This week's PubMed 6ᵗʰ – 12ᵗʰ August 2023: articles of interest n = 50

<u>CPR AND COVID-19</u>

ETView SL versus Macintosh Direct Laryngoscope for Endotracheal Intubation Amid Simulated COVID-19 Cardiac Arrest: A Randomized Crossover Study.

Evrin T(1), Dabkowski M(2), Pruc M(2)(3), Hernik J(4), Wieczorek W(2)(5), Chabowski L(2)(6), Wieczorek P(2)(7), Chmielewski J(8)(9), Feduniw S(10)(11), Szarpak L(12)(13).

ABSTRACT

Airway management procedures, such as endotracheal intubation (ETI), pose a significant risk of aerosol generation, requiring robust personal protective equipment (PPE) against aerosol-generating procedures (AGP). This study aimed to assess the impact of PPE-AGP on intubation success rates, time to intubation, and glottic visualization using ETView and a standard Macintosh laryngoscope (MAC). A total of 52 physicians participated in this prospective, observational, randomized crossover study conducted in a medical simulation setting. Participants included COVID-19 patients with cardiac arrest scenarios with and without PPE-AGP who were intubated with ETView and MAC. During intubation without PPE-AGP, ETView showed a similar first-pass success rate (FPS) but had a shorter intubation time and better glottal hydration compared to MAC. In scenario B (with PPE-AGP), ETView outperformed MAC in FPS, initiation time, and glottic visualization. The use of PPE-AGP had little impact on ETView's performance. However, it negatively affected the Macintosh laryngoscope, reducing FPS and glottic visibility. Participants found intubation with ETView easier in both scenarios. In conclusion, as compared to the Macintosh laryngoscope, ETView demonstrated higher performance under the circumstances of the simulation, especially when PPE-AGP was used.

<u>CPR/MECHANICAL CHEST COMPRESSION</u>

No articles identified.

<u>REGISTRIES, REVIEWS AND EDITORIALS</u>

Different neuroprognostication thresholds of neuron-specific enolase in shockable and non-shockable out-of-hospital cardiac arrest: a prospective multicenter observational study in Korea (the KORHN-PRO registry).

Kim YJ(1), Kim YH(2), Youn CS(3), Cho IS(4), Kim SJ(5), Wee JH(6), Park YS(7), Oh JS(8), Lee BK(9), Kim WY(10).

ABSTRACT

BACKGROUND: Serum neuron-specific enolase (NSE) is the only recommended biomarker for multimodal prognostication in postcardiac arrest patients, but low sensitivity of absolute NSE threshold limits its utility. This study aimed to evaluate the prognostic performance of serum NSE for poor neurologic outcome in out-of-hospital cardiac arrest (OHCA) survivors based on their initial rhythm and to determine the NSE cutoff values with false positive rate (FPR) < 1% for each group.
METHODS: This study included OHCA survivors who received targeted temperature management (TTM) and had serum NSE levels measured at 48 h after return of spontaneous circulation in the Korean Hypothermia Network, a prospective multicenter registry from 22 university-affiliated

teaching hospitals in South Korea between October 2015 and December 2018. The primary outcome was poor outcome at 6 month, defined as a cerebral performance category of 3-5. RESULTS: Of 623 patients who underwent TTM with NSE measured 48 h after the return of spontaneous circulation, 245 had an initial shockable rhythm. Median NSE level was significantly higher in the non-shockable group than in the shockable group (104.6 [40.6-228.4] vs. 25.9 [16.7-53.4] ng/mL, P < 0.001). Prognostic performance of NSE assessed by area under the receiver operating characteristic curve to predict poor outcome was significantly higher in the non-shockable group than in the shockable group (0.92 vs 0.86). NSE cutoff values with an FPR < 1% in the non-shockable and shockable groups were 69.3 (sensitivity of 42.1%) and 102.7 ng/mL (sensitivity of 76%), respectively. CONCLUSION: NSE prognostic performance and its cutoff values with FPR < 1% for predicting poor outcome in OHCA survivors who underwent TTM differed between shockable and non-shockable rhythms, suggesting postcardiac arrest survivor heterogeneity.

Outcome Analysis after Out-of-Hospital Cardiac Arrest.
[Article in English, Portuguese]
Salim TR(1)(2), Soares GP(1)(2).
NO ABSTRACT AVAILABLE

Out-of-Hospital Cardiac Arrest-One Size Does Not Fit All.
Pareek N(1)(2), Keeble TR(3)(4), Banerjee S(5).
NO ABSTRACT AVAILABLE

Junior doctors' experience of debrief after cardiac arrest and medical emergencies.
Pittaway H(1), Harbach S(2), Sutton C(3).
NO ABSTRACT AVAILABLE

AI and machine learning in resuscitation: Ongoing research, new concepts, and key challenges.
Okada Y(1)(2), Mertens M(3)(4), Liu N(1), Lam SSW(1), Ong MEH(1)(5).
ABSTRACT
AIM: Artificial intelligence (AI) and machine learning (ML) are important areas of computer science that have recently attracted attention for their application to medicine. However, as techniques continue to advance and become more complex, it is increasingly challenging for clinicians to stay abreast of the latest research. This overview aims to translate research concepts and potential concerns to healthcare professionals interested in applying AI and ML to resuscitation research but who are not experts in the field. MAIN TEXT: We present various research including prediction models using structured and unstructured data, exploring treatment heterogeneity, reinforcement learning, language processing, and large-scale language models. These studies potentially offer valuable insights for optimizing treatment strategies and clinical workflows. However, implementing AI and ML in clinical settings presents its own set of challenges. The availability of high-quality and reliable data is crucial for developing accurate ML models. A rigorous validation process and the integration of ML into clinical practice is essential for practical implementation. We furthermore highlight the potential risks associated with self-fulfilling prophecies and feedback loops, emphasizing the importance of transparency, interpretability, and trustworthiness in AI and ML

models. These issues need to be addressed in order to establish reliable and trustworthy AI and ML models. CONCLUSION: In this article, we overview concepts and examples of AI and ML research in the resuscitation field. Moving forward, appropriate understanding of ML and collaboration with relevant experts will be essential for researchers and clinicians to overcome the challenges and harness the full potential of AI and ML in resuscitation.

IN-HOSPITAL CARDIAC ARREST

1. Eur Heart J Open. 2023 Jun 22;3(4):oead066. doi: 10.1093/ehjopen/oead066. eCollection 2023 Jul.
Aetiology and outcome in hospitalized cardiac arrest patients.
Albert M(1), Herlitz J(2), Rawshani A(3), Forsberg S(1), Ringh M(1), Hollenberg J(1), Claesson A(1), Thuccani M(4), Lundgren P(2)(3)(5), Jonsson M(1), Nordberg P(1)(6).

ABSTRACT
AIMS: To study aetiologies of in-hospital cardiac arrests (IHCAs) and their association with 30-day survival. METHODS AND RESULTS: Observational study with data from national registries. Specific aetiologies (n = 22) of IHCA patients between April 2018 and December 2020 were categorized into cardiac vs. non-cardiac and six main aetiology categories: myocardial ischemia, other cardiac causes, pulmonary causes, infection, haemorrhage, and other non-cardiac causes. Main endpoints were proportions in each aetiology, 30-day survival, and favourable neurological outcome (Cerebral Performance Category scale 1-2) at discharge. Among, 4320 included IHCA patients (median age 74 years, 63.1% were men), approximate 50% had cardiac causes with a 30-day survival of 48.4% compared to 18.7% among non-cardiac causes (P < 0.001). The proportion in each category were: myocardial ischemia 29.9%, pulmonary 21.4%, other cardiac causes 19.6%, other non-cardiac causes 11.6%, infection 9%, and haemorrhage 8.5%. The odds ratio (OR) for 30-day survival compared to myocardial ischemia for each category were: other cardiac causes OR 1.48 (CI 1.24-1.76); pulmonary causes OR 0.36 (CI 0.3-0.44); infection OR 0.25 (CI 0.18-0.33); haemorrhage OR 0.22 (CI 0.16-0.3); and other non-cardiac causes OR 0.56 (CI 0.45-0.69). IHCA caused by myocardial ischemia had the best favourable neurological outcome while those caused by infection had the lowest OR 0.06 (CI 0.03-0.13). CONCLUSION: In this nationwide observational study, aetiologies with cardiac and non-cardiac causes of IHCA were evenly distributed. IHCA caused by myocardial ischemia and other cardiac causes had the strongest associations with 30-day survival and neurological outcome.

2. J Thorac Dis. 2023 Jul 31;15(7):4033-4039. doi: 10.21037/jtd-23-145. Epub 2023 Jun 21.
Closing the evidence gap for in-hospital cardiac arrest: a focus on advanced airway management.
Balakrishnan R(1), Andrea L(1), Moskowitz A(1).
NO ABSTRACT AVAILABLE

3. Zhonghua Wei Zhong Bing Ji Jiu Yi Xue. 2023 Jul;35(7):719-723. doi: 10.3760/cma.j.cn121430-20230131-00054.
[Clinical characteristics of in-hospital cardiac arrest in emergency patients in Kashgar area and analysis of influencing factors on success rate of cardiopulmonary resuscitation].
[Article in Chinese]
Long Y(1), Li X(2), Liang Y(3), Maimaitiaili T(2), Maihemuti A(4), Deng M(2), Wu X(5), Liu G(6), Quan Y(7), Yang J(8), Han J(9), Reyihanguli T(10), Zhang C(2).

ABSTRACT
OBJECTIVE: To analyze the clinical characteristics of patients with emergency in-hospital cardiac arrest (IHCA) in Kashgar, Xinjiang Uygur Autonomous Region and the factors affecting the success rate of cardiopulmonary resuscitation. METHODS: Retrospectively selected patients who had cardiac arrest and cardiopulmonary resuscitation in the emergency department of the People's Hospital of 6 counties and cities in Kashgar area from January 2019 to January 2022. The clinical data of all

patients were collected, including gender, age, major underlying diseases, the beginning and duration of resuscitation, the number of electric defibrillation acute physiology and chronic health evaluation II (APACHE II). According to whether the resuscitation was successful, all patients were divided into successful resuscitation group and failed resuscitation group. The clinical characteristics of the two groups were compared. Then, the influencing factors of the success rate of cardiopulmonary resuscitation in IHCA patients were analyzed by binary Logistic regression. RESULTS: A total of 1 376 patients were enrolled, including 1 117 cases of failed resuscitation and 259 cases of successful resuscitation. The success rate of resuscitation was 18.82%. Compared with the resuscitation failure group, the patients in the successful resuscitation group were younger (age: 49.10±20.99 vs. 58.44±18.32), the resuscitation start time was earlier [resuscitation start time ≤ 5 minutes: 76.45% (198/259) vs. 66.61% (744/1 117)], the proportion of cardiovascular and cerebrovascular diseases was lower [cardiovascular disease: 49.42% (128/259) vs. 58.19% (650/1 117), cerebrovascular disease: 17.37% (45/259) vs. 21.58% (241/1 117)], the number of electric defibrillation was lower [times: 0 (0, 2) vs. 1 (0, 1)], the proportion of endotracheal intubation was more [80.31% (208/259) vs. 55.60% (621/1 117)], APACHE II score was lower (13.75±8.03 vs. 17.90±4.63), and the difference was statistically significant (all P < 0.01). Binary Logistic regression analysis showed that age, start time of resuscitation, ventilation mode and APACHE II score were protective factors affecting the success rate of cardiopulmonary resuscitation in patients with emergency IHCA [age: odds ratio (OR) = 0.982, 95% confidence interval (95%CI) was 0.973-0.991, P < 0.001; resuscitation start time ≤ 5 minutes: OR = 0.629, 95%CI was 0.409-0.966, P = 0.034; tracheal intubation assisted ventilation: OR = 0.243, 95%CI was 0.149-0.397, P < 0.001; low APACHE II score: OR = 0.871, 95%CI was 0.836-0.907, P < 0.001], while underlying diseases (cardiovascular diseases) are a risk factor affecting the success rate of cardiopulmonary resuscitation (OR = 1.190, 95%CI was 1.015-1.395, P = 0.036). CONCLUSIONS: Age, resuscitation start time, ventilation mode, APACHE II score and major underlying diseases (cardiovascular diseases) have a greater impact on the success rate of resuscitation in IHCA patients. The above factors are conducive to improving or formulating more effective rescue strategies for IHCA patients, so as to achieve the purpose of improving the success rate of clinical treatment.

