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Abstract Presentations

“Best of the Best” Presentations

Advanced Life Support

BoB1

Hypothermia during vs. after CPR in out of hospital cardiac arrest. Preliminary results of a controlled randomized trial

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Introduction: Therapeutic hypothermia (TH) after cardiac arrest (CA) improves neurological outcome. Immediate initiation of TH just during cardiopulmonary resuscitation (CPR) could improve the outcome even more. Our objective was to assess the safety and effectiveness of TH during CPR (TH-CPR) compared to TH after return of spontaneous circulation (ROSC) in out-of-hospital cardiac arrest (OH-CA).

Methods: Randomized, multicenter, controlled, double-blind, parallel group clinical trial. Inclusion criteria: males >18 y and women >50 y with OH-CA and candidates to CPR. Exclusion criteria: CA not witnessed or prolonged over 20 min without CPR, CPR not indicated, environmental hypothermia. Variables studied: ROSC and survival, cerebral function category score (CFC), and Barthel functional index (BFI) at hospital discharge, at one month and at 6 months. Full study period: June 2013 to May 2016. This is a preliminary intermediate analysis to assess the protocol safety. Analyzed period: June 2013 to January 2014 (7 months).

Results: Forty-eight patients were included, 25 in TH group (52%) and 20 in TH-CPR group (48%). ROSC was 64.0% in TH and 52.2% in TH-CPR group (p n.s.). At 6 months follow-up global survival was 36% (9/25) in TH and 40% (9/23) in TH-CPR (p n.s.). At hospital discharge, mean CFC score was 1.4 in TH vs. 2.2 in TH-CPR (p n.s.), and mean BFI scale was 1.6 vs. 2.6 respectively (p n.s.). At one month follow-up, mean CFC score was 1.6 in TH vs. 1.5 in TH-CPR group (p n.s.), and mean BFI scale, 1.6 vs. 1.7 respectively.

Conclusion: Our preliminary intermediate analysis of the trial indicates that in case of OH-CA in our setting, TH-CPR is feasible and it is as safe and effective as TH after ROSC. Our results support to continue the study until a representative sample be obtained, in order to assess the real impact of TH-CPR.

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CPR Quality

BoB2

Chest compression release velocity is independently associated with survival from out-of-hospital cardiac arrest

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Purpose: There is mounting evidence that prehospital CPR quality (CPRQ) strongly impacts survival. Animal studies have demonstrated the influence of chest compression release velocity...
(CCRV) on survival, but there is insufficient clinical data. We tested the hypothesis that CCRV is independently associated with survival in out-of-hospital cardiac arrest (OHCA).

**Materials and methods**: CPRQ was measured using a monitor/defibrillator equipped with accelerometer-based CPR sensing technology (E Series, ZOLL Medical) during the treatment of consecutive OHCA patients by 4 EMS agencies in the state of Arizona between 09/2008 and 06/2013 as part of an ongoing study to improve CPRQ. Cases of non-EMS witnessed arrest of presumed cardiac etiology were included. Fisher’s exact test was used to compare survival among arrests grouped into categories of CCRV: fast (>400 mm/s), moderate (300–400 mm/s), or slow (<300 mm/s). The impact of CCRV on survival to hospital discharge was also assessed using multivariable logistic regression to calculate adjusted odds ratios (aOR) for survival to discharge adjusting for known confounders.

**Results**: 730 adult OHCA (mean age 66 ± 16, 65% male, 11% survival to discharge) were analyzed. Survival varied significantly with CCRV (p < 0.001; fast = 18/78 [23%]; moderate = 48/404 [12%]; slow = 16/248 [6%]). Logistic regression revealed that fast CCRV was independently associated with increased survival to discharge compared to both slow (aOR 3.86; 95% CI: 1.54, 9.66) and moderate CCRV (aOR 3.31 [1.50, 7.29]). When assessed as a continuous variable (per 10 mm/s), CCRV remained an independent predictor of survival (p < 0.05) and the adjusted odds of survival increased 5% for each 10 mm/sec increase in CCRV (aOR 1.05 [1.00, 1.10]).

**Conclusion**: CCRV is significantly associated with survival from adult OHCA after controlling for known confounders and independent risk factors. Prospective studies are required to confirm the linkage between CCRV and survival and to determine if improving CCRV will result in better survival.

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**Acute Coronary Syndromes**

**BoB3**

Pre-hospital metoprolol administration in Killip-class I–II anterior ST-segment elevation acute myocardial infarction is safe and reduces infarct size and adverse events. Insights from the METOCARD-CNIC trial

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**Objective**: Pre-reperfusion administration of i.v. metoprolol has been shown to reduce infarct size in Killip-class I–II anterior ST-segment elevation myocardial infarction (STEMI) patients undergoing primary angioplasty (METOCARD-CNIC trial, Circulation 2013). The objective of the present study was to study the effects of i.v. metoprol administration in the pre-hospital emergency care environment.

**Methods**: This study is a pre-specified sub-analysis of the recruited (randomized and treated) patients in the pre-hospital environment by emergency medical services (EMS) in the METOCARD-CNIC trial. Inclusion criteria were: Killip-class I–II anterior STEMI, anticipated reperfusion by primary angioplasty within 6 h from symptoms onset, systolic blood pressure ≥ 120 mmHg, heart rate ≥ 60 bpm. Patients were randomized to receive i.v. metoprolol (up to three 5-mg boluses) or control before reperfusion. The primary endpoint was infarct size measured by MRI one week post-infarction. Primary safety endpoint was the presence of major adverse cardiac events (MACE) in the first 24 h.

**Results**: From the 270 patients of this trial, 147 (54%) were recruited in the pre-hospital environment (74 i.v. metoprolol and 73 controls). Groups were balanced for baseline characteristics: age (58.5 vs 59.1, p = 0.7), BMI (27.6 vs 27.7, p = 0.8), gender (female 16.2% vs 17.8%, p = 0.8), hypertension (39.1% vs 41.7%, p = 0.9), diabetes (19.1% vs 19.4%, p = 1), dyslipidemia (44.1% vs 38.0%, p = 0.5) and smoking (53.6% vs 47.2%, p = 0.5). Mean (SD) infarct size on one-week MRI was 23.4 grams (15) vs. 34.0 grams (24) in i.v. metoprolol and control respectively, p = 0.005. Mean (SD) LVEF on one-week MRI in the metoprolol group was 48.1% (8.4) vs. 43.1% (10.2) in control, p = 0.004.

There was as a significant reduction in the pre-specified safety MACE (composite of death, malignant ventricular arrhythmias, cardiogenic shock, or AV block during the first 24 h) in the i.v. metoprolol group: 6.8% vs. 17.8% in controls (p = 0.047). The same trend was observed in all individual components of MACE but mainly driven by a reduced rate of ventricular fibrillation during transfer to the hospital (4.1% vs. 9.6%).

**Conclusions**: Early i.v. administration of metoprolol in the extrahospital environment by EMS in Killip-class I–II anterior STEMI patients is safe and results in a significant reduction of infarct size and higher LVEF one week after infarction. If these data are confirmed in other trials, clinical guidelines might change in this regard.

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**Education**

**BoB4**

Increased rate of bystander-initiated CPR during the initial 3 months after completion of the week of cardiac arrest awareness “Viva!” in two Italian cities

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**Background**: Public awareness of CPR is relatively low in Italy, with a bystander-initiated CPR in less than 20% of cardiac arrests. The Italian Resuscitation Council (IRC) organized a week of
awareness and mass training on CPR for lay people in Italy, called “Viva!” (October 14th–20th 2013). We have now evaluated the effects of the Viva! campaign on bystander-initiated CPR during the first 3 months after its completion.

Methods: Data on cardiac arrest events, witnessed instances, bystander-initiated CPR, and use of automated external defibrillators (AED) by lay people, were collected from two cities, Bologna and Bolzano, where different Viva! events were organized. More specifically, data collected during the initial 3 months after Viva! (21 October 2013–20 January 2014) were compared with those collected during the same period, the previous year (21 October 2012–20 January 2013).

Results: There were 123 cardiac arrests in the pre-Viva! period compared to 93 in the post-Viva! period. Seventy-five % of cardiac arrests were witnessed in the pre-Viva! period compared to 69% during the post-Viva! one. Bystander CPR initiated by lay people increased from 18% of witnessed cardiac arrests during the pre-Viva! period to 27% after the Viva! campaign. Moreover, in two instances of cardiac arrest, occurred in the post-Viva! period, a defibrillation was delivered by lay rescues with the aid of an AED, in contrast to none in the pre-Viva! period. No effects on ROSC improvement were observed.

Conclusions: Viva! campaign was successfully organized and increased the rate of bystander-initiated CPR in two cities during the initial 3 months after its completion. Nevertheless, more data from all the cities reached by Viva! need to be retrieved in order to confirm this initial positive effects of the awareness campaign. Viva! like campaigns need to be further supported.

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Post Resuscitation Care

BoB5

Admission interleukin-6 predicts post resuscitation organ dysfunction and long-term outcome after out-of-hospital ventricular fibrillation

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Purpose of the study: To study plasma concentrations of interleukin-6 (IL-6), high sensitive C-reactive protein (hs-CRP) and S100B during intensive care after out-of-hospital cardiac arrest (OHCA), and to study their associations with the duration ischemia, organ dysfunction and long-term neurological outcome.

Materials and methods: A 12-month prospective observational multicenter study conducted in 21 Finnish intensive care units in 2011.1 Interleukin-6, hs-CRP and S100B were measured with an automatic immune analyzer and an enzyme-linked immunosorbent assay at 0–6, 24, 48 and 96 h after ICU admission. Associations with time to return of spontaneous circulation (ROSC) and Sequential Organ Failure Assessment (SOFA) scores divided in tertiles and 12-month Cerebral Performance Category (CPC) were tested for using statistical methods.

Results: A total of 186 OHCA patients resuscitated from ventricular fibrillation were included in the study and 109 (58.6%) patients survived with good neurologic outcome (CPC 1–2) at 12 months after cardiac arrest. Admission plasma concentrations of IL-6 but not hs-CRP were higher with prolonged time to ROSC (p < 0.001, 0.203), SOFA scores (p < 0.001, 0.069) and in patients with poor long term outcome (p < 0.001, 0.315). S100B concentrations over time were higher in patients with a poor neurological outcome (p < 0.001). The area under the curve for prediction of poor 12-month outcome was 0.711 for IL-6, 0.663 for S100B and 0.534 for hs-CRP. With multivariate logistic regression analysis admission IL-6 (p = 0.046, OR 1.006, 95% CI 1.000–1.011/increase), but not hs-CRP and S100B, was an independent predictor of poor outcome.

Conclusion: Admission interleukin-6, but not hs-CRP or S100B, predicted long-term neurologic outcome and subsequent organ failure.

Reference


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Prognostication

BoB6

Long-term evolution after in-hospital cardiac arrest in children: Prospective multinational study

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Objective: To study survival and neurologic evolution of children who suffered in-hospital pediatric cardiac arrest (CA).

Methods: Prospective, international, observational, multinational study in 48 hospitals of 10 countries. CA in children between 1 month and 18 years were analyzed using the Utstein template. Survival and neurological state measured by Pediatric Cerebral Performance Category (PCPC) scale one year after hospital discharge was evaluated.

Results: 502 patients in-hospital CA were evaluated. 197 of them (39.7%) survived to hospital discharge. PCPC at hospital discharge was available in 160 (81.2%) patients. 74.4% had good neurologic state (PCPC 1–2) and 25.8% poor PCPC 3–6. One year after hospital discharge we could obtain data of 143 patients (72.5%). Survival was 128 (89.5%). PCPC was available in 120 patients. 90 (75.6%) had a good neurologic evaluation and 29 (24.4%) a poor one. One year after hospital discharge, 7 patients (5.4%) showed a better PCPC, in 112 (87.6%) the PCPC was the same, and in 9 (7%) the PCPC was worse.

Conclusion: Survival one year after hospital discharge in children after in-hospital cardiac arrest is high. Neurologic outcome of these children a year after cardiac arrest is mostly the same as after hospital discharge.

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Oral Presentations

Advanced Life Support

AS001

Administration of Erythropoietin in a swine model of prolonged cardiac arrest

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Purpose of the study: Recombinant human erythropoietin (rh-EPO) has been shown to exert tissue protective properties in various experimental models. However, its potential role in the cardiac arrest (CA) setting has not yet been sufficiently elucidated. The purpose of our study was to evaluate the effect of rh-EPO administration in swine model of ventricular fibrillation (VF) CA. The primary goal of our study was to investigate whether rh-EPO exerts any beneficial effect on Return of Spontaneous Circulation (ROSC) rates, while the secondary aim was to assess its impact in the short-term basis of 24-h and 48-h survival.

Materials and methods: VF was electrically induced in 20 piglets and remained untreated for 8 min before attempting resuscitation. Animals were randomized to receive rh-EPO (5000 IU kg$^{-1}$, EPO group, $n = 10$) immediately before the initiation of chest compressions, or to receive 0.9% NaCl solution instead (control group, $n = 10$). Endpoints of the experiment were defined as either asystole or ROSC.

Results: Compared with controls, the EPO group had higher rates of ROSC (100% vs 60%, $p = 0.011$), and higher 48-h survival (100% vs 40%, $p = 0.001$). Diastolic aortic pressure (DAoP) and coronary perfusion pressure (CPP) during cardiopulmonary resuscitation (CPR) were significantly higher in the EPO group compared to the placebo group. EPO treated animals required fewer number of shocks in comparison with animals that received normal saline ($p = 0.04$). Furthermore, the neurologic alertness score was higher in the EPO group compared to placebo at 24 ($p = 0.004$) and 48 hours ($p = 0.021$).

Conclusion: Administration of rh-EPO in a pig model of VF-induced CA just before reperfusion facilitates ROSC and improves survival rates as well as hemodynamic variables.

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Basic Life Support

AS002

Using surveillance video for insight into Out-of-Hospital Cardiac Arrest (OHCA)

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Background: Bystander and telephone assisted cardiopulmonary resuscitation (CPR) is important, however little is known about the first critical minutes. On 8th of July 2013, a 57 year old man collapsed with OHCA at a train station in Copenhagen. The incident was captured on closed circuit television (CCTV). We combined CCTV and audio recordings from the emergency medical dispatcher (EMD) in order to identify the learning possibilities.

Methods: A qualitative approach based on systematic text condensation with NVivo 10 software. We focused on the interval from collapse until the arrival of an ambulance.

Results: Themes (1) organization: Call-processing-time was 101 s (measured from bystander call to the emergency services until the caller was connected to EMD); (2) communication between EMD and caller versus observed by CTTV: The caller could not see the patient very well. EMD was not aware of this and did not realize that the patient had cardiac arrest before CPR was started by other bystanders. The caller himself was not performing CPR, but the CPR instruction was given to him. EMD informed about the...
location of an automated external defibrillator (AED), but this message was overheard because caller was communicating with other bystanders. EMD made caller interrupt CPR unnecessarily one time; (3) treatment: compressions and ventilations ratio was first 15:2 and change to compressions only. AED was first mentioned 185 s after the diagnosis of cardiac arrest; (4) Behavior of bystanders: people standing less than 3 meters away helped immediately. However, everyone left when the train arrived – except the caller and one other person.

Conclusion: CCTV combined with audio recordings from the emergency call can provide unique insights in the challenges of treating OHCA and can improve our understanding of the challenges in communication between emergency medical dispatchers and bystanders. Furthermore it gives insight to the behavior of bystanders.

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AS003

Energy expenditure of compression-only basic life support versus 30:2 – Simulation study

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Purpose of the study: One of the factors that may affect the quality of basic life support (BLS) is its energy expenditure. Therefore, we performed the study to compare energy expenditure of standard BLS with compression–ventilation ratio 30:2 (S-BLS) and compression-only BLS (CO-BLS) and assess sensation of fatigue and perceived exertion associated with these activities.

Materials and methods: We conducted simulation cross-over study with 10 healthy volunteers on resuscitation manikin. Participants were randomly assigned to start with CO-BLS or with S-BLS in accordance with the ERC guidelines 2010. A few days later, every individual underwent the other type of BLS than was performed high-quality CPR for 30 min. Energy expenditure of BLS was measured in all participants continuously by spiroergometric monitoring system. We calculated relative oxygen consumption (VO2/kg) and area under the curve of all VO2/kg measurements during each BLS procedure indexed to one minute (AUCVO2/kg/min). All participants completed a short survey to assess perceived intensity of exertion by Borg and sensation of general fatigue by visual analogue scale (0–100).

Results: Average quality and duration of CO-BLS and S-BLS procedure were comparable. Maximal VO2/kg reached during S-BLS was significantly higher than during CO-BLS (23.16 ± 3.94 vs. 20.17 ± 2.14 ml kg⁻¹ min⁻¹, p = 0.049). AUCVO2/kgmin was found significantly higher while performing S-BLS than CO-BLS (18.90 ± 3.13 vs. 15.91 ± 2.07 ml/min²; p = 0.021). Conversely, more intense rate of perceived exertion (16.6 ± 2.0 vs. 13.8 ± 1.2, p = 0.001) and the rate of sensation of general fatigue (86.5 ± 10.8 vs. 75.0 ± 14.3, p = 0.058) were associated with CO-BLS approach.

Conclusion: We found that the energy expenditure of S-BLS procedure was higher than of CO-BLS in our study, while sensation of fatigue and perceived exertion reflected the opposite association.

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AS004

Do bystanders need follow-up after performing CPR?

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Introduction: Bystanders increase the chance of survival in out of hospital cardiac arrest (OHCA) victims by two to three times by alerting the Emergency Medical Services (EMS) and performing cardiopulmonary resuscitation (CPR). To improve survival for OHCA victims, the health care system is dependent on community citizens to perform appropriate actions. However, we do not know whether the bystanders need follow-up after a cardiac arrest situation. The aim of this study was to reveal bystanders need of follow-up after performing CPR in an OHCA situation.

Methods: Twelve bystanders, who performed CPR to OHCA victims, took part in a qualitative interview study. We used in-depth interviews with open-ended and continuous questions, focusing on emotions, coping strategies and expectations to follow-up after performing CPR.

Results: All CPR bystanders reported strong emotional reactions even after several years. They wished to know the most frequent emotions after being present in an OHCA situation. All bystanders described a strong need to talk to health care professionals, preferably EMS staff, shortly after performing CPR. One essential wish was to receive information on the cardiac arrest victim’s outcome, and they used great efforts to obtain information on the patient outcome. Many bystanders had been in touch with family members and friends who were health care professionals to receive recognition and acceptance for their own CPR performance. Bystanders who experienced life threatening situations in their daily work described less emotional stress.

Conclusions: Bystanders performing CPR in OHCA situations need follow-up from health care professionals to learn about frequent emotions after CPR and to receive feedback on patient outcome. We believe that organizing professional follow-up after CPR performance might mitigate emotional stress among OHCA bystanders.

Reference


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CPR Quality
AS005

What can CPR in simulated hypogravity teach us about CPR on Earth?

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Introduction: Studies were conducted to evaluate cardiopulmonary resuscitation (CPR) in a simulated low gravitational field, such as Mars (hypoG), aimed at providing an insight into the performance of terrestrial CPR.

Methods: Two studies were conducted to evaluate external chest compressions (ECC) depth and rate, as well as perceived exertion (RPE) and the physiological cost, when 4 sets of 30 ECCs were performed on a standard CPR mannequin for 1.5 min during Mars simulation, using terrestrial (1 Gz) as control. The first study (n = 20; 2005 guidelines) also evaluated the electromyographic (EMG) activity of four muscles (triceps brachii, erector spinae, upper rectus abdominis, pectoralis major). The second study (n = 30; 2010 guidelines) included range of elbow flexion, minute ventilation (VE) and peak oxygen consumption (VO2 peak) measurements. HypoG simulation was achieved using a body suspension device (BSD) and a counterweight system.

Results: In both studies, subjects successfully performed ECCs at 1Gz and hypoG. In the first study, there were increases from 1 Gz values of 32% (p < 0.001) for RPE and 44% (p = 0.002) for HR when ECCs were performed during Mars simulation. In hypoG, the triceps brachii showed less activity when compared with the other three muscles studied (p < 0.001). A higher RPE (p < 0.05) was also seen in the second study, which was accompanied by an increased VE (11.4 ± 5.9 to 37.5 ± 10.3 L min⁻¹, p < 0.05) and VO2 peak (3.2 ± 1.1 to 20.5 ± 7.6 mL kg⁻¹ min⁻¹, p < 0.05). The arm flexion angle during hypogravity CPR, compared to 1Gz CPR, was also increased (4.3 ± 2.8° to 14.0 ± 8.1°, p < 0.05).

Conclusion: Simulated reduction of upper body weight did not decrease the ability to perform proper ECCs, however, it increased the physiological cost and altered performance of the 'straight arm' CPR technique. These findings could be used to improve terrestrial CPR, especially when physical disparities are encountered with the rescuer being smaller and lighter than the patient.

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AS006

The correlation between the impedance cardiogram and end-tidal carbon dioxide during cardiopulmonary resuscitation in a porcine model of cardiac arrest

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Introduction: Changes in expired end-tidal carbon dioxide (EtCO2) during cardiopulmonary resuscitation (CPR) have been shown to be a predictor of successful resuscitation attempts. Non-invasive monitoring of the impedance cardiogram (ICG) after cardiac arrest via standard defibrillation pads has been shown to relate positively to compression depth during CPR. This study aims to demonstrate how the correlation between ICG amplitude, compression depth and EtCO2 in a porcine model, could resultantly be used to enhance CPR feedback systems which use ICG as a real-time feedback platform for CPR efficacy.

Materials and methods: Porcine ICG amplitude was monitored and recorded via defibrillation pads connected to an automated HeartSine defibrillator. Following anaesthetisation of the model, 3 min of untreated ventricular fibrillation (VF) was induced using a Grass® Single channel Stimulator. A mechanical resuscitator (Thumper®) was used to administer CPR at approximately 110 compressions per minute at depths ranging between 1 and 6 cm, over 2 min periods. Compression depth was measured using a Philips Q-CPR device and EtCO2, SpO2 and blood pressure measurements were monitored using a Datex vital signs monitor. Sensitivity, specificity and accuracy (and corresponding 95% CI) were calculated based on pre-qualified logistic regression models.

Results: The following graphs show the association between ICG amplitude and EtCO2 for different compression depths. Correlation between; Q-CPR depth and ICG amplitude r = 0.88, 95% CI (0.84, 0.91); Thumper depth and ICG amp r = 0.89, 95% CI (0.85, 0.92); EtCO2 and ICG amplitude r = 0.88, 95% CI (0.85, 0.92).

Conclusions: The data presented demonstrate that there is strong association between depth and ICG amplitude. It also demonstrated a high sensitivity and specificity can be achieved for various well established physiological thresholds for end-tidal carbon dioxide and depth at depths of 30 and 40 mm as well as EtCO2 of 20 mmHg.

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Table 1

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<th>Phase</th>
<th>Hospital 1</th>
<th>Hospital 2</th>
<th>Hospital 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control</td>
<td>QCPR</td>
<td>Control</td>
</tr>
<tr>
<td>ROSC (%)</td>
<td>39%</td>
<td>42%</td>
<td>51%</td>
</tr>
<tr>
<td>Survival to discharge (%)</td>
<td>17%</td>
<td>13%</td>
<td>19%</td>
</tr>
<tr>
<td>Compression rate (min)</td>
<td>Mean</td>
<td>126.69</td>
<td>115.73</td>
</tr>
<tr>
<td></td>
<td>sd</td>
<td>16.82</td>
<td>10.75</td>
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<tr>
<td>Compression depth (mm)</td>
<td>Mean</td>
<td>50.42</td>
<td>48.83</td>
</tr>
<tr>
<td></td>
<td>sd</td>
<td>23.92</td>
<td>10.09</td>
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<tr>
<td>Flow fraction</td>
<td>Mean</td>
<td>78.06</td>
<td>81.87</td>
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<tr>
<td></td>
<td>sd</td>
<td>7.54</td>
<td>7.44</td>
</tr>
<tr>
<td>Incomplete release</td>
<td>Mean</td>
<td>14.37</td>
<td>2.11</td>
</tr>
<tr>
<td></td>
<td>sd</td>
<td>19.81</td>
<td>3.35</td>
</tr>
</tbody>
</table>

* P < 0.05 between control and implementation phase.

AS007

The impact of real-time audiovisual feedback and post-event debriefing: The CPR Quality Improvement Initiative

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2 Warwick Medical School, University of Warwick, Coventry, UK

Purpose of the study: The quality of CPR (cardiopulmonary resuscitation) is an important determinant of survival in cardiac arrest. This study sought to evaluate the effect of implementing CPR feedback and prompt technology (Q-CPR) with and without post event debriefing on survival and the quality of CPR.

Methods: We conducted a two-phase prospective cohort study across one UK NHS Trust, comprising three hospital sites. Consecutive adult patients receiving CPR for an in-hospital cardiac arrest were included. Data on survival and quality of CPR were recorded during the control (November 2009–November 2011) and implementation (December 2011–May 2013) phases. During the implementation phase, Q-CPR was introduced at Hospital One and Q-CPR and post-event debriefing were introduced at Hospital Two. No intervention was delivered at Hospital Three. Data were analysed using logistic and linear regression models which adjusted for known confounders.

Results: 1739 patients were screened for study inclusion, of whom 1395 (761 phase one; 634 phase two) were eligible. The changes in AED charge of patients with ventricular fibrillation. The quality of CPR feedback and prompt technology (Q-CPR) and improved overall hands-on time, but did not improve survival to hospital admission or discharge of patients with ventricular fibrillation. The changes in AED

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AS008

Maximizing administering CPR during the use of the Automatic External Defibrillator

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Background: It is claimed that any interruption of CPR has a negative impact on outcome. However, automated external defibrillators (AED) in the Guideline 2000 protocol, results in long pauses in CPR for rhythm analysis, shock delivery and pulse checks. We tested a different AED protocol aimed to increase the CPR administered to patients with out-of-hospital cardiac arrest (OHCA) and VF, focusing on short pre-shock pauses and post-shock pauses.

Methods: Patients with OHCA requiring defibrillation were treated with AED protocol A or B in a randomized manner. Randomization was blinded until AED power-on and electrode connection was completed. In control protocol (A), based on Guidelines 2000, no CPR is delivered from analysis, during charging until shock delivery and rhythm analysis after every shock, followed by a second or third shock when needed. Pulse check done after every shock; when no pulse is detected, CPR is resumed for 60 s. In the experimental protocol B, a 15 s period of CPR after shock decision, during charging but before delivery of the shock is added to the voice prompts, to minimize pre-shock pauses. Protocol B further included no pulse check, no rhythm analyze after the shock, and CPR for 2 min before next rhythm analysis, as recommended in the Guidelines 2005.

Results: Of 1216 OHCA patients connected to an AED, 480 required defibrillation, and 392 were included in the final analysis. Study patients (n = 196) had shorter preshock pauses (A; 20 s versus B: 6 s; P < 0.001), shorter postshock pauses (A; 28 s versus B: 7 s; P < 0.001), received more CPR measured by chest compression fraction (A; 41% versus B: 57%; P < 0.001) and fewer shocks than control patients (n = 196) (A; 1.8 versus B: 1.5; P = 0.008). Similar proportions survived to Emergency Room (A; 79.6% versus B: 82.1%; P = 0.54), hospital admission (A; 57.7% versus B: 60.6%; P = 0.56) and survived to hospital discharge (A: 40.9% versus B: 37.3%; P = 0.59).

