine metabolism, adipocytokine signaling, and cAMP signaling. By revealing the change of expression profiles of circRNAs in the brain after DHCA, this study indicates possible involvements of these dysregulated circRNAs in brain injury and suggests a potential of targeting circRNAs for prevention and treatment of neurological dysfunction associated with DHCA.

7. Aging (Albany NY). 2021 Jan 12;13. doi: 10.18632/aging.103920. Online ahead of print.
Combined transplantation of neural stem cells and bone marrow mesenchymal stem cells promotes neuronal cell survival to alleviate brain damage after cardiac arrest via microRNA-133b incorporated in extracellular vesicles.

Li F(1), Zhang J(2), Chen A(1), Liao R(1), Duan Y(1), Xu Y(1), Tao L(1).

ABSTRACT

Neural stem cell (NSC) transplantation has prevailed as a promising protective strategy for cardiac arrest (CA)-induced brain damage. Surprisingly, the poor survival of neuronal cells in severe hypoxic condition restricts the utilization of this cell-based therapy. Extracellular vesicles (EVs) transfer microRNAs (miRNAs) between cells are validated as the mode for the release of several therapeutic molecules. The current study reports that the bone marrow mesenchymal stem cells (BMSCs) interact with NSCs via EVs thereby affecting the survival of neuronal cells. Hypoxic injury models of neuronal cells were established using cobalt chloride, followed by co-culture with BMSCs and NSCs alone or in combination. BMSCs combined with NSCs elicited as a superior protocol to stimulate neuronal cell survival. BMSCs-derived EVs could protect neuronal cells against hypoxic injury. Silencing of miR-133b incorporated in BMSCs-derived EVs could decrease the cell viability and the number of NeuN-positive cells and increase the apoptosis in the CA rat model. BMSCs-derived EVs could transfer miR-133b to neuronal cells to activate the AKT-GSK-3 β -WNT-3 signaling pathway by targeting JAK1. Our study demonstrates that NSCs promotes the release of miR-133b from BMSCs-derived EVs to promote neuronal cell survival, representing a potential therapeutic strategy for the treatment of CA-induced brain damage.

CASE REPORTS

1. BMC Anesthesiol. 2021 Jan 13;21(1):18. doi: 10.1186/s12871-021-01240-w.

Case report: 2 cases of cardiac arrest caused by rhino-cardiac reflex while disinfecting nasal cavity before endonasal transsphenoidal endoscopic pituitary surgery.

Wang W(1), Cai H(1), Ding H(1), Xu X(2).

ABSTRACT

BACKGROUND: Trigeminal-cardiac reflex (TCR) is a brainstem vagus reflex that occurs when any center or peripheral branch of the trigeminal nerve was stimulated or operated on. The typical clinical manifestation is sudden bradycardia with or without blood pressure decline. The rhino-cardiac reflex which is one type of TCR is rare in clinical practice. As the rhino-cardiac reflex

caused by disinfection of the nasal cavity is very rare, we report these two cases to remind other anesthesiologists to be vigilant to this situation. **CASE PRESENTATION:** This case report describes two cases of cardiac arrest caused by rhino-cardiac reflex while disinfecting nasal cavity before endoscopic transsphenoidal removal of pituitary adenomas. Their heart rate all dropped suddenly at the very moment of nasal stimulation and recovered quickly after stimulation was stopped and the administration of drugs or cardiac support. **CONCLUSION:** Although the occurrence of rhino-cardiac reflex is rare, we should pay attention to it in clinical anesthesia. It is necessary to know the risk factors for preventing it. Once it occurs, we should take active and effective rescue measures to avoid serious complications.