INJURIES AND CPR

No articles identified.

CAUSE OF THE ARREST

1. JACC Clin Electrophysiol. 2023 Aug;9(8 Pt 1):1321-1329. doi: 10.1016/j.jacep.2023.01.010. Epub 2023 Mar 22.
Commotio Cordis in Non-Sport-Related Events: A Systematic Review.
Lee RN(1), Sampaio Rodrigues T(2), Gan JT(1), Han HC(1), Mansour R(1), Sanders P(3), Farouque O(1), Lim HS(4).
ABSTRACT
BACKGROUND: Commotio cordis is an increasingly recognized cause of sudden cardiac death. Although commonly linked with athletes, many events occur in non-sport-related settings. OBJECTIVES: The goal of this study was to characterize and compare non-sport-related vs sport-related commotio cordis. METHODS: PubMed and Embase were searched for all cases of commotio cordis from inception to January 5, 2022. RESULTS: Of 334 commotio cordis cases identified, 121 (36%) occurred in non-sport-related contexts, which included assault (76%), motor vehicle accidents (7%), and daily activities (16%). Projectiles were implicated significantly less in non-sport-related events (5% vs 94%, respectively; P < 0.001). Nonprojectile etiologies in non-sport-related events

mostly consisted of impacts with body parts (79%). Both categories affected similar younger aged demographic (P = 0.10). The proportion of female victims was significantly higher in non-sport-related events (13% vs 2%, respectively; P = 0.025). Mortality was significantly higher in non-sport-related events (88% vs 66%, respectively; P < 0.001). In non-sport-related events, rates of cardiopulmonary resuscitation (27% vs 97%, respectively; P < 0.001) and defibrillation (17% vs 81%, respectively; P < 0.001) were both lower and resuscitation was more commonly delayed beyond 3 min (80% vs 5%, respectively; P < 0.001). CONCLUSIONS: Commotio cordis occurs across a spectrum of non-sport-related settings including assault, motor vehicle accidents, and daily activities. Both categories affected a younger and male-predominant demographic. Mortality is higher in non-sport-related commotio cordis, likely owing to lower rates of cardiopulmonary resuscitation, defibrillation, automated external defibrillator availability, and extended time to resuscitation. Increased awareness of non-sport-related commotio cordis is essential to develop a means of prevention and mortality reduction, with earlier recognition and prompt resuscitation measures.

Sudden Cardiac Death in People With Schizophrenia: Higher Risk, Poorer Resuscitation Profiles, and Differing Pathologies.

Paratz ED(1), van Heusden A(2), Zentner D(3), Morgan N(4), Smith K(5), Thompson T(3), James P(6), Connell V(7), Pflaumer A(8), Semsarian C(9), Ingles J(10), Parsons S(11), Rauchberger I(12), Stub D(13), La Gerche A(14).

ABSTRACT
BACKGROUND: People with schizophrenia account for approximately 1.0% of the population and seem to experience increased rates of sudden cardiac death (SCD). OBJECTIVES: This study sought to determine characteristics of increased SCD in people with schizophrenia. METHODS: The End Unexplained Cardiac Death (EndUCD) prospective state-wide registry compared people aged 15 to 50 years with and without schizophrenia who experienced SCD within a 2-year time period and were referred for forensic evaluation. RESULTS: We identified 579 individuals, of whom 65 (11.2%) had schizophrenia. Patients with schizophrenia were more commonly smokers (46.2% vs 23.0%; P < 0.0001), consumed excess alcohol (32.3% vs 21.4%; P = 0.05), and used QTc-prolonging medications (69.2% vs 17.9%; P < 0.0001). They were less likely to arrest while exercising (0.0% vs 6.4%; P = 0.04). Unfavorable arrest-related factors included lower rates of witnessed arrest (6.2% vs 23.5%; P < 0.0001), more likely to be found in asystole (92.3% vs 73.3%; P < 0.0001), and being more likely to be found as part of a welfare check after a prolonged period of time (median 42 hours vs 12 hours; P = 0.003). There was more frequent evidence of decomposition, and they more commonly underwent autopsy (41.2% vs 26.4%; P = 0.04 and 93.8% vs 82.5%; P = 0.05), with a diagnosis of nonischemic cardiomyopathy being more common (29.2% vs 18.1%; P = 0.04). CONCLUSIONS: People with schizophrenia account for 11% of young SCD patients referred for forensic investigations, exceeding population rates by 11-fold. They have a higher preexisting cardiac risk factor burden, unfavorable resuscitation profiles, and higher rates of nonischemic cardiomyopathy. Strategies targeting biopsychosocial support may deliver not only psychological benefits, but also help to decrease unwitnessed cardiac arrest.

END-TIDAL CO_2

No articles identified.

ORGAN DONATION

1. Circulation. 2023 Aug 8. doi: 10.1161/CIR.0000000000001125. Online ahead of print.
Organ Donation After Out-of-Hospital Cardiac Arrest: A Scientific Statement From the International Liaison Committee on Resuscitation.

Morrison LJ, Sandroni C, Grunau B, Parr M, Macneil F, Perkins GD, Aibiki M, Censullo E, Lin S, Neumar RW, Brooks SC; International Liaison Committee on Resuscitation.

ABSTRACT
AIM OF THE REVIEW: Improving rates of organ donation among patients with out-of-hospital cardiac arrest who do not survive is an opportunity to save countless lives. The objectives of this scientific statement were to do the following: define the opportunity for organ donation among patients with out-of-hospital cardiac arrest; identify challenges and opportunities associated with organ donation by patients with cardiac arrest; identify strategies, including a generic protocol for organ donation after cardiac arrest, to increase the rate and consistency of organ donation from this population; and provide rationale for including organ donation as a key clinical outcome for all future cardiac arrest clinical trials and registries. METHODS: The scope of this International Liaison Committee on Resuscitation scientific statement was approved by the International Liaison Committee on Resuscitation board and the American Heart Association, posted on ILCOR.org for public comment, and then assigned by section to primary and secondary authors. A unique literature search was completed and updated for each section. RESULTS: There are a number of defining pathways for patients with out-of-hospital cardiac arrest to become organ donors; however, modifications in the Maastricht classification system need to be made to correctly identify these donors and to report outcomes with consistency. Suggested modifications to the minimum data set for reporting cardiac arrests will increase reporting of organ donation as an important resuscitation outcome. There are a number of challenges with implementing uncontrolled donation after cardiac death protocols, and the greatest impediment is the lack of legislation in most countries to mandate organ donation as the default option. Extracorporeal cardiopulmonary resuscitation has the potential to increase organ donation rates, but more research is needed to derive neuroprognostication rules to guide clinical decision-making about when to stop extracorporeal cardiopulmonary resuscitation and to evaluate cost-effectiveness. CONCLUSIONS: All health systems should develop, implement, and evaluate protocols designed to optimize organ donation opportunities for patients who have an out-of-hospital cardiac arrest and failed attempts at resuscitation.

2. Resuscitation. 2023 Aug 3:109864. doi: 10.1016/j.resuscitation.2023.109864. Online ahead of print.
Organ Donation After Out-of-Hospital Cardiac Arrest: A Scientific Statement From the International Liaison Committee on Resuscitation.

Morrison LJ, Sandroni C, Grunau B, Parr M, Macneil F, Perkins GD, Aibiki M, Censullo E, Lin S, Neumar RW, Brooks SC; International Liaison Committee on Resuscitation.

ABSTRACT
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Resuscitation scientific statement was approved by the International Liaison Committee on Resuscitation board and the American Heart Association, posted on ILCOR.org for public comment, and then assigned by section to primary and secondary authors. A unique literature search was completed and updated for each section. RESULTS: There are a number of defining pathways for patients with out-of-hospital cardiac arrest to become organ donors; however, modifications in the Maastricht classification system need to be made to correctly identify these donors and to report outcomes with consistency. Suggested modifications to the minimum data set for reporting cardiac arrests will increase reporting of organ donation as an important resuscitation outcome. There are a number of challenges with implementing uncontrolled donation after cardiac death protocols, and the greatest impediment is the lack of legislation in most countries to mandate organ donation as the default option. Extracorporeal cardiopulmonary resuscitation has the potential to increase organ donation rates, but more research is needed to derive neuroprognostication rules to guide clinical decision-making about when to stop extracorporeal cardiopulmonary resuscitation and to evaluate cost-effectiveness. CONCLUSIONS: All health systems should develop, implement, and evaluate protocols designed to optimise organ donation opportunities for patients who have an out-of-hospital cardiac arrest and failed attempts at resuscitation.

FEEDBACK

No articles identified.

DRUGS

1. Resuscitation. 2023 Aug 8:109933. doi: 10.1016/j.resuscitation.2023.109933. Online ahead of print.

Efficacy of Emergency Department Calcium Administration in Cardiac Arrest: A 9-year Retrospective Evaluation.

Dillon DG(1), Wang RC(2), Shetty P(3), Douchee J(4), Rodriguez RM(2), Carlos C Montoy J(2).

ABSTRACT

BACKGROUND: The efficacy of empiric calcium for patients with undifferentiated cardiac arrest has come under increased scrutiny, including a randomized controlled trial that was stopped early due to a trend towards harm with calcium administration. However, small sample sizes and non-significant findings have hindered precise effect estimates. In this analysis we evaluate the association of calcium administration with survival in a large retrospective cohort of patients with cardiac arrest treated in the emergency department (ED). METHODS: We conducted a retrospective review of medical records from two academic hospitals (one quaternary care center, one county trauma center) in San Francisco between 2011-2019. Inclusion criteria were patients aged greater than or equal to 18 years old who received treatment for cardiac arrest during their ED course. Our primary exposure was the administration of calcium while in the ED and the main outcome was survival to hospital admission. The association between calcium and survival to admission was estimated using a multivariable log-binomial regression, and also with two propensity score models. RESULTS: We examined 781 patients with cardiac arrest treated in San Francisco EDs between 2011-2019 and found that calcium administration was associated with decreased survival to hospital admission (RR 0.74; 95% CI 0.66 - 0.82). These findings remained significant after adjustment for patient age, sex, whether the cardiac arrest was witnessed, and including an interaction term for shockable cardiac rhythms (RR 0.60; 95% CI 0.50 - 0.72) and non-shockable cardiac rhythms (RR 0.87; 95% CI 0.76 - 0.99). Risk ratios for the association between calcium and survival to hospital

admission were also similar between two propensity score-based models: nearest neighbor propensity matching model (RR 0.79; 95% CI 0.68 - 0.89) and inverse propensity weighted regression adjustment model (RR 0.75; 95% CI 0.67 - 0.84). CONCLUSIONS: Calcium administration as part of ED-directed treatment for cardiac arrest was associated with lower survival to hospital admission. Given the lack of statistically significant outcomes from smaller, more methodologically robust evaluations on this topic, we believe these findings have an important role to serve in confirming previous results and allowing for more precise effect estimates. Our data adds to the growing body evidence against the empiric use of calcium in cardiac arrest.