Conclusion: The tested AED protocol, with a period of CPR immediately before the shock, significantly shortened pre-shock pauses and other pauses in CPR and improved overall hands-on time, but did not improve survival to hospital admission or discharge of patients with ventricular fibrillation.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.028

CPR Systems

AS009

Is dispatcher-assisted CPR (DA-CPR) associated with regional variations in outcome of out-of-hospital cardiac arrests (OHCAs)? A nation-wide population-based study

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3 Emergency Medical Center, Ishikawa Prefectural Central Hospital, Kanazawa, Ishikawa, Japan

Aims: To investigate whether DA-CPR provision is associated with regional variations in outcome of bystander-witnessed OHCAs.

Methods: Data for 157,093 bystander-witnessed OHCAs having complete dataset for analysis but no involvement of physician were extracted from the nationwide database of 588,742 OHCAs collected prospectively between 2007 and 2011. The activities of DA-CPR provision in 47 prefectures of Japan were assessed by the rate of DA-CPR provision in OHCAs that did not receive bystander CPR on bystander’s own initiative; the top five prefectures in terms of this rate (63.4–73.6%) was defined as advanced region (OHCA number: N = 16,232), the low rank five (32.4–41.6%) as intermediate region (N = 22,439) and the others as intermediate region (N = 118,422). The rate of one-month neurologically favorable survival and the backgrounds of emergency medical service patients were determined and compared among the three groups of region.

Results: The rate of survival was 4.8%, 4.0% and 3.3% for advanced, intermediate and less-advanced region, respectively; odds ratio (95% CI) for survival with advanced region as reference, 0.82 (0.76–0.89) vs. intermediate, 0.67 (0.60–0.74) vs. less advanced region. Number of ambulance cars over one-million population was 42.1, 50.5 and 32.8, respectively. The proportion of total bystander CPR was the highest (56.1%) in advanced region and lowest (35.8%) in less-advanced region while the proportion of bystander-initiated CPR without instruction was the highest (18.5%) in less-advanced region and lowest (11.0%) in advanced region. Early emergency call was the most frequent in advanced region and response time interval was the shortest in less-advanced region. After adjustment for patient age, etiology of arrest, initial rhythm and response time, adjusted odds ratio (95% CI) for survival with advanced region as reference were 0.87 (0.79–0.95) vs. intermediate region and 0.45 (0.40–0.50) vs. less-advanced region.

Conclusions: DA-CPR provision activity is associated with regional variations in outcome of bystander-witnessed OHCAs.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.029

Defibrillation

AS010

Defibrillation during different phases of the mechanical chest compression–decompression cycle – Effects on termination of ventricular fibrillation/pulseless ventricular tachycardia

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2 Houston Fire Department and the Baylor College of Medicine, Houston, USA
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Purpose of the study: Guidelines emphasize minimizing pre-shock chest compression pauses. One way to achieve this is to defibrillate without stopping chest compressions. This is possible when using an automatic mechanical chest compression device. An animal study showed a higher termination of ventricular fibrillation (VF)/pulseless ventricular tachycardia (VT) (TOF) rate if the shock hit the decompression phase of the compression–decompression cycle. We wanted to investigate clinically if TOF was influenced by where in the compression–decompression cycle the shock impacted, based on electronic ECG data from the Circulation Improving Resuscitation Care (CIRC) trial.

Materials and methods: Patients receiving Load Distributing Band-compression (LDB-c) prior to a defibrillation attempt (LifePak 500/12/15), were analyzed. Initial rhythm, pre-shock rhythm and rhythm 5 s post-shock were recorded as shockable or non-shockable. TOF rates were defined as absence of ventricular arrhythmia 5 s post-shock. The LDB-c cycle was divided into 3 phases: (a) compress and hold, (b) decompression and (c) release. Each shock was scored for TOF according to which of these three phases it hit. Differences between the phases were calculated using the chi-square test.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Compression and hold</th>
<th>Decompression</th>
<th>Release</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial VF/VT</td>
<td>220 (75.1%)</td>
<td>73 (80.2%)</td>
<td>211 (80.5%)</td>
<td>0.26</td>
</tr>
<tr>
<td>All initial rhythms</td>
<td>313 (76.0%)</td>
<td>121 (80.7%)</td>
<td>310 (80.1%)</td>
<td>0.28</td>
</tr>
</tbody>
</table>


**Results**: Of 4978 indicated and delivered shocks, 1130 shocks were delivered during continuous LDB-c. All data parameters were available for 949 (84%) of these shocks. TOF for the three phases are shown in Table 1.

**Conclusion**: TOF rates were not different for defibrillation delivered during the three different phases of the LDB-c cycle irrespective of initial rhythm. How TOF rates for each of the phases compares to LDB-c shocks with different pre-shock pauses warrants further investigation.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.030

**AS011**

**Transthoracic impedance-guided AMSA threshold adjustment for robust defibrillation outcome prediction**

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2 ZOLL Medical Corporation, Chelmsford, MA, USA
3 Mario Negri Institute for Pharmacological Researches, Milan, Italy

**Purpose**: Previous studies have demonstrated that the multifactorial nature of the ventricular fibrillation (VF) waveform may undermine a universal amplitude spectrum area (AMSA) threshold for the prediction of defibrillation outcome. In the present study, we investigated the effect of transthoracic impedance (TTI) on the performance of AMSA for the prediction of defibrillation outcome using registry data of out-of-hospital cardiac arrests.

**Materials and methods**: Digitalized ECG recordings, along with TTI measurements between two shocking pads, were collected from multiple emergency medical services (EMSs) in the USA through a regular field case submission program sponsored by ZOLL Medical Corporation. All the EMSs in this study used ZOLL AED which employs current-based impedance compensation technique. The sampling rate of the ECG data files was 250 Hz. An episode of 2.05 s (512 data points) waveform ending at 0.5 s before each shock attempt was selected for analysis. Shock success was defined as an organized rhythm that was present for a minimum of 30 s, started within 60 s after the shock, and had a rate of 40 beats per minute or greater.

**Results**: A total of 1262 shocks (305 successful) from 580 patients with VF were included in the analysis. AMSA value was significantly higher when the TTI was greater than 150 ohm (11.6 ± 8.9 vs. 9.8 ± 7.1, p = 0.002) as compared with those shocks with TTI less than 150 ohm. The AMSA threshold value was increased from 8.2 to 10.3 mVHz and from 11.8 to 14.2 mVHz when sensitivity and specificity were set to 85%, respectively.

**Conclusions**: In this patient population, the patient’s TTI affects the predictability of AMSA by shifting the threshold upward for a given sensitivity or specificity value. Using real-time TTI recorded from the same defibrillation pads to adjust AMSA threshold may provide robust prediction for defibrillation outcome.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.031

**AS012**

**Automatic detection of chest compression pauses for rhythm analysis during 30:2 CPR in an ALS scenario**

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2 Oslo University Hospital and University of Oslo, Oslo, Norway
3 University of Stavanger, Stavanger, Norway

**Introduction**: Ventilation pauses in cardiopulmonary resuscitation (CPR) could be used for rhythm analysis without chest compression (CC) artefacts by analyzing short ECG segments (<4 s). The objective of this study is to automatically detect CC pauses (>3.5 s) using the impedance in 30:2 CPR during advanced life support (ALS).

**Materials**: Eighty out-of-hospital cardiac arrest episodes collected in Oslo in 2012 during ALS were analyzed. ECG and impedance were recorded using LP12/LP15 defibrillators (Physio-Control). Then, 128 intervals with 30:2 CPR (792 min) and median duration 305 s (IQR, 143–495) were selected. CCs were automatically annotated using CodeStat (Physio-Control), and manually corrected by inspecting the impedance and ECG. These intervals contained 1118 pauses (>3.5 s) with median duration 4.8 s (IQR, 4.0–7.4).

**Methods**: The CC-pause detector applied two sequential algorithms to the impedance. First, an envelope detector identified the presence of a pause. Then, a CC-detector analyzed the vicinity of the impedance to determine its start/end points. The sensitivity (Se), proportion of pauses (>3.5 s) correctly detected, and positive predictive value (PPV), proportion of correct pause detections, were evaluated. The time-shift in the detection of the start of the pause was measured.

**Results**: The Se and PPV of the detector were 94.8% and 96.1%, respectively. The median Se and PPV per episode were 93.1 (95% CI, 90.3–95.4) and 96.2% (95% CI, 93.7–98.0). The median time-shift for the start of the pause was 0.0 s (5–95 percentile range, 0.0–0.7).

**Conclusions**: CC pauses and their starting point were accurately detected in 30:2 CPR during ALS. This would enable automatic rhythm analysis for very short ventilation pauses, as found in CPR performed by well-trained ALS providers. Further analysis is needed to confirm the accuracy of rhythm analysis in combination with CC-pause detection.

**References**


http://dx.doi.org/10.1016/j.resuscitation.2014.03.032
**Drugs**

**AS013**

Reduction in carotid blood flow after epinephrine during CPR in a porcine model of cardiac arrest is probably related to an increased vascular bed resistance

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2 ZOLL Medical Corporation, Chemsfold, MA, USA

**Introduction:** We have previously reported the detrimental effect of epinephrine (epi) during CPR on carotid blood flow (CBF) in an animal model. We now sought to investigate the epi-altered CBF profile in a porcine model of post-shock pulseless electrical activity (PEA) cardiac arrest.

**Methods:** 9 domestic pigs were anesthetized, endotracheally intubated and mechanically ventilated. Aortic and right atrial pressures were invasively monitored and coronary perfusion pressure (CPP) calculated. CBF was continuously monitored by a Transonic flow probe. VF was electrically induced and PEA produced by delivering electrical countershock(s). CPR, including mechanical chest compression and ventilation, was then initiated and continued for 15 min. Epi (20 μg·kg−1) was administered into the right atrium after 2 min of CPR and repeated every 3 min thereafter.

**Results:** CPP significantly increased from 14 ± 6 mmHg before epi to a peak of 32 ± 13 mmHg (p < 0.01) at 1 min after epi administration. Concurrent to CPP increases, net CBF decreased from 46 ± 19 mL/min before epi to the lowest value of 22 ± 18 mL/min (p < 0.01) at 30 s after epi. Bipolar integration revealed that decrease in net CBF was from a decrease in the forward flow as well as an increase in the backflow fraction. The decrease in the forward CBF started approximately 30 s post epi administration and persisted beyond 3 min after epi, while the backflow fraction remained augmented for the 3 min after epi.

**Conclusions:** In this model, CPP was significantly increased, while CBF was markedly reduced following epi administration during CPR. Decrease in CBF mainly resulted from a reduction in forward blood flow and an augmentation of backflow fraction probably due to the increase in vascular bed resistance.

![CBF and fraction](image)

http://dx.doi.org/10.1016/j.resuscitation.2014.03.033

**Education**

**AS014**

Opinions of secondary school students about obligatory CPR training in school

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2 Maastricht University Medical Center, Department of Cardiology, Maastricht, The Netherlands
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**Purpose of the study:** Guidelines state that to obtain cardiopulmonary resuscitation (CPR) skills in an entire community, training during the secondary school curriculum is recommended. In some countries CPR-training is already implemented in the school curriculum, while others are still hesitating. An important aspect in this regard is the opinion of secondary school students about this topic.

**Materials and methods:** A total of 1720 school students of a secondary school in the Dutch province of Limburg participated in a 1½ hour Meuse-Rhine Euregion CPR training program EMuRgency. Before the training most students had little knowledge on the topic. A questionnaire regarding opinion and willingness about the obligation of CPR-training in school was completed before and after the CPR-training.

**Results:** A total of 1252 students completed both questionnaires (mean age 14.4; SD: 1.3; male: 46.6%). Before the CPR-training 1100 (87.9%) students agreed that CPR-training should be part of the school curriculum and 1063 (84.9%) after the training. For male students these figures were 83% and 77% and for female students 92% and 91%. Regarding educational level these figures were respectively: higher educational level 83% and 77%, preparatory scholarly education 90% and 89%. An increase was observed per higher school year: 1st year: 84% and 78%, 2nd year 87% and 83% 3rd year 92% and 91%, 4th year 88% and 90% and 5th year 96% and 96%.

**Conclusions:** Although students, before participating in CPR training, had little knowledge on the topic, the large majority agreed that CPR-training should be obligatory in secondary schools. This opinion persisted after the training and increased per higher school year. This information is encouraging when considering implementing CPR training in secondary schools.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.034

**Epidemiology & Outcome**

**AS015**

Ventricular fibrillation in cardiac arrest. Is the decline over years really so large when measured early after collapse?

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**Purpose:** Worldwide the incidence of ventricular fibrillation (VF) in Out-of-Hospital Cardiac Arrest (OHCA) declined. However, this decline has mainly been reported without reference to delay between collapse and initial rhythm assessment. We investigated the time course of the deterioration of shockable (VF/VT) to non-shockable rhythms in two time periods.
**Methods:** Data from the ARREST-study, a registry of all OHCA in North-Holland, were used. We included all bystander witnessed OHCA of cardiac origin in 1995–1997 (n = 779) and in 2006–2012 (n = 4220). Cases with available ECG and known elapsed time between EMS-call (t = 0 in the figure) and initial rhythm assessment were included. When an AED was used, time from EMS call to initial rhythm could be negative. We calculated the proportion of shockable rhythm, stratified for delay from EMS-call to initial rhythm. We calculated the slope of the deterioration using binary linear regression, comparing two time periods.

**Results:** A shockable rhythm was observed in 75% of cases at moment of EMS-call. There was a modest overall decline in percentage shockable rhythm from 67% to 56% (p < 0.01). The proportion of VF in every time block was lower in 2006–2012 than in 1995–1997 (Fig. 1, showing % and 95% CI). The slope of deterioration of shockable rhythm was not different (p = 0.39) between the two time periods, indicating parallel lines.

**Conclusion:** Despite the overall decrease in incidence of VF, there still is a high proportion of VF/VT at the shortest time delays. The decline in VF incidence is not caused by faster deterioration of shockable rhythms after collapse. VF remains the most important cause of witnessed OHCA.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.035

**Ethics**

**AS016**

**Inconsistencies in Do Not Attempt Cardiopulmonary Resuscitation (DNACPR) policies: A review of 20 NHS acute trusts**

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**Purpose of the study:** In the UK national guidelines for DNACPR decisions exist, however, implementation is dependent on local policies. This study examined acute hospitals DNACPR policies to identify variations and inconsistencies in implementation of national guidelines.

**Methods:** Freedom of information requests for adult DNACPR policies were sent to all English acute trusts and a random 20 were analysed. DNACPR policies were assessed on 18 aspects identified from national guidelines including relevant laws, the legal basis of DNACPR decisions, consultation of multidisciplinary teams, validity as well as portability of decisions.

**Results:** Five teaching hospitals, 14 DGHs and one specialist centre were analysed. Policies consistently (20/20, 100%) referred to relevant guidelines/laws and correctly described the legal basis for DNACPR decision. 19/20 (95%) defined the relationship of DNACPR decisions to other aspects of care. The validity period for DNACPR decisions varied from indefinitely (n = 9), duration of hospital admission (n = 7), to a specific time point (n = 3), or not defined (n = 1). DNACPR decisions were valid outside the hospital for 9/20 trusts. Some (n = 6) described systems through which DNACPR decisions could be transferred between providers. Three policies failed to describe any system for handover. Most policies (17/20) recommended consultation amongst the multidisciplinary team for decision making. Only one mandated it and two made no reference. Decisions could be made by the consultant (n = 20), by the GP (n = 1), a nurse (n = 5) and by other doctor grades (n = 18). The lowest doctor grade making DNACPR decisions was Foundation Year 2.

**Conclusions:** While some aspects of the national guidelines have been implemented consistently, there is generally huge variability between local policies particularly concerning the validity and portability of decisions which greatly affects the interface between services. The fact that junior doctors can make decisions without mandated consultation of multidisciplinary teams needs reconsideration. The variability of local policies is deeply concerning and warrants attention by policy makers.

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**Implementation**

**AS017**

**Results of the implementation of hands-only CPR for cardiac arrest in Sao Paulo Metro**

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2 Anhembi Morumbi University, School of Medicine, Laureate International Universities, Sao Paulo/SP, Brazil

**Introduction:** Sao Paulo’s Subway carries about 4.5 million people per day. Since November 2008, the employees (lays rescuers) from Sao Paulo’s Subway facilities conduct continuous training (at least every two years) in cardiopulmonary resuscitation (CPR), instructed to perform hands only (HO) CPR and handling of the automatic external defibrillator (AED). Previously (September 2006 to October 2009), patients were treated by conventional CPR and obtained a survival rate of 22%, with minimal neurologic impairment one year after cardiac arrest (CA).
Objectives: Calculate the rate of hospital survival in patients that suffered from cardiac arrest (CA) at Sáo Paulo Subway after employees had received training in HO-CPR.

Methods: We studied a prospective series of cases of sudden cardiac arrest in Sáo Paulo’s Subways from November 2009 to November 2012. Subway security officials were instructed to perform HO-CPR and to use AEDs. The outcome of each patient was followed through medical records of the hospitals to which patients were referred. Reading the AED registration of each patient was performed. The primary outcome was minimal neurologic impairment one year after an out-of-hospital cardiac arrest.

Results: Automated external defibrillators were used in 40 patients whose initial cardiac rhythm was ventricular fibrillation. The average age of victims was 60 ± 12 years and 29 (72%) were male. The percentage of patients who achieved sustained return of spontaneous circulation was 28 (70%), 24 (60%) of patients arrived alive at the hospital and 18 (45%) were discharged and survival one year after of the event without neurological deficits. Comparing the periods of the September/2006–November/2009 with October/2009–November/2012, respectively, the rate of survival without neurological impairment was 22% versus 45% one year after the event (p = 0.0824).

Conclusion: We conclude that the implementation of the HO-CPR at the program of public access to defibrillation greatly increased the survival rate of victims who suffered CA in Sáo Paulo’s Subways. This is the highest rate of survival of CA registered in public place from Latin America so far.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.037

Mechanical Devices

AS018

Central site photoplethysmography tracks arterial pressure during resuscitation

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2 Philips Healthcare, Bothell, WA, USA

Purpose: Assess feasibility of monitoring pulse noninvasively during resuscitation with photoplethysmography (PPG) of central circulatory sites.

Materials and methods: Under a protocol approved by the MUV Ethics Committee, unfiltered waveforms from commercial oximeters (Oxypleth, Philips) were obtained from sensors applied to two central sites (nasal septum, ear pinna) concurrent with arterial blood pressure (ABP) waveforms from bedside monitors (Intellivue, Philips) and additional supporting data during treatment of hemodynamically unstable patients. Infrared (IR) PPG waveforms were normalized to the median of the adjacent 2 s period.

Results: We recorded over 190 h of artifact-free ABP signals from 50 patients during stabilization and resuscitation, including over 4 h of cardiopulmonary resuscitation (CPR) from October 2012 to January 2014. Technical difficulties precluded analysis of 4 patients. PPG waveforms corresponded to ABP waveforms during normal blood pressures. During blood pressures in the clinically challenging range of 60 mmHg to 90 mmHg, where palpation can be particularly difficult and unreliable, PPG continued to reflect ABP. When ABP subsided below the level at which it can be expected to be clinically palpable, PPG remained indicative of ABP. During chest compressions and pauses in compressions, PPG reflected ABP including following changes in magnitude of ABP during compressions when one rescuer replaced another.

Conclusions: A noninvasive pulse monitor using PPG applied to central circulatory sites appears feasible and may be useful in guiding resuscitation therapy, including CPR.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.038

Post Resuscitation Care

AS019

Prognostic implication of out of hospital cardiac arrest in patients with cardiogenic shock and acute myocardial infarction

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Objectives: We aim to evaluate if out of hospital cardiac arrest (OHCA) aggravates the prognosis in patients with acute myocardial infarction complicated by cardiogenic shock (CS).

Background: Cardiogenic shock complicating acute myocardial infarction (AMI) is a severe condition with a high mortality rate of 50%. Approximately 5% of AMI patients develop CS. OHCA is estimated to occur in one in fifty AMI patients. Little is known of the independent effects of OHCA and CS on prognosis in these patients.

Methods and results: In a retrospective study from 2008 to 2013 we included patients admitted to the intensive cardiac care unit with the diagnosis of CS and AMI. The group included both patients with OHCA and return of spontaneous circulation ROSC 127 (49%) and non-OHCA patients 132 (51%). Long-term mortality until June 2013 was 75% percent of all CS patients. One-week mortality was 56% in the non-OHCA group and 64% in the OHCA group. Median lactate level in OHCA patients was significantly higher 9 mmol l−1 (SD 6) vs. 6 mmol l−1 (SD 4) p < 0.0001. The multivariate analysis showed only two highly significant predictors of one-week and long-term mortality: age (Hazard Ratio = 1.019 [CI 1.005–1.034], p = 0.009), and lactate level at admission (HR = 1.064 [1.033–1.096], p < 0.0001). OHCA was not significant and independent predictor of excess mortality (HR = 1.05 [CI 0.79–1.4], p = 0.6).

Conclusion: OHCA is not an independent predictor of death in AMI complicated by cardiogenic shock. This should encourage active intensive treatment of CS patients regardless of OHCA.

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AS020

Ischemic post-conditioning and nitric oxide inhalation failed to demonstrate protective effect in comparison with mild hypothermia in porcine model of cardiac arrest

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Background: The protective effects of ischemic post-conditioning (IPC) and nitric oxide inhalation (NO) have been demonstrated in several ischemic situations. Current evidence on
the effect of IPC and NO in the management of post-cardiac arrest syndrome, however, remains insufficient.

Methods: Fifteen female swine (Sus scrofa domestica; body weight 45 kg) underwent veno-arterial extracorporeal membrane oxygenation (ECMO) implantation and at minimal ECMO flow of 0.5 L min⁻¹ the animals were exposed to cardiac arrest (CA) by induction of ventricular fibrillation by rapid ventricular pacing. After 20 min of CA, blood flow was restored by increasing the ECMO flow to 4.5 L min⁻¹ (100 mL min⁻¹ kg⁻¹). The animals (five animals per group) were then randomly assigned to receive IPC (three cycles of 3 min ischemia followed by 3 min reperfusion), NO (80 ppm via oxygenator) or mild hypothermia (HT; 33.0 °C). After 90 min of reperfusion, blood samples were drawn for the measurement of troponin I (TnI), myoglobin (MBG), creatine-phosphokinase (CPK), alanin-aminotransferase (ALT), neuron-specific enolase (NSE), cys-tatin C (CysC), and reactive oxygen metabolite (ROM) levels. Near-infrared spectroscopy was used for measurement of cerebral oxygenation and aortic blood pressure was monitored invasively.

Results: Significantly higher blood pressure and cerebral oxygen saturation values were observed in the HT group in comparison with IPC and NO (P < 0.05). The levels of TnI, MBG, CPK, and ALT were significantly lower in the HT group (P < 0.05); levels of NSE, CysC, and ROM were not significantly different between groups. IPC and NO were comparable in all monitored parameters.

Conclusions: Our results indicate that IPC and NO failed to demonstrate any protective effect over HT in the maintenance of blood pressure, cerebral oxygenation, organ protection and oxidative stress suppression following CA.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.040

Prognostication

AS021

Early activation of the kynurenine pathway predicts early death and long-term outcome in patients resuscitated from out-of-hospital cardiac arrest

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Background: Kynurenine pathway (KP) is the major route of tryptophan (TRP) catabolism and is activated by inflammation and after cardiac arrest (CA) in animals. We investigated post-CA KP activation in a large representative cohort of CA patients. We hypothesized that the KP activation level correlates with the severity of post-CA hypotension, early death, and long term outcome.

Methods: Plasma was obtained from 245 patients enrolled in a prospective multicentre observational study in 21 intensive care units (ICU) in Finland. Time to return of spontaneous circulation (ROSC), lowest systolic arterial pressure (SAP) and bicarbonate (BIC) during the first 24 h of ICU were collected. A cerebral performance category (CPC) of 3–5 defined 12-month poor outcome. Plasma TRP and KP metabolites, kynurenic acid (KYN), kynurenine (KYN), 3-hydroxyanthranilic acid (3-HAA), and the KYN/TRP ratio, were measured by liquid-chromatography and mass-spectrometry.

Results: All KP metabolites at ICU admission were significantly higher in CA with a non-shockable rhythm compared to those with a shockable one, and KYN and 3-HAA correlated with time to ROSC. Patients with higher levels of KYN, KYN/TRP ratio, KYN, and 3-HAA had lower 24 h SAP and BIC. All KP metabolites and KYN/TRP ratio, but not TRP, were significantly higher in patients who died in ICU in comparison to those who survived (p < 0.001). Multivariable logistic regression showed that higher KYN (OR 1.004, 95% CI 1.001–1.008, per nM increase, p = 0.014), and 3-HAA (OR 1.011, 95% CI 1.001–1.022, per nM increase, p = 0.03) were independently associated with 12-month poor outcome and significantly improved risk reclassification.

Conclusions: KP is activated early after CA and is associated with the severity of hypotension, early death and poor long-term outcome. KP metabolites may have clinical value for prognostication.

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AS022

Relationship between plasma high-sensitive cardiac Troponin T and infarct size in a porcine model of acute myocardial infarction and cardiac arrest and resuscitation

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Introduction: Cardiac troponins (c-Tn) are important diagnostic markers in setting of acute myocardial infarction (AMI) and more recently in chronic cardiovascular conditions. Less is known about the relation between plasma high-sensitivity c-TnT (hs-cTnT) and myocardial injury after AMI leading to cardiac arrest (CA). We determined the association between plasma hs-cTnT levels and left ventricular infarct size (LVIS) after AMI and CA in a pig model.

Methods: 12 pigs were anesthetized, endotracheally intubated and mechanically ventilated. AMI was induced by occlusion of the left anterior descending coronary artery (LAD) with a balloon catheter. CA was then induced and left untreated for 8 min. CPR was then performed for 5 min, prior to defibrillation. After successful resuscitation, animals were followed up to 72 h. LAD balloon was removed 45 min after resuscitation from CA. Serial blood samples were withdrawn for plasma hs-cTnT assay. Left ventricular ejection fraction (LVEF) was echocardiographically assessed, while LVIS was measured by tetrazolium chloride staining on histological sections.

Results: At 2 and 4 h post AMI and CA, plasma hs-cTnT levels significantly increased compared to baseline (BL) and remained significantly elevated up to 72 h (p < 0.01). Inversely, LVEF significantly decreased at 2 and 4 h post AMI and CA (p < 0.01) and completely recovered to BL values after 72 h. At sacrifice, LVIS extension was 17 ± 2% of the LV area. Peak plasma hs-cTnT levels were highly correlated with LVIS (r = 0.81, p < 0.0001) and inversely correlated...
with LVEF ($r = -0.64, p < 0.01$). LVEF was also inversely correlated with LVIS ($r = -0.61, p < 0.01$), but this relation was lesser strong compared to that between hs-cTnT and LVIS.

**Conclusions:** Plasma concentrations of hs-cTnT are highly correlated with LV infarct size in a porcine model of AMI and cardiac arrest and resuscitation.

![Graph showing LV Ejection Fraction and Hs-cTnT levels over time](image)

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**Trauma/Disaster Med**

**AS023**

**Compliance with prehospital traumatic brain injury guidelines is poor with longer prehospital treatment duration**

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**Purpose:** Traumatic brain injury (TBI) is a major public health problem worldwide. The Guidelines recommend documentation of vital signs (VS-SpO2, SBP, ETCO2) at least every 5 min in TBI patients as hypotension, hypoxia, and hyperventilation are all associated with significantly worse outcome. We examined whether frequency of VS documentation is associated with prehospital treatment duration.

**Materials and methods:** Patient care reports were reviewed from the treatment of 47 prehospital patients with moderate to severe TBI (initial GCS median 11, IQR 6–13) by 2 EMS agencies formally participating in a prehospital TBI project aimed at implementing nationally-vetted TBI Guidelines in Arizona (US). Times of VS documentation were abstracted from electronic patient care reports. Duration of EMS treatment was determined as time from EMS arrival on scene to ED arrival. EMS treatment time was divided into tertiles to categorize short (18 ± 3 min), moderate (24 ± 2 min), and long (34 ± 6 min) treatments. Frequency of VS documentation was compared between calls of different duration using the Chi-square statistic.

**Results:** A total of 47 TBI cases were analyzed (mean age 42 ± 20 years, 67% male). Documentation of SpO2 every 5 minutes was significantly less likely for longer (1/17; 6%) compared with moderate (5/15; 33%) and short (7/15; 47%) EMS treatment durations ($p = 0.03$). BP was significantly less likely to be documented every 5 minutes for longer duration (0/17, 0%) compared with moderate (3/15; 20%), and short (6/15; 40%) duration EMS treatments ($p = 0.02$). Regardless of treatment duration, ETCO2 was only documented in 7/47 (15%) cases and none documented ETCO2 every 5 min.

**Conclusion:** Prehospital providers are challenged to document VS at the recommended frequency of every 5 min, especially when prehospital EMS duration is long. More research is needed to determine the reasons and implications of this finding. Technologies to automate VS measurement and documentation should be considered.

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Resuscitation 2014, ERC Symposium on Guidelines: Abstract Presentations

Poster Presentations

**Acute Coronary Syndromes**

**AP001**

**Incidence of Culprit lesions after successful resuscitation from out of hospital cardiac arrest**


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**Purpose of the study:** To identify the underlying reason for out of hospital cardiac arrest remains challenging. Therefore, we studied the relation between acute coronary artery disease (culprit lesion at angiography) and stable coronary artery or other diseases in survivors of out of hospital cardiac arrest.

**Materials and methods:** We retrospectively analysed all successful resuscitation attempts from our mobile ICU from 2007 to 2012 which were admitted to our hospital. Patient's files and electronic database were reviewed and ECG's and coronary angiograms evaluated.

**Results:** We found 767 out of hospital resuscitation attempts. 220 (28.7%) were successful and admitted to hospitals, 166 (21.6%) to our hospital. In 83 out of the 166 patients coronary angiography was performed. Pre-hospital or hospital ECG recording where diagnostic for STEMI in 39 cases (group A) and not diagnostic for STEMI in 44 cases (group B). Culprit lesion was found in 77% in group A and in 48% in group B. Overall, acute coronary artery disease either confirmed by angiography or typical enzymatic patterns was found as underlying mechanism in only 38.4%, chronic coronary artery disease and reduced ejection fraction in 15%.

**Conclusion:** Acute coronary artery disease was the dominant diagnosis but found only in 38% of cases as underlying mechanism in survivors from out of hospital cardiac arrest. ECG recording (pre Hospital or Hospital) predicted culprit lesions correctly in 77%, but culprit lesions were also found in 48% of cases with non diagnostic ECG.

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**AP002**

**The role of paramedics in pre-hospital systemic delay. Comparison of transport methods for patients with ST-elevation myocardial infarction to a Percutaneous Coronary Intervention Centre and long-term mortality**

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**Background:** The pre-hospital phase is critical for patients with ST-elevation myocardial infarction (STEMI), because the length of delay before full treatment is inversely proportional to myocardial salvage. This study focused on differences in patient transportation methods and their influence on long-term mortality.

**Methods:** Patients with STEMI (n = 631), admitted to our department between 2009 and 2011, were enrolled. Those with percutaneous coronary intervention (PCI; n = 554), were divided into three groups: Group AR: first admitted to a local hospital (n = 326); or transported directly to the PCI centre with (Group S; n = 139), or without (Group P; n = 89), a physician. Kaplan-Meier, co-variate and discriminant analysis were carried out using these groups.

**Results:** Cumulative (and one year) mortality rates were: Group AR: 13.5% (9.5%); Group S: 24.5% (23.0%); Group P: 9.0% (7.9%); total patients after PCI: 15.9% (13.0%). Median follow-up time 940 days; interquartile range 520–1250 days. Transportation delay times (median (interquartile)) were: Group AR: 115 (73–180) minutes; Group S: 50 (30–90) minutes; Group P: 38.5 (20–55) minutes (p < 0.001). Transportation delay time was one independent factor for long-term survival, as assessed by discriminant analysis (p < 0.05).

**Conclusions:** Our study showed that the shortest transportation delay time was with paramedics only, i.e. without a physician,
Comparison of the short-term predictive value of four risk scores in chest pain patients in a Hong Kong emergency department: TIMI, GRACE, Banach and HEART

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Background and objectives: Four scores – TIMI, GRACE, Banach and HEART – for risk stratifying patients with chest pain presenting to emergency departments (EDs) have been developed in Western settings but have never been compared and validated in Chinese patients. We aimed to compare the performance of these scores in Chinese patients with suspected cardiac chest pain (CCP) in Hong Kong (HK).

Methods: Prospective observational study in the Prince of Wales Hospital ED in HK from 21 May 2012 to 3 March 2013. Patients age >18 years with potential CCP were enrolled. Acute ST-segment elevation myocardial infarction patients were excluded. Patients were followed up through an electronic medical records system and by telephone. The outcomes were major adverse cardiac events (MACE) at 7- and 30-days. MACE was a composite of death, revascularization, readmission with cardiac arrest, cardiogenic shock and hyperglycemia.

Results: 563 patients enrolled (mean age 63.9 [SD 14.6] years; 63.4% male). The respective areas under the curve (AUC), sensitivity (Sn) and specificity (Sp) and 95%CIs are as follows:

- **HEART 7-day MACE:** [AUC 0.742 (95% CI: 0.704-0.778), (Sn:72.0%, Sp:66.4%)]
- **HEART 30-day MACE:** [AUC 0.764 (95% CI: 0.726-0.798), (Sn:72.7%, Sp:67.0%)]
- **TIMI 7-day MACE:** [AUC 0.691 (95% CI: 0.651-0.729), (Sn:88.0%, Sp:42.4%)]
- **TIMI 30-day MACE:** [AUC 0.731 (95% CI: 0.692-0.767), (Sn:69.7%, Sp:65.3%)]
- **Banach 7-day MACE:** [AUC 0.588 (95% CI: 0.546-0.629), (Sn:64.0%, Sp:51.9%)]
- **Banach 30-day MACE:** [AUC 0.631 (95% CI: 0.590-0.671), (Sn:66.7%, Sp:52.3%)]
- **GRACE 7-day MACE:** [AUC 0.533 (95% CI: 0.491-0.575), (Sn:80.0%, Sp:37.0%)]
- **GRACE 30-day MACE:** [AUC 0.560 (95% CI: 0.518-0.602), (Sn:81.8%, Sp:24.2%)]

Conclusion: In Chinese patients presenting to an ED in HK, the HEART score was the best predictor of 7-day and 30-day MACE.

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AP004

Management and mortality of patients with ST elevation myocardial infarction presenting to two University Hospital Emergency Departments in China: Retrospective comparison between Hong Kong and Guangzhou

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Background and objectives: Healthcare systems are organized very differently in Hong Kong (HK) and Guangzhou (GZ). This study aimed to compare the Emergency Department (ED) management and mortality of ST-segment elevation myocardial infarction (STEMI) patients in teaching hospitals in GZ and HK.

Methods: Retrospective observational study from the Prince of Wales Hospital (HK) and the Second Affiliated Hospital of Guangzhou Medical University (GZ) conducted between January and December 2010. Univariate and multivariate logistic regression analyses were performed. The primary outcome was mortality at 30 days.

Results: Univariate analysis of 76 cases from HK and 111 cases from GZ showed similar clinical characteristics except GZ had lower proportions of males (74% vs 92%, P=0.002), hyperlipidemia (5% vs 25%, P=0.001), and Killip class I patients (56% vs 91%; P<0.001). The onset-to-door time of STEMI patients in GZ was longer than in HK (median 200 min [IQR 95–432] vs 120 min [IQR: 55–225], P=0.001). In GZ, 85 (77%) patients received primary percutaneous coronary intervention (PPCI) as the main reperfusion treatment, whereas in HK 18 (24%) received PPCI and 51 (67%) patients received thrombolytic therapy. Overall the one-year mortality in GZ was 19.8%, while in HK it was 14.4% (P=0.436). The adjusted odds of death in GZ compared with HK were 1.461 (95% CI: 0.66–3.22). Independent predictors of one-year mortality included older age and hyperglycemia.

Conclusions: Although we identified different patterns for managing STEMI patients between HK and GZ, the overall adjusted one year mortality was similar.

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Comparison of the prognostic value of TIMI, GRACE, Banach and HEART scores to evaluate patients with chest pain in a Guangzhou emergency department: Prospective observational study

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Background and objectives: TIMI, GRACE, Banach and HEART scores have been widely used in Western settings to risk stratify patients with chest pain but they have never been validated in Chinese. This study investigated the value of these scores in predicting major adverse cardiac events (MACE) in Chinese patients presenting with chest pain in Guangzhou in Southern China.

Methods: Prospective observational study performed in the ED of the 2nd Affiliated Hospital of Guangzhou Medical University. Patients ≥18 years with suspected cardiac chest pain were recruited. Patients were followed up through the Guangzhou Medical Insurance System and by telephone. The primary outcome was 7 and 30-day MACE, defined as a composite of death, revascularization, cardiac arrest readmission, cardiogenic shock, myocardial infarction, ventricular arrhythmia or high-grade atrioventricular block needing intervention.

Results: 432 patients were recruited (age 66.0 ± 15.2 years, 56.3% males). The areas under the curve (AUC), sensitivity (Sn) and specificity (Sp) and 95% CIs were as follows:

<table>
<thead>
<tr>
<th>Score</th>
<th>AUC (95% CI)</th>
<th>Sn (%)</th>
<th>Sp (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIMI 7-day MACE</td>
<td>0.625 (0.564–0.683)</td>
<td>80.3</td>
<td>40.7</td>
</tr>
<tr>
<td>TIMI 30-day MACE</td>
<td>0.643 (0.583–0.701)</td>
<td>81.6</td>
<td>47.3</td>
</tr>
<tr>
<td>GRACE 7-day MACE</td>
<td>0.605 (0.544–0.664)</td>
<td>44.4</td>
<td>76.1</td>
</tr>
<tr>
<td>GRACE 30-day MACE</td>
<td>0.608 (0.546–0.666)</td>
<td>42.5</td>
<td>76.7</td>
</tr>
<tr>
<td>Banach 7-day MACE</td>
<td>0.602 (0.541–0.661)</td>
<td>35.8</td>
<td>84.6</td>
</tr>
<tr>
<td>Banach 30-day MACE</td>
<td>0.617 (0.556–0.676)</td>
<td>35.6</td>
<td>85.6</td>
</tr>
<tr>
<td>HEART 7-day MACE</td>
<td>0.691 (0.632–0.746)</td>
<td>81.5</td>
<td>45.7</td>
</tr>
<tr>
<td>HEART 30-day MACE</td>
<td>0.701 (0.642–0.755)</td>
<td>81.6</td>
<td>47.2</td>
</tr>
</tbody>
</table>

Conclusions: In Chinese patients presenting to an ED in Guangzhou, the HEART score demonstrated better predictive accuracy for 7 and 30-day MACE.

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Advanced Life Support

AP006

Ultrafast cooling with hypothermic total liquid ventilation is potently protective after non-shockable cardiac arrest in rabbits

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Purpose of the study: Ultrafast cooling with total liquid ventilation (TLV) can induce a potent benefit in animal models of shockable cardiac arrest. Our purpose was to determine whether it can also induce neuroprotection after non shockable cardiac arrest.

Materials and methods: Anesthetised rabbits were submitted to 13 min of asphyxial cardiac arrest. After cardiopulmonary resuscitation, animals were randomized to undergo either normothermic life support (Control group), conventional cooling induced by i.v. cold saline (30 ml/kg; CC group) or hypothermia by 30 min of TLV with a liquid ventilator designed for pediatric use (“Inolivent-5”; TLV group). In the latter groups, hypothermia was maintained externally during 4 h at 32 °C. Neurological dysfunction and survival were further assessed during the next 3 days.

Results: After cardiac arrest, twelve rabbits were successfully resuscitated and included in each group. Target esophageal and tympanic temperatures of 32 °C were reached within 5 min in the TLV group. In comparison, 90 min were required to achieve similar temperatures in the CC group. Importantly, TLV procedure did not impair respiratory parameters such as pulmonary compliance (0.64 ± 0.05, 0.59 ± 0.02 and 0.57 ± 0.02 ml/cmH2O/kg in Control, CC and TLV groups, respectively, NS). Blood gases were also similar between groups throughout mechanical ventilation (PaO2 = 146 ± 8, 154 ± 16 and 170 ± 8 mmHg at t = 6 h in Control, CC and TLV groups, respectively).

Conclusions: Ultrafast cooling with total liquid ventilation (TLV) can induce a potent benefit in animal models of shockable cardiac arrest. Our purpose was to determine whether it can also induce neuroprotection after non shockable cardiac arrest.
and TLV groups, respectively, NS; all FiO₂ = 30%). After weaning and awakening, the neurological status was improved in TLV group as compared to the two other groups (Fig. 1, left panel). This led to a significant improvement in survival (see Fig. 1) and to a significant decrease in histological brain ischemic lesions in TLV vs Control and CC groups.

**Conclusion:** Ultra-fast cooling by TLV improves neurologic outcome and survival after non shockable asphyxial cardiac arrest in rabbits.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.055

**AP007**

**Changes in expression of V-ATPase in hippocampus and cortex after cardiopulmonary resuscitation in rats**

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**Objective:** Apoptosis and necrosis of neurons induced by hypoxia-ischemia and reperfusion are thought to be the main mechanisms of postresuscitation brain injury. Vacular H+ -ATPase (V-ATPase) has been shown an essential role in the anti-oxidative and anti-apoptotic activities. The aim of this study was to investigate changes in V-ATPase expression in the cerebrum after cardiopulmonary resuscitation (CPR) in a rat model.

**Methods:** One hundred male Sprague-Dawley rats were randomized either to a sham group or to one of 5 CPR groups. Cardiac arrest (CA) was induced by transcutaneous electrical epicardium stimulation during general anaesthesia, and CPR was performed with the Utstein mode 6 min after cardiac arrest. Animals were sacrificed at 1, 3, 6, 12 or 24 h after restoration of spontaneous circulation (ROSC). Immunofluorescence was performed to map the distribution of V-ATPase in rat cerebrum, whereas western blot was performed for quantitative analysis.

**Results:** There was a transient down-regulation of subunit V0a1both in hippocampus (1 h, P < 0.001; 3 h, P < 0.001) and cortex (1 h, P < 0.001) in response to CPR compared with the sham group respectively. Subunit V0a1 expression in the hippocampus began to increase at 3 h, reached peak at 6 h and returned to baseline at 24 h. The similar increase was observed in the cortex but with an earlier return at 12 h. However, the expression of subunit V1A showed no significant difference in both areas. V-ATPase showed unique co-localization with neurons.

**Conclusions:** A transient decrease of V-ATPase expression occurred in vulnerable areas of the brain early after ROSC. V-ATPase might be a potential therapeutic target of postresuscitation brain injury.

**References**

We describe the main features of EMS in Spain. Spanish Registry of out-of-hospital cardiac arrest

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15 Servicio de Asistencia Municipal de Urgencia y Rescate (SAMUR)-Protección Civil, Madrid, Spain
16 Servicio de Urgencias Médicas de Madrid (SUMMA 112), Comunidad de Madrid, Spain
17 Servicio de Emergencias 061, Murcia, Spain
18 Agencia Navarra de Emergencias, Navarra, Spain
19 SAMU Servicio de Emergencias Sanitarias, Comunidad de Valencia, Spain
20 Servicio de Bomberos, Zaragoza, Spain

Variability in the structure and operation of out-of-hospital emergency services in Spain. Spanish Registry of out-of-hospital cardiac arrest


AP009

Purpose: The diagnosis of pulmonary embolism (PE) during cardiopulmonary resuscitation (CPR) is challenging, and often is established only by autopsy. Here, we aimed to describe the clinical characteristics of PE as cause of out-of-hospital cardiac arrest (OHCA) and evaluate the diagnostic value of emergency ultrasound (E-US) during CPR.

Methods: We conducted a retrospective analysis of non-traumatic OHCA patients who were admitted to an urban emergency department and underwent autopsy between April 2010 and April 2013 in Japan.

Results: In total, 214 patients with OHCA were included (136 men [63.6%], 78 women [36.4%]; mean age, 71.4 ± 14 years). Of these, 8 patients (3.7%) were diagnosed with a PE at autopsy, and only 2 of these patients were diagnosed during CPR. Of the 8 patients, the initial cardiac arrest rhythm was pulseless electrical arrest in 6 patients (75%) and asystole in 2 (25%). The primary symptoms reported before the cardiac arrest were dyspnea (2/8, 25%), nausea/fatigue (2/8, 25%), chest pain (1/8, 12.5%), and syncope (1/8, 12.5%). Two patients had predisposing factors for PE: 1 had a prior history of PE/deep vein thrombosis, whereas the other was bed-ridden. E-US was performed in 172 patients and detected PE with a sensitivity of 28.6% (95% confidence interval [CI], 10.3–28.6), specificity of 100% (95% CI, 99.2–100), and overall accuracy of 97.0% (95% CI, 95.5–97.0).

Conclusions: It is difficult to diagnose PE during CPR on the basis of only patient history and physical examination. E-US is proven to be an effective tool to diagnose PE with high accuracy, and seamless thrombolytic therapy may improve patient outcomes.

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AP010

Use of emergency ultrasound during cardiopulmonary resuscitation to detect pulmonary embolism

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Purpose: The diagnosis of pulmonary embolism (PE) during cardiopulmonary resuscitation (CPR) is challenging, and often is established only by autopsy. Here, we aimed to describe the clinical characteristics of PE as cause of out-of-hospital cardiac arrest (OHCA) and evaluate the diagnostic value of emergency ultrasound (E-US) during CPR.

Methods: We conducted a retrospective analysis of non-traumatic OHCA patients who were admitted to an urban emergency department and underwent autopsy between April 2010 and April 2013 in Japan.

Results: In total, 214 patients with OHCA were included (136 men [63.6%], 78 women [36.4%]; mean age, 71.4 ± 14 years). Of these, 8 patients (3.7%) were diagnosed with a PE at autopsy, and only 2 of these patients were diagnosed during CPR. Of the 8 patients, the initial cardiac arrest rhythm was pulseless electrical arrest in 6 patients (75%) and asystole in 2 (25%). The primary symptoms reported before the cardiac arrest were dyspnea (2/8, 25%), nausea/fatigue (2/8, 25%), chest pain (1/8, 12.5%), and syncope (1/8, 12.5%). Two patients had predisposing factors for PE: 1 had a prior history of PE/deep vein thrombosis, whereas the other was bed-ridden. E-US was performed in 172 patients and detected PE with a sensitivity of 28.6% (95% confidence interval [CI], 10.3–28.6), specificity of 100% (95% CI, 99.2–100), and overall accuracy of 97.0% (95% CI, 95.5–97.0).

Conclusions: It is difficult to diagnose PE during CPR on the basis of only patient history and physical examination. E-US is proven to be an effective tool to diagnose PE with high accuracy, and seamless thrombolytic therapy may improve patient outcomes.

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**AP011**

A comparison of intravenous and intraosseous vascular access during simulated cardiac arrest on an Advanced Life Support course

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**Purpose:** Vascular access during a cardiac arrest is a significant challenge faced by responding healthcare professionals. It has been suggested that as many as 40% of intravenous attempts during cardiac arrest are unsuccessful and that the time taken to achieve access can be up to thirty minutes (Lapostelle et al., 2007). The purpose of this study was to compare the time taken and number of attempts taken to achieve intravenous access compared to intraosseous access during a simulated cardiac arrest on a Resuscitation Council (UK) Advanced Life Support course.

**Methods:** The design was a prospective randomised controlled cross over. During the ALS course, study participants completed a vascular access skills station. Participants were then randomly allocated to either attempt IV access or IO access during a simulated PEA cardiac arrest. The simulation involved trained ALS faculty performing compressions and airway management. The time taken and number of attempts to obtain access was recorded. The participants then repeated the simulation but with the other vascular access method. Participants were also asked to complete a pre and post IO access station qualitative questionnaire.

**Results:** Thirty three candidates consented to participate in the study. Successful IV access was obtained at first attempt 70% of the time, compared to 100% for IO access. There was no statistically significant difference in time taken to obtain access between the two devices. There was a significant increase in participants confidence and awareness of the IO route, from a VAS of 22–65, demonstrating an almost 300% increase in confidence.

**Conclusion:** This study concludes that successful humeral IO access can be achieved following a short education input. The implications for clinical and educational practice is wide-reaching and it is hoped that a follow up study looking at skill retention will add to the findings from this study.

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**AP012**

Factors associated with the Return of Spontaneous Circulation (ROSC) outcome in cardiopulmonary resuscitated patients

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**Objectives:** The recent studies proved poor outcome after cardiac arrest (CA) despite of the 2010 ERC Guidelines implementation. Nevertheless, in various European centers, examples of excellent practice could be mentioned. Improving outcome requires better knowledge about CA mechanism, about patients and process of cardiopulmonary resuscitation. Our study about including patients with out-of-hospital and in-hospital CA try to demonstrate what is different inside the survival group compared with non-survival patients and what is the role of the focused echocardiography during resuscitation for recognition and treatment of reversible causes of the cardiac arrest.

**Methods:** We prospectively analyzed a group of 109 patients with cardiac arrest (CA) admitted consecutively in the Cardiology Clinic of an academic hospital for adults in Iasi, Romania.

**Results:** The study did not show a significant difference in the ejection fraction in patients with ROSC subgroup (39.28 ± 11.11) than the subgroup without ROSC (38.88 ± 14.28), but significant differences between the two subgroups were identified regarding to the collapse/small size of the inferior vena cava (hypovolemic status marker) (p < 0.005). We find also statistically significant differences between patients with/without ROSC regarding the association of acute heart failure manifestations, the CA-CPR times, CPR duration, initiation of CPR by witnesses, the place of the CA (OHCA vs. IHCA), GCS and SaO2 score, the use of clopidogrel, heparin, amiodarone and vasopressors (positive inotropic) as pre-existing medication.

**Conclusion:** The study showed statistically significant differences between patients with/without ROSC regarding the hypertension history, the association of acute heart failure manifestations and hypovolemic status. When hypovolemia was identified by using ultrasonography and treated by aggressively fluid replacement in the ALS algorithm, ROSC and survival is observed to be more frequent.

**Keywords:** Cardiac arrest outcome; Reversible causes of cardiac arrest; Focused echocardiography; Resuscitation

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**AP013**

Clinicians’ views on the effectiveness of adrenaline to treat cardiac arrest

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**Purpose of the study:** Recent evidence has cast doubt on the safety and effectiveness of adrenaline as a treatment for cardiac arrest.1,2 The purpose of this study was to obtain the views of UK clinicians on the effects of adrenaline on outcomes from cardiac arrest and whether a randomized controlled trial is needed.

**Materials and methods:** We distributed questionnaires to participants at the Resuscitation Council (UK) Annual Scientific Conference held in September 2012. Participants were asked to rate their views using a 7-point Likert scale (1 strongly disagree to 7 strongly agree) on the effect of adrenaline on short- and long-term survival, long-term patient focused outcomes (e.g. neurocognitive function) and whether the risks of adrenaline outweighed the benefit. In addition we sought views on an appropriate comparator agent and setting for a randomized controlled trial. Data shown are median and [interquartile range] for Likert responses.

**Results:** Completed questionnaires were received from 216 delegates. Respondents agreed that adrenaline improved short-term survival (median 6 [6–7]) but disagreed that it improved long-term survival (2 [1–3]) or patient focused long-term outcomes (2 [1–3]). Respondents’ views about whether the risk of adrenaline outweighs the benefit are shown in the figure. 95% of respondents agreed with a need for a large randomized controlled trial including standard dose adrenaline (72% strongly agreed, 2% disagreed). The majority (58%) felt the comparator in a trial should be placebo, 14% low-dose adrenaline and 26% adrenaline as a continuous infusion.
Conclusions: Clinicians in the UK are uncertain about the safety and effectiveness of adrenaline as a treatment for cardiac arrest and support the need for a placebo-controlled trial.

Overall the risks of IV adrenaline in cardiac arrest outweigh the benefit

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References


Result/conclusion: The pathway started in November 2013 and has included 9 patients whereas 7 survived to hospital discharge. Of those, two patients have survived among the none-ROSC group. This patients was transported direct to the cathlab with mechanical compression made by Lucas. We have no previous experience from survival in groups not receiving ROSC outside hospital.


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AP014

PCI-de-Lucs: A safety and feasibility study on a pathway to the cathlab for patients with out-of-hospital cardiac arrest

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Purpose: In Sweden ambulance delay, from call to arrival, is around 12 min in outside hospital cardiac arrest (OHCA). However, there is a small group of OHCA (20%) where this delay time is deleted, namely those occurring some minute before or after the arrival of the ambulance. In spite of CPR and/or defibrillation within one minute no more than one third of the patients with ventricular fibrillation (VF) are successfully defibrillated. Totally, only 20% survives to hospital discharge in this favorable group. One reason for this could be that it is impossible to open an occluded coronary artery with electricity. The aim of this pilot is to observe safety, feasibility and survival in a favorable group of OHCA transported direct to the cathlab by the ambulance in a new pathway.

Materials and methods: Inclusion: (1) Crew witnessed CA of cardiac origin; (2) OHCA immediate defibrillated to return of spontaneous circulation (ROSC) by Public access defibrillators or at the primary care centers; (3) CA occurring 2–3 min before ambulance arrival where the patient had immediate bystander CPR of high quality or still is breathing at ambulance arrival. Exclusion: None cardiac origin, high physiologic age (hospis patients). Logistics: According to inclusion criteria no more than 30–40 patients a year are expected in this pathway. Some have ROSC (40–60%) and some have not. The none-ROSC patients are only accepted if treated with mechanical compression during transport.

Result/conclusion: The pathway started in November 2013 and has included 9 patients whereas 7 survived to hospital discharge. Of those, two patients have survived among the none-ROSC group. This patients was transported direct to the cathlab with mechanical compression made by Lucas. We have no previous experience from survival in groups not receiving ROSC outside hospital.

Conclusions: The factor that was related to immediate survival and “ad integrum” neurological recovery was the HR after REC. The MBP was associated with immediate mortality (p = 0.021) but not “ad integrum” recovery. The HR was associated with immediate mortality (6 hours) p = 0.03 and survival at 7 days p = 0.04 and “ad integrum” (p = 0.03).

Further reading

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AP016

Hydrogen ions instead minutes: The Initial pH level may predict survival without neurological impairment in the not witnessed prehospital cardiac arrest

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Objective: To analyze the possible association of venous pH values collected in blood sample at the beginning of resuscitation and neurological recovery (CPC I-II).


Results: 454 non-traumatic prehospital cardiac arrests. 94% (427) had analytical register. The average time from receipt of notification to obtain the blood sample was 12 min (IQR: 9–14). There’s an inverse association between levels of pH and time of obtaining the blood sample (p = 0.007). The prevalence of patients with neurologic recovery ad integrum was 20.14%. Initial pH was also associated to arrival time. Ph levels below 6.77 were associated with 100% mortality. REC was not associated with initial pH (p = 0.48). However, the initial pH was associated with survival without neurological impairment (CPC I-II) (p = 0.001). The interval (7.09–7.25) was associated with improved survival. The initial pH above 7.06 had 82% specificity for predicting recovery ad integrum and positive predictive value of 89%. Initial pH values greater than 7.06 were associated with survival (CPC I-II) OR = 3.027 (95% CI 1.6 to 5.3).