Epinephrine in Out-of-Hospital Cardiac Arrest: A Network Meta-analysis and Subgroup Analyses of Shockable and Nonshockable Rhythms.
Fernando SM(1), Mathew R(2), Sadeghirad B(3), Rochwerg B(4), Hibbert B(5), Munshi L(6), Fan E(7), Brodie D(8), Di Santo P(9), Tran A(10), McLeod SL(11), Vaillancourt C(12), Cheskes S(13), Ferguson ND(7), Scales DC(14), Lin S(15), Sandroni C(16), Soar J(17), Dorian P(18), Perkins GD(19), Nolan JP(20).
ABSTRACT
BACKGROUND: Epinephrine is the most commonly used drug in out-of-hospital cardiac arrest (OHCA) resuscitation, but evidence supporting its efficacy is mixed. RESEARCH QUESTION: What are the comparative efficacy and safety of standard dose epinephrine, high-dose epinephrine, epinephrine plus vasopressin, and placebo or no treatment in improving outcomes after OHCA? STUDY DESIGN AND METHODS: In this systematic review and network meta-analysis of randomized controlled trials, we searched six databases from inception through June 2022 for randomized controlled trials evaluating epinephrine use during OHCA resuscitation. We performed frequentist random-effects network meta-analysis and present ORs and 95% CIs. We used the the Grading of Recommendations, Assessment, Development, and Evaluation approach to rate the certainty of evidence. Outcomes included return of spontaneous circulation (ROSC), survival to hospital admission, survival to discharge, and survival with good functional outcome. RESULTS: We included 18 trials (21,594 patients). Compared with placebo or no treatment, high-dose epinephrine (OR, 4.27; 95% CI, 3.68-4.97), standard-dose epinephrine (OR, 3.69; 95% CI, 3.32-4.10), and epinephrine plus vasopressin (OR, 3.54; 95% CI, 2.94-4.26) all increased ROSC. High-dose epinephrine (OR, 3.53; 95% CI, 2.97-4.20), standard-dose epinephrine (OR, 3.00; 95% CI, 2.66-3.38), and epinephrine plus vasopressin (OR, 2.79; 95% CI, 2.27-3.44) all increased survival to hospital admission as compared with placebo or no treatment. However, none of these agents may increase survival to discharge or survival with good functional outcome as compared with placebo or no treatment. Compared with placebo or no treatment, standard-dose epinephrine improved survival to discharge among patients with nonshockable rhythm (OR, 2.10; 95% CI, 1.21-3.63), but not in those with shockable rhythm (OR, 0.85; 95% CI, 0.39-1.85). INTERPRETATION: Use of standard-dose epinephrine, high-dose epinephrine, and epinephrine plus vasopressin increases ROSC and survival to hospital admission, but may not improve survival to discharge or functional outcome. Standard-dose epinephrine improved survival to discharge among patients with nonshockable rhythm, but not those with shockable rhythm.

TRAUMA

Development of a prediction model for emergency medical service witnessed traumatic out-of-hospital cardiac arrest: A multicenter cohort study.

Wang SA(1), Chang CJ(1), Do Shin S(2), Chu SE(1), Huang CY(1), Hsu LM(3), Lin HY(4), Hong KJ(2), Jamaluddin SF(5), Son DN(6), Ramakrishnan TV(7), Chiang WC(8), Sun JT(9), Huei-Ming Ma M(10); PATOS Clinical Research Network.

ABSTRACT

BACKGROUND/PURPOSE: To develop a prediction model for emergency medical technicians (EMTs) to identify trauma patients at high risk of deterioration to emergency medical service (EMS)-witnessed traumatic cardiac arrest (TCA) on the scene or en route. METHODS: We developed a prediction model using the classical cross-validation method from the Pan-Asia Trauma Outcomes Study (PATOS) database from 1 January 2015 to 31 December 2020. Eligible patients aged ≥18 years were transported to the hospital by the EMS. The primary outcome (EMS-witnessed TCA) was defined based on changes in vital signs measured on the scene or en route. We included variables that were immediately measurable as potential predictors when EMTs arrived. An integer point value system was built using multivariable logistic regression. The area under the receiver operating characteristic (AUROC) curve and Hosmer-Lemeshow (HL) test were used to examine discrimination and calibration in the derivation and validation cohorts. RESULTS: In total, 74,844 patients were eligible for database review. The model comprised five prehospital predictors: age <40 years, systolic blood pressure <100 mmHg, respiration rate >20/minute, pulse oximetry <94%, and levels of consciousness to pain or unresponsiveness. The AUROC in the derivation and validation cohorts was 0.767 and 0.782, respectively. The HL test revealed good calibration of the model (p = 0.906). CONCLUSION: We established a prediction model using variables from the PATOS database and measured them immediately after EMS personnel arrived to predict EMS-witnessed TCA. The model allows prehospital medical personnel to focus on high-risk patients and promptly administer optimal treatment.

VENTILATION

No articles identified.

CERERBRAL MONITORING

No articles identified.

ULTRASOUND AND CPR

Point of Care Ultrasonographic Life Support in Emergency (PULSE)-a quasi-experimental study.
Ali N(1), Chhotani AA(2), Iqbal SP(3), Soomar SM(2), Raheem A(2), Waheed S(2).

ABSTRACT

BACKGROUND: Many physicians use point-of-care ultrasound (PoCUS) in their clinical practice to improve their diagnostic capabilities, accuracy, and timeliness. Over the last two decades, the use of PoCUS in the emergency room has dramatically increased. This study aimed to determine emergency physicians' retention of knowledge and skills after a brief training workshop on a focused ultrasound-guided approach to a patient presenting with undifferentiated shock, shortness of breath, and cardiac arrest in the emergency department of a tertiary care hospital. The secondary

aim was to deliver the PoCUS-guided algorithmic approach to manage a patient presenting with undifferentiated shock, respiratory distress, and cardiac arrest in the emergency department. METHODS: A quasi-experimental study was conducted with a single-day Point of Care Ultrasonographic Life Support in Emergency (PULSE) training workshop in October 2021 at the Aga Khan University Hospital, Karachi, Pakistan. A total of 32 participants attended the course, including twenty-one junior residents (PGY 1 and 2) and medical officers with experience of fewer than two years working in different emergency departments of urban tertiary care hospitals across Karachi, Pakistan. Pre- and post-assessment tools comprised a written examination, evaluating participants' knowledge and skills in ultrasound image acquisition and interpretation. Cronbach's alpha was used to calculate the validity of the tool. Results obtained before and after the training session were compared by the McNemar's test. A p value of ≤ 0.05 was considered significant. RESULTS: There was a significant improvement in response to each question pre to post-test after completion of the course (Table 1). The significant change can be seen in questions 7, 8, 13, and 15, with a percentage change of 33.3, 80.9, 42.9, and 47.7. There was a significant improvement in the understanding and knowledge of participants after the training. The scores in the post-test were high compared to the pre-test in each category, i.e., respiratory distress ($p < 0.017$), cardiac arrest ($p < 0.041$), basic ultrasound knowledge ($p < 0.001$), and undifferentiated shock ($p < 0.001$). CONCLUSION: All participants showed improvement in their knowledge and confidence regarding using PoCUS in life-threatening conditions. Through this study, we have also developed an algorithmic approach to managing undifferentiated shock, respiratory failure, and cardiac arrest. Future studies must assess the effectiveness and feasibility of incorporating these algorithms into clinical practice.

ORGANISATION AND TRAINING

Effect of a national awareness campaign on ambulance attendances for chest pain and out-of-hospital cardiac arrest.
Nehme Z(1), Cameron P(2), Nehme E(3), Finn J(4), Bosley E(5), Brink D(6), Ball S(6), Doan TN(7), Bray JE(8).

ABSTRACT
AIM: Awareness of heart attack symptoms may enhance health-seeking behaviour and prevent premature deaths from out-of-hospital cardiac arrest (OHCA). We sought to investigate the impact of a national awareness campaign on emergency medical service (EMS) attendances for chest pain and OHCA. METHODS: Between January 2005 and December 2017, we included registry data for 97,860 EMS-attended OHCA cases from 3 Australian regions and dispatch data for 1,631,217 EMS attendances for chest pain across 5 Australian regions. Regions were exposed to between 11 and 28 months of television, radio, and print media activity. Multivariable negative binomial models were used to explore the effect of campaign activity on the monthly incidence of EMS attendances for chest pain and OHCA. RESULTS: Months with campaign activity were associated with an 8.8% (IRR 1.09, 95% CI: 1.07, 1.11) increase in the incidence of EMS attendances for chest pain and a 5.6% (IRR 0.94, 95% CI: 0.92, 0.97) reduction in OHCA attendances. Larger intervention effects were associated with increasing months of campaign activity, increasing monthly media spending and media exposure in 2013. In stratified analyses of OHCA cases, the largest reduction in incidence during campaign months was observed for unwitnessed arrests (IRR 0.93, 95% CI: 0.90, 0.96), initial non-shockable arrests (IRR 0.93, 95% CI: 0.90, 0.97) and arrests occurring in private residences (IRR 0.95, 95% CI: 0.91, 0.98). CONCLUSION: A national awareness campaign targeting knowledge of heart

attack symptoms was associated with an increase in EMS use for chest pain and a reduction in OHCA incidence and may serve as an effective primary prevention strategy for OHCA.

The availability and delivery of culturally responsive Australian Aboriginal infant resuscitation education programmes: a structured literature review.
Stephens N(1), Nilson C(1), Reibel T(2), Marriott R(2).
ABSTRACT
AIM: To critically appraise the literature to determine availability and identify the cultural responsiveness of infant resuscitation education for Aboriginal and Torres Strait Islander populations. BACKGROUND: Despite overall reductions in infant mortality in the last two decades, Aboriginal people have some of the highest rates of infant mortality of any developed nation. One of the key factors that has attributed to improvements in infant mortality rates is parent and carer education around risk factors and actions of first responders. Identifying gaps in the current basic first-aid initiatives available to Aboriginal communities may contribute to developing resources to contribute to reductions in Aboriginal neonatal mortality rates. METHOD: The review used key terms and Boolean operators across an 11-month time frame searching for research articles utilising the databases of CINAHL, Scopus, Ovid Emcare, Informit, Pubmed and Proquest. After review, 39 articles met the inclusion criteria, 25 articles were discarded due to irrelevant material and 14 articles were included in the structured literature review. The search process was developed using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines. Articles were assessed for validity and inclusion using the Critical Appraisal Skills Program checklist. RESULTS: Research literature relating to First Nation community-based CPR and first-aid education programmes in Canada, USA, India, UK and Europe, Asia and Africa were identified; however, none pertaining specifically to CPR and first-aid education in Australian Aboriginal communities were found. DISCUSSION: Despite the lack of research evidence relating to infant cardiopulmonary resuscitation (CPR) education for Australian Aboriginal populations, the reviewed studies noted the importance of culturally responsive education designed in collaboration with First Nation peoples, using novel ways of teaching CPR, that align with the language, culture and needs of the communities it is intended for. CONCLUSION: Further research is required to create a framework for the delivery of culturally responsive infant resuscitation education for Australian Aboriginal parents and communities.

Can drones save lives and money? An economic evaluation of airborne delivery of automated external defibrillators.
Röper JWA(1), Fischer K(2), Baumgarten MC(3), Thies KC(4), Hahnenkamp K(3), Fleßa S(2).
ABSTRACT
BACKGROUND: Out-of-hospital cardiac arrest is one of the most frequent causes of death in Europe. Emergency medical services often struggle to reach the patient in time, particularly in rural areas. To improve outcome, early defibrillation is required which significantly increases neurologically intact survival. Consequently, many countries place Automated External Defibrillators (AED) in accessible public locations. However, these stationary devices are frequently not available out of hours or too far away in emergencies. An innovative approach to mustering AED is the use of unmanned aerial systems (UAS), which deliver the device to the scene. METHODS: This paper evaluates the economic implications of stationary AED versus airborne delivery using scenario-based cost analysis. As an example, we focus on the rural district of Vorpommern-Greifswald in Germany. Formulae are developed to calculate the cost of stationary and airborne AED networks. Scenarios include different

catchment areas, delivery times and unit costs. RESULTS: UAS-based delivery of AEDs is more cost-efficient than maintaining traditional stationary networks. The results show that equipping cardiac arrest hot spots in the district of Vorpommern-Greifswald with airborne AEDs with a response time < 4 min is an effective method to decrease the time to the first defibrillation The district of Vorpommern-Greifswald would require 45 airborne AEDs resulting in annual costs of at least 1,451,160 €. CONCLUSION: In rural areas, implementing an UAS-based AED system is both more effective and cost-efficient than the conventional stationary solution. When regarding urban areas and hot spots of OHCA, complementing the airborne network with stationary AEDs is advisable.