Conclusion: Together with others signs, the initial pH may be a useful tool to predict neurological recovery in the non witnessed prehospital cardiac arrest. When is not possible to know the exact arrest time, the pH can help us for making some decisions in theprehospital setting.

Further reading


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AP017

Factors associated to the survival in pre-hospital Sudden Cardiac Arrest


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Background: The incidence and outcomes of sudden cardiac death (SCD) vary greatly between countries. We describe the results of an Out-of-hospital cardiac arrest registry (OHCAR).

Methods: We analysed the cardiac aetiology cases from an OHCAR attended by emergency services (EMS) in Spain, between January 2008 and December 2010. Factors related to hospital discharge with good neurologic status (Cerebral Performance Category CPC1–2) were analysed.

Results: The registry included 3054 patients with OHCAR. Cardiac aetiology was estimated in 2447 (80.1%) patients, 1773 (72.5%) men, aged 62.6 ± 15.6 years (61.4 ± 14.7 men vs 66 ± 17.2 women). Call reason was unconscious in 70% and 1368 (55.9%) of the events occurred at home. 681 (27.8%) were unwitnessed and time of collapse was not recorded in 15.8% of cases. Initial rhythm was shockable in 21.6%. Basic life support (BLS) before EMS arrival was provided in 1039 (42.5%) patients, 384 (37%) by witness. 130 patients were defibrillated prior EMS on scene. 699 (28.6%) patients reached the hospital with pulse. 287 (54.4%) when the initial rhythm was shockable, and 79 (3.2%) patients arrived with ongoing CPR. 239 (9.8%) patients were discharged with CPC1–2, no any patient from the ongoing CPR group. Factors associated with CPC1–2 at discharge were, age (OR 0.981, CI 0.968–0.994), non-home collapse (OR 2.148, CI 1.282–3.598), witnessed SCD (OR 2.612, CI 1.304–5.234), initial shockable rhythm (OR 6.661, CI 4.199–10.567), defibrillation before EMS arrival (OR 1.892, CI 1.304–5.234), intubation before CPR group (OR 2.612, CI 1.304–5.234).

Conclusions: SCD occur in a middle-aged population. Only one in five initial rhythms is shockable. SCD at home remains as an important prognostic variable. Ongoing CPR has no results. The time and actions prior to the emergency team arrival is critical for the survival with good neurologic status.

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AP018

Effect of selective intra-aortic volume expansion in CPP during prolonged ventricular fibrillation

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Background: Coronary perfusion pressure (CPP) is a valuable predictor of return of spontaneous circulation. In refractory cardiac arrest, CPP is usually inadequate. Resuscitative efforts based solely on external chest compression may be limited in their ability to generate adequate CPP. The aim of this study is to investigate the effect of selective intra-aortic volume expansion in CPP during prolonged ventricular fibrillation (VF).

Methods: Nine adult male Sprague-Dawley rats were used and were block randomized at the end of stabilization as three groups including Chest Compression (CP), CP-Crystalloid, and CP-Colloid. Experiments were performed according to protocol timelines.

Results: CPP responded to intra-aortic volume expansion (16.3 ± 2.3 mm Hg in CP group, 52.2 ± 29.7 mm Hg in CP-Crystalloid group, and 84.2 ± 27. mm Hg in CP-Colloid group, respectively, p < 0.05). At the end of resuscitation, ECG showed PEA (3 of 3 rats) in CP group and VF (5 of 6 rats) in CP-Fluid groups.

Conclusion: Selective intra-aortic volume expansion was effective on elevating CPP during cardiopulmonary resuscitation in prolonged VF-induced cardiac arrest.

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AP019

Acidosis in ventricular fibrillation: Does the administration of sodium bicarbonate (SB) prevent from or delay return of spontaneous circulation (REC)?

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Introduction: Studies have shown that the administration of SB could not be beneficial in cardiac arrest when analytical or metabolic parameters are not available. Our study describes the most common metabolic condition founded in VF Rate of REC and REC time. Statistical quantitative: Central and Dispersion Measures. Qualitative: percentages. Contrast of normality, Kolmogorov–Smirnov: Mean and standard deviation (SD). Normal distribution: Median and interquartile ranges (IQR) and Kaplan–Meier estimator and Log–Rank Test. ACCES, Excel, SPSS. Data Confidentiality.

Results: 127 OOHCA with initial rhythm VF were studied. The mean time for venous blood sample was 12 min with a (IQR: 11–15). 96% (122) had a venous pH below 7.31 and 81.14% of them (99) had a pCO2 > 51. In these group, 81.8% (81). SB was administered and associated with no REC (p = 0.002) and longer duration of CPR until REC (34.56 vs 17.89 minutes) p = 0.016 (Fig. 1). More shocks were needed when bicarbonate was administered (4.81 vs 2.11) (p = 0.001).

Conclusion: The most common metabolic pattern in the onset of VF was respiratory acidosis. Administration of sodium bicarbonate was associated with lower REC rate and longer time to get it. As well as an increased number of shocks needed. Therefore, in this situation the administration of bicarbonate should be avoided, as there is a negative relation with REC.

Further reading

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AP020

Prehospital cardiac arrest

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Purpose of the study: Chain of surviving victims of cardiac arrest is a series of activities designed to bring together and coordinate the increase of survival rates and recovery of victims of cardiac arrest. The aim is to show the treatment of pre-hospital cardiac arrest in terms of ambulance Sarajevo.

Materials and methods: Retrospective study has been used in the one-year period to analyze experience of cardiac arrest in the Emergency Medical Service Centre of Sarajevo, Bosnia and Herzegovina. For the analysis we have used data from the protocols medical teams and emergency medicine ambulances.
**Results:** Retrospective method has been used to analyze the period from January to December 2012. From a total of 116 patients in cardiac arrest 4 patients were taken to the infirmary emergency medicine and 112 patients were treated at the site of the incident. Average response time of emergency medical team was 6.35 min. Of the total number 21.5% patients had shockable rhythm on the monitor. Return of spontaneous circulation – ROSC – is achieved in 17.25% of patients.

Cardiopulmonary resuscitation performed by bystanders at the scene increases the survival rate of 2–3 times. Experience of emergency medical teams in the implementation of early cardiopulmonary resuscitation performed by bystanders including other health professionals (primary care workers) is devastating. Neither one of victims of cardiac arrest receive cardiopulmonary resuscitation until the arrival of emergency medical team.

**Conclusion:** It is necessary to develop programs to raise awareness among the population about the importance of providing assistance to victims of cardiac arrest, as well as education programs of basic cardiopulmonary resuscitation and AED use. Good equipment, organization and education of emergency medical team to care for victims of cardiac arrest is crucial to improving survival.

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**AP021**

**Role of the emergencies coordinating center managing an OHCA call and its influence on the variables that may improve the outcome of the EMS response**

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**Objectives:** To define variables occurring in the lapse between reception of an OHCA-call and arrival of ALS-Team to evaluate their influence on the outcome of EMS response.

Rates of telephonic diagnosis of OHCA and DA-CPR, times of activation and mobilization of ALS-Team and rates of bystanders CPR are related to the ratio of survival at hospital arrival.

**Materials and methods:** Descriptive study of the OHCA assisted by SAMU-Asturias from July 1st to September 30th 2013. Data extracted from medical records and UTSTEIN data base, and processed using SPSS Statistics 21 programme.

**Results:** 90 cases meet the criteria for inclusion: OHCA with estimated collapse time prior to call time. Activation cause: OCHA in 65.6% of cases with DA-CPR was provided in 46.6% of them. OHCA identified calls get bystanders CPR in 41.9% of cases, while on other calls it is in 17.2% (p < 0.05).

Patients age: 4 children (under 12 years) (20%) and 16 adults (80%).

Puncture site: proximal tibia 14 (70%) distal tibia 5 (25%) proximal humerus 1 (5%) Children: Proximal Tibia: 4 (100%)
Adults: Proximal Tibia: 10 (62.5%) distal tibia: 5 (31.25%) proximal humerus: 1 (6.25)

Results puncture: Strength: 15 (75%) No effective: 5 (25%) Children: Strength: 3 (75%) No effective: 1 (25%)
Adults: Strength: 12 (75%) No staff: 4 (25%).

**Conclusion:** The intraosseous access as an alternative to those situations where it is not possible peripheral venous access, it becomes a real and reliable alternative, fast implementation and high success rate of CPR in which administration is required pressing of drugs and fluids.

**Further reading**


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Evaluation of cardiac arrest patients in University Hospital in Turkey

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**Purpose:** Cardiac arrest could be due to many acute and chronic factors. In this study, we aimed to investigate cardiac arrest causes in university hospital.

**Materials and methods:** We aimed to analyse the patients diagnosed with cardiac arrest in the hospital in accordance to their demographic variables, reversible causes in cardiac arrest, return of spontaneous circulation time, cardiac arrest rhythm, the duration of the cardiopulmonary resuscitation and blood pressure values. SPSS 15.0 is used to analyse and p < 0.05 is accept meaning.

**Results:** We analysed 189 patients. Seventy three of patients were woman (37.2%), one hundred twenty three of patients were men (62.8%). The mean age were 58.74 ± 16.66. Mean of women BMI is 27.04 ± 5.78 (n = 73); and men is 23.60 ± 4.370 (n = 123) (p < 0.05). Patients have got 34.7% HT, 28.1% DM, 23.5% CAD, 14.3% COPD, 12.2% CRF, 14.3% SVD, 12.8% TRAUMA, 14.3% HF ve 7.1% MI. DM is seen to be significantly higher in women (p < 0.05).

CPR time is 38.47 ± 14.71 min (n = 189). In the 46 of the patients (24.3%), spontaneous circulations were returned, in the 143 of theirs (75.7%) considered to be exitus. ROSC time is 14.80 ± 9.07 min. Their SBP was 74.35 ± 32.63, DBP was 45.00 ± 18.34 mmHg.

The first arrest rhythm encountered most frequently NEA (18.5%) and asystole (77.2%) were observed. Reasons that cause arrest can be reversed hypoxia (10.6%) and hypo/hyperkalemia (8.5%) are the most common. Others were hypovolemia (4.2%), thromboembolism (1.6%) and tension pneumothorax (1.1%).

**Conclusion:** Most of patients have got unshockable rhythms such as pulseless electrical activity and asystole. The short cardiac arrest duration is favour for survival. Cardiac arrest reversible causes should be pre-determined and critical evaluation of patients before cardiac arrest emergency response team should be notified.

**Reference**


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Differences in airway management during out-of-hospital cardiopulmonary resuscitation (CPR) between experienced and inexperienced emergency medical physicians

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**Purpose:** Airway management is one of the primary considerations during CPR. Although endotracheal intubation (ETI) is the safest method to secure the airway, it requires skill and experience, so introduction of supraglottic devices (SGDs) revolutionized airway management. However, these advanced techniques have complications and are often poorly performed by inexperienced physicians. This study investigates differences in airway management during out-of-hospital CPR between experienced and inexperienced emergency medical physicians.

**Materials and methods:** We analysed Utstein Style Forms (USFs) and medical records of all out-of-hospital CPRs performed between January 1, 2008 and December 31, 2013 by Emergency Medical Service (EMS) Varazdin, Croatia. Experienced physicians were considered those working ≥ 1 year, while inexperienced those working < 1 year in a prehospital setting.

**Results:** We analyzed 213 USFs and medical records of out-of-hospital CPRs: 154 were performed by experienced physicians (no. of physicians = 14), while 59 were performed by inexperienced physicians (no. of physicians = 26). Airway management was dependent on physicians’ experience in a prehospital setting (inexperienced vs. experienced physicians: P = 0.016). Compared with experienced physicians, inexperienced physicians used Guedel airway together with bag-valve-mask ventilation more frequently (inexperienced vs. experienced = 26% vs. 9%, P = 0.003; Bonferroni corrected P < 0.017), and less frequently the advanced techniques (inexperienced vs. experienced = 71% vs. 88%, P = 0.004). There was no difference in airway management during out-of-hospital CPRs by placing SGDs (inexperienced vs. experienced physicians = 41% vs. 44%, P = 0.758), and ETI (inexperienced vs. experienced physicians = 31% vs. 46%, P = 0.063).

**Conclusion:** For the past decade the best method of airway management during CPR still stands controversial because of the complications associated with advanced techniques, such as ETI and SGDs. That is probably why inexperienced physicians in EMS Varazdin felt more comfortable using basic airway manoeuvres and adjuncts when performing CPR.

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Impact of different ventilation modalities on lung volumes and pressures during automatic cardio pulmonary resuscitation: A bench study

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\textbf{Introduction:} During cardio-pulmonary resuscitation (CPR), the ventilation strategy applied may affect tidal volume ($V_t$), minute ventilation ($V_E$), lung volume and hemodynamics. Also, by decreasing lung volumes, chest compressions (CC) can create lung injury.

\textbf{Objective:} This bench study aimed to evaluate current recommendations for ventilation during CPR and to compare it to continuous flow insufflation (CFI) with positive pressure.

\textbf{Materials and methods:} In a lung test model specifically designed to allow standardized chest compressions with an automatic device (LUCAS \textsuperscript{2}®), we evaluated manual bag ventilation (10 cycles/minute), volume controlled ventilation (VCV) mode using Oxylog 3000\textsuperscript{®} (respiratory rate at 10 min\textsuperscript{-1}, $V_t$ = 500 ml and zero of end-expiratory pressure). We also tested CFI set at 10 cmH\textsubscript{2}O-1 L min\textsuperscript{-1} using CPR Boussignac\textsuperscript{®} tube. Ventilation mobilized by CC (black in the figure) and by the conventional ventilatory strategy (gray in the figure), changes in intrathoracic pressure and dynamic lung volume reduction compared to the FRC were measured.

\textbf{Results:} With the two conventional ventilatory strategies, main part of minute ventilation was related to CC alone (84% for ventilation ball and 78% for VCV) and lung volume was reduced far below FRC. With CFI, minute ventilation was significantly greater and the loss of lung volume was less important. Finally, with CFI the intrathoracic pressure during compression (red) was positive but remained negative (blue) during decompression thus preserving venous returns.

\textbf{Conclusion:} With current conventional ventilatory strategies, ventilation was essentially due to CC and took place entirely below FRC. CFI was more efficient in terms of ventilation, FRC protection and intrathoracic pressure variation. These results show the predominant role played by CC in terms of ventilation and suggest that ventilation with CFI should be considered for CPR.

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tive predictive value of 96.8%/98.6% (training set) and 96.1%/99.5% (test set) respectively, with a mean ventilation-rate error of 0.32 ± 0.58 (training set) and 0.36 ± 0.67 (test set) vent/min.

**Conclusion:** Ventilation patterns were clearly recognizable in most of the capnogram (93.6% of the time). The developed ventilation detector reported a mean error of 0.36 ± 0.67 vent/min with the test set. Monitoring respiratory rate with capnography during CPR is feasible.

*Further reading*
1. Equipment and drug list for cardiopulmonary resuscitation, Primary Care. London: Resuscitation Council (UK); 2013.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.076

AP027

**Availability of resuscitation airway equipment in areas of the hospital: Closing the audit circle**

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**Introduction:** Guideline from The Resuscitation Council (RC) (UK) recommends the availability of minimum airway equipment as part of the provision of high quality resuscitation service within healthcare organisation in the UK. The audit was aimed at evaluating the implementation and compliance with the recommendations made in the last audit with a view of closing the audit cycle.

**Methods:** All the wards in the hospital where resuscitation trolleys are available were visited. It was an unannounced visit and inspection of the resuscitation trolley by the investigator. A proforma with the RC minimum equipment list was ticked according to their presence on the trolleys. One point is scored for the presence of an item and none for unavailable equipment.

**Results:** There is a significant improvement with all the ward recording more than 50% compliance (Fig. 1). One ward recorded 100% compliance and more than 80% of the equipment was available on the wards visited. Fig. 2 shows the comparison of the previous audit with the current one. Overall performance shows moderate improvement. We also recorded the presence of end tidal CO₂ monitor in more than 50% of the wards.

**Conclusion:** We are still not compliant with the provision of minimum airway equipment for CPR in our Trust. However there has been a moderate change in practice and availability of airway equipment. We are proactively ensuring the implementation of our recommendations. A robust funding, staff education and motivation are key.
malleable stylet McGrath MAC-shaped in cervical spine immobilization condition.

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AP029
The laryngeal tube LTS-D: A quick and easy airway management device for prehospital emergency nurses
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Introduction: The disposable laryngeal tube suction (LTS-D, VBM Medizintechnik GmbH, Germany) is a single-use supra-glottic device included in the international resuscitation guidelines. The aim of the study was to evaluate how well emergency nurses can insert it in a manikin after a quick education program.

Materials and methods: No details of the protocol were revealed before the study. Our nurses followed a one-hour theoretical teaching about the LTS-D by a manufacturer delegate without any practice. They had to manage airway of a manikin head in neutral position using a LTS-D size 4. At the beginning of the test, the LTS-D, the empty syringe for cuff inflation and a bag-valve ventilator were ready on the table. Data collected were: time needed for insertion (started when the nurse took the device, stopped at the first complete and symmetrical inflation of the artificial lungs), numbers of attempts and if additional instructions were needed. They were also asked to complete a sheet about demographics data and previous acquaintance with the LT.

Results: 159 fire and rescue nurses were included in the study. 77 Men and 82 Women, age was 34 ± 7. Thirty-nine percent of them knew the device theoretically before the study and 12.6% practically. Mean insertion time was 17.5 ± 6 s (min: 9, max: 40, Q1: 13, Q3: 20). In 97.5% the device was correctly inserted on first attempt. No failed attempt and no significant mistake were collected. Additional oral instructions were needed in 22 cases (most frequent in 7 cases: improper insertion depth). All of them found the insertion easy and comfortable.

Conclusion: Implementation of the LTS-D in our nurses’ resuscitation algorithms seems feasible and safe. Its use is instinctive and it offers, in less than 20 s, a reliable airway management. A skill retention assessment is intended.

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AP030
Capnography as standard ventilation monitoring during life support. Do we fulfill ERC guidelines?
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Objective: Assessment of End Tidal CO2 levels during critical care monitoring and life support is a source of information about victim clinical situation and resuscitation prognosis being recommended to use since 2005 ERC guidelines.

The objective of our study is to evaluate the knowledge on capnography of critical care staff and how do they use this monitoring during life support.

Methods: A descriptive, transversal and retrospective study was performed using 162 questionnaires completed through “Google Drive” by critical care providers from different hospitals and prehospital emergency services. 25 questions about ventilatory monitoring and capnography use according to ERC guidelines were analysed and grouped to get our results.
Results:

- The use of EtCO₂ monitoring during ALS is largely limited to check tube position and to assess and diagnose respiratory pathology on critical care.
- Assessment and use of EtCO₂ as an indirect measure of CPR quality and prognosis of the cardiac arrest is still underemployed.
- Although a high self-perceived level of knowledge about capnography during life support, this technique is not familiar enough for critical care providers, so we can conclude that it is necessary to emphasize on using EtCO₂ during ALS, trying to find better ways to diffuse the use of it and fulfill what ERC guidelines shows.

Conclusions:

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Influence of mechanical ventilation with Chest Compression Synchronized ventilation (CCSV) or Intermitted Positive Pressure Ventilation (IPPV) on haemodynamics in a pig model

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Objective: Guidelines recommend mechanical ventilation with Intermitted Positive Pressure Ventilation (IPPV) during resuscitation. Positive pressure ventilation might influence the effects of chest compressions on haemodynamics. We investigated the influence of the novel ventilator mode Chest Compression Synchronized Ventilation (CCSV) on arterial blood pressure compared with IPPV in a cross-over pig model.

Methods: After approval by local authorities 12 pigs were included (general anaesthesia/intubation). Ventricular fibrillation (VF) was induced and continuous chest compressions were started after 3 min. Pigs were mechanically ventilated in a cross-over setting with 5 ventilation periods of 3 min each during the first and last period ventilation was applied with IPPV (100% O₂, tidal volumes 7 ml kg⁻¹, respiratory rate 10/min, PEEP = 0 mbar). During the 2nd, 3rd and 4th period ventilation with Chest Compression Synchronized Ventilation (CCSV), a pressure-controlled and with each chest compression synchronized breathing pattern with three different presets was applied in randomized order. Presets of CCSV (100% O₂): CCSVA: \( P_{\text{insp}} = 60 \text{ mbar}, \) inspiratory time 205 ms; CCSVB: \( P_{\text{insp}} = 60 \text{ mbar}, \) inspiratory time 265 ms; CCSVC: \( P_{\text{insp}} = 45 \text{ mbar}, \) inspiratory time 265 ms. Arterial blood pressure was continuously recorded. The Friedman-Test with multiple post-hoc comparisons was performed and results were expressed as median (25%/75%percentiles).

Results: Mean arterial pressures: IPPVfirst: 42 (33/48) mmHg, IPPVlast: 22 (18/39) mmHg (\( p<0.001 \) vs IPPVfirst), CCSVA: 40 (34/44) mmHg (\( p=1.0 \) vs IPPVfirst, \( p<0.001 \) vs IPPVlast), CCSVB: 39 (35/44) mmHg (\( p=1.0 \) vs IPPVfirst, \( p<0.001 \) vs IPPVlast), CCSVC: 37 (35/42) mmHg (\( p=0.95 \) vs IPPVfirst, \( p<0.001 \) vs IPPVlast). The Friedman-Test with multiple post-hoc comparisons was performed and results were expressed as median (25%/75%percentiles).

Conclusions: All patterns of Chest Compression Synchronized Ventilation (CCSV) avoid an arterial blood pressure drop during resuscitation and lead to a higher arterial blood pressure after prolonged CPR compared with IPPV in this cardiac arrest pig model.
Utility of the use of timer for laryngoscopes

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Background: Tracheal intubation is a practice traditionally recommended for certain types of patients – in the field of cardiorespiratory arrest (CPR) and out of it- due to the advantages shown regarding the level of oxygen uptake and the isolation of the airway.1 However, it is very important not to exceed the technique in time. If 30 seconds are considered (sgs.) to be the maximum acceptable time for intubation, CPR is now recommended not to exceed 10 sgs. Thus, for the technique learning, it can be very interesting to include a timer in the laryngoscope.2

This instrument (Illustration 1) is activated at the beginning of intubation and it alerts by lighting and producing sounds when it reaches the time it has been programmed for. Thus, learning involves internalization of the importance of time and especially trains inexperienced people in this important facet.3

Its use has already been tested in the area of education and specialized training.

Purpose of the study: to know the satisfaction level and perceived usefulness of the Laryngoscope timer.

Materials and methods: An ad hoc questionnaire for 109 training courses professionals using a Laryngoscope timer.

Results: 72.8% have considered themselves to feel safer with the instrument, and 83.4% states that it is a very useful training system (positive values considered >8 on a scale from 1 to 10).

Conclusions: In this approach, the satisfaction level and the perceived usefulness of the Laryngoscope timer were considered to be very acceptable.

Recommendations: It is advisable to further progress in the research on the usefulness of the laryngoscope timer in teaching and practice.
Results:

Conclusions: Adaptation of conventional oxigenotherapy devices as a bracket to adjust an intubated EtCO₂ cannula to non-intubated patients would permit us to obtain reliable capnographic and capnometric registers without significant deviations. It would be interesting to study more these adaptations on different kind of patients.

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AP034

Is McGrath® MAC better than Glidescope® Ranger for novice providers in the simulated difficult airway? A randomized manikin study

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Purpose of this study: McGrath® MAC and Glidescope® Ranger are portable video laryngoscopes that are easy to learn for novice and useful in difficult airway environment. We anticipated that McGrath® MAC would show performance in intubation of novices as equal as Glidescope® Ranger in normal and difficult airway.

Materials and Methods: Primary outcomes were the rate of successful intubation, intubation time and overall glottic view of McGrath® MAC, Glidescope® Ranger and Macintosh. We performed a prospective, single-blinded, randomized crossover study of 39 medical students using three laryngoscopes in a manikin, with simulated normal and difficult airway scenarios.

Results: The successful intubation rate of McGrath® MAC (82.5 (38.5)%) was better than Macintosh (57.5 (50.1)%; p = 0.026) and equal to Glidescope® Ranger (85 (36.2)%) at first attempt of easy scenario. However, McGrath® MAC was equal to Macintosh and Glidescope® Ranger from second to fifth attempt. The intubation time of McGrath® MAC (24.4 (14.7) s) was also equal to Glidescope® Ranger (22.2 (8.7) s) and Macintosh laryngoscopes (25.4 (12.2) s). The glottic view of McGrath® MAC (38.5) was better than Macintosh (57.5 (50.1)%; p = 0.000) and not in comparison with Glidescope® Ranger (1 (1-1)).

Conclusions: The rate for successful intubation and intubation time with McGrath® MAC in novices were equal to Glidescope® Ranger and Macintosh laryngoscope. Novices achieved a better glottic view with McGrath® MAC than Macintosh and not in comparison to Glidescope® Ranger in both of airway environments.

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AP035

Impact of dynamic airway collapse and continuous flow insufflation on initial and dynamic lung volume changes and intrathoracic pressure variation during automated cardiopulmonary resuscitation

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Introduction: During CPR, chest compressions (CC) cause variations in intrathoracic pressure (PTH) that (1) allow blood circulation, (2) generate ventilation, (3) reduce lung volumes below the functional residual capacity (FRC). During the decompression phase, the negative PTH favors venous return but also promotes airways collapse. During compression phase, positive PTH favors the heart ejection.

Objective: Study the effects of CC on PTH and lung volume changes relative to initial FRC.

Materials and methods: Original bench test comprising a CRF allowing to simulate or not a dynamic airway collapse while receiving mechanical CC (Lucas 2®). We simulated three different situations. (1) Simple model without collapse and in the absence of superimposed ventilation; (2) simulation model of collapse and in the absence of superimposed ventilation; (3) simulation model of collapse and application of a positive pressure of 10 cm H2O by continuous flow insufflation (CFI) with CPR Boussignac® tube.

Results: The addition of airway collapse (situation 2) results in: (A) Significant reduction of lung volume relative to FRC at the end of the chest decompression phase; (B) Significant reduction in the tidal volume mobilized; Decrease in maximum (red in Fig. 1) and minimal (blue in Fig. 1) PTH. The application of positive pressure via the CFI system partially restored the FRC, the minute ventilation and thoracic pressures compared to the situation 1.

Conclusion: Mechanical CC plus dynamic airway collapses reproduces minute ventilation and lung volume changes that better represent clinical observations. The application of a positive pres-
Airway management in out of hospital cardiac arrest

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Purpose: Preshospital endotracheal intubation is a risk prone procedure in emergency medical services (EMS). Aim of our study was to evaluate the incidence of both documented endotracheal tube displacement and of difficult airway in out of hospital cardiac arrest (OHCA).

Methods: Routine documentation gathered from January 1st to December 31st, 2013 during Deutsche Rettungslflugwacht (German Air Rescue) missions was analysed. Data from all primary emergency missions in adult patients (>14 years) undergoing CPR were included. Medat® 3.0 data base was used for documentation and Excel® 2011 for statistical analysis.

Results: 24,668 missions were evaluated, with n = 708 (3%) meeting inclusion criteria. In 604 (85%) cases airway was managed using ET (n = 501; 83%) or supraglottic devices (n = 103; 17%). ET placement had been performed in 140 (28%) patients before arrival of the HEMS crew; in 110 cases by emergency physicians (EP) and 30 by EMT-paramedics (EMT-P).

Endobronchial tube placement was documented in 2.9% (EP 2.7/EMT-P 3.3%), esophageal placement in 3.6% (EP 2.7/EMT-P 6.7%) and other incorrect placement in 0.7% (0.7%; EP 0/EMT-P 3.3%).

HEMS physicians intubated 387 patients; with 55% considered as Cormack Lehane (CL) 1, 29% CL2, 13% CL3 und 2% CL4. Intubation was successful upon first attempt in 85%, second attempt in 13%. Monitoring of EtCO2 was not documented in 36%.

Conclusions: Incidence of difficult airway is common in OHCA. Esophageal tube placement is still a patient safety hazard, though incidence was lower than in the benchmark study by Timmermann et al. There was a trend towards higher rates of esophageal intubations by EMT-P compared to EP. Monitoring of EtCO2 as advocated by ILCOR 2010 guidelines is not yet fully established.

Reference

**AP038**

Ventricular fibrillation/tachycardia, pulseless electrical activity and asystole are equally common initial rhythms in in-hospital cardiac arrest due to cardiac reasons

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**Purpose of the study:** Prompt recognition of the primary cause for cardiac arrest is important in order to allow selection of specific treatment intervention. We have analysed the reasons for in-hospital cardiac arrest (IHCA) at the Tampere University Hospital (TAUH) and studied its relationship to the initial rhythm and recorded the frequency of patients receiving specific treatment.

**Materials and methods:** All adult IHCA patients resuscitated during years 2009–2011 in TAUH were considered eligible for the study. Past medical history, initial rhythm and resuscitation details were obtained from the medical records. The cause of IHCA were analysed from the medical records and from the medical and forensic autopsy records. Data are presented as median (Q1, Q3) and percentages of proportions, as appropriate.

**Results:** Altogether 384 resuscitation attempts were analysed. 65% (n = 248) of the patients were male. Median age was 72 (63, 79) years. IHCA was in 192 (50%) cases due to cardiac reasons, in 44 (12%) cases to respiratory infections and in 148 (38%) cases to other causes 5%, 50%, 37% and 8%, respectively (p < 0.001). The underlying cause of IHCA was treated in 20% (n = 78) of the resuscitations. Six-month survival was 21% (n = 79). 14/79 patients had received treatment for the underlying cause (p = 0.52).

**Conclusion:** The initial rhythm VF/VT observed in IHCA patients is often due to cardiac reasons, but it is equally common that the initial rhythm in cardiac IHCA is PEA or asystole. Rather few patients received specific treatment for the underlying cause of the cardiac arrest.

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**AP039**

Intra-operative transcutaneous pacing in the setting of an urgent surgery: Case-report

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**Background:** Patients with Mobitz type II second-degree atrioventricular (AV) block present high risk of progression to complete AV block. Temporary pacing presents advantages over pharmacological therapeutic in the perioperative setting 1 but there are few reports including transcutaneous approach despite its safety and efficacy.2 We report a case of intraoperative progression to complete heart block managed with transcutaneous pacing.

**Case report:** An 87-year-old Caucasian woman with personal history of Alzheimer and Parkinson disease, essential hypertension, chronic renal failure and chronic anemia was admitted with the diagnosis of community-acquired pneumonia. Further investigation revealed a pelvic mass with associated peritonitis and she was proposed for urgent exploratory laparotomy. At physical examination she was awake but non-collaborative, apyretic, normotensive, with irregular and arrhythmic pulse and crackles audible on the left hemithorax. Analytic evaluation indicated normocytic normochromic anemia, increasing inflammatory parameters and renal function deterioration. The chest X-ray presented a left lung condensation. The electrocardiogram showed sinus rhythm with intervals of Mobitz type II second-degree AV block and idioventricular rhythm. Cardiologic evaluation determined no current indication for definitive pacing. We applied adhesive pads preoperatively and tested the median current strength for successful capture. After inducing general balanced anesthesia without intercurrences an arterial line was placed. The progression to complete AV block was detected and the pacing was initiated with its efficacy checked with the direct blood pressure monitoring. During the procedure there were no complications and the patient remained hemodynamically stable.

**Discussion:** Transcutaneous pacing allowed a successful management of the progression to complete AV block during the intraoperative period. In this context and on the setting of an urgent surgery it represented a noninvasive, simple and effective approach.

**References**


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Basic Life Support

AP040

Does emergency call placed before cardiac arrests improve the survival from out-of-hospital cardiac arrests (OHCAs)?

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Aim: To evaluate the efficacy of emergency call before cardiac arrest in survival from OHCAs witnessed by bystanders and emergency medical technicians (EMTs).

Methods: Data for 210,134 bystander-witnessed and 49,654 EMT-witnessed OHCAs having complete dataset for analysis but no involvement of physician were extracted from the nationwide database of 588,742 OHCAs collected prospectively between 2005 and 2011. Of 259,788 cases in total, 255,386 cases having usual time intervals (0.5–99.5% values) were divided into the three groups and analysed for one-month neurologically favourable survival: Emergency call before arrest (Interval between arrest witness and emergency call ranging from 5–60 min, N = 63,674), standard emergency call (−48 to −5 min, N = 134,923) and delayed emergency call (5–60 min, N = 56,789).

Results: The rate of one-month neurologically favourable survival was 6.2, 4.5 and 1.8% for before-arrest group, standard group and delayed group, respectively; odds ratio (95% CI) with before-arrest group as reference were 0.71 (0.68–0.74) vs. standard group, 0.27 (0.25–0.29) vs. delayed group. The proportion of EMT-witnessed cases was 74.6%, 0.3% and 0%, respectively. When analysed only for bystander-witnessed cases, the rate of survival was 3.2%, 4.5% and 1.8%, respectively; 1.39 (1.28–1.53) vs. standard, 0.53 (0.48–0.59) vs. delayed. The rate of dispatcher-assisted CPR (DA-CPR) and success of DA-CPR to induce bystander CPR in these cases was the lowest (24.8% and 57.6%, respectively) in before-arrest group and highest (45.1% and 64.4%, respectively) in delayed group. After adjustment for patient age, arrest witness, aetiology of arrest, initial rhythm and response time, adjusted odds ratio (95% CI) for survival with before-arrest group as reference were 0.87 (0.79–0.95) vs. standard group and 0.45 (0.40–0.50) vs. delayed group.

Conclusions: Emergency call placed before cardiac arrest was efficient in survival from witnessed OHCAs. However, this favourable effect was invalidated when the patients descending into cardiac arrest before EMT arrival.

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The Langeland AED project – Incorporates emergency dispatch, FirstAED GPS technology, Smartphones, first responders with distinct roles, and an AED network

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Purpose: FirstAED is meant as a supplement to the existing emergency response systems. The purpose is to shorten the first responder response times at emergency calls to below 5 min on the island of Langeland. The FirstAED project defines a new way to dispatch the nearby first responders and organize their roles in the hope of reducing response times and improving survival rates.

Materials and methods: First aid and cardiopulmonary resuscitation is provided by 215 first responders who use their smartphone (iPhone 4S/5). The population purchased 95 AED’s which are available around the clock and placed less than two kilometres apart. FirstAED is an auxiliary to the public services and it enables the emergency dispatcher to send an organized team of first responders with distinct roles to the scene. FirstAED global positioning system GPS-track the 9 nearby first responders. FirstAED chooses the 3 most optimally located first responders who have accepted the alarm. FirstAED organizes the three first responders in a team: no. 1 reaches the patient to give cardiopulmonary resuscitation; no. 2 brings the AED; and no. 3 is the onsite coordinator.

Results: During the first 17 months the FirstAED GPS system was used 513 times. Three first responders arrived in 90% of the cases, and they arrived before the ambulance in 95% of the cases. FirstAED entailed a significant reduction in median response time from more than 8 min before to 4 min 6 sec after. The first responder was on site in less than 5 min in more than 60% of the cases. The AED was on site within a median time of 6 min and 10 s.

Conclusions: GPS-tracking reduces the response times, and the quality of the effort improves as all the first responders who accept the FirstAED alarm have distinct roles.

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Impact of a public awareness campaign promoting bystander-CPR: Results from a representative survey

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Introduction: About 75,000 patients face a pre-clinical cardiac arrest in Germany each year. An early cardio-pulmonary resuscitation (CPR) by lay people can increase the chance of survival by a factor of up to four. 1 Nevertheless, a bystander CPR is undertaken in only about twenty percent of cases. 2 To increase this low proportion, in September 2013 the so-called “Week of Resuscitation” took place in Germany. Accompanying this nationwide public-awareness campaign we investigated, how it alters peoples’ knowledge and attitude towards CPR.

Methods: About two month before and after the campaign, we questioned the population of Münster, one of the action weeks’ major spots. Using computer-assisted telephone interview (CATI) technology, 2004 people were interviewed by a standardized questionnaire. A random representative sample was drawn by the random last digit-method (Gabler-Häder-design).

Results: In the follow-up survey, 58,6% of the interviewees reported that they realized the “week of resuscitation”. This post-intervention subgroup’s results (“post-group”) were compared with those of the initial inquiry (“pre-group”) to assess the action week’s impact.

Asked about the accurate action in case of cardiac arrest, 58% of interviewees in the pre- but 73% in the post-group named “thoracic compressions”. In the pre-group, 10% of participants choose the correct frequency of thoracic compressions and 53% the correct depth. In the post-group, correct answers to these questions were given by 30% and 70%, respectively. In the pre-group 49% of interviewees stated they would detect a cardiac arrest and 55% believed they knew what to do in such a scenario. These self-perception’s results increased to 64% and 72% after the “week of resuscitation”.

Interpretation: These results show a significant impact of the action week on both, the knowledge and the self-perception, in Münster’s population of about 300.000 inhabitants. They should encourage undertaking further efforts in promoting bystander-CPR.

References

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School children learn BLS better and in less time than adults

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Purpose: It has already been shown that school children are able to learn and perform CPR, but their long-time retention of knowledge is not known. We want to assess children’s knowledge of the BLS sequence one year after the BLS course and compare it to that of an adult group.

Methods: A group of Italian school children who did a 1-hour BLS course were, one year later, given an anonymous questionnaire with three multiple-choice questions on the first two rings of the Chain of Survival. The first question was about recognizing a person in cardiac arrest, the second was about the importance of the early activation of the emergency system and the third was about the correct compression:ventilation ratio. We gave the same questionnaire to a group of Italian lay adults a year after completing a 5-hour BLS-D course.

Results: The school children group comprised 70 subjects (50% males), mean age 13.2 ± 0.6 years. The adult group comprised 43 subjects (62.8% males), mean age 38.4 ± 12.4 years. In the school children group, the first question was answered correctly by 85.7%, the second by 48.6% and the third by 94.3%. Comparing these results to those of the adults, there was no significant difference in the first question (83.7% vs 82.4%, p = 0.99) or in the second (48.6% vs 62.8%,...


**Conclusions:** Children’s retention of BLS knowledge after a year is good, but more emphasis needs to be made on the early activation of the emergency system. Compared to adults, children’s retention is better regarding the correct compression:ventilation ratio, despite the fact the course lasted only 1-hour.

References


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**AP046**

**Implementation of CPR in Flemish secondary schools: Results of a self-training strategy without practice on a manikin**

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**Introduction:** Basic Life Support (BLS) training is mandatory in Flemish schools. Because of limitations in time and training equipment, there is a need for alternative training strategies. De Vries suggested that laypeople could train themselves in BLS and Automated External Defibrillation (AED) by a web-based micro-simulation programme. This study measures BLS and AED-skills taught by an online simulation scenario without manikin training.

**Methods:** School pupils (N = 41, 15–17 years) without previous BLS training were selected for an online self-training intervention consisting of a theoretical course, a cognitive test and an interactive video simulation (Kennisdesk Doczero Academy, The Netherlands). In 50 min they learned how to use the platform. Six weeks later, skills were measured and recorded on video. An instructor certified by the European Resuscitation Council (ERC) evaluated the skills by the assessment form of the ERC BLS course. Each participant’s training time was measured online. Skillreporting software (Laerdal, Norway) measured motor skills. Data were analysed by frequencies and cross tabulation with IBM® SPSS® Statistics version 21.

**Results:** Mean training time was 43 min. Respectively 92% and 72% of the participants alerted the emergency services and assessed consciousness correctly. Assessment of breathing was ineffective: everyone failed in tilting the head of the victim backwards. Chin lift was performed by only 25%. Forty-four percent of the participants placed hands correctly for chest compressions. Mean compression depth was too low (35 mm, SD 13 mm). Mean compression rate (90/min, SD 21/min) scored close to the guidelines. Electrodes were placed correctly in 89% of the cases. Everyone used the AED.

**Conclusion:** The learning platform needs to be improved to teach ventilation skills effectively. Ventilation and compression skills cannot be learned without manikin practice. The online learning tool may prepare pupils to learn how to use an AED before hands-on training.

References

Impact of the newly implemented human feedback in contrast to Q-CPR® feedback and standard BLS on the “Effective Compression Ratio” outcome

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Purpose of the study: Resuscitation feedback prompt devices are endorsed by the current ERC guidelines and should improve CPR quality. The aim of the study was to follow up on the question whether the mechanical feedback prompt devices are more effective for CPR quality than feedback from trained humans. This study was part of a research project on CPR feedback devices and other CPR feedback concepts.

Materials and methods: 326 medical students were randomly assigned to one of three groups in this open, prospective RCT in order to compare the Effective Compression Ratio (ECR1, defined as effective compression2 multiplied by flow time; corrected BLS has an ECR of 0.79) between human feedback, audio-visual Q-CPR®/MRx Defibrillator feedback and standard BLS. Participants performed 2-rescuer BLS on an Ambu®ManC over 8 min. All of them were trained by video and hands-on training. Additionally, the human feedback group was instructed in giving verbal feedback regarding their partner’s performance considering compression rate and depth, correct pressure point, decompression and hands-off time. All data were presented as mean and IQR.

Results: Standard BLS had an ECR of 0.27 (0.07–0.36). The Q-CPR® feedback device achieved 0.35 (0.21–0.45), and the human feedback group reached 0.33 (0.1–0.46). Standard BLS vs. Q-CPR® was significantly different (p = 0.004), whereas the others were not.

Training time for the human feedback group was 50% longer [9:32 min (8:34–11:14)] than for the other two groups.

Conclusion: In accordance with the current ERC guidelines, we demonstrated that the use of feedback prompt devices has a positive impact on the quality of BLS, but this requires additional investments. Interestingly, the human feedback with our rather short training time was not significantly different from the feedback device. Further studies should investigate whether extended human feedback training also improves CPR quality at comparable costs.

Analysis of survival in patients with out-of-hospital cardiac arrest when using iCPR application

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Purpose of study: To analyse the correlation between using or no the iCPR, and its direct consequences on the Return of Spontaneous Circulation (ROSC) of the patients who suffered an out-of-hospital cardiac arrest.

Materials and methods: The pilot test was experimental, retrospective and transversal within a period of nine months. The sample was made of 26 assisted patients with an out-of-hospital cardiac arrest on whom the iCPR application was applied or not. To get the information we used the healthcare assistance reports about these patients. Our variables were: demographic, development of the assistance and Utstein report.

Results: We collected the information about 26 assistance reports out of which 13 (50%) iCPR were applied and 13 (50%) were not. The average age was 69.3 (±10.7) years. 73.1% were men, in 76.9% the cardiac arrest was watched by witnesses, in 61.5% the aetiology was cardiologic, the average time to start CPR was 4.3 (±4.2) min, the average time to start CPR for healthcare professionals was 5.3 (±4.5) min and in 46.4% ROSC was achieved until the patient was transferred to hospital. In cases where the iCPR was used vs. not used we obtained ROSC [9 (69.2%) vs. 3 (31.8%); p < 0.05] and the mortality was [4 (30.7%) vs. 10 (69.3%); p < 0.05].

Conclusion: This pilot test concluded that the use of iCPR significantly improves the survival of patients who suffered an out-of-hospital cardiac arrest until they are transferred to a hospital. In order for this pilot test to be conclusive it would be necessary to have a bigger sample size to have more accurate statistics.

Influence of maximal oxygen uptake of university students in the ability to perform quality cardiopulmonary resuscitation

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Background: It has been hypothesized that fitness and body mass index of the rescuers are predictors of the adequacy of external chest compressions. The aims of this study were to: (1) analyze by sex the evolution of effort indicator (percentage of maximum heart rate-%EMHR) reached in 8 min [1, 2, 3, 6, 9, 12, 15 and 20 min] on 20 min of cardiopulmonary resuscitation (CPR) and, (2) examine the influence of both body mass index (BMI) and maximal oxygen uptake (VO₂ max) on predicting adequate chest compressions.
Methods: Quasi-experimental study involving sixty three subjects, which were recruited from University of Castilla-La Mancha, Spain. We determined weight, height, maximal heart rate and cardiorespiratory fitness (VO2 max). After previous training, participants performed cardiopulmonary resuscitation on a mannequin during 20 min.

Results: The %EMHR evolution increases over the time and was higher in women than in men (p < 0.05) in eight analyzed minutes. These differences disappear when controlling factors such as BMI and VO2 max. The mean percentage of adequate chest compressions was higher on the participants with normal weight/overweight (p < 0.001), and on those who had a low level of cardiorespiratory fitness (p = 0.004). Body mass index and cardiorespiratory fitness are predictors of correct compression depth and chest compression when controlling for age and sex.

Conclusions: Anthropometric and cardiorespiratory fitness conditions may influence the external chest compressions performance on prolonged CPR. Our data suggest that rescuers should improve their fitness in order to increase their capacity to provide cardiopulmonary resuscitation.

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AP050

A randomized control trial to compare retention rate of two cardiopulmonary resuscitation instruction methods in the novice

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Aim: To conduct a randomized control trial to compare the retention rates of two cardiopulmonary resuscitation (CPR) instruction methods:

1. Conventional CPR – chest compression before month to month ventilation.
2. Chest compression only CPR.

Methods: Participants were freshman nursing students who have not been instructed on CPR techniques for the past 2 years. They were randomized into 2 groups: Group A (Gp A): 30 compressions before 2 ventilations and Group B (Gp B): chest compression only CPR. Participants in Gp A were taught to perform only chest compressions if they were not willing or unable to perform mouth-to-mouth ventilation. A 2-h teaching session was conducted utilizing Laerdal Resusci-Annie manikin with a skill metre. All participants were required to take a practical test after the teaching session. Six months later, participants underwent an unannounced assessment where they were required to attend to a cardiac arrest scenario for 5 min. Performance were recorded via the skill meter manikin and recorded on film, which was later rated by blinded reviewers.

Results: 154 participants were randomized to Gp A and 193 to Gp B with 107/154 (Gp A) and 146/193 (Gp B) attending the assessment at 6 months. Mean compression per minute rates were higher in the chest compression only arm (Gp B) 77.7/min vs. 57.8/min in the CPR arm (Gp A) [p < 0.001]. Mean total number of compressions were also significantly higher; 319 (Gp B) vs. 226 (Gp A) [p < 0.001]. There was no statistical difference in mean compression depth between 2 groups. Multivariate analysis showed weight to be the only significant variable affecting compression depth in both groups. In those who performed ventilation, only 3/107 had 10 effective ventilations, 7/107 had more than 5 effective ventilations in 5 min. Many who attempted ventilation had no actual mouth-to-mouth contact, 48/107.

Conclusion: Teaching chest compression only CPR is associated with a significantly higher rate of chest compressions; hence performance of effective chest compressions was better than those who were taught and performed conventional CPR. Majority did not perform effective ventilations, suggestive of poor retention in ventilation skills. In general, performances declined after a post-training interval of 6 months.

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AP051

Comparison of 30:1 and 30:2 compression:ventilation ratios for cardiopulmonary resuscitation. Are two ventilations necessary?

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Purpose: Optimal compression:ventilation (CV) ratio and need of ventilation still remains controversy. The aim of this study was to investigate whether two ventilations are necessary during a compression and ventilation cycle for cardiopulmonary resuscitation (CPR).

Materials and methods: After 1 min of electrically induced ventricular fibrillation (VF), twenty-four mongrel dogs were randomized to receive compression-only CPR (COC group, n = 5), CPR with 30:1 CV ratio (30:1 group, n = 9), or CPR with 30:2 CV ratio (30:2 group, n = 10) for 7 min. Subsequently, advanced life support was done for 12 min. Defibrillation was not performed. Arterial oxygen profiles and hemodynamic parameters were measured.

Results: SaO2, PaCO2, end-tidal CO2 (ETCO2), and coronary perfusion pressure (CPP) at 5, 10, 15, and 20 min after VF were not different between 30:2 group and 30:1 group. SaO2 (%) at 10, 15, and 20 min was higher in 30:2 group and 30:1 group than COC group (30:1 group: 91 ± 7, 87 ± 10, 87 ± 9, 30:2 group: 90 ± 13, 89 ± 14, 83 ± 17, COC group: 85 ± 4, 80 ± 5, 79 ± 2, respectively; p = 0.043).

Conclusions: CPR with 30:1 CV ratio produces comparable arterial oxygenation saturation with CPR with 30:2 CV ratio.

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Differences of verbal feedback between human feedback and an audio-visual feedback device during two-rescuer CPR

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Purpose of the study: ERC guidelines 2010 recommend feedback while performing CPR. A variety of audio-visual feedback devices are available but the evidence on whether they improve BLS quality is not solid.1 In a research project on CPR feedback devices we implemented a structured verbal feedback approach in two-rescuer CPR, which is described below.

Materials and methods: For the open, prospective, randomised, controlled BLS trial, 326 trained medical students were randomized into three groups (human feedback, standard BLS without verbal feedback, audio-visual Q-CPR®/MRx Defibrillator feedback) to perform two-rescuer CPR for 8 min. We trained the study participants for about 10 min to provide structured verbal feedback in 5 categories: correct hand position/depth/decompression, compression rate and minimal hands-off time. The rescuer providing ventilation had to give verbal feedback on all 5 categories after the first 2 min of BLS. After that, the rescuer in the head position provided feedback either on each category or stated, “everything is all right” during each 2 min CPR slot. In contrast, the Q-CPR® gave feedback on 3 categories: depth, decompression and compression rate. All data are presented as mean and IQR.

Results: The verbal feedback rate of the Q-CPR® was within the 8 min: 3 (1–5) for depth, 2 (1–4) for decompression and 1 (0–2) for rate. The human feedback revealed: 6 (3–7) for depth, 3 (2–6) for decompression, 6 (4–9) for rate (for all p < 0.001). The other human feedback frequency was: 5 (3–7) for correct hand position, 4 (4–5) for hands-off-time, and 3 (1–6) for general “OK”.

Conclusions: Even short training in providing verbal feedback increased the amount of feedback substantially compared to a costly commercially available feedback prompt device. How the amount and quality of the verbal feedback improves the CPR quality needs to be investigated further.

Reference

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Achieving an out of hospital cardiac arrest survival rate of over 79%

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Aim: The study reviewed out of hospital cardiac arrests that occurred within a Health & Fitness chain over a 3 year period form 1st January 2011 to 31st December 2013. All branches of the chain have an Automated External Defibrillator (AED), lay rescuers trained in CPR and the use of AEDs and a robust AED policy to ensure that the AED arrives at all incidents rapidly.

Method: The study was undertaken by reviewing detailed incident reports that were compiled following each cardiac arrest, AED download data, Resuscitation Council UK event submissions and patient follow up notes. In all incidents casualties were attended to by at least two lay rescuers trained in CPR and AED and the AED electrodes were placed on the casualty’s chest rapidly.

Results: During the 3 year period under review lay rescuers responded to 29 out of hospital cardiac arrests with 24 casualties surviving to hospital discharge generating an overall survival rate of over 79%. Survival rates peaked in 2012 with lay rescuers providing immediate assistance to 8 casualties in out of hospital cardiac arrest with 7 surviving to hospital discharge.

Conclusion: The study demonstrates that lay rescuers can achieve exceptionally high out of hospital cardiac arrest survival rates, of at least 79%, by having a robust AED policy in place and a clear and focus training programme.

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Quality of external chest compressions, time or body mass index and fitness

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Background: In sudden cardiac arrest the standard of care remains the prompt initiation of cardiopulmonary resuscitation (CPR), and even if the patient is not recovering, the unprofessional rescuer will only stop the CPR when their state of exhaustion prevents them to continue. Significant physical fatigue and shallow compressions are seen after already 1–5 min of CPR. However, in out-of-hospital cardiac arrest, properly administer CPR may by sustained continuously for prolonged periods. It has been hypothesized that fitness and body mass index (BMI) of the rescuers are predictors of the adequate external chest compressions (ECC) performance in prolonged CPR. The aims of this study were; (1) to analyze the differences within the mean percentage of adequate ECC and its components performed in 1, 2, 3, 5, 10 and 20 min by categories of body mass index (BMI), cardiorespiratory fitness (VO2 max) and muscle strength, and (2) to establish the optimal cut-off points of VO2 max and arms muscle strength to perform adequate ECC.

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Methods: Quasi-experimental study involving sixty three subjects, which were recruited from University of Castilla-La Mancha, Spain. We determined BMI, VO_{2max} and muscle strength. After previous training, participants performed CPR on a mannequin during 20 min.

Results: The mean percentage of adequate ECC was higher on males (p < 0.05) in the eight analyzed minutes in CPR test. Those gender differences disappear when controlling for other variables such as age, BMI, cardiorespiratory and muscular fitness. The corresponding area under the receiver operating characteristic curves (ROC) to predicted adequate ECC for VO_{2max} and muscle strength were 0.868 and 0.872, with statistical significance (p ≤ 0.001). The best cut-off points for predicting successful ECC using ROC curves were 44.45 ml/kg/min for VO_{2max}, and 30.22 kg for muscular fitness.

Conclusions: Anthropometric and physical fitness has a greater influence than the time on performing ECC on prolonged CPR.

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CPR Quality

AP055

How we perform real CPR? Are we as good as we think when we train?

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Objective: Feedback devices seem to improve CPR quality when used over mannequins for training use even when the firmness of a mannequin thorax is not comparable with a real human thorax, but usually real CPR quality is below the guidelines standards. The objective of this study is to describe the quality of real CPR performed by ALS teams with the assistance of the TrueCPR® feedback device.

Methods: Crossover multicenter study from July to September 2013. 3 Advanced Life Support Units of SUMMA-112, the Emergency Medical Systems (EMS) of Madrid, and 3 of SEM-112, the EMS of Barcelona were equipped with the True CPR® device. Quality data was collected from the device. Percents were used to describe categorical variables and median and Interquartil range for quantitative data because non-normal distribution of the variable values. Mann–Whitney U test was used to compare both EMS.

Results: Sixteen cardiac arrests were assisted during the period of the study. 61.5% were male, the median age was 65 (IQR: 58.5–79.5), 100% presented non-shockable rhythms and 4 patients recovered spontaneous circulation. The median of the percent of hands-on time was 76.3% (IQR: 68.8–83.4%), the median of the medians of chest compressions (CC) depth was 3.8 cm (IQR: 3.3–4.3). A median of 94.9% (IQR: 79.5–98%) CC were too shallow for a median of 0.5% (IQR: 0–2.6%) too deep. The median percent of CC with complete recoil was 81.4% (IQR: 62.2–97.7%). The median of the medians of CC rate was 111.5 (IQR: 106–116.5) per minute (pm). The median of the percent of CC under 100pm was 5.6% (IQR: 3.7–8.7%) and over 120pm, 16.7% (IQR: 5.9–32.9%). No significant differences were found between both EMS in any of the studied variables.