A Cross-Sectional Study Investigating the Knowledge and Attitude of Health Professions Students in Saudi Arabia: Are They Ready for Cardiopulmonary Resuscitation?
Awawdeh M(1), Alanzi AM(2), Alhasoun M(2), Babtain A(2), Alshahrani N(2), Alhamdan A(2), Almutairi N(2), Oteir A(3), Almhdawi K(4).
ABSTRACT
INTRODUCTION: Cardiopulmonary resuscitation (CPR) training is important for students of health professions to learn and be prepared to perform. Colleges have a responsibility to provide adequate training for their students to ensure that they are ready and confident to deal with life-threatening situations. However, studies have shown that some graduates and practitioners lack sufficient knowledge in performing CPR. The aim of this study is to assess the knowledge of health professions students in the Kingdom of Saudi Arabia (KSA) who have started clinical practice. Methodology: This cross-sectional study was conducted in February 2022 and included health professions students in all academic years, including interns and residents, across colleges of King Saud bin Abdulaziz University for Health Sciences, Riyadh, KSA. The study questionnaire consisted of three sections: attitudes, knowledge, and demographics. The attitudes section included 11 questions, while the knowledge section included 10. The demographic section included university level, Grade Point Average (GPA), CPR training status, willingness to learn CPR, witnessing CPR, and family history of cardiac disease. Statistical analysis was conducted using chi-squared tests, t-tests, two-sample proportion tests, ANOVA, and bivariate correlation analyses. RESULTS: The mean age of the participants was 21.2 (±1.9) years. Participants had a mean knowledge score of 5.1 (±1.8) out of 10 potential points. Also, the participants had a total attitude score of 42.7 (±6.2) out of 55 potential points. CONCLUSION: The study highlights the importance of CPR training for healthcare providers and the need for ongoing training to maintain knowledge and skills. The results suggest that attitudes towards providing CPR may be influenced by cultural beliefs and fear of liability or disease transmission. Higher participant GPA and positive attitudes towards chest compressions and CPR training were found to be associated with increased knowledge.

Delayed arrival of advanced life support adversely affects the neurological outcome in a multi-tier emergency response system.
Yang HC(1), Park SM(2), Lee KJ(3), Jo YH(2), Kim YJ(2), Lee DK(4), Jang DH(5).
ABSTRACT
AIM: Prehospital management of out-of-hospital cardiac arrest (OHCA) is based on basic life support, with the addition of advanced life support (ALS) if possible. This study aimed to investigate the effect of delayed arrival of ALS on neurological outcomes of patients with OHCA at hospital discharge. METHODS: This was a retrospective study of a registry of patients with OHCA. A multi-tier emergency response system was established in the study area. ALS was initiated when the second-arrival team arrived at the scene. A restricted cubic spline curve was used to investigate the

relationship between the response time interval of the second-arrival team and neurological outcomes at hospital discharge. Multivariable logistic regression analysis was performed to assess the independent association between the response time interval of the second-arrival team and neurological outcomes of patients at hospital discharge. RESULTS: A total of 3186 adult OHCA patients who received ALS at the scene were included in the final analysis. A restricted cubic spline curve showed that a long response time interval of the second-arrival team was correlated with a high likelihood of poor neurological outcomes. Meanwhile, multivariable logistic regression analysis showed that a long response time interval of the second-arrival team was independently associated with poor neurological outcomes (odds ratio, 1.10; 95% confidence interval, 1.03-1.17). CONCLUSION: In a multi-tiered prehospital emergency response system, the delayed arrival of ALS was associated with poor neurological outcomes at hospital discharge.

Integrative virtual nursing simulation in teaching cardiopulmonary resuscitation: A blended learning approach.
Li Y(1), Lv Y(2), Dorol RD(3), Wu J(2), Ma A(4), Liu Q(2), Zhang J(2).
ABSTRACT
BACKGROUND: Online learning resources facilitated educational development during the COVID-19 pandemic. This study focuses on the integration of online virtual simulation with interactive exercises and offline low-fidelity simulation for the first time to explore the impact on CPR skills. METHODS: First year nursing students from a medical college participated as volunteers in this study. They were divided randomly into two groups with both having a cardiopulmonary resuscitation (CPR) lesson with the same timings and objectives. The experimental group (n = 36) adopted a blended learning method, with virtual simulation and low-fidelity simulation as resources; the control group (n = 36) used the same method without virtual simulation. The same lecturers taught both classes. Students' self-directed learning (SDL) and critical thinking skills were assessed before and after the intervention and their CPR skills were examined afterward. RESULTS: The experimental group exhibited significantly greater improvement in their SDL abilities and CPR skills. By contrast, we found no statistical differences in their critical thinking abilities. CONCLUSIONS: During CPR training, blended learning method was used to integrate virtual nursing simulation in teaching, which effectively improved students' SDL and CPR skills.

Knowledge and willingness of schoolteachers in Jordan to perform CPR: a cross-sectional study.
Alwidyan MT(1), Alkhatib ZI(2), Alrawashdeh A(2), Oteir AO(2)(3), Khasawneh EA(2), Alqudah Z(2)(3), Albataineh SA(2), Abukheat Y(2).
ABSTRACT
OBJECTIVES: This study aimed to assess the cardiopulmonary resuscitation (CPR) knowledge and willingness of schoolteachers in Jordan. DESIGN: This was a cross-sectional study conducted using an online questionnaire. SETTING: For inclusion in this study, schoolteachers must be currently teaching at any level in schools across the country. Responses were collected from 1 April 2021 to 30 April 2021. PARTICIPANTS: All schoolteachers actively working in public or private schools were included in our study. PRIMARY AND SECONDARY OUTCOME MEASURES: Continuous variables were summarised as means and SD, whereas categorical variables were reported as frequencies and percentages (%). A χ^2 test for independence, independent sample t-tests and analysis of variance were used appropriately. A p-value less than 0.05 was used to determine statistical significance. RESULTS: A total of 385 questionnaires were eligible for analyses. Only 14.5% of the participants

received CPR training and overall correct knowledge answers were 18.8% of the total score. Those participants with previous CPR training had higher mean knowledge scores (2.34 vs 1.15, p<0.001). Trained participants were also more likely to provide hands-only CPR to various patient groups than untrained participants (p<0.05). Participants were more willing to provide standard CPR to family members than hands-only CPR (p<0.001), but more willing to provide hands-only CPR to friends (p<0.001), students (75.1% vs 58.2%, p<0.001), neighbour (p<0.001), stranger (p=0.001) and patient from the opposite gender (p<0.001). CONCLUSIONS: Schoolteachers in Jordan possess limited knowledge of CPR. However, the study participants showed a positive attitude towards performing CPR. The study revealed that they were more inclined to provide hands-only CPR than standard CPR. Policymakers and public health officials can take advantage of these findings to incorporate CPR training programmes for schoolteachers, either as a part of their undergraduate studies or as continuing education programmes with an emphasis on hands-only CPR.

POST-CARDIAC ARREST TREATMENTS

1. Nutrients. 2023 Aug 4;15(15):3462. doi: 10.3390/nu15153462.
The Impact of Body Mass Index on In-Hospital Mortality in Post-Cardiac-Arrest Patients-Does Sex Matter?
Czapla M(1)(2), Kwaśny A(3), Słoma-Krześlak M(4), Juárez-Vela R(2), Karniej P(2)(5), Janczak S(6), Mickiewicz A(1), Uchmanowicz B(7), Zieliński S(8), Zielińska M(8).
ABSTRACT
BACKGROUND: A number of factors influence mortality in post-cardiac-arrest (CA) patients, nutritional status being one of them. The aim of this study was to assess whether there are sex differences in the prognostic impact of BMI, as calculated on admission to an intensive care unit, on in-hospital mortality in sudden cardiac arrest (SCA) survivors. METHODS: We carried out a retrospective analysis of data of 129 post-cardiac-arrest patients with return of spontaneous circulation (ROSC) admitted to the Intensive Care Unit (ICU) of the University Teaching Hospital in Wrocław between 2017 and 2022. RESULTS: Female patients were significantly older than male patients (68.62 ± 14.77 vs. 62.7 ± 13.95). The results of univariable logistic regression analysis showed that BMI was not associated with the odds of in-hospital death in either male or female patients. In an age-adjusted model, age was an independent predictor of the odds of in-hospital death only in male patients (OR = 1.034). In our final multiple logistic regression model, adjusted for the remaining variables, none of the traits analysed were a significant independent predictor of the odds of in-hospital death in female patients, whereas an initial rhythm of ventricular fibrillation or pulseless ventricular tachycardia (VF/pVT) was an independent predictor of the odds of in-hospital death in male patients (OR = 0.247). CONCLUSIONS: BMI on admission to ICU is not a predictor of the odds of in-hospital death in either male or female SCA survivors.

2. Diagnostics (Basel). 2023 Jul 28;13(15):2522. doi: 10.3390/diagnostics13152522.
Association of B-Type Natriuretic Peptide Level with Clinical Outcome in Out-of-Hospital Cardiac Arrest in Emergency Department Patients.
Hong H(1), Kim J(1), Min H(2), Kim YW(1), Kim TY(1).
ABSTRACT
OBJECTIVES: B-type natriuretic peptide (BNP) is used for outcome assessment of various diseases. We designed this study to investigate whether BNP, which has been proven useful in the risk stratification of sudden cardiac arrest (SCA) of cardiac etiology, can also prove to be a valuable prognostic tool for SCA also included with non-cardiac etiology. In this study, we aim to investigate the relationship between measured BNP levels and clinical outcomes in SCA, regardless of the cause of SCA. METHODS: This retrospective multicenter observational study was performed in two tertiary university hospitals and one general hospital between January 2015 and December 2020. The total

number of SCA patients was 1625. The patients with out-of-hospital cardiac arrest over 19 years old and acquired laboratory data, including BNP at emergency department (ED) arrival, were included. BNP was measured during advanced Cardiovascular Life Support (ACLS). The exclusion criteria were age under 18 years, traumatic arrest, and without BNP. RESULTS: The median BNP was 171.8 (range; 5-5000) pg/mL in the return of Spontaneous Circulation (ROSC), higher than No-ROSC (p = 0.007). The median BNP concentration was 99.7 (range; 5-3040.68) pg/mL in the survival to discharge, which was significantly lower than the death group (p = 0.012). The odds ratio of survival to discharge decreased proportionally to the BNP level. The odds ratio of neurologic outcome was not correlated with the BNP level. CONCLUSION: In patients with SCA of all origins, low BNP concentration measured during ACLS correlated with an increased ratio of survival to discharge. However, BNP measured during ACLS was not found to be an independent factor.