Conclusions: Feedback devices may help to improve hands-on time and CC rate but even with the help of a feedback device CC are not delivered at the 2010 Guidelines depth standards.

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AP056

A digital filter can effectively remove mechanical chest compression artifact

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Purpose: Chest compression artifact interferes with ECG rhythm evaluation during cardiac arrest resuscitation. Previously proposed filters for manual compressions may not allow reliable rhythm interpretation. Because artifact is more consistent from LUCAS mechanical compressions than manual compressions, we tested if a simple digital filter would greatly attenuate artifact but preserve ECG quality.

Methods: Ten ECG segments were collected from asystolic cardiac arrest patients during LUCAS compressions. We created ten segments each of VF and QRS rhythms with challenging levels of LUCAS compression artifact by adding recordings of unartifacted VF and QRS rhythms to the artifacted asystolic segments with the artifact increased in amplitude by 4×. Artifacted segments were then filtered with a digital filter designed to remove LUCAS compression artifact. The signal quality of filtered VF and QRS segments was assessed by analysing the segments with an established VF detection algorithm.

Results: Mean (±standard deviation) peak-peak amplitude of unfiltered asystole segments was 0.62 ±0.29 mV (range: 0.28–1.1 mV). Filtered asystole segments were reduced to 0.085 ±0.044 mV, (range: 0.034–0.164 mV). Sensitivity and specificity of automated rhythm analysis were 70% and 75% for unfiltered, and 100% and 100% for filtered signals.

Conclusions: A simple digital filter reduced LUCAS artifact that might be interpreted as VF to a level below the 0.2 mV threshold used to define coarse VF. Signal quality of filtered VF/QRS segments was sufficient to allow correct automatic rhythm interpretation even with artifact 4× greater than that seen during LUCAS compressions. This approach should be evaluated in a larger dataset to assess if it would allow accurate automatic or manual rhythm interpretation during LUCAS chest compressions.

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High Quality CPR and Mass Training: Is it achievable combination?

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Purpose: ILCOR 2010 Guidelines stressed the importance of High Quality CPR to improve survival in cardiac arrest but it is also necessary to train more and more people to increase the frequency of bystander CPR. The aim of this study is to evaluate the quality of chest compression after Mass Training and compare it to classic BLS training.

Methods: We enrolled 136 lay people (18–35 years) untrained in CPR onto one of two courses: course A (55 people) and course B (81 people). Course A was Mass Training consisting of 30-min of theory and 45-min of practice performed on a personal low-budget inflatable manikin (Laerdal MiniAnne) with an instructor:attendee:manikin ratio of 1:15:1. Course B was a classic BLS course characterized by 1-h of theory and 4-h of practice on a classic BLS manikin (Laerdal LittleAnne) with an instructor:attendee:manikin ratio of 1:5:1. At the end of both courses and for each participant we evaluated 1-min compression-only CPR using a monitored manikin (Laerdal Wireless SkillReporter).

The measured parameters were: compressions per minute (Cmin), percentage of adequate compression depth (target 5 cm, max 6 cm) (Cdepth%) and percentage of correctly released compressions (target 0 cm) (Cre%).

Results: There was no difference between course A and course B regarding the Cmin median (115 (IQR, 108–121) vs. 120 (IQR, 113–126)) and the Cre% median (96% vs. 95%), whilst the Cdepth% median was better in Course A (89.1% vs. 67%).

Conclusions: Results show that Mass Training is at least as effective as classic BLS Training according to all parameters analyzed. Mass Training attendees reached the target of chest compression depth more often than those on BLSD. This could be due to using a personal manikin instead of sharing one. Mass Training achieves the goal of training more and more people in High Quality CPR.

Quality of compression-only vs. standard bystander CPR in out-of-hospital cardiac arrest: Take the breath away?

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Introduction: Early recognition of out-of-hospital cardiac arrest (OHCA) and initiation of high quality cardiopulmonary resuscitation (CPR) by laypersons before emergency medical services (EMS) arrive are key determinants of OHCA survival. Emergency medical dispatcher driven telephone-CPR (T-CPR) can increase initiation and quality of bystander CPR. It remains unclear, whether compression-only or standard CPR is recommended for T-CPR. The aim of this prospective, randomized study was to evaluate both principles of T-CPR with respect on compliance with actual guidelines.

Methods: After approval of the local ethics committee and obtained informed consent n = 58 medical laypersons between 18 and 65 years were asked to treat a unconscious and pulseless person represented by a Manikin (AmbuMan W) while having the possibility to make an emergency call with a given mobile phone. By randomisation the participants were divided into three groups: not telephone-guided CPR (“NT”), compression-only T-CPR (“COT”) and standard T-CPR (“ST”) according to a standardized protocol. Using video surveillance and Ambu CPR Software V 3.0.6 we collected...
parameters to define the quality of bystander CPR over a period of 8 min.

**Results:** To assess the quality of CPR we compared initial (i.e. before termination of the dispatchers comments) and over-all no-flow-time (NFT), compression depth and frequency as well as ventilation parameters. The initial NFT was lower in COT (12.1 ± 5.4%) compared with G3 (20.7 ± 8.1%). Over-all NFT was lowermost in COT (21.3 ± 14.4%), followed by G3 (49.1 ± 8.5%) and by NT (57.6 ± 16.4%). The mean compression depth was similar in all three groups: 40.6 ± 13.0 mm (NT), 41.0 ± 12.2 mm (COT) and 38.8 ± 15.8 mm (ST). The average compression frequencies were 75.8 ± 37.6 1/min (NT), 86.1 ± 24.2 1/min (COT) and 94.6 ± 23.5 1/min (ST). As a parameter of ventilation quality the mean minute volumes were 2.2 ± 2.5 l/min (NT) and 1.2 ± 1.7 l/min (ST).

**Conclusion:** As compression rate was similar in all three groups, just the compression frequency was superior in the standard T-CPR group. Compared with its poor NFT, best quality of layperson CPR was achieved by compression-only T-CPR based on the shortest NFT.

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**AP060**

**CPR feedback devices: Length of use does not affect CPR quality**

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**Purpose:** CPR feedback devices improve CPR Quality, but the amount of time they need to be used is not known. The aim of our study is to compare the results of using CPR feedback devices for 2-min and 20-min.

**Methods:** We evaluated 1-min compression-only CPR using a Resusci Anne Wireless SkillReporter manikin at the end of two different 5-h BLS-D courses for lay-rescuers (ILCOR 2010 Guidelines). Course A included 20-min training with real-time visual feedback by Resusci Anne Wireless SkillReporter software per person, whilst Course B included only 2-min per person. The measured parameters were Total CPR Score (a comprehensive scoring algorithm developed by Laerdal and members of the AHA ECC Subcommittees), number of compressions, percentage of correctly released compressions, compression mean depth and percentage of compressions with correct hand position.

**Results:** Course A comprised 87 people (70.1% males; mean age 37.5 ± 11 years), whilst Course B comprised 113 people (50.4% females; mean age 31.3 ± 12.5 years). Sex, weight, height and BMI were not significantly related to Total CPR Score. There was no statistically significant difference between Course A and Course B in Total CPR Score (95% (95%CI, 92–96.1) vs. 95% (95%CI, 94–97%), p = 0.7), number of compressions (119 (95%CI, 116–121) vs. 118 (95%CI, 117–120), p = 0.84), percentage of correctly released compressions (97% (95%CI, 93.9–99) vs. 98% (95%CI, 95–99%), p = 0.63), compression mean depth (54 mm (95%CI, 52–54.1) vs. 54 mm (95%CI, 53–56), p = 0.38) and percentage of compressions with correct hand position (100% (95%CI, 100–100) vs. 100% (95%CI, 100–100), p = 0.59).

**Conclusions:** Twenty minutes visual feedback does not improve CPR quality more than 2-min. The improvement in CPR quality seems to be due to the use of the feedback device itself, not how long it is used for.

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**AP061**

**Quality of chest compressions differs substantially between ALS and BLS**

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**Purpose:** Updated guidelines recommendations specify that >80% of the time must be constituted by chest compressions.1 Our hypothesis was that efforts during advanced life support (ALS) in the ambulance setting might take focus from chest compressions. 

**Aim:** To analyze the quality and continuity of chest compression in 10 ALS cases versus 10 basic life support (BLS) cases.

**Method:** All ALS cases (n=10) were performed in the clinical setting and were non-shockable. The BLS cases (n=10) were performed by the same ambulance service (10 different pairs) on a manikin. In both settings CODE-STAT impedance data were collected from a LIFEPAK 12 Defibrillator. To collect impedance data from the manikin setting we used a modified Laerdal skillmaster manikin. Parameters compared were: numbers and length of pauses, total time of CC (%) and numbers and rate/min of CC. Data are presented as median and range over 10 min of resuscitation in both scenarios.

**Results:** We noted lower number of CC pauses in the ALS cases 25 (14–33) vs. 32 (26–33), P = 0.1. However, the pauses were longer in the ALS cases 204 s (176–250s) vs. 129s (105–155 s), P = 0.02. In the ALS cases chest compression was made during 68% of the time (59–77%) vs. 79% (74%–84%), P = 0.0003. In spite of higher CC rate/min 125 (76–175) vs. 116 (92–133), P = 0.0007, fewer number of CC were given in the ALS cases 774 (590–951) vs. 913 (779–963), P = 0.0002.

**Conclusion:** The quality of chest compression was closer to guideline recommendation when BLS was performed.

**Reference**


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Increasing importance of release velocity with vasopressor use in a porcine model of cardiac arrest

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Introduction: We have previously reported the benefit of faster release velocity on central blood flows in a porcine model of prolonged CPR without rescue shocks or vasopressor administration. We examined the importance of release velocity with vasopressor administration during the same model of prolonged CPR.

Methods: CPR hemodynamics in four domestic swine were studied using standard monitoring. Flow probes were placed on the inferior vena cava (IVC) and the right common carotid. Ventricular fibrillation (VF) was electrically induced. A mechanical chest compression (CC) device was started after ten minutes of untreated VF. CC release was changed so that sternal recoil lasted 100 ms (WF1), 200 ms (WF2), or 300 ms (WF3). CC were delivered at a rate of 100 per minute and a depth of 48 mm. Transitions between randomized waveforms occurred every 2 min. Vasopressors were given every two minutes using the following pattern: epinephrine (1 ml/kg), epinephrine (1 ml/kg), vasopressin (40 U/kg).

Results: Throughout the first 18 min of CC, aortic pressure was significantly higher and right atrial pressure was significantly lower with WF1 and WF2 compared to WF3 (p < 0.05). Carotid flow was higher with WF1 compared to WF3 and carotid flow was higher with WF1 in the first 8 min of CC compared to WF3. With 8 to 18 showed similar IVC flows for WF1 and WF2 which were higher than WF3 (p < 0.05). During the first 18 min of CC, IVC and carotid blood flows produced by WF3 with vasopressors were 3-fold less than those produced by WF3 in our no-vasopressor model.

Conclusions: The use of vasopressors increased the impact of CC release velocity. The arterial-venous pressure difference, cerebral blood flow, and venous return were highest when the sternal recoil time was 100 ms. However, the use of vasopressors tended to decrease carotid and IVC flow and exacerbated the negative effect of slow release.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.111

Correction for body displacement for accurate delivery of chest compressions on a soft surface: The triaxial field induction technology

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Purpose: Accelerometer based chest compression feedback devices do not account for a soft surface below the victim and may overestimate compression depth. TrueCPR, a new real time feedback device, is based on measured changes in magnetic field strength between a backpack and a chestpad. We determined accuracy of that method on a manikin independent of the stiffess of the surface upon which the CPR is being performed with a constant underestimation of <4 mm. A sternum-only accelerometer substantially overestimates compression depth when performing CPR on a soft surface. Correction for body displacement on a soft surface is essential for accurate delivery of chest compressions within the recommended depth range.

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Water rescue with aids. Do they improve rescue and cardiopulmonary resuscitation performance?

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Purpose of the study: The lifeguard work requires physical competency skills to dominate the aquatic environment and to per-
form high-quality cardiopulmonary resuscitation (CPR). Our goal was to assess the impact of each equipment aids on the lifesaving CPR performance.

**Materials and methods:** 35 lifeguards accepted the invitation to participate. A quasi-experimental design was used. The lifeguards performed a baseline CPR test, a water rescue (150 meters) in 4 different equipment aids situations (fins, fins and rescue tube, rescue board and no material), and a post-rescue CPR test.

**Results:** In the intragroup analysis for water rescue time (WRT), we found that it was faster (301 ± 51.2 s) with the rescue board (RB) (p < 0.001). Lifeguards who used this aid were 98 s, 86 s and 84 s faster than using no material (Nm), fins (F) and fins and rescue tube (FRC) respectively. Only the CPR performed at baseline (B) and RB post rescue reached the quality standard (QS) equal to or greater than 70% (B, 82 ± 18.7; Nm, 69 ± 29.5; F, 56 ± 35.2; FRT, 52 ± 29.9; RB, 79 ± 20.8). Quality of ventilations (QB) was deficient in all cases (B, 46 ± 22.5; Nm, 36 ± 36.4; F, 46 ± 36.2; FRT, 36 ± 36.2; RB, 46 ± 33.0).

**Conclusions:** Water rescue equipment aids (especially RB) improve rescue performance. Only baseline and RB chest compressions quality is acceptable (over 70%). Quality of ventilations has been poor and innovative strategies should be tested to improve this point.

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AP065
Analysis about use of a CPR optimization prototype during out-of-hospital cardiac arrest
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**Purpose of study:** To analyse the relationship between using or not using the CPR optimization prototype. To analyse the development of CPR procedure. Assess the satisfaction of the professionals who used the prototype.

**Materials and methods:** A prospective and experimental randomized study was conducted. Between June 2012 and January 2013 135 surveys were filled by the healthcare professionals who participated in 35 out-of-hospital cardiac arrest. They had been previously trained in the use of the prototype. This prototype was a set alarm, which sounded every 2 min, on a Smartphone. The use of the prototype was randomized. Variables were: demography, development of the assistance and users satisfaction. We used a numerical scale for the variables: being 1 low/bad and 5 high/good. Statistics: descriptive, Chi square, -Student.

**Results:** We collected 152 surveys about 35 CPR assistances; the prototype was used by 84 respondents (55.3%). Differences between the use vs. non-use were: execution times accurately [82 (97.6%)] vs. 25 (36.7%), p < 0.001, adherence to execution times [4.30 (±0.69) vs. 3.38 (±0.69), p < 0.001], control of alternations in chest compressions [4.46 (±0.64) vs. 3.62 (±0.71), p < 0.001], effectiveness administering drugs [4.42 (±0.54) vs. 3.84 (±0.78) p < 0.001] and difficulty to following the execution times [1.84 (±0.76) vs. 3.56 (±0.74), p < 0.001]. The 55.3% of professionals who used the prototype scored according to a scale (1–5) their satisfaction level [4.50 (±0.61); p < 0.001].

**Conclusion:** To use the CPR optimization prototype significantly improve the control of the execution times protocoted in the International Guidelines and healthcare professionals’ satisfaction.

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AP066
Evaluation of prehospital use of manual defibrillators; the dangers of inappropriate or delayed defibrillation
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**Purpose:** Pauses in chest compressions during cardiopulmonary resuscitation (No Flow Time; NFT), especially pre-shock pauses (PP), are detrimental. Manual mode use of defibrillators has been found to reduce PP, but may result in more inappropriate (IS) or delayed shocks (DS). During CPR with defibrillators in manual mode, our standard approach is to pause for analysis (AP) and then charge the defibrillator while compressing until a short pause for defibrillation (SP). The next defibrillation should be delivered 3 min later if a shockable rhythm is present.

**Materials and methods:** Consecutive Utstein data and defibrillator-registrations from the out-of-hospital cardiac arrests (OHCA) in Oslo and Akershus (pop: 1.1 m ill) for one year; 1/7/2012–30/6/2013, were studied. For each episode we determined episode length and NFT; PP, divided into AP and SP; number of IS, which is shock given on ROSC, PEA or asystole; and DS which is >3 min of shockable rhythm before defibrillation. Compressions and pauses were determined by characteristic deflections in transthoracic impedance.

**Results:** Three-hundred-and-eighty-four OHCA were identified, 44 lacked ECG, impedance signal, or CPR. Complete Utstein registrations were missing in 68/384 cases (18%). The number of episodes with ≥1 shock was 112, with mean 3.4 shocks per episode. Median (25–75 percentile) episode duration was 1205s (781, 1831), and NFT was 142s (80, 214).

The number of manual shocks was 360. PP, AP, and SP was 9s (6, 17), 7s (5, 14), and 2s (1, 5), respectively. The number of IS was 24/360 (7%). The number of DS were 182 (51%) of which 62 (17%) were delayed >4 min.

**Conclusions:** Using manual mode there were less IS and shorter PP than previously reported. However, half of the shocks were delayed for more than 3 min, and 17% were delayed >4 min. Delayed shocks are probably detrimental and possible to avoid by using a built-in timer mode.

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AP067
Mechanical chest compressions improve quality of CPR in out-of-hospital cardiac arrest
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**Background:** Mechanical chest compression devices have been proposed to provide high-quality CPR; however, research in the prehospital setting is limited.

**Aim:** This study aims to evaluate mechanical chest compressions provided by the LUCAS (Lund University Cardiac Arrest
System) device compared to manual chest compression in a cohort of out-of-hospital cardiac arrest (OHCA) cases.

**Methods:** In a prospective study conducted in the Central Denmark Region, the Emergency Medical Service and the physician-manned Ambulances treated 196 non-traumatic OHCA cases occurring from April 1st 2011 to February 1st 2013. The 196 OHCA cases were treated with LUCAS-CPR after an episode with manual chest compressions. 41 OHCA cases were excluded due to missing trans-thoracic impedance measurements and the remaining 155 OHCA cases comprised the study population. The CPR quality was evaluated using trans-thoracic impedance measurements collected from the Life-pack 12 connected to the OHCA patient and the effect was assessed in terms of no-flow fraction.

**Results:** The median total episode duration was 21 min (interquartile range 13–34 min). The episode with LUCAS-CPR was significantly longer compared to the duration of the episode with manual chest compressions (13 min vs. 5 min, \( P < 0.001 \)).

The no-flow fraction was significantly lower during LUCAS-CPR (16%) compared to manual compressions (35%) with a mean difference of 19% (95% confidence interval 16%; 21%), \( P < 0.001 \).

Compared to manual chest compressions the average compression rate during LUCAS-CPR was performed according to the recommendation from Guidelines for Resuscitation (102/min vs. 124/min, \( P = 0.001 \)). The average number of chest compressions delivered per minute were significantly higher during LUCAS-CPR compared to manual compressions (94/min vs. 74/min, \( P = 0.012 \)).

**Conclusion:** LUCAS-CPR is associated with a significant reduction in no-flow fraction compared to manual chest compressions during OHCA resuscitation.

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**AP068**

**Two minutes training with visual feedback significantly improves CPR quality in lay-rescuers**

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**Purpose:** It has already been demonstrated that CPR feedback devices improve CPR Quality during training. We wanted to assess whether 2-minutes training with visual feedback was sufficient to obtain a significant improvement in CPR quality.

**Methods:** We evaluated 1-min compression-only CPR using a Resusci Anne SkillReporter manikin (Laerdal Medical) at the end of a 5-hour BLS-D course for lay-rescuers (performed according to the 2010 ILCOR Guidelines) before (test A) and after (test B) a 2-minutes training with a real-time visual feedback by Resusci Anne Wireless SkillReporter software. The measured parameters were: Total CPR score (a comprehensive scoring algorithm developed by Laerdal and members of the AHA ECC Subcommittees), number of compressions, percentage of correctly released compressions, compression mean depth and percentage of compressions with correct hand position.

**Results:** Our population comprised 113 lay-people (50.4% females; mean age 31.3 ± 12.5 years; mean weight 68.2 ± 13.1 kg; mean height 172.5 ± 9.1 cm; mean BMI 22.8 ± 3.3 kg/m²). Sex, weight, height and BMI were not significantly related to Total CPR Score. From test A to test B, there was a statistically significant improvement in all the parameters: Total CPR Score (85% (95%CI, 80–90) vs. 95% (95%CI, 94–97), \( p < 0.0001 \)), number of compressions (121 (95%CI, 119.6–123) vs. 118 (95%CI, 117–120), \( p = 0.03 \)), percentage of correctly released compressions (93% (95%CI, 86.6–96) vs. 98% (95%CI, 95–99), \( p = 0.002 \)); compression mean depth (51 mm (95%CI, 49–53) vs. 54 mm (95%CI, 53–56), \( p < 0.001 \)) and percentage of compressions with correct hand position (100% (95%CI, 100–100) vs. 100% (95%CI, 100–100), \( p = 0.01 \)).

**Conclusions:** 2-min visual feedback approach significantly improves the overall quality of CPR, and it is sufficient for achieving goals in compression rate and compression mean depth of ILCOR 2010 Guidelines. This approach should be used on every BLS-D course.

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**AP069**

**Assessment of chest compressions quality performed by residents before and after pediatric cardiopulmonary resuscitation training**

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**Introduction:** All healthcare professionals must demonstrate competence in life support skills. Debate remains about the ideal teaching and training method in terms of immediate performance and long-term survival. Our objective was to assess the improvement in chest compressions (CC) quality by pediatric residents after a brief cardiopulmonary resuscitation (CPR) program focused on quality CC.

**Methods:** Pediatric residents were invited to participate. Their performance was evaluated by means of a quality CPR measuring device (Q-CPR meter®, Laerdal, Norway) before and after a brief (60 min) training session tailored to reinforce the message of high-quality CC avoiding interruptions. No Q-CPR meter® feedback was permitted during training. Residents were asked to perform 2 min of continuous CC on a child manikin.

**Results:** Twenty-two residents (2 male and 20 female) were included. Before training, 22.7% of residents performed good quality CC, a figure that increased to 63.6% after training.

<table>
<thead>
<tr>
<th>Item</th>
<th>Target</th>
<th>Before ∗</th>
<th>After ∗</th>
</tr>
</thead>
<tbody>
<tr>
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<td>100%</td>
<td>97% (84–100)</td>
<td>99% (92–100)</td>
</tr>
<tr>
<td>Deep chest compressions</td>
<td>100%</td>
<td>56% (0–98)</td>
<td>86% (30–99)</td>
</tr>
<tr>
<td>Frequency target time</td>
<td>100%</td>
<td>30% (0–92)</td>
<td>50% (0–100)</td>
</tr>
<tr>
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<td>2:21 (1:13–3:41)</td>
<td>1:58 (1:40–2:33)</td>
</tr>
</tbody>
</table>

∗ Mean (range).

**Conclusions:** A brief hands on training achieves a significant improvement in residents’ performance, especially in terms of depth of compression and frequency. Estimation of time elapsed also improved. Objective measurement of CC quality should be mandatory in CPR courses evaluations. Only providers that demonstrate a minimum performance should pass the course.

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AP070

Family presence during ALS in the out-of-hospital emergency: An overview of the Emergency Medical System in Andalusia

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Objectives:

1. To describe this topic like a relevant quality item recorded for the SCA attendances in the procedures developed based upon ERC guides from 2005/2010 and related consistent documentation.
2. To show how interventions aligned with the ethics aspects of the resuscitation concerning with the family presence are developed in cases of patients attended for SCA by the SME personnel, and its recording in paper or electronic clinical records towards the nursing interventions NIC 7170 “Family presence Facilitation” and NIC 7140 “Family support” as the base for the quality assessment in this way.

Method: Retrospective description of the results of quality assessment of SCA attendance procedures about family presence and support in feasible cases, in Andalusia from April 2012 when this “new” aspect for the ALS quality assessment was introduced in addition to the previous ones that already belonged to the quality criteria of the SCA attendance process and quality assessment tool script.

An amount of 446 records were evaluated, representing more than 30% of the global amount of patients with SCA.

Material: Clinical records of SCA attendances in the mentioned period.

Quality assessment outputs obtained by the clinical records evaluation, provided by the EPES System Information.

Outcomes: In 2012, the above interventions were recorded in the 34.4% of the cases.

In 2013, Family presence and/or support were recorded in the 63.3% of the cases.

Conclusions: Despite the first outcomes have a wide range for improving, recently data show that family presence is an ethic aspect about the ALS procedures that is routinely addressed and recorded by the EPES teams. Out-of-hospital emergency critical care not only deals with the physical aspects but also family presence and support is a reality in the emergency care provided.

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AP071

The gap between guidelines and the real practice. Not always what is presumed to happen really happens

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Purpose: Since 1991 the chain of survival is at the centre of both basic and advanced cardiac life support. The aim of our study was to assess the solidity of the first three links of the chain of survival in a population of Italian lay rescuers.

Methods: Before the beginning of each retraining course of cardio-pulmonary resuscitation (CPR) for lay rescuers an anonymous questionnaire was distributed to each participant asking them both about the first link of the chain of survival [if you are alone in front of an unconscious and unbreathing subject and you do not have a phone what would you do?]; the second link [which is the recommended compressions to ventilation ratio?] and the third one [would you use an Automated External Defibrillator (AED) even if untrained?]

Results: 349 questionnaires have been collected (mean age 47.9 ± 7.8 years; time since the last CPR course 4.2 ± 1.6 years; 93.1% males, 62.8% high school, 12% degree). The knowledge of the chain of survival was very poor: 14.9% of participants gave the correct answer only to the question about the first link; 30.7% to the second and 5.7% to both. At multivariate analysis only the time since the last course has been shown to independently influence this last percentage [OR 0.67 (95%CI 0.49–0.91) p = 0.01]. However, the knowledge of the first two links of the chain of survival was extremely poor even when the course has been attended in the last two years (22% of participants gave the correct answer to both). Surprisingly 31.5% of participants would use and AED event if untrained.

Conclusion: The first two links of the chain of survival were shown to be extremely weak; on the contrary the third link appeared stronger than expected. These data demonstrate the presence of a significant and dangerous gap between guidelines and the real practice.

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AP072

Improving out of hospital resuscitation quality by reviewing automatic external defibrillator data

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Objective: Detection of improvement opportunities in the quality of Cardiopulmonary Resuscitation (CPR) initiated by Emergency Medical Technicians (EMT) in Basic Life Support Units (BLS) after analyzing the ECG and sound recorders in Automated External Defibrillators (AED).

Methods: Observational study through experts’ opinion poll.

Sample: ECG and sound records of AED’s used by EMT in out-of-hospital cardio-respiratory arrest (OOHCA) during one year.

Variables: age, gender, OOHCA aetiology, AED defibrillation (DF), established possible errors.


Results: We analyze 64 records. OOHCA was confirmed in 90% of cases (58). The 71.9% were male (46), with a mean age of 58.5 (SD 18.8) years. Rhythms detected were: asystole in 50% (29), Ventricular Fibrillation (VF) in 39.66% (23) and 10.34% (6) of pulseless electrical activity (PEA). In 42.2% (27) cases, the compressions were often higher than those recommended, and in 43.8% (28) did not follow the ventilation-compression sequence. 14.1% (9) there were no advise detected before discharge and the 13.7% (8) a delay was recorded in compression (in 3 cases the EMT were looking at the
screen, 2 while transfer to SVA, 2 after SHOCK and 1 by agonal breaths). In the 29.3% of records (17) no error were detected.

**Conclusions:** The most important errors found are related to the high frequency in compressions and delay in compression, major changes in 2010 ILCOR CPR guidelines, which emphasize on minimizing interruptions in compressions.

The improvements implemented after the analysis were: 1. To block AED’ screens/2. To allow EMT to analyse their CPR records guided/3. To train EMT in the recognition of OOHCA signs/4. To train EMT with records from real cases/5. To emphasize in the importance of compressions/6. To report EMT about survival of their patients.

**Further reading**


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AP074

**Comparison of survival in cardiorespiratory arrest patients receiving conventional manual or external mechanical chest compression**

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**Objective:** To compare survival rates in out-of-hospital cardiorespiratory arrest (CRA) patients receiving manual cardiopulmonary resuscitation (M-CPR) or automatic CPR (A-CPR) by LUCAS™ device.

**Materials and methods:** This prospective observational cohort study included adult patients (≥18 years) with out-of-hospital CRA attended by emergency medical services 061 Seville (Spain). Cases were grouped as A-CPR and controls as M-CPR, according to pre-hospital CPR modality. The variables studied included predictors of survival (to hospital arrival and discharge), age, sex, initial heart rhythm (VF, VT, PEA or asystole), presence of a witness and origin of CRA. Each case was matched with at least two controls.

**Results:** During 2012, 169 patients were attended for out-of-hospital CRA; 61 (36.09%) received A-CPR and 108 (63.91%) received M-CPR (1/1.77). A-CPR patients were predominantly male, mean age 67 [56–76] years; in 54.7% of cases, CRA was not witnessed. M-CPR patients were also predominantly male, mean age 53 (45–65) years; in 75.9% of cases, CRA was not witnessed. Survival to hospital arrival was achieved in 18/61 (29.5%) of the A-CPR group versus 26/108 (24.1%) of the M-CPR group, without significant differences [OR = 1.32 (0.652, 2.673)]. Survival to hospital discharge was achieved in 8/61 (13.3%) of the A-CPR group versus 16/108 (14.8%) of the M-CPR group, without significant differences.

**Conclusions:** Prehospital use of automatic CPR resulted in a higher rate of survival to hospital arrival compared to manual CPR. However, we observed no significant differences in survival at discharge between patients treated with automatic or manual CPR.

**Further reading**

Public access defibrillator use by untrained bystanders: Does patient gender affect the time to first shock during resuscitation attempts?

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Introduction: The design of public access, automatic external defibrillators (AED) must be intuitive, offering clear and easy-to-follow instructions and is assessed as part of the regulatory approval process. Regulatory authorities such as the FDA seek evaluation of the extent to which the voice prompts of AED devices successfully instruct the user to remove clothing (including a bra) from the pad placement area, since some users are reluctant to do this. This usability study was used to assess if patient gender affects the time-to-first shock by untrained bystanders during resuscitation attempts using a public access defibrillator?

Methods: Randomly selected untrained users (15 to 65+ years old, n = 78) were assessed for time to place electrodes, electrode placement, time to first shock and participant contact with patient during “shock delivery”. Half of the users encountered a manikin clothed in a front-opening hooded sweater with a bra underneath i.e. as “female” and half as “male” i.e. without a bra. Audio-visual data was gathered to analyse and evaluate all parameters. Results were compared to previously published studies. Statistical analysis was performed using the R statistical package.

Results: All participants successfully delivered a shock. There was no statistically significant difference between the times to first shock of the female and male clothed manikin groups. 88.5% of the participants were able to correctly place the electrodes and deliver a shock. Average time to first shock was 81, 75 and 93.5 seconds for the 15–21, 22–64 and 65+ age groups, respectively.

Conclusions: These results indicate that the time to first shock may not be affected on the basis of participant gender, manikin gender or participant CPR training.

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Instructors must be trained the ability to evaluate chest compressions

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Background: Appropriate chest compressions are well known as the most important factor for Cardiopulmonary Resuscitation (hereafter CPR). On CoSTR2010, CPR training is strongly recommended for all population. Some tools or some mannequins can measure an accuracy of chest compressions, but they are expensive, we cannot prepare them at all training sites. So in most cases, instructors must evaluate an accuracy of chest compressions by their subjects.

Purpose: (1) To evaluate the ability of instructors to evaluate an accuracy of chest compressions. (2) To evaluate the efficacy of the training for instructors to brush up their ability to evaluate chest compressions.

Methods: This study followed a prospective design. Participants were fourteen experienced instructors and ten fresh instructors. To show chest compressions for one minute performed by simulated student three times, instructors subjectively evaluate an accuracy of chest compressions and the motion capture camera records them objectively. After 10 min of self-learning time, we did same as above again. The evaluation is classified into four stages. We assessed the variability between instructors and motion capture camera, and the improvement after self-learning.

Results: Score between experienced instructors and the device is similar (2.67 of 4–2.26 of 4), Fresh instructors tend to give higher score than the device (2.57 of 4–2.26 of 4), and sometimes give certification to inappropriate performances. After self-learning, the ability of fresh instructors to evaluate chest compressions is improved, but cannot catch up to experienced instructors.

Conclusions: Instructors must be trained the ability to evaluate chest compressions, especially at the early phase of their carrier as instructors.

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AP077
How to improve cardiopulmonary resuscitation in an Emergency Medical Service: Role of professional practice assessment
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SAMU 13, Marseille, France

Purpose of the study: Cardiac arrest remains a major public health problem in France with 50,000 cases annually and less than 5% of patients alive at hospital discharge. Our goal was improve quality and reduce the mean time to induce cardiopulmonary resuscitation among an emergency team, using a new concept of professional practice assessment.

Material and methods: This study was conducted in a Mobile Unit of Emergency and Resuscitation (SMUR). 35 medical doctors, 24 nurses and 14 ambulance drivers were prospectively assessed. Each SMUR team including one doctor, one nurse and one ambulance driver was placed in a room, with a dummy simulating a patient in cardiac arrest. This session run in two steps: a first passing without instruction, a second passing with corrective measurements. A debriefing was conducted for each step by two medical inspectors, who noticed the duration for diagnosis of cardiac arrest, initiation of cardiac external massage and defibrillation, and the delay to perform tracheal intubation. Both scenes were filmed and timed.

Results: After the second session, we noticed a significant reduction of 30% for diagnosis time of cardiac arrest and respectively 26 and 59% of time saving for the initiations of cardiac massage and defibrillation. A significant time reduction of 28% was noticed to perform intubation. The main correction measurements consisted in a better definition of the position and the role of each rescuer (intubation for doctor, initiation of defibrillation for driver, intravenous puncture for nurse, and rotation every 2 min for cardiac massage between driver and nurse).

Conclusions: This simple professional practice assessment was allowed to save up to 30% of time to perform a medical cardiac resuscitation. Specifying the role of each member and ergonomics around the patient may therefore help our team to probably significantly improve the prognosis.

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AP078
More accurately perform chest compressions by oneself, more accurately evaluate chest compressions done by others
Yoshihiro Yamahata , Bon Ohta, Jin Irie, Kotaro Takebe
Kyoto Prefectural University of Medicine, Kyoto, Kyoto, Japan

Background: Appropriate chest compressions are well known as the most important factor for Cardiopulmonary Resuscitation. Some tools or some mannequins can measure an accuracy of chest compressions during training, but they are expensive and cannot apply for clinical use with reliability. So in most cases, instructors must evaluate an accuracy of chest compressions by their subjects during both training and clinical scene.

Purpose: Instructors must have both the ability to perform accurate chest compressions and the ability to evaluate an accuracy of chest compressions. To make the basis of strategies to train instructors, we assess the relevance of both abilities.

Methods: This study followed a prospective design. Participants were thirty-one Japanese emergency medical technicians who are familiar with both CPR training and CPR performance. We used the motion capture camera that can measure chest compressions directly. (1) To assess the accuracy of chest compressions performed by participants. (2) To show chest compressions for one minute performed by simulated student three times, participants subjectively evaluate an accuracy of chest compressions and the motion capture camera records them objectively. (3) To analyze the correlation between both abilities.

Results: Almost all participants performed exact rhythm and exact evaluation on rhythm. Some participants did poor performance on recoil or depth, and their evaluation skills were also poor.

Conclusions: There will be a weak correlativity between both abilities. It is suggested that more accurately one performs chest compressions, one will be able to evaluate chest compressions done by others.

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AP079
Music will save lives!
Yoshihiro Yamahata , Bon Ohta, Jin Irie, Kotaro Takebe
Kyoto Prefectural University of Medicine, Kyoto, Kyoto, Japan

Background: There are some studies that describe about the effectiveness of music during performing chest compressions. But they use the specific song such as “Stayin’ Alive” or “Achy break heart”. But we Japanese do not used to “Achy break heart”, or elderly people feel aversion against using “Stayin’ Alive”.

Purpose: We try to reveal the effectiveness of Music itself (not the specific song) to maintain recommended chest compressions.

Methods: We requested composing new melody to Music classroom of children Kyoto (see figure). We arranged the melody to four version; (1) 100/min and 4 beat, (2) 120/min and 8 beat, (3) 120/min and 4 beat, 4) 120/min and 8 beat. Forty EMT participated. We randomly assigned them to each group and let them perform chest compressions on the each music.

Results: Almost all participants could perform chest compressions on the melody, but some could not do. Rhythm: 100/min was too slow to maintain accurate rhythm. Beat: with 8 beat the duty cycle will be more accurate and recoil will be achieved more certainly.

Conclusions: Music will have power to maintain recommended chest compressions. Sometimes recommendation changes, but we can use our favorite songs that match to the new recommendation.

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**AP080**

**CPR Quality: Perception versus reality**


Southampton General Hospital, Southampton, UK

Introduction: The quality of CPR impacts on patient outcome. Feedback devices make it possible to record CPR quality, both the rate and depth of compressions. Most doctors and medical students believe they are proficient in performing CPR though only revalidate their life support training every 4 years. 

Methods: A questionnaire was given to a selection of medical students and doctors assessing how they perceived themselves at maintaining rate and depth of compressions over a 2 min period and their view of further training. An app on a phone recorded quality and depth of compressions and was used to assess each individual’s CPR technique over a 2 minute period on a mannequin.

Results: 16 medical students and 13 doctors completed the study. 3 medical students and 8 doctors felt they needed no further training in CPR. Medical students’ perception of their CPR quality (mean perception of achieving correct rate was 68%, SD 19.5; and depth was 62.8%, SD 20.2) was lower than the doctors’ perception of their CPR quality (mean perception of achieving correct rate was 86.2%, SD 10.6; depth was 86.9%, SD 10.5). Medical students exceeded their expectations and achieved a mean correct rate and depth of 70.9% (SD 19.4) and 71.2% (SD 18.2) respectively, compared with doctors achieving a mean correct rate and depth of 80.5% (SD 12.5) and 80.7% (SD 6.6) respectively.

Conclusions: Perception of CPR differs between medical students and doctors, with doctors seemingly more unaware of a deficit in the quality of the CPR they provide. Both medical students and doctors require further or more regular training to achieve high quality CPR.

References


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**AP081**

**Functioning of the survival chain in a real life case**


Great Western Hospital, Swindon, UK

West Midlands Deanery, Birmingham, UK

Objective:

To analyse a real life case of a cardiac arrest from the survival chain perspective.

To divulge the survival chain concept as well as the necessity for the wider population to learn about the cardiopulmonary resuscitation (CPR).

To analyse the role of the emergency response team in the diffusion of CPR across the population.

**Materials and methods**: Based on a real case where the survival chain worked successfully resulting in the survival of the patient without sequelae, all persons involved in the incident were located and interviewed, asked about their previous knowledge of CPR as well as their feelings and experience during this case. A video has been generated with these testimonies in such a way that it can be used for the broader audience in order to motivate the population to learn about CPR.

**Results**: Male, 54 years old, displays a sudden loss of consciousness at his residence. His wife calls next door (a dental clinic) where they proceed to assist the patient, determining cardiac arrest; thus, they contact 112 and proceed with CPR (30:2). The dentist and a patient from the clinic with previous training take charge of the CPR procedure. 10 min after the incident a basic support ambulance arrives followed by an advanced support ambulance. The respiratory airway is channelled and advanced CPR is delivered with the patient regaining spontaneous respiration after 8 min, and presenting a weak pulse with normal frequencies and an arterial tension of 120/80. The hypothermia protocol is initiated and the patient is taken to hospital having pre-warned the coronary unit. At the hospital, the patient is catheterised with a stent fixation and treatment for hypothermia is resumed. The patient wakes up presenting no neurological sequelae and with preserved cardiac function. To date (4 months later), the patient has resumed normal life.

After analysing the case, witnesses are gathered and an interview is performed and recorded on video.

**Conclusions:**

The survival chain contributed to the decrease of the patient’s morbimortality. The survival chain’s success was due to the witnesses CPR training. It is necessary to motivate the population to learn about CPR. We believe that on this matter, the role of the medical emergency response team must be relevant.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.130

**CPR Systems**

**AP082**

**Local lay rescuers with AEDs, alerted by text messages, contribute to early defibrillation in a Dutch out-of-hospital cardiac arrest system**

Jolande van Lammeren-Zijlstra *, Remy Stieglis, Rudolph Koster

Academic Medical Center, Amsterdam, The Netherlands

Objective: Public access defibrillation (PAD) rarely reaches OHCA patients in residential areas, where 3/4 of all cardiac arrests (CA) occur. We developed a text message (TM) alert system dispatching local lay rescuers with AEDs to the CA. The contribution of this system to early defibrillation is unclear and is currently evaluated.

Methods: In November 2012, 12,295 lay-rescuers (TM-responders) and 1344 AEDs were registered in a database residing with the dispatch center. TM-responders living <1000 m radius of the patient received an automated TM to go to the patient and perform CPR, or were directed via a nearby AED first. We analyzed all 1536 OHCA patients where a defibrillator was connected from February 2010 until July 2013 (42 months), in two regions of the Netherlands with 1.27 million inhabitants. We excluded EMS-witnessed arrests. ECGs from ambulance defibrillators and all

**Materials and methods**: Based on a real case where the survival chain worked successfully resulting in the survival of the patient without sequelae, all persons involved in the incident were located and interviewed, asked about their previous knowledge of CPR as well as their feelings and experience during this case. A video has been generated with these testimonies in such a way that it can be used for the broader audience in order to motivate the population to learn about CPR.

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**CPR Systems**

**AP082**

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Jolande van Lammeren-Zijlstra *, Remy Stieglis, Rudolph Koster

Academic Medical Center, Amsterdam, The Netherlands

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AEDs were analyzed with dedicated software. Clock drift for each recording was corrected and compared with time of initiation of EMS-call.

**Results:** Outcomes are shown in the table. The dispatcher activated the TM-alert system 893 times alerting mean 32.2 TM-responders 2.4 AEDs. In 850 cases ≥1 TM-responder received a TM-alert and in 738 cases ≥1 AED was involved. A TM-responder AED arrived first on scene and was connected in 184 of all 1536 OHCA (12%), corresponding with 23% of all connected AEDs. Patients treated with a TM-responder AED were more likely to have collapsed in residential areas compared to other defibrillators (88% vs. 77%; p < 0.001). TM-responders with AEDs shortened time to defibrillation with mean 2:28 (min:s) compared to EMS. Eleven percent of TM-responder AEDs delivered a shock ≤6 min.

<table>
<thead>
<tr>
<th>Origin defibrillator</th>
<th>First responder</th>
<th>TM-responder</th>
<th>On-site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total patients, N</td>
<td>739</td>
<td>449</td>
<td>184</td>
</tr>
<tr>
<td>OHCA in residential area, n (%)</td>
<td>585 (79)</td>
<td>330 (74)</td>
<td>161 (88)</td>
</tr>
<tr>
<td>1st rhythm VF/VT, n (%)</td>
<td>245 (39)</td>
<td>178 (44)</td>
<td>76 (43)</td>
</tr>
<tr>
<td>Time from call to 1st shock*</td>
<td>10:28 (8–13)</td>
<td>8:03 (7–10)</td>
<td>8:00 (7–10)</td>
</tr>
<tr>
<td>First shock ≤6 min, n (%)</td>
<td>6 (2)</td>
<td>33 (19)</td>
<td>8 (11)</td>
</tr>
</tbody>
</table>

**Conclusion:** The great majority of TM-responder AEDs were used on patients at residential locations. In 11% of resuscitations, TM-responders contributed to earlier defibrillation compared to EMS and dispatched first responders.

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**AP084**

**Doctor ambulance dispatch was an independent predictor of favorable outcome in ROSC, survival and functional outcome**

Kazuhide Yoshikawa *, Atsushia Shiraishi, Yasuhiro Otomo

Tokyo Women's Medical University Medical Centre East, Tokyo, Japan

**Introduction:** A number of doctor ambulance (DA) dispatched to scene of out-of-hospital cardiac arrest (OHCA) were actively operated in several emergency centers in Japan, efficacy on outcomes of OHCA victims remained unclear.

**Method:** We included consecutive OHCA subjects transferred to the study hospital from January 2009 to March 2012 and excluded if a subject were transferred to another hospital after recovery of spontaneous circulation (ROSC) at the emergency department. Effects of doctor ambulance dispatch on ROSC, in-hospital mortality and functional outcome were assessed by descriptive statistics and logistic regression analysis adjusted for age, gender, intrinsic or extrinsic cause, ECG rhythm at scene, airway management at scene and IV drug administration at scene.

**Results:** Of a total of 478 eligible subjects, 81 were with DA. No significant difference by sex, age, endogenous disease, rhythm at contact observed, but advantageous difference observed in Tracheal Intubation and Administration of Medicine (85% vs. 15% P < 0.001, 88% vs. 16% P < 0.001). Time to contact emergency physician was significantly shorter in subjects with DA (13 vs. 37 min, P < 0.001), whereas time to the emergency department did not differ (35 vs. 37 min, P = 0.136). DA dispatch associated with higher rate of ROSC (OR 3.3, 95%CI 1.3–8.7, P = 0.011), survival (OR 4.2, 95%CI 1.4–14.0, P = 0.015) and favorable neurological outcome defined as the modified Rankin scale <2 (OR 5.5, 95%CI 1.2–27.1, P = 0.030).

**Conclusion:** In our retrospective observation, DA dispatch was an independent predictor of favorable outcome in ROSC, survival and functional outcome. Prospective observational study is needed to investigate efficacy of DA in multicenter setting.

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Impact of the use of Autopulse® on intubation conditions in cardiac arrest patients

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SAMU 93 GHU Avicenne, APHP, Bobigny, France

Introduction: Uninterrupted chest compressions are the cornerstone of CPR. Then, maintaining this massage during intubation procedure is a legitimate objective. However, this assumes that the intubation procedure is not complicated and long. This is what we evaluated in this study.

Methods: Prospective registry of out-of-hospital resuscitated cardiac arrest.

Studied parameters: Utstein criteria and intubation’s conditions.

Primary end-point: Intubation time with manual chest compressions interrupted during intubation procedure vs continuous chest compressions performed by Autopulse®.

Secondary end-point: Cormack score and intubation difficulties evaluated on a visual analogic scale (0: easy–100: impossible).

Number of patients to include: 10 patients of each criteria studied (time, facility and Cormack score): 30 patients per group.

Results: 123 patients were included, 49 (40%) under manual chest compressions and 74 (60%) under Autopulse®. Chest compressions were interrupted during intubation procedure in 45 (37%) cases. No significant difference in intubation time between Autopulse® and manual chest compressions was reported: 25 (10–40) vs. 26 (15–45) s; p = 0.26. No significant difference in intubation time without vs. with interruption in chest compression was reported: 20 (12–32) vs. 30 (15–45); p = 0.26. No significant difference was found in the global analysis and in comparison between groups for every criteria. Results for each sub-group are reported in the table.


<table>
<thead>
<tr>
<th>Procedure</th>
<th>Manual chest compressions</th>
<th>Autopulse®</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Interruption</td>
<td>Continuous</td>
</tr>
<tr>
<td>N</td>
<td>37</td>
<td>12</td>
</tr>
<tr>
<td>Time (s)</td>
<td>30(15–50)</td>
<td>20(12–33)</td>
</tr>
<tr>
<td>Facility (VAS)</td>
<td>14(4–55)</td>
<td>6(5–25)</td>
</tr>
<tr>
<td>Cormack</td>
<td>1(1–2)</td>
<td>2(1–2)</td>
</tr>
</tbody>
</table>

Conclusion: Intubation time was not increased under continuous chest compressions. It should become the gold standard procedure. Chest compressions should be interrupted only in case of (predictable) intubation difficulty.

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Major differences in member composition on cardiac arrest teams and limited pre-arrest allocation of tasks—A nationwide study

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² Department of Internal Medicine, Regional Hospital of Randers, Randers, Denmark
³ Department of Cardiology, Aarhus University Hospital, Aarhus, Denmark
⁴ Institute of Clinical Medicine, Aarhus University Hospital, Aarhus, Denmark

Background: In-hospital resuscitation is often performed by a team of health care providers. Resuscitation system errors are associated with decreased survival. Improving team performance may increase survival. Currently, no standards for cardiac arrest teams exist in terms of member composition and pre-arrest allocation of tasks.

Aim: To describe the member composition of in-hospital cardiac arrest teams and review pre-arrest allocation of tasks.

Methods: All hospitals in Denmark with a cardiac arrest team were included in the study. Psychiatric hospitals and hospitals serving out-patients only were excluded. In Denmark it is mandatory for each hospital to have a protocol describing the cardiac arrest team composition. Protocols were collected (December 2012–April 2013) and systematically reviewed for the member composition of the cardiac arrest team and pre-allocation of tasks.

Results: Data on the cardiac arrest team were available from 44 hospitals (94%). The average team size was 5.3 ± 1.7 persons. Teams included a nurse anaesthetist (100%), a medical house officer (82%), an orderly (73%), an anaesthesiology house officer (66%) and a medical assistant (20%). Less likely to participate was a cardiologist house officer (27%) or a cardiology specialist registrar (5%). Only 20% of teams included a specialist registrar and 20% of hospitals used a different team during nights and weekends. In total 45% of hospitals did not define a team leader pre-arrest and the majority of the hospitals did not define the tasks (e.g. defibrillation, performance of chest compressions, drug administration) of the remaining team members.

Conclusion: There are major differences in member composition on hospital cardiac arrest teams. There is limited pre-arrest allocation of tasks for members on the cardiac arrest team; this includes defining the team leader.

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Defibrillation

AP087

Electrocardiographic characteristics of ventricular fibrillation in patients with a wearable cardioverter defibrillator

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Introduction: Surface electrocardiographic (ECG) changes in ventricular fibrillation (VF) waveform characteristics at its onset in patients experiencing cardiac arrest have not been quantified. The amplitude spectral area (AMSA) method was developed to analyze surface ECG VF amplitude and frequency characteristics and contains information related to VF rotor stability and myocardial viability. We aimed to characterize changes in AMSA at the onset of VF to gain insight into myocardial dynamics in patients with a wearable cardioverter defibrillator (WCD).

Methods: Out of 30 patients randomly identified from a manufacturer-maintained registry, 25 patients (14 Male, 11 Female, Age = 62 ± 14 yr) were included. Remaining patients experienced either sustained monomorphic ventricular tachycardia or had motion artifact, precluding AMSA analysis. Using the WCD ECG, AMSA was calculated as the summed product of frequency and square root of power at that frequency from 2 to 48 Hz with a continuous sliding 2.1 s Tukey window. The median time to shock for AMSA was calculated every 0.5 s and averaged every 1 s for up to 45 s after VF initiation. Results are presented as mean ± standard error.

Results: At onset of VF, AMSA was 33.6 ± 3.3 mVHz which decreased progressively to 23.4 ± 2.2 mV Hz (p < 0.01) after 45 sec of untreated VF (Fig. 1).

Conclusions: After the onset of VF, AMSA decreased 30% of its original value. Tracking changes in AMSA may prove beneficial in understanding myocardial viability and duration of untreated VF during cardiac arrest.

AP088

Is hands-on defibrillation safe when using insulating gloves? A clinical trial

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2 Department of Anaesthetics, University Hospital Southampton, Southampton, UK
3 Department of Medical Physics, University Hospital Southampton, Southampton, UK
4 Department of Internal Medicine, Regional Hospital of Randers, Randers, Denmark

Introduction: Interruptions in chest compressions during defibrillation reduce the chances of ROSC and successful defibrillation. Safe hands-on defibrillation (HOD) will allow uninterrupted chest compression during defibrillation and may improve resuscitation success. We tested electrical insulating gloves during clinical defibrillation to assess their ability to allow safe hands-on defibrillation.

Materials and methods: Leakage current flowing from the patient to the ‘rescuer’ during defibrillation of patients undergoing elective defibrillation was measured. The ‘rescuer’ remained in contact with the patient during defibrillation, wearing Class 1 electrical insulating gloves while simulating an inadvertent contact with the patient, through an additional wired contact between ‘rescuer’ and patient.

Results: Data from 49 shocks from 34 different patients were recorded. The median leakage current from all defibrillations was 21.8 μA (range: 7.0–105.0). In total, 11 of the shocks were delivered at 360 J and had a median leakage current of 30.6 μA (range: 14.3–79.0), all below the safety threshold of 1 mA.

Conclusion: This preliminary data suggests that leakage current is within a safe threshold to allow hands-on defibrillation using electrically insulated gloves. Conclusion of the study with further patients will allow confirmation of these early findings.

References

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AP089

Comparison of eight automated external defibrillators. It’s a matter of time

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1 Fondazione IRCCS Policlinico San Matteo, Pavia, Italy
2 APT Group, Pavia, Italy

Purpose: Early defibrillation and cardiopulmonary resuscitation (CPR) quality are essential for cardiac arrest victims survival. Notably the quality of CPR may be influenced by the performance of the automated external defibrillator (AED). The aim of our study was to assess the performance of different AEDs.

Methods: We analyzed eight AEDs (Rescue SAM and Rescue life AED by Progetti, Turin, Italy; FR2 and FR3 by Philips, Eindhoven, Netherlands; 3G Plus by Cardiac Science, Bothell, WA, USA;
FRED Easy by Shiller, Baar, Switzerland; Lifeline AED by Defibtech, Guilford, CT, USA; Heartsave AD by Primedic, Rottweil, Germany). After turning on the machine AED paddles were attached on a manikin (ALS trainer by Laerdal Medical, Norway) and the performance both for shockable and non-shockable rhythms were tested.

Results: Rhythm analysis times were identical when comparing shockable and non-shockable rhythms (10.4 ± 2.5 s.) and only in 3/8 (37.5%) AEDs was less than 10 s. The mean charging time was 7.4 ± 3.4 s and only in 1/8 (12.5%) AEDs was more than 10 s. A not recommended latency of 6.2 ± 2.2 s has been found between shock delivery and the indication to resume CPR with a resulting mean paddles to CPR time of 23.9 ± 5 s and in 0/8 AEDs was less than 10 s. While all the machines correctly identified sinus rhythm, ventricular fibrillation (VF) and asystole only 6/8 (75%) and 1/8 (12.5%) AEDs classified as shockable a fast ventricular tachycardia (VT) at 225 bpm and a slow VT at 125 bpm respectively. When the rhythm was changed during the charging phase only 3/8 (37.5%) AEDs recognized the changing and did not indicate the shock.

Conclusion: AED performance may really affect the quality of CPR because of interruptions often longer than ten seconds in disagreement with international guidelines. Industry leaders should focus their research in that direction.

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AP090

Resuscitation by text-message responders in The Netherlands

Wim van der Worp
Ambulance Oost, Hengelo, The Netherlands

Since 2008 there are projects in the Netherlands that provide civilians as lay-responders/volunteers to OHCA’s. One of these projects resulted in a system called HartslagNu (HeartbeatNow), which currently counts app. 60,000 volunteers and has approximately 7000 AED’s available spread over the larger part of The Netherlands.