Saline versus Plasma Solution-A in Initial Resuscitation of Patients with Out-of-Hospital Cardiac Arrest: A Randomized Clinical Trial.
Woo JH(1), Lim YS(1), Cho JS(1), Yang HJ(1), Jang JH(1), Choi JY(1), Choi WS(1).
ABSTRACT
BACKGROUND: Although saline is commonly used during cardiopulmonary resuscitation (CPR) or post-cardiac arrest care, it has detrimental effects. This trial aimed to evaluate the efficacy of a balanced crystalloid solution (Plasma Solution-A [PS]) in out-of-hospital cardiac arrest (OHCA) patients and compare it with the efficacy of saline. METHODS: A randomized, unblinded clinical trial was conducted using PS and saline for intravenous fluid administration during CPR and post-cardiac arrest care of non-traumatic OHCA patients admitted to the emergency department of a tertiary university hospital. Patients received saline (saline group) or PS (PS group) within 24 h of hospital arrival. The primary outcomes were changes in arterial pH, bicarbonate, base excess (BE), and chloride levels within 24 h. The secondary outcomes were clinical outcomes including mortality. RESULTS: Of the 364 patients, data from 27 and 26 patients in the saline and PS groups, respectively, were analyzed. Analysis using a linear mixed model revealed a significant difference in BE change over time between the groups (treatment-by-time p = 0.044). Increase in BE and bicarbonate levels from 30 min to 2 h was significantly greater (p = 0.044 and p = 0.024, respectively) and the incidence of hyperchloremia was lower (p < 0.001) in the PS group than in the saline group. However, there was no difference in clinical outcomes. CONCLUSION: Use of PS for resuscitation resulted in a faster improvement in BE and bicarbonate, especially in the early phase of post-cardiac arrest care, and lower hyperchloremia incidence than the use of saline, without differences in clinical outcomes, in OHCA patients.

Coronary Angiography After Out-of-Hospital Cardiac Arrest Without ST-Segment Elevation: One-Year Outcomes of a Randomized Clinical Trial.
Desch S(1)(2)(3)(4), Freund A(1)(2)(4), Akin I(4)(5), Behnes M(4)(5), Preusch MR(4)(6), Zelniker TA(4)(6)(7), Skurk C(4)(8), Landmesser U(4)(8), Graf T(3)(4), Eitel I(3)(4), Fuernau G(9), Haake H(10), Nordbeck P(11), Hammer F(4)(12), Felix SB(4)(12), Hassager C(13)(14), Kjærgaard J(13)(14), Fichtlscherer S(4)(15), Ledwoch J(4)(16), Lenk K(17), Joner M(4)(18), Steiner S(19), Liebetrau C(4)(20), Voigt I(21)(22), Zeymer U(23), Brand M(24), Schmitz R(25), Horstkotte J(26), Jacobshagen C(4)(27)(28), Pöss J(1), Abdel-Wahab M(1), Lurz P(1), Jobs A(1)(2)(3)(4), de Waha S(29), Olbrich D(4)(30), Sandig F(4)(31), König IR(4)(31), Brett S(4)(30), Vens M(4)(31), Klinge K(4)(30), Thiele H(1)(2); TOMAHAWK Investigators.
ABSTRACT
IMPORTANCE: Myocardial infarction is a frequent cause of out-of-hospital cardiac arrest (OHCA). The long-term effect of early coronary angiography on patients with OHCA with possible coronary trigger but no ST-segment elevation remains unclear. OBJECTIVE: To compare the clinical outcomes of early

unselective angiography with the clinical outcomes of a delayed or selective approach for successfully resuscitated patients with OHCA of presumed cardiac origin without ST-segment elevation at 1-year follow-up. DESIGN, SETTING, AND PARTICIPANTS: The TOMAHAWK trial was a multicenter, international (Germany and Denmark), investigator-initiated, open-label, randomized clinical trial enrolling 554 patients between November 23, 2016, to September 20, 2019. Patients with stable return of spontaneous circulation after OHCA of presumed cardiac origin but without ST-segment elevation on the postresuscitation electrocardiogram were eligible for inclusion. A total of 554 patients were randomized to either immediate coronary angiography after hospital admission or an initial intensive care assessment with delayed or selective angiography after a minimum of 24 hours. All 554 patients were included in survival analyses during the follow-up period of 1 year. Secondary clinical outcomes were assessed only for participants alive at 1 year to account for the competing risk of death. INTERVENTIONS: Early vs delayed or selective coronary angiography and revascularization if indicated. MAIN OUTCOMES AND MEASURES: Evaluations in this secondary analysis included all-cause mortality after 1 year, as well as severe neurologic deficit, myocardial infarction, and rehospitalization for congestive heart failure in survivors at 1 year. RESULTS: A total of 281 patients were randomized to the immediate angiography group and 273 to the delayed or selective group, with a median age of 70 years (IQR, 60-78 years). A total of 369 of 530 patients (69.6%) were male, and 268 of 483 patients (55.5%) had a shockable arrest rhythm. At 1 year, all-cause mortality was 60.8% (161 of 265) in the immediate angiography group and 54.3% (144 of 265) in the delayed or selective angiography group without significant difference between the treatment strategies, trending toward an increase in mortality with immediate angiography (hazard ratio, 1.25; 95% CI, 0.99-1.57; P = .05). For patients surviving until 1 year, the rates of severe neurologic deficit, myocardial infarction, and rehospitalization for congestive heart failure were similar between the groups. CONCLUSIONS AND RELEVANCE: This study found that a strategy of immediate coronary angiography does not provide clinical benefit compared with a delayed or selective invasive approach for patients 1 year after resuscitated OHCA of presumed coronary cause and without ST-segment elevation.

Sex differences in symptoms of anxiety, depression, post-traumatic stress disorder and cognitive function among survivors of Out-of-Hospital Cardiac Arrest.
Grand J(1)(2), Fuglsbjerg C(1), Borregaard B(3)(4)(5), Wagner MK(1), Kragh AR(1), Bekker-Jensen D(3), Mikkelsen AD(1), Møller JE(1)(3), Glud H(1), Hassager C(1), Kikkenborg S(1), Kjaergaard J(1)(6).
ABSTRACT
BACKGROUND: Anxiety, depression, and post-traumatic stress disorder (PTSD) among out-of-hospital cardiac arrest (OHCA) survivors may impact long-term recovery. Coping and perception of symptoms may vary between sexes. The aim was to explore sex-differences in psychological consequences following OHCA. METHODS: Prospective observational study of OHCA survivors that attended structured three-month follow-up. Symptoms of anxiety/depression was measured using Hospital Anxiety and Depression Scale (HADS), range 0-21, with a cut-off score of ≥8 for significant symptoms. PTSD were measured with the PTSD Checklist for DSM-5 (PCL-5), range 0-80. A score of ≥33 indicated PTSD-symptoms. Cognitive function was assessed by Montreal Cognitive Assessment. RESULTS: From 2016-2021, 381 consecutive comatose OHCA survivors were invited. Of these, 288 patients (76%) participated in the follow-up visit (53 (18%) females, out of 80 survivors and 235 (82%) out of 300 alive at follow-up (78%). Significant symptoms of anxiety were present in 47 (20%) males and 19 (36%) females, p=0.01. Significant symptoms of PTSD were present in 30% of males and 55% of females, p=0.01. Adjusting for prespecified covariates using multivariable logistic regression, the female sex as significantly associated with anxiety (odds ratio: 2.18, confidence interval: 1.09-4.38, p=0.03). This difference was especially pronounced among young females (below median age, odds ratioadjusted 3.31 CI 1.32-8.29, p=0.01), compared to young males. No sex-

significant difference was observed for depression or cognitive function. CONCLUSIONS: Symptoms of anxiety and PTSD are frequent in OHCA survivors, and female survivors report significantly more symptoms of anxiety, and PTSD compared to males. Especially, young females were significantly more symptomatic than young males.

TARGETED TEMPERATURE MANAGEMENT

Implementing a Stepwise Shivering Protocol During Targeted Temperature Management.
Bock CA(1), Medford WG(1)(2), Coughlin E(3), Mhaskar R(4), Sunjic KM(1)(5).
ABSTRACT
Background: Shivering is often encountered in patients undergoing targeted temperature management (TTM) after cardiac arrest. The most efficient, safe way to prevent shivering during TTM is not clearly defined. Objective: The purpose of this study was to evaluate the impact of shivering management using a stepwise shivering protocol on time to target temperature (TT), medication utilization and nursing confidence. Methods: Single-center, retrospective chart review of all post-cardiac arrest patients who underwent TTM between 2016 and 2021. The primary outcome is a comparison of time to TT pre- and post-protocol implementation. Secondary objectives compared nursing confidence and medication utilization pre- and post-shivering protocol implementation. Results: Fifty-seven patients were included in the pre-protocol group and thirty-seven were in the post-protocol group. The median (IQR) time to TT was 195 (250) minutes and 165 (170), respectively (p = 0.190). The average doses of acetaminophen was 285 mg pre- vs 1994 mg post- (p <0.001, buspirone 47 mg pre- vs 127 mg post- (p < 0.001), magnesium 0.9 g pre-vs 2.8 g post- (p < 0.001), and fentanyl 1564 mcg pre- vs 2286 mcg post- (p=0.023). No difference was seen for midazolam and cisatracurium. Nurses reported feeling confident with his/her ability to manage shivering during TTM 38.5% of the time pre-protocol compared to 60% post-protocol (p = 0.306). Conclusion: Implementation of a stepwise approach to prevent and treat shivering improved time to TT in our institution, although this finding was not statistically significant. The stepwise protocol supported a reduced amount of high-risk medication use and increased nursing confidence in shivering management.

Effects of Hypothermia vs Normothermia on Societal Participation and Cognitive Function at 6 Months in Survivors After Out-of-Hospital Cardiac Arrest: A Predefined Analysis of the TTM2 Randomized Clinical Trial.
Lilja G(1), Ullén S(1), Dankiewicz J(2), Friberg H(3), Levin H(3), Nordström EB(4), Heimburg K(4), Jakobsen JC(5)(6), Ahlqvist M(7), Bass F(8)(9), Belohlavek J(10), Olsen RB(11), Cariou A(12), Eastwood G(13), Fanebust HR(14), Grejs AM(15), Grimmer L(16), Hammond NE(8)(9), Hovdenes J(17), Hrecko J(18), Iten M(19), Johansen H(20), Keeble TR(21)(22), Kirkegaard H(23), Lascarrou JB(24), Leithner C(25), Lesona ME(26), Levis A(19)(27), Mion M(21)(22), Moseby-Knappe M(4), Navarra L(28), Nordberg P(29)(30), Pelosi P(31)(32), Quayle R(33)(34), Rylander C(35), Sandberg H(36), Saxena M(37), Schrag C(38), Siranec M(10), Tiziano C(39), Vignon P(40), Wendel-Garcia PD(41), Wise MP(42), Wright K(16), Nielsen N(43), Cronberg T(4).
ABSTRACT
IMPORTANCE: The Targeted Hypothermia vs Targeted Normothermia After Out-of-Hospital Cardiac Arrest (TTM2) trial reported no difference in mortality or poor functional outcome at 6 months after out-of-hospital cardiac arrest (OHCA). This predefined exploratory analysis provides more detailed

estimation of brain dysfunction for the comparison of the 2 intervention regimens. OBJECTIVES: To investigate the effects of targeted hypothermia vs targeted normothermia on functional outcome with focus on societal participation and cognitive function in survivors 6 months after OHCA. DESIGN, SETTING, AND PARTICIPANTS: This study is a predefined analysis of an international multicenter, randomized clinical trial that took place from November 2017 to January 2020 and included participants at 61 hospitals in 14 countries. A structured follow-up for survivors performed at 6 months was by masked outcome assessors. The last follow-up took place in October 2020. Participants included 1861 adult (older than 18 years) patients with OHCA who were comatose at hospital admission. At 6 months, 939 of 1861 were alive and invited to a follow-up, of which 103 of 939 declined or were missing. INTERVENTIONS: Randomization 1:1 to temperature control with targeted hypothermia at 33 °C or targeted normothermia and early treatment of fever (37.8 °C or higher). MAIN OUTCOMES AND MEASURES: Functional outcome focusing on societal participation assessed by the Glasgow Outcome Scale Extended ([GOSE] 1 to 8) and cognitive function assessed by the Montreal Cognitive Assessment ([MoCA] 0 to 30) and the Symbol Digit Modalities Test ([SDMT] z scores). Higher scores represent better outcomes. RESULTS: At 6 months, 836 of 939 survivors with a mean age of 60 (SD, 13) (range, 18 to 88) years (700 of 836 male [84%]) participated in the follow-up. There were no differences between the 2 intervention groups in functional outcome focusing on societal participation (GOSE score, odds ratio, 0.91; 95% CI, 0.71-1.17; P = .46) or in cognitive function by MoCA (mean difference, 0.36; 95% CI,-0.33 to 1.05; P = .37) and SDMT (mean difference, 0.06; 95% CI,-0.16 to 0.27; P = .62). Limitations in societal participation (GOSE score less than 7) were common regardless of intervention (hypothermia, 178 of 415 [43%]; normothermia, 168 of 419 [40%]). Cognitive impairment was identified in 353 of 599 survivors (59%). CONCLUSIONS: In this predefined analysis of comatose patients after OHCA, hypothermia did not lead to better functional outcome assessed with a focus on societal participation and cognitive function than management with normothermia. At 6 months, many survivors had not regained their pre-arrest activities and roles, and mild cognitive dysfunction was common.

3. Zhonghua Wei Zhong Bing Ji Jiu Yi Xue. 2023 Jul;35(7):773-776. doi: 10.3760/cma.j.cn121430-20230217-00095.
[Research progress of target temperature management on protective mechanism of cardiac function after cardiac arrest].
[Article in Chinese]
Liang Z(1), Yang S(2), Wang T(1), Tang Z(1).
ABSTRACT
Targeted temperature management (TTM) has been partially applied in patients with restoration of spontaneous circulation (ROSC) after cardiac arrest (CA). In the 2020 American Heart Association (AHA) cardiopulmonary resuscitation (CPR) guidelines, TTM is used as advanced life support after ROSC for the treatment of patients with CPR. TTM has a protective effect on cardiac function after CA, but the specific mechanism of its protective effect on cardiac function remains unclear. In this paper, the basic experimental progress, clinical trial progress and development prospect of TTM on the protective mechanism of cardiac function after CA are reviewed.

4. Am J Emerg Med. 2023 Sep;71:182-189. doi: 10.1016/j.ajem.2023.06.040. Epub 2023 Jun 28.
Therapeutic hypothermia in patients after cardiac arrest: A systematic review and meta-analysis of randomized controlled trials.
Chiu PY(1), Chung CC(2), Tu YK(3), Tseng CH(4), Kuan YC(5).
ABSTRACT

OBJECTIVE: Targeted temperature management (TTM) with therapeutic hypothermia (TH) has been used to improve neurological outcomes in patients after cardiac arrest; however, several trials have reported conflicting results regarding its effectiveness. This systematic review and meta-analysis assessed whether TH was associated with better survival and neurological outcomes after cardiac arrest. METHOD: We searched online databases for relevant studies published before May 2023. Randomized controlled trials (RCTs) comparing TH and normothermia in post-cardiac-arrest patients were selected. Neurological outcomes and all-cause mortality were assessed as the primary and secondary outcomes, respectively. A subgroup analysis according to initial electrocardiography (ECG) rhythm was performed. RESULT: Nine RCTs (4058 patients) were included. The neurological prognosis was significantly better in patients with an initial shockable rhythm after cardiac arrest (RR = 0.87, 95% confidence interval [CI] = 0.76-0.99, P = 0.04), especially in those with earlier TH initiation (<120 min) and prolonged TH duration (≥24 h). However, the mortality rate after TH was not lower than that after normothermia (RR = 0.91, 95% CI = 0.79-1.05). In patients with an initial nonshockable rhythm, TH did not provide significantly more neurological or survival benefits (RR = 0.98, 95% CI = 0.93-1.03 and RR = 1.00, 95% CI = 0.95-1.05, respectively). CONCLUSION: Current evidence with a moderate level of certainty suggests that TH has potential neurological benefits for patients with an initial shockable rhythm after cardiac arrest, especially in those with faster TH initiation and longer TH maintenance.

Target temperature in post-arrest comatous patients. Is something changed in the postpandemic era?
Garcia-Rubira JC(1), Olivares-Martínez B(2), Rivadeneira-Ruiz M(2), Fernández-Valenzuela I(2), Recio-Mayoral A(2), Almendro-Delia M(2), Hidalgo-Urbano R(3).

ABSTRACT
INTRODUCTION: The recommended target temperature in the treatment of comatous patients after cardiac arrest has recently changed. We analyzed the impact on the neurological outcome of a change in the target temperature from July 2021. MATERIAL AND METHODS: This was a retrospective analysis comparing the discharge status of 78 patients with a target temperature of 33 °C (group 1) with that of 24 patients with a target temperature of 36.5 °C (group 2). Pearson chi-square and Mann-Whitney U tests were used. RESULTS: The initial rhythm was defibrillable in 65% of group 1 and 71% of group 2, and cardiac arrest was witnessed in 93% of group 1 and 96% of group 2. There was an adverse outcome (death or vegetative state) in 37 patients in group 1 (47%) compared to 18 in group 2 (74%) (Pearson chi-square 5.612, p = 0.018). CONCLUSIONS: In our series of patients, the temperature control target temperature change from 33 °C to 36.5 °C was associated with worse neurological outcome. Further studies are needed to evaluate the outcome of a generalized modification of temperature control targets in comatose patients after cardiac arrest in our postpandemic era.

ELECTROPHYSIOLOGY AND DEFIBRILLATION

Deep learning for EEG-based prognostication after cardiac arrest: from current research to future clinical applications.
Zubler F(1), Tzovara A(2)(3).

ABSTRACT
Outcome prognostication in comatose patients after cardiac arrest (CA) remains to date a challenge. The major determinant of clinical outcome is the post-hypoxic/ischemic encephalopathy.

Electroencephalography (EEG) is routinely used to assess neural functions in comatose patients. Currently, EEG-based outcome prognosis relies on visual evaluation by medical experts, which is time consuming, prone to subjectivity, and oblivious to complex patterns. The field of deep learning has given rise to powerful algorithms for detecting patterns in large amounts of data. Analyzing EEG signals of coma patients with deep neural networks with the goal of assisting in outcome prognosis is therefore a natural application of these algorithms. Here, we provide the first narrative literature review on the use of deep learning for prognostication after CA. Existing studies show overall high performance in predicting outcome, relying either on spontaneous or on auditory evoked EEG signals. Moreover, the literature is concerned with algorithmic interpretability, and has shown that largely, deep neural networks base their decisions on clinically or neurophysiologically meaningful features. We conclude this review by discussing considerations that the fields of artificial intelligence and neurology will need to jointly address in the future, in order for deep learning algorithms to break the publication barrier, and to be integrated in clinical practice.

Amplitude spectral area of ventricular fibrillation and defibrillation success at low energy in out-of-hospital cardiac arrest.
Gentile FR(1)(2), Wik L(3)(4), Isasi I(5), Baldi E(1), Aramendi E(5), Steen-Hansen JE(6), Fasolino A(1)(2), Compagnoni S(1)(2), Contri E(7), Palo A(7), Primi R(1), Bendotti S(1), Currao A(1), Quilico F(1)(2), Vicini Scajola L(1)(2), Lopiano C(1)(2), Savastano S(8).
ABSTRACT
The optimal energy for defibrillation has not yet been identified and very often the maximum energy is delivered. We sought to assess whether amplitude spectral area (AMSA) of ventricular fibrillation (VF) could predict low energy level defibrillation success in out-of-hospital cardiac arrest (OHCA) patients. This is a multicentre international study based on retrospective analysis of prospectively collected data. We included all OHCAs with at least one manual defibrillation. AMSA values were calculated by analyzing the data collected by the monitors/defibrillators used in the field (Corpuls 3 and Lifepak 12/15) and using a 2-s-pre-shock electrocardiogram interval. We run two different analyses dividing the shocks into three tertiles (T1, T2, T3) based on AMSA values. 629 OHCAs were included and 2095 shocks delivered (energy ranging from 100 to 360 J; median 200 J). Both in the "extremes analysis" and in the "by site analysis", the AMSA values of the effective shocks at low energy were significantly higher than those at high energy (p = 0.01). The likelihood of shock success increased significantly from the lowest to the highest tertile. After correction for age, call to shock time, use of mechanical CPR, presence of bystander CPR, sex and energy level, high AMSA value was directly associated with the probability of shock success [T2 vs T1 OR 3.8 (95% CI 2.5-6) p < 0.001; T3 vs T1 OR 12.7 (95% CI 8.2-19.2), p < 0.001]. AMSA values are associated with the probability of low-energy shock success so that they could guide energy optimization in shockable cardiac arrest patients.

PEDIATRICS AND CHILDREN

Sociodemographic Factors Associated with Paediatric Out-of-Hospital Cardiac Arrest: A Systematic Review.
Idrees S(1), Abdullah R(2), Anderson KK(3), Tijssen JA(4).
ABSTRACT

BACKGROUND: Paediatric out-of-hospital cardiac arrest (POHCA) is associated with poor survival and severe neurological sequelae. We conducted a systematic review on the impact of sociodemographic factors across different stages of POHCA. METHODS: We searched MEDLINE, EMBASE, and Web of Science from database inception to October 2022. We included studies examining the association between sociodemographic factors (i.e., race, ethnicity, migrant status and socioeconomic status, SES) and POHCA risk, bystander cardiopulmonary resuscitation (CPR) provision, bystander automated external defibrillator (AED) application, survival, or neurological outcome (at or 30-days post-discharge). We synthesized the data qualitatively. RESULTS: We screened 11,097 citations and included 19 articles (arising from 16 studies). There were 4 articles reporting on POHCA risk, 5 on bystander CPR provision, 3 on bystander AED application, 14 on survival, and 6 on neurological outcome. In all studies on POHCA risk, significant differences were found across racial groups, with minority populations being disproportionately impacted. There were no articles reporting on the association between SES and POHCA risk. Bystander CPR provision was consistently associated with race and ethnicity, with disparities impacting Black and Hispanic children. The association between bystander CPR provision and SES was variable. There was little evidence of socioeconomic or racial disparities in studies on bystander AED application, survival, and neurological outcome, particularly across adjusted analyses. CONCLUSIONS: Race and ethnicity are likely associated with POHCA risk and bystander CPR provision. These findings highlight the importance of prioritizing at-risk groups in POHCA prevention and intervention efforts. Further research is needed to better understand underlying mechanisms.

2. Resusc Plus. 2023 Jul 27;15:100433. doi: 10.1016/j.resplu.2023.100433. eCollection 2023 Sep.
Evaluation of hospital management of paediatric out-of-hospital cardiac arrest.
Gupte D(1), Assaf M(2), Miller MR(2)(3), McKenzie K(1), Loosley J(4), Tijssen JA(1)(2)(3)(5).
ABSTRACT
INTRODUCTION: Pediatric out of hospital cardiac arrest (POHCA) is rare, with high mortality and neurological morbidity. Adherence to Pediatric Advanced Life Support guidelines standardizes in-hospital care and improves outcomes. We hypothesized that in-hospital care of POHCA patients was variable and deviations from guidelines were associated with higher mortality. METHODS: POHCA patients in the London-Middlesex region between January 2012 and June 2020 were included. The care of children with ongoing arrest (intra-arrest) and post-arrest outcomes were reviewed using the Children's Hospital, London Health Sciences Centre (LHSC) patient database and the Adverse Event Management System. RESULTS: 50 POHCA patients arrived to hospital, with 15 (30%) patients admitted and 2 (4.0%) surviving to discharge, both with poor neurological outcomes and no improvement at 90 days. Deviations occurred at every event with intra-arrest care deviations occurring mostly in medication delivery and defibrillation (98%). Post-arrest deviations occurred mostly in temperature monitoring (60%). Data missingness was 15.9% in the intra-arrest and 1.7% in the post-arrest group. DISCUSSION: Deviations commonly occurred in both in-hospital arrest and post-arrest care. The study was under-powered to identify associations between DEVs and outcomes. Future work includes addressing specific deviations in intra-arrest and post-arrest care of POHCA patients and standardizing electronic documentation.

EXTRACORPOREAL LIFE SUPPORT

1. J Clin Med. 2023 Jul 26;12(15):4922. doi: 10.3390/jcm12154922.
The Beginning of an ECLS Center: First Successful ECPR in an Emergency Department in Romania-Case-Based Review.

Nedelea PL(1)(2), Manolescu E(1)(2), Ciumanghel AI(1)(3), Constantin M(4)(5), Hauta A(1), Sirbu O(4)(5), Ionescu L(6), Blaj M(3), Corlade-Andrei M(7), Sorodoc V(4)(5), Cimpoesu D(1)(2).

ABSTRACT

According to the latest international resuscitation guidelines, extracorporeal cardiopulmonary resuscitation (ECPR) involves the utilization of extracorporeal membrane oxygenation (ECMO) in specific patients experiencing cardiac arrest, and it can be considered in situations where standard cardiopulmonary resuscitation efforts fail if they have a potentially reversible underlying cause, among which we can also find hypothermia. In cases of cardiac arrest, both witnessed and unwitnessed, hypothermic patients have higher chances of survival and favorable neurological outcomes compared to normothermic patients. ECPR is a multifaceted procedure that requires a proficient team, specialized equipment, and comprehensive multidisciplinary support within a healthcare system. However, it also carries the risk of severe, life-threatening complications. With the increasing use of ECPR in recent years and the growing number of centers implementing this technique outside the intensive care units, significant uncertainties persist in both prehospital and emergency department (ED) settings. Proper organization is crucial for an ECPR program in emergency settings, especially given the challenges and complexities of these treatments, which were previously not commonly used in ED. Therefore, within a narrative review, we have incorporated the initial case of ECPR in an ED in Romania, featuring a successful resuscitation in the context of severe hypothermia (20 °C) and a favorable neurological outcome (CPC score of 1).

Impact of a VA-ECMO in Combination with an Extracorporeal Cytokine Hemadsorption System in Critically Ill Patients with Cardiogenic Shock-Design and Rationale of the ECMOsorb Trial.

Haertel F(1), Lehmann T(2), Heller T(2), Fritzenwanger M(1), Pfeifer R(1), Kretzschmar D(1), Otto S(1), Bogoviku J(1), Westphal J(1), Bruening C(1), Gecks T(1), Kaluza M(3), Moebius-Winkler S(1), Schulze PC(1).

ABSTRACT

BACKGROUND: Cardiogenic shock and arrest present as critical, life-threatening emergencies characterized by severely compromised tissue perfusion and inadequate oxygen supply. Veno-arterial extracorporeal membrane oxygenation (VA-ECMO) serves as a mechanical support system for patients suffering shock refractory to conventional resuscitation. Despite the utilization of VA-ECMO, clinical deterioration due to systemic inflammatory response syndrome (SIRS) resulting from the underlying shock and exposure of blood cells to the artificial surfaces of the ECMO circuit may occur. To address this issue, cytokine adsorbers offer a valuable solution by eliminating blood proteins, thereby controlling SIRS and potentially improving hemodynamics. Consequently, a prospective, randomized, blinded clinical trial will be carried out with ECMOsorb. METHODS AND STUDY DESIGN: ECMOsorb is a single-center, controlled, randomized, triple-blinded trial that will compare the hemodynamic effects of treatment with a VA-ECMO in combination with a cytokine adsorber (CytoSorb®, intervention) to treatment with VA-ECMO only (control) in patients with cardiogenic shock (with or without prior cardiopulmonary resuscitation (CPR)) requiring extracorporeal, hemodynamic support. Fifty-four patients will be randomized in a 1:1 fashion to the intervention or control group over a 36-month period. The primary endpoint of ECMOsorb is the improvement of the Inotropic Score (IS) 72 h after the intervention. Prognostic indicators, including mortality rates, hemodynamic parameters, laboratory findings, echocardiographic assessments, quality of life measurements, and clinical parameters, will serve as secondary outcome measures. The safety evaluation encompasses endpoints such as air embolisms, allergic reactions, peripheral ischemic complications, vascular complications, bleeding incidents, and stroke occurrences. CONCLUSIONS: The ECMOsorb trial seeks to assess the efficacy of a cytokine adsorber (CytoSorb®; CytoSorbents Europe GmbH, Berlin, Germany) in reducing SIRS and improving hemodynamics in patients with cardiogenic shock who are receiving VA-ECMO. We hypothesize that a reduction in

cytokine levels can lead to faster weaning from inotropic and mechanical circulatory support, and ultimately to improved recovery.

Cardiopulmonary resuscitation in veno-venous-ECMO patients-A retrospective study on incidence, causes and outcome.
Booke H(1)(2), Zacharowski K(1), Adam EH(1), Raimann FJ(1), Bauer F(1), Flinspach AN(1).
ABSTRACT
INTRODUCTION: Cardiac arrest in a modern intensive care unit (ICU) is associated with poor outcome although optimal resources are present at all times. Data on cardiac arrest (CA) of the increasing cohort of patients with veno-venous-extracorporeal membrane oxygenation (VV-ECMO) are not available. Due to the highly invasive nature of this procedure, other incidences and causes of cardiac arrest are expected when compared to the ICU population without ECMO. This study focuses on cardiac arrest under VV-ECMO treatment. METHODS: Retrospective single-center observational study including all VV-ECMO patients from 1st January 2019 until 31st March 2022. Primary focus of this study was number and causes for CA during VV-ECMO treatment. Secondary endpoints were treatment procedure, complications and outcome. RESULTS: 140 patients were treated with VV-ECMO in the study period. Of those, 23 patients had 29 CA with need for cardiopulmonary resuscitation (CPR) during VV-ECMO treatment. Nearly half of all CA (48%; n = 14) occurred during medical procedures and 21% (n = 6) were device related. Pulseless electric activity (PEA) was the most common rhythm upon CPR initiation (72%). ROSC was achieved in 86%, two CA (6.9%) resulted in extracorporeal CPR. Survival to hospital discharge was 13% following CPR. CONCLUSION: CA occurs in over 15% of all patients treated with a VV-ECMO. Medical procedures during VV-ECMO are associated with a high risk of CA and should be planned with care. Also, the rate of ROSC was very high, only a small number of patients survived the overall VV-ECMO treatment course.

ECMO PAL: using deep neural networks for survival prediction in venoarterial extracorporeal membrane oxygenation.
Stephens AF(#)(1)(2), Šeman M(#)(3)(4)(5), Diehl A(4)(6), Pilcher D(4)(6), Barbaro RP(7), Brodie D(8), Pellegrino V(6), Kaye DM(5)(9), Gregory SD(#)(3), Hodgson C(#)(4)(10); Extracorporeal Life Support Organization Member Centres.
ABSTRACT
PURPOSE: Venoarterial extracorporeal membrane oxygenation (VA-ECMO) is a complex and high-risk life support modality used in severe cardiorespiratory failure. ECMO survival scores are used clinically for patient prognostication and outcomes risk adjustment. This study aims to create the first artificial intelligence (AI)-driven ECMO survival score to predict in-hospital mortality based on a large international patient cohort. METHODS: A deep neural network, ECMO Predictive Algorithm (ECMO PAL) was trained on a retrospective cohort of 18,167 patients from the international Extracorporeal Life Support Organisation (ELSO) registry (2017-2020), and performance was measured using fivefold cross-validation. External validation was performed on all adult registry patients from 2021 (N = 5015) and compared against existing prognostication scores: SAVE, Modified SAVE, and ECMO ACCEPTS for predicting in-hospital mortality. RESULTS: Mean age was 56.8 ± 15.1 years, with 66.7% of patients being male and 50.2% having a pre-ECMO cardiac arrest. Cross-validation demonstrated an inhospital mortality sensitivity and precision of 82.1 ± 0.2% and 77.6 ± 0.2%, respectively. Validation accuracy was only 2.8% lower than training accuracy, reducing from 75.5% to 72.7% [99% confidence interval (CI) 71.1-74.3%]. ECMO PAL accuracy outperformed the ECMO ACCEPTS (54.7%), SAVE (61.1%), and Modified SAVE (62%) scores. CONCLUSIONS: ECMO PAL is the first AI-powered ECMO survival score trained and validated on large international patient cohorts. ECMO PAL demonstrated high generalisability across ECMO regions and outperformed

existing, widely used scores. Beyond ECMO, this study highlights how large international registry data can be leveraged for AI prognostication for complex critical care therapies.

Time-saving effect of real-time ultrasound-guided cannulation for extracorporeal cardiopulmonary resuscitation: A multicenter retrospective cohort study.

Nakatsutsumi K(1), Endo A(2), Todd W C(3), Takayama W(4), Morishita K(4), Otomo Y(5), Inoue A(6), Hifumi T(7), Sakamoto T(8), Kuroda Y(9); Save-J Ⅱ study group.

ABSTRACT

BACKGROUND: Extracorporeal cardiopulmonary resuscitation (ECPR), a bridge to treatments for cardiac arrest patients, can be technically challenging and requires expertise. While ultrasound guidance is frequently used for vascular access, its effects on cannulation time in patients treated with ECPR are poorly defined. We hypothesized that real-time ultrasound guidance would contribute to faster and safer cannulation for ECPR. METHODS: This nationwide, multicenter, retrospective study analyzed data from 36 Japanese institutions. Patients who were over age 18 years and underwent ECPR between January 1, 2013, and December 31, 2018, were included. Patients who underwent open surgical vascular access were excluded. Cannulation time and outcomes of patients who underwent real-time ultrasound-guided cannulation (i.e., ultrasound-guided group) were compared to those cannulated without the use of real-time ultrasound guidance (control group) using propensity score matching analysis. RESULTS: The ultrasound-guided group comprised 510 cases, whereas the control group comprised 941 cases. Of those, 443 propensity score-matched pairs were evaluated. Cannulation time in the ultrasound-guided group was 2.5 minutes shorter than in the control group (difference, -2.5 minutes; 95% CI, -3.7 - -1.3, p<0.001). The incidence of catheter-related complications and the incidence of the poor neurological outcomes (Cerebral Performance Category ≥3) did not differ between groups (OR, 1.51; 95% CI, 0.75 - 2.74; OR, 1.51; 95% CI, 0.64 - 3.74; OR, 1.08; 95% CI, 0.83 - 1.59). CONCLUSION: Real-time ultrasound-guided cannulation was associated with shorter cannulation time of ECPR.

Neurological outcomes and reperfusion strategies in out-of-hospital cardiac arrest patients due to pulmonary embolism who underwent venoarterial extracorporeal membrane oxygenation: a post-hoc analysis of a multicenter retrospective cohort study.

Sakuraya M(1), Hifumi T(2), Inoue A(3), Sakamoto T(4), Kuroda Y(5); SAVE-J Ⅱ Study Group.

ABSTRACT

INTRODUCTION: This study aimed to evaluate the effect of different reperfusion strategies on neurological outcomes in patients with pulmonary embolism who received venoarterial extracorporeal membrane oxygenation (VA-ECMO) for out-of-hospital cardiac arrest (OHCA). METHODS: This was a post-hoc analysis of a multicenter retrospective cohort study conducted in 36 institutions in Japan over six years. We included patients who underwent VA-ECMO and were diagnosed with pulmonary embolism caused by OHCA. Neurological outcomes were evaluated on the basis of the cerebral performance category at hospital discharge. We also assessed the association between reperfusion strategies and successful separation from ECMO. RESULTS: Among the 78 included patients, approximately half were successfully weaned from ECMO. Hospital mortality and favorable neurological outcomes at hospital discharge were 60.3% and 17.9%, respectively. Thirty-one patients (39.7%) underwent reperfusion strategies after ECMO, including 13 who received systemic thrombolytic therapy and 18 who underwent mechanical reperfusion strategy. After adjusting for prespecified covariates using the competing risk model, reperfusion strategies increased ECMO separation rate (systemic thrombolytic therapy: subdistribution hazard ratio [sHR] 2.24, 95% confidence interval [CI] 1.21-4.17, P = 0.011; mechanical reperfusion strategy:

sHR 1.70, 95% CI 0.86-3.41, P = 0.129) compared with anticoagulation therapy alone, whereas higher cardiac Sequential Organ Failure Assessment score decreased ECMO separation rate (sHR 0.81, 95% CI 0.67-0.97, P = 0.020). CONCLUSIONS: Favorable neurological outcomes were observed in less than 20% of patients with OHCA due to pulmonary embolism undergoing ECMO. Reperfusion strategies may be associated with shorter ECMO durations in these patients.

EXPERIMENTAL RESEARCH

Myocardial Recovery, Metabolism, and Structure after Cardiac Arrest with Cardioplexol.
Hemmerich C(1), Heep M(1), Gärtner U(2), Taghiyev ZT(1), Schneider M(3), Böning A(1)(4).
ABSTRACT
OBJECTIVES: Clinical studies indicate encouraging cardioprotective potential for Cardioplexol. Its cardioprotective capacities during 45 minutes of ischemia compared with pure no-flow ischemia or during 90 minutes of ischemia compared with Calafiore cardioplegia were investigated experimentally. METHODS: Forty-four rat hearts were isolated and inserted into a blood-perfused pressure-controlled Langendorff apparatus. In a first step, cardiac arrest was induced by Cardioplexol or pure no-flow ischemia lasting 45 minutes. In a second step, cardiac arrest was induced by Cardioplexol or Calafiore cardioplegia lasting 90 minutes. For both experimental steps, cardiac function, metabolic parameters, and troponin I levels were evaluated during 90 minutes of reperfusion. At the end of reperfusion, hearts were fixed, and ultrastructural integrity was examined by electron microscopy. RESULTS: Step 1: after 90 minutes of reperfusion, hearts exposed to Cardioplexol had significantly higher left ventricular developed pressure (CP-45': 74%BL vs. no-flow-45': 45%BL; p = 0.046) and significantly better maximal left ventricular relaxation (CP-45': 84%BL vs. no-flow-45': 51%BL; p = 0.012). Oxygen consumption, lactate production, and troponin levels were similar in both groups. Step 2: left ventricular developed pressure was lower (22 vs. 48% of BL; p = 0.001) and coronary flow was lower (24 vs. 53% of BL; p = 0.002) when Cardioplexol was used compared with Calafiore cardioplegia. Troponin I levels were significantly higher under Cardioplexol (358.9 vs. 106.1 ng/mL; p = 0.016). CONCLUSION: Cardioplexol significantly improves functional recovery after 45 minutes of ischemia compared with pure ischemia. However, Cardioplexol protects the myocardium from ischemia/reperfusion-related damage after 90 minutes of ischemia worse than Calafiore cardioplegia.

TWEAK Knockdown Alleviates Post-Cardiac Arrest Brain Injury via the p38 MAPK/NF-κB Pathway.
Zhang H(1), Wang R(2).
ABSTRACT
BACKGROUND: Cardiac arrest (CA) and subsequent cardiopulmonary resuscitation (CPR) can cause brain injury, which is one of the factors affecting the recovery of brain function in CA patients. There is increasing evidence that tumor necrosis factor-like weak apoptosis-inducing factor (TWEAK) is associated with the brain injury diseases. This study was aimed to investigate the modulation mechanism of TWEAK involved in brain injury after cardiac arrest/subsequent cardiopulmonary resuscitation (CA/CPR). MATERIALS AND METHODS: For in vivo experiments, healthy male Sprague-Dawley (SD) rats were applied to establish CA/CPR model, and oxygen-glucose deprivation/reoxygenation (OGD/R)-stimulated neurons model was established in vitro. TWEAK short hairpin RNAs (shRNAs) were injected into the lateral ventricle of CA/CPR rats or transfected into OGD/R cell culture to analyze the consequent alteration in neurological scores, behavioral tests, cell proliferation, cell apoptosis, and neuroinflammation through immunofluorescence staining, terminal

deoxynucleotidyl transferase-mediated dUTP-biotin nick end labeling (TUNEL) staining and enzyme linked immunosorbent assay (ELISA). RESULTS: There were high expressions of TWEAK and fibroblast growth factor-inducible 14 (Fn14) in the cerebral cortex of CA/CPR rats and OGD/R-stimulated neuronal cells. TWEAK knockdown attenuated cell apoptosis, inflammation and showed better behavioral tests in CA/CPR rats. Furthermore, TWEAK shRNAs obviously facilitated cell proliferation, suppressed apoptosis and inflammation after OGD/R injury. Western blotting results stated that TWEAK silencing promoted phosphorylated p38 (p-p38) and phosphorylated p65 (p-p65) expressions. CONCLUSIONS: TWEAK might be involved in the pathogenesis of CA/CPR through inhibiting p38 MAPK/NF-κB pathway.

CASE REPORTS

1. Medicine (Baltimore). 2023 Aug 11;102(32):e34535. doi: 10.1097/MD.0000000000034535.
Refractory cardiac arrest caused by type I Kounis syndrome treated with adrenaline and nicorandil: A case report.
Ichinomiya T(1), Sekino M(1), Toba M(2), Yokoyama A(1), Iwasaki N(1), Kasai Y(1), Araki H(1), Yano R(1), Matsumoto S(1), Kurobe M(3), Sasaki R(4), Hara T(1).

ABSTRACT
RATIONALE: Kounis syndrome is a rare but life-threatening anaphylactic reaction that can lead to acute coronary syndrome and cardiac arrest, and requires prompt diagnosis. Adrenaline, which is used to treat anaphylaxis, may cause coronary vasoconstriction and worsen ischemia, whereas coronary vasodilators may dilate systemic vessels and exacerbate hypotension. Delayed diagnosis of Kounis syndrome and inadequate therapeutic intervention may thus lead to a poor outcome. PATIENT CONCERNS: A 59-year-old man was treated for sepsis due to a liver abscess. Following administration of daptomycin, the patient developed severe anaphylactic shock leading to refractory cardiac arrest. Because conventional cardiopulmonary resuscitation was ineffective, extracorporeal cardiopulmonary resuscitation was considered as an alternative approach. DIAGNOSES: On bedside monitoring during cardiopulmonary resuscitation, unexpected ST-segment elevation was found on lead II electrocardiogram. Accordingly, the patient was clinically diagnosed with Kounis syndrome. INTERVENTIONS: Nicorandil (6 mg/h), a coronary vasodilator with minimal blood pressure effects, was administered along with high doses of vasopressors, including adrenaline 0.2 µg/kg/min. OUTCOMES: After the initiation of nicorandil administration, the patient achieved return of spontaneous circulation and did not require extracorporeal cardiopulmonary resuscitation. Based on the elevated serum tryptase level, normal creatine kinase-MB range, and lack of stenosis on coronary angiography, the patient was definitively diagnosed with type I (coronary vasospasm) Kounis syndrome. He was subsequently transferred to the referring hospital without neurological sequelae. LESSONS: If anaphylaxis leads to refractory shock and cardiac arrest, ischemic changes on the electrocardiogram should be investigated to identify underlying Kounis syndrome. In addition to adrenaline, coronary dilators are the definitive treatment. Nicorandil may be a useful treatment option because of its minimal effect on blood pressure.

2. Am J Med Genet A. 2023 Aug 9. doi: 10.1002/ajmg.a.63370. Online ahead of print.
A Noonan-like pediatric patient with a de novo CBL pathogenic variant and an RNF213 polymorphism p.R4810K presenting with cardiopulmonary arrest due to left main coronary artery ostial atresia.
Chida-Nagai A(1), Tonoki H(1)(2), Makita N(3), Ishiyama H(4), Ihara M(4), Maruo Y(1), Tsujioka T(1), Sasaki D(1), Izumi G(1), Yamazawa H(1), Kato N(5), Ito M(6), Fujimura M(6), Sasaki O(1)(7), Takeda A(1).

ABSTRACT

Left main coronary artery ostial atresia (LMCAOA) is an extremely rare condition. Here, we report the case of a 14-year-old boy with Noonan syndrome-like disorder in whom LMCAOA was detected following cardiopulmonary arrest. The patient had been diagnosed with Noonan syndrome-like disorder with a pathogenic splice site variant of CBL c.1228-2 A > G. He suddenly collapsed when he was running. After administering two electric shocks using an automated external defibrillator, the patient's heartbeat resumed. Cardiac catheterization confirmed the diagnosis of LMCAOA. Left main coronary artery angioplasty was performed. The patient was discharged without neurological sequelae. Brain magnetic resonance imaging revealed asymptomatic Moyamoya disease. In addition, RNF213 c.14429 G > A p.R4810K was identified. There are no reports on congenital coronary malformations of compound variations of RNF213 and CBL. In contrast, the RNF213 p.R4810K polymorphism has been established as a risk factor for angina pectoris and myocardial infarction in adults, and several congenital coronary malformations due to genetic abnormalities within the RAS/MAPK signaling pathway have been reported. This report aims to highlight the risk of sudden death in patients with RASopathy and RNF213 p.R4810K polymorphism and emphasize the significance of actively searching for coronary artery morphological abnormalities in these patients.

3. Cureus. 2023 Jul 5;15(7):e41408. doi: 10.7759/cureus.41408. eCollection 2023 Jul.

Exercise-Induced Intraventricular Gradients As a Potential Cause of Sudden Cardiac Death.

Cotrim CA(1)(2)(3), Cotrim N(4), Guardado JH(2), Baquero L(1).

ABSTRACT

A 16-year-old boy reported an episode of dizziness related to intense training six months before an episode of aborted sudden death. The screening required for competitive sports practice was normal. There were no personal or familial antecedents of sudden death or heart disease. After winning a triathlon competition, he experienced a cardiac arrest episode. He received defibrillation with the return of spontaneous circulation. A medical evaluation that included electrocardiogram (ECG) and echocardiogram had normal results. A complete study including cardiac MRI, coronary CT angiography, a genetic study for heart disease, the flecainide test, and a stress echocardiogram with ergometrine was done, and all results were normal. During a Holter ECG and exercise stress echo, isolated premature ventricular complexes were detected. During the effort treadmill stress echocardiogram, the athlete developed a significant intraventricular obstruction with an end-systolic peak, without systolic anterior movement of the mitral valve, which disappeared in the first minute of the recovery. We highlight the possible cause-effect relation between the events.

4. Acute Med Surg. 2023 Aug 3;10(1):e881. doi: 10.1002/ams2.881. eCollection 2023 Jan-Dec.

Uterine rupture successfully treated with a damage-control strategy of hysterectomy and resuscitative endovascular balloon occlusion of the aorta-assisted cardiopulmonary resuscitation.

Okamoto Y(1), Ishida K(1), Matsumura Y(2), Yoshikawa Y(1), Sogabe T(1), Fujikami Y(3), Ban K(3), Tatsumi K(3), Ohnishi M(1).

ABSTRACT

BACKGROUND: Uterine rupture is a major cause of postpartum hemorrhage (PPH) that requires surgery. Resuscitative endovascular balloon occlusion of the aorta (REBOA) is also helpful for PPH. However, the effectiveness of REBOA in PPH with cardiac arrest is unknown. CASE PRESENTATION: A 40-year-old woman developed hemorrhagic shock due to uterine rupture after an induced delivery. She developed cardiac arrest, but was rescued by cardiopulmonary resuscitation (CPR), REBOA, a hysterectomy, and pelvic gauze packing. The hemodynamics were too unstable to move to the operating room. Then we initiated the CPR assisted with REBOA and decided to activate massive transfusion and perform laparotomy in the emergency room. She was finally discharged home

without neurological sequelae. CONCLUSION: Our damage control strategy, including REBOA-assisted CPR, contributed to saving the life of a patient with a life-threatening PPH.