After the dispatch centre receives a 112-call for a resuscitation the dispatcher immediately sends out an ambulance and activates the system HartslagNu. Within a few seconds volunteers and AED’s are located in a circle of max 1000 m around the victims address. Volunteers receive a text message and max 10 of them are sent directly to the victims address to start CPR. Max. 20 volunteers are sent to an AED within the proximity, take it with them to the victim and use it if necessary.

(pictures and slides of how the system works are available)

All volunteers must be trained in CPR and use of AED. They subscribe to the system with name, address, phone number, email and training institute.

17 of the 24 dispatch centres are currently connected to the system.

In 2013 the numbers were:

| Nr of activations of the system | 4176 |
| Nr of dispatched volunteers | 74307 |
| Nr of which sent directly to victim | 40906 |
| Nr of which sent to AED | 33401 |
| Nr of AED’s dispatched to | 8282 |

Effectiveness is currently under study by Dr. R. W. Koster, Amsterdam Medical Centre and will be published later in 2014.

This project is unique. There is no place in the world where there is a system with this number of available volunteers and AED’s, used on national scale. I’d like to show a presentation and tell the world about it!

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AP091

Witnessed cardiac arrest

Amela Komilija∗, Amra Basic-Zivadinovic
Emergency Medical Service Centre, Sarajevo, Bosnia and Herzegovina

Purpose of the study: The aim is to show the most common cause of cardiac arrest during physical examination and emphasize the importance of defibrillation as the only treatment of ventricular fibrillation.

Materials and methods: Retrospective study has been used in the five-year period to analyze experience of cardiac arrest in the Emergency Medical Service Centre of Sarajevo (EMSC).

For the analysis we have used data from the protocols medical teams, emergency medicine ambulance and definitive diagnosis and condition of the patient discharge letters, Clinical Center University of Sarajevo.

Results: During medical examination 76 patients experienced acute cardiac arrest. At the first site acute myocardial infarction-STEMI was diagnosed in 82% of patients. Initial rhythm in 82% of patients was ventricular fibrillation. The male population was dominant, in 74% of cases. Commonly witnessed cardiac arrest was in the age group over 60 years, in 60% of cases. Significant percentage of working age population between 45 and 60 years was 38%. Analysis time events showed that in 40% of cases occurred in the period from 6.00 p.m. to midnight, and 22% from midnight till 6.00 a.m. In all patients in whom the initial rhythm at the time of cardiac arrest was ventricular fibrillation the DC shock was immediately delivered. After defibrillation 47% of patients were hospitalized at the Clinic for heart and rheumatism of Sarajevo, fully conscious with stable vital parameters. At the Heart (PCI) center of Sarajevo, 17% of all witnessed cardiac arrest patients PCI intervention was performed.

Conclusion: EMSC is unique pre-hospital institution that operates 24h a day/7 days a week. Thanks to adequate treatment, defibrillation, 76% of patients were hospitalized after the return of spontaneous circulation. Adequate treatment of witnessed cardiac arrest implies well-organized, highly sophisticated equipment and continuous education of emergency teams.

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AP092

The reliability of “hands on” defibrillation in patients with internal cardioverter defibrillator

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1 Gulhane Military Faculty of Medicine, Ankara, Turkey
2 Beytepe Military Hospital, Ankara, Turkey
3 TDV 29 Mayis Hospital, Ankara, Turkey

The advice regarding the potential dangers of practitioners contact with a patient during the firing of an internal cardioverter defibrillator (ICD) is rare. This case report presents an affected practitioner due to a shock obtained from an ICD during chest compression on a patient in cardiac arrest.
69 years-old male patient scheduled for an endobronchial biopsy procedure under general anesthesia because of a mass. After 10 min from the beginning of bronchoscopy, cardiac arrest occurred and we began chest compressions. During CPR we applied 4 times external defibrillation and 4 times internal defibrillation occurred. During internal defibrillation strong contractions were observed that made patients arm flexed. The practitioner, who was performing chest compressions, felt a shock travel up his left arm causing him to withdraw his hands from the patient’s chest. We noticed that he had perforated gloves. At the end of an hour patient’s heart rate improved and the patient was taken to intensive care.

The European Resuscitation Council advises that “…discharge may cause pectoral muscle contraction, but an attendant touching the patient will not receive an electric shock…” In our case, the contractions were seen was more powerful that flex patients arms. Several authors comment on the wearing of gloves by rescuers to reduce the chances of shock. In our case, due to the tearing of gloves practitioner impressed from the current but this situation did not cause complications.

We conclude that the practitioners can be affected by current from ICD while making chest compressions and to prevent this situation undamaged gloves should be used.

Further reading

http://dx.doi.org/10.1016/j.resuscitation.2014.03.141

AP093

Training in the use of AED from the Girona Heart Protected Territory Program
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Background: The Girona Heart Protected Territory Program, led by Dipsalut, wants to bring defibrillators closer to population, facilitating their use in order to improve people’s survival when they suffer a cardiac arrest. For this reason, it promotes training through three programs: Basic life support and use of AED course of 6 h, Renewal of accreditation in basic life support and use of AED course of 1.5 h and Basic course for the use of AED of 3 h. The first two courses are regulated by the Decrete that standardizes the use of AED and the last one depends on the Catalan Resuscitation Council. Activities like workshops and demonstration sessions (tents) are organized in public spaces to promote the use of AEDs among the general population. In these sessions citizens learn how to use the AED and can answer their doubts through practical demonstrations. Tents are matched with social events in the municipalities to disseminate the program to the maximum amount of people.

Objective: Describe participation in training and dissemination activities of the “Girona Heart Protected Territory” program in the 221 municipalities within the province of Girona from June 2011 to December 2013.

Results: 2284 people attended these courses, 69% male and 31% female. 330 dissemination activities have been done and the number of people who attended them is about 6800 (Tables 1 and 2).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Participants in the courses to use AED.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
</tr>
<tr>
<td>BLS AED 6 HOURS</td>
<td>957</td>
</tr>
<tr>
<td>AED RECERTIFICATION</td>
<td>425</td>
</tr>
<tr>
<td>BLS AED 3 HOURS</td>
<td>902</td>
</tr>
<tr>
<td>Total</td>
<td>2,284</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Dissemination activities carried out in the municipalities.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of activities</td>
<td>N* activities</td>
</tr>
<tr>
<td>Workshops</td>
<td>228</td>
</tr>
<tr>
<td>Tents</td>
<td>102</td>
</tr>
<tr>
<td>Total</td>
<td>330</td>
</tr>
</tbody>
</table>

* 221 municipalities within the province of Girona.

Conclusions: 78% of municipalities have people trained in Basic life support and use of AED. Good reception and acceptance of the work done shown in all municipalities.

http://dx.doi.org/10.1016/j.resuscitation.2014.03.142

AP094

Use of automated external defibrillator: As easy as necessary
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1 Faculty of Teacher Training, University of Santiago de Compostela, Lugo, Spain
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3 Faculty of Education and Sport Sciences, University of Vigo, Pontevedra, Spain
4 Faculty of Sport Sciences and Physical Education, University of A Coruña, A Coruña, Spain

Purpose of the study: Automated external defibrillators (AED) can be used safely by nonprofessional people and first participants. The aim of this study was to compare the time difference (between trained and untrained staff), from the moment that a person is identified to have suffered from a cardiac arrest, until the application of the first discharge.

Materials and methods: 64 students of primary education without training in AED and 32 trained people, composed the sample of this study. All of them sat for the same test (T1): to operate an AED training. AED Time was taken until the first discharge. After T1, the students were individually explained the operation of the AED and they repeated the test (T2). After 7 months, 32 of 64 students repeated once again the test (T3).

Results: Students reduce the time to make the first discharge after a simple explanation (p<0.001). T3 time is less than T1 (p<0.001), but more than T2 (p<0.001). The time of T1 is less in formed people, but comparing T2 in not formed people, and T1 in formed people, the time of the not formed is less (p<0.001).

Conclusions: Demonstrates the easy function of an AED, visible in the decrease of the time as far as the first discharge of the untrained group (T1 vs T2) is concerned. Therefore, it is necessary to make revisions in the laws of use of the AED. For example, in Spain, the lack of common rules and regulations of different territories heterogeneity makes the approval difficult. Which makes the possibility of AED’s use by medical staff, as no sanitary, be reduced.
All this, when AED application before EMS arrival is associated with improved survival after out-hospital cardiac arrest.

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AP095

Girona, cardio-protected territory

Ramon Brugada 1, 2, *, Alex Morales 1, Rafael Ramos 2, Jaume Heredia 2, Ester Ruiz de Morales 1, Pau Batlle 1

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2 Universitat de Girona, Girona, Spain
3 Emergències Mèdiques de la Generalitat de Catalunya, Girona, Spain

Introduction: Currently, the chance of a person surviving an out of the hospital sudden death is less than 5%. Experience demonstrates the effectiveness of early defibrillation in the recovery of an effective heart rhythm, especially if a defibrillation is delivered within the first minutes of cardiac arrest. Unfortunately, after 10 min the chances of survival are minimal. Public access defibrillation programs aim at improving response times by providing lay people access to defibrillators. Thus, public access defibrillation programs are considered key in the prevention of death in out of hospital cardiac arrests.

Objective: Dipsalut is an organization run by the provincial government of Girona that provides technical service and support for all the municipalities within the province of Girona, in order to promote public health and to improve the quality of life of its citizens. In collaboration with the University of Girona, Dipsalut has established a Public access defibrillator program in the province of Girona, with the objective to improve survival in victims of out of hospital cardiac arrest, and improve public awareness.

Methods: Defibrillator allocation has been based on several factors:

• Fix defibrillators. With a total of 508, they have been placed in public spaces with 24 hour access. Location has been determined by population density as well as areas with at risk population.
• Mobile defibrillators. With a total of 197, these are provided to security and health responding agencies.
• Free defibrillators. With a total of 43, these are provided for seasonal at risk.

Awareness programs have been started in all cities and villages in the province to learn the basics of defibrillator use.

Results: We have deployed 748 defibrillators. The total cost of the program, including awareness, for the next 10 years amounts to 3,000,000 euros. This program has promoted a change in legislation, by which at present, in case of emergency, the defibrillator can be used by the lay citizen, no matter his level of training.

In the last 18 months, while the program was being deployed, there have been 129 uses of defibrillators with 11 successful interventions. No vandalism has been recorded.

During this last year 6800 people have undergone training.

Conclusions: Public access defibrillation programs can be safely deployed in the community. There has been an increased use of the defibrillators in case of cardiac arrest. Given that the use of defibrillators is without risk, its use can only improve the chances of survival in the community.

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AP096

Access to public defibrillation for people with visual disability

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Introduction: The latest scientific recommendations on cardiopulmonary resuscitation (CPR) and the technical improvements that have been applied to a community program of public access defibrillation and to Basic Life Support (BLS) program. The aim is that citizens could administer premature PCR. International Societies of reference about PCR recommend overcoming barriers for act. In spite of, there are some obstacles that impede the access to determined people.

Objectives: To involve people in PAD. To adapt educational and training programs to a disability. To train lay rescuers with this disability. To propose technological improvements regarding AEDs.

Methodology: Design: reviews of texts and adaptation to educational ways for blind people and people with other types of visual disabilities. Get experience in small groups following the usual teaching method of the SEMES Emergency Cardiovascular Care Plan.


System for collect information: tabs of records of critical actions performed. Satisfaction surveys.

Data management and statistical analysis: Computation of the results obtained after assign to each variable a punctuation. The variables that will be studied are defined in the critical actions follow-up checklists.

Results: 13 courses have been imparted. Partakers: 103 pupils. All the partakers pass the course and are ready for apply the skills learned. A manual was written in Microsoft Word format for electronic reading and information access software such as "Jaws" and also in Braille. Its contents are "illustrated" with detailed descriptions of the actions and presentations. The AED was adapted by inscriptions in Braille and sound messages that allow location improvement, as well as the incorporation of vibration devices that are activated simultaneously with the LED.

Conclusion: The recommendations ILCOR 2010 allowed the participation of people with DV. The docent actions that included this methodology get the same results of the traditional ones.

Further reading


http://dx.doi.org/10.1016/j.resuscitation.2014.03.145
Drugs

AP097

Relationship with between adrenaline dose and survival from out of hospital cardiac arrest

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2 Warwick University, Coventry, UK
3 South Central Ambulance Service, Southampton, UK

Purpose: There is uncertainty about the safety and effectiveness of adrenaline use as a treatment for out of hospital cardiac arrest. In preparing for a randomized placebo controlled trial we sought to determine the relationship between the number of doses of adrenaline and outcome.

Methods: Cardiac arrest cases were identified through the London Ambulance Service Out of Hospital Cardiac Arrest Registry. Patients who were treated for out of hospital cardiac arrest (irrespective of cause) and received one or more doses of adrenaline were eligible for inclusion. Data were collected between 2012 and 2013.

Results: There were 3300 cardiac arrests where resuscitation was attempted and the patient received one or more doses of adrenaline. Survival for patients requiring adrenaline was 3.8% overall. Survival rates fell sequentially the more doses of adrenaline were required (survival 17.7% for patients requiring a single dose of adrenaline falling to 1.4% amongst patients requiring 5 doses. There were no survivors amongst patients requiring 10 or more doses of adrenaline.

Conclusion: Survival rates fell progressively with increasing doses of adrenaline. There were no survivors amongst patients requiring ten or more doses of adrenaline.

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AP098

Differences in blood pressures and flows with and without vasopressors in a porcine model of cardiac arrest

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2 ZOLL Medical Corporation, Chelmsford, MA, USA

Introduction: Resuscitation guidelines recommend the use of vasopressors during ACLS. We have reported that the arterial-venous pressure drop decreases and chest compression (CC) generated blood flow transitions from a “forward” to a “sloshing” dominated flow as time progresses in a porcine model of prolonged CPR with no defibrillation or vasopressor administration. Here we investigate the effect of vasopressor administration on this model of prolonged CPR.

Methods: Hemodynamics were monitored in eleven domestic swine (~30 kg) (Vasopressor = 4; no-Vasopressor = 7) using standard physiological monitoring. Flow probes were placed on the abdominal aorta (AA), inferior vena cava (IVC), and the right common carotid. Ventricular fibrillation (VF) was electrically induced. Mechanical CCs were started after ten minutes of untreated VF. Vasopressors were given every two minutes (in sync with changes in CC waveform) using the following pattern: epinephrine (1 ml/kg), epinephrine (1 ml/kg), vasopressin (40 U/kg). 48 mm deep CCs were delivered at a rate of 100 cpm for 54 min.

Results: In the first 8 min, right atrial pressure was elevated and end-tidal CO2 (EtCO2) was reduced (p < 0.05) in animals that received vasopressors. No other differences were observed. During min 8–18, vasopressors increased aortic and right atrial pressure (RAP) and reduced carotid flow and end-tidal CO2 (both p < 0.05). AA and IVC flow and central pressures were increased during min 18–54 with vasopressors.

Conclusions: Early administration (1–8 min) of vasopressors increased RAP but decreased EtCO2. Increased RAP may interfere with coronary perfusion. As time progressed, the animals that received vasopressor support exhibited increased central pressures and flows. Additionally, animals that received vasopressor support exhibited decreased EtCO2 and carotid flow. These data suggest that the immediate use of vasopressors does not improve CPR efficacy and that later vasopressor use improves central hemodynamics at the expense of tissue perfusion.

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used by 17.9% of the staff. 53.8% reported having experienced medication errors, resulting in adverse events like hypotension, apnoea and, in one case, cardiac arrest. CIRS were available in 51.3%. Less than one half of respondents received feedback concerning incidents on a regular basis.

**Conclusion:** Drug related risks are not adequately managed in prehospital emergency care. In addition there are deficits in critical incident reporting and processing, comprehensive introduction of labels following ISO standards (2) and effective use of CIRS may lead to improvement in medication safety as well as overall patient safety.

**Further reading**


http://dx.doi.org/10.1016/j.resuscitation.2014.03.148

**Education**

**AP100**

**Achievements of the week of cardiac arrest awareness “Viva!” in Italy**

Giuseppe Ristagno *, Nicolò Grieco, Tommaso Pelli, Andrea Scapigliati, Federico Semeraro, Erga Cerchiari  
**Italian Resuscitation Council, Bologna, Italy**

**Background:** Public awareness of CPR is relatively low in Italy, where almost 80% of cardiac arrests are witnessed while bystander CPR is initiated in less than 20% of cases. In compliance to a European call, the Italian Resuscitation Council (IRC) planned a week of awareness in Italy, called “Viva!” (October 14th–20th 2013).

**Methods:** The Viva! week was mainly directed to the lay population and 6 different areas of interest were considered: home, public places, working place, school, sport, health care setting. The awareness campaign was conducted using internet, social networks, dedicated webpages and blogs (www.viva2013.it). The process continued with the creation of advertisements, flyers, posters, videos, dedicated IRC statements and public mass training. During the week, media were also involved.

**Results:** The Viva! campaign achieved more than 310,000 online contacts, i.e. web visualizations and downloads, tweets and “I like”. More than 200,000 between gadgets and educational materials have been distributed to the general population. Seventy-seven thousands people have been trained in CPR during the 276 public events organized by Viva!, which included schools, hospitals and sport environments, together with public places. Numerous endorsements and collaborations with scientific societies have been established, that were determinant in the campaign organization, together with the economic support by IRC and additional 13 sponsors (see Table 1).

**Conclusions:** Viva! campaign was successfully organized and its achievements override the initial expectations. Viva! like campaigns need to be advocated and supported.

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**AP101**

The impact of human factors in Immediate Life Support course providers

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2 University of Technology, Graz, Styria, Austria  
3 Elisabethinen Hospital, Graz, Styria, Austria  
4 State Hospital, Stolzalpe, Styria, Austria  
5 AUVA Trauma Centre, Salzburg, Salzburg, Austria

**Purpose of the study:** There is an increasing emphasis on non-technical skills (NTS), respectively human factors in healthcare environment, with purpose to improve patient care and safety.1,2 The aim of our study was to explore the self expected behaviour related to this field, in medical emergency situations, from Immediate Life Support (ILS) course providers in traditional course structure compared with ILS course providers with supplementary training in NTS.

**Materials and methods:** A controlled multi-centre trail was performed within twelve ILS provider courses in several hospitals and training centres in Austria from June till December 2013. At the closure of each course all participants completed a questionnaire with statements around the elements of the Anaesthetists Non-Technical Skills (ANTS) as behavioural marker.3,4 The approval rating was measured with counter from one (I agree with...) to six (I disagree with...). In the end, five courses had been allocated as control group (CG) with a standard ILS course and seven courses as intervention group (IG) with an interactive, video supported and directed targeted – training in NTS, according to the ILS course regulation.3

**Results:** Out of 184 surveys 147 had been validated positively (IG n = 88 and CG n = 59). The distribution of the overall result with reference to ANTS behavioural in IG and CG shows a statistically significant difference (p < 0.001) between responder trends (IG median 1.00, SD ± 0.503; CG median 2.00, SD ± 0.608). In detail we determined differences in the skill category “Decision making” (p < 0.001) and “Situational awareness” (p < 0.001), not in “Teamwork” (p = 0.312) and “Task management” (p = 0.062).

**Conclusions:** Out of our results we recommend the use of NTS specific targeted – training in ILS provider courses to come closer to the requirements of well – performed human factors.

**Table 1**

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Achievements of the Viva! week</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>On-line contacts</strong></td>
<td><strong>Materials</strong></td>
</tr>
<tr>
<td>Facebook contacts 111,203</td>
<td>Youtube access 22,053</td>
</tr>
<tr>
<td>Tweets 317</td>
<td>CPR manoeuvres cards 105,000</td>
</tr>
<tr>
<td>Emails &gt;6000</td>
<td>Poster with CPR manoeuvres 40,000</td>
</tr>
<tr>
<td>“I like” 4312</td>
<td>Press releases 17</td>
</tr>
<tr>
<td>Pictures &gt;10,000</td>
<td>Tv shows 23</td>
</tr>
<tr>
<td>Streaming tv 111,203</td>
<td>Streaming live events 720</td>
</tr>
<tr>
<td>Streaming live events 30</td>
<td>Streaming live events 720</td>
</tr>
<tr>
<td>Downloads of Viva! apps 7422</td>
<td>Streaming live events 720</td>
</tr>
</tbody>
</table>

**References**

Children drawing CPR process during the Restart a Heart Day

Diana Cimpanoeu 1, Mihaela Dumea 1, Ovidiu Popa 1, Anca Haisan 1, Mihaela Corlade-Andrei 1, Paul Nedelea 2, Antoniu Petris 1

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2 Sf. Spiridon Clinical Emergency Hospital, Iasi, Romania

Objectives: To analyse the children drawings after the first course or refresher course of BLS, to present the most important elements learnt by children during the training and reflected in their drawings which are extremely significant in assessing memory and sentiments at infant years and teen age.

Materials and methods: On the 16th of October of 2013, within the University of Medicine and Pharmacy Iasi, a team of 6 physicians led by an ERC ALS instructor organised a BLS course for school children and presented the Viral Video provided by the ERC. After the course, the children were invited to draw for half an hour the most significant thing to them about the cardiopulmonary resuscitation. All four elements of the chain of survival were analyzed, looking to the drawings.

Results: 73 children were involved, 29 from the primary school (about 11 years old), 27 from the eighth grade (about 15 years old) and 17 from the high-school (19 years old). 60 drawings were provided by the school children after the course. The most frequent element in their drawings was the chest compressions – 63.8%, followed by the ambulance presence (means ALS) – 41.6%, and the 112 number, in 33.3% of the drawings. Only nine children drew the mouth to mouth ventilation (all from the 15 and 19 years groups) and 18 children drew a written message about CPR.

Conclusion: Chest compression was the most frequent element children kept in their minds and then put in their drawings after the BLS course, that is, one of the most important elements to save a life by CPR within the chain of survival. Drawing CPR process could be a good feed-back for BLS training.

Comparison of instructor-led Automated External Defibrillation training and two alternative web-based self-training methods

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2 Region Emergency Medical Services Ambulance Oost, Hengelo, The Netherlands

Purpose: CPR/AED courses last on average 3–4 h. 1,2 Self-directed training has been shown to be as effective in less time. 3,4 We compared online training with and without a personal training manikin, with the standard ERC CPR/AED training.

Materials and methods: Ninety-eight voluntary lay persons were trained in three groups. Group A received a standard instructor-guided ERC CPR/AED training. Group B and C received licenses to access the web-based training 14 days before the scheduled post-test. Group C received together with this license a personal training manikin. All participants were tested before, immediately after and six months after the course/self-training. Non-inferiority criteria were evaluated based on two-sided 90% CI. A relative risk margin of less than 0.2 was assumed for non-inferiority. 5 The null hypothesis (H0) stated that both web-based trainings were inferior to instructor-led training. Item analysis between groups was done with the Kruskal–Wallis test.

Results: None of the web based training methods met the criterion of non-inferiority, (see Table). During the post-test 37.9% of the participants of the web based training only passed (>70% score) vs 37.8% in the web based with manikin group and 96.8% in the
instructor led group. For the retention test this results were 58.3%, 45.9% and 82.7%. Four items (safety, call for help, CPR delivered and average frequency class) remained significant different between the groups, in favour for the instructor led group.

Conclusions: The test results showed that the instructor-led training was superior to both web based training methods. Self-training cannot yet be recommended as an alternative training method.

References


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AP105

Profile of educational institutions and teachers interested in learning CPR to teach in their schools

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Purpose of study: To investigate the profile of educational institutions and teachers who show interest in a CPR training course to spread CPR knowledge in their centres in Navarra, Spain.

Material and methods: a free CPR training program to enable teachers to spread CPR knowledge in their schools was offered to all types of educational institutions, at all levels (from kindergarten to secondary) and to any teacher interested. After training, teachers carried out a project in their institutions. Didactic material and manikins were available on a free rental basis. Teachers reported the type of educational centre they belonged to, the level of students they taught and their area of expertise.

Results: A 190 teachers from 176 educational institutions participated in one of 7 courses offered between September 2011 and June 2013. 90% were public schools, the rest charter or private. 70% of the schools were located in urban centres (>10,000 inhabitants); 17% small urban (between 3000 and 10,000 inhabitants) and 13% in rural towns (<3000 inhabitants). Training projects were observed from kindergarten up to secondary level. Kindergarten training was directed mainly to colleagues and parents, while throughout primary and secondary schools, mainly students were trained (94%). Early primary school students were taught basic skills like identifying the emergency number (112), and with age more concepts were gradually introduced until full CPR training was given from 10 to 11 years. Teacher area of expertise varied: physical education (64%), biology and health sciences (13%), language 2%; chemistry, mathematics, religion, physics accounted for 2%; Teachers from polytechnics (electronics, mechanics) made up 19%. Other participants included hair dressing schools, the official art school and institutions for children with special needs.

Conclusions: There is an interest for CPR training throughout the educational framework and among teachers from different backgrounds. Gradual age adjusted CPR training can be introduced in schools from early primary school.

Further reading


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AP106

Instructional quality of official lay BLS courses: Do instructors foster self-confidence of participants?

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2 Charité – Medical University of Berlin, Berlin, Germany

Introduction: ILCOR guidelines strongly advocate CPR training for the lay public. However, many lay bystanders still do not start CPR in real life cardiac arrest (CA), although having attended BLS courses. Amongst other reasons, this could be attributed to the quality how psychomotor skills and attitudes are taught. Therefore, the objective of this study was to analyse the instructional quality in lay BLS courses.

Methods: 20 randomly chosen BLS courses were prospectively evaluated by “undercover” participating observation. In particular, it was studied whether (a) severe standardised mistakes conducted by the participating observer were corrected by instructors, whether (b) instruction was “meaningful” (i.e. relevance was explained from a learner’s perspective, practice phases were attributed in a positive way, and fear of mistakes was effectively reduced), and whether (c) teaching contents were correct. For quantification, 5-point Likert scales were used, ranging from -2 (“very poor”) to +2 (“excellent performance”).

Results: Of the standardised mistakes conducted by the participating observer 35% (14/40) were not corrected by instructors. Average scores for “Explaining course relevance from a learner’s perspective” were < minus > −1.1 (range: −2.0 to 1.0), for “Positive attribution of practice phases” < minus > −1.2 (range −2.0 to 2.0), and for “Reducing fear of making mistakes” < minus > −0.9 (−2.0 to 1.0). Five instructors gave grossly incorrect information with the potential to deter participants from starting CPR.

Discussion: In a substantial proportion of the BLS courses observed, instructional quality (for psychomotor skills and attitudes) was not sufficient. Thus, improvement of instructor training may be a key to raise bystander CPR rates.

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AP107

Peer assessment of resuscitation skills by secondary school teachers

Clint Jean Louis∗, Diego Reyero Diez, Yolanda Encina Aguirre, Miguel Castro Neira, Carlos Beaumont Caminos, Amaya Ibarra Bolt

Navarra Health Services, Navarra, Spain

Purpose of the study: To validate an assessment template to help teachers evaluate resuscitation skills in students.

**Materials and methods:** 32 teachers were provided a basic CPR course and practical workshops on fundamental aspects on CPR to bear in mind when teaching students. To help teachers evaluate the acquisition of CPR skills an assessment template was designed. To validate the assessment tool, student resuscitation skills were evaluated simultaneously and independently by teachers and by certified health care faculty, and a comparison was made.

**Results:**

<table>
<thead>
<tr>
<th>Passed by instructor</th>
<th>Passed by teacher</th>
<th>Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure safety</td>
<td>17/26 (65.38%)</td>
<td>23/26 (88.46%)</td>
</tr>
<tr>
<td>Check response</td>
<td>32/32 (100%)</td>
<td>30/32 (93.75%)</td>
</tr>
<tr>
<td>Shout for help</td>
<td>21/29 (72.41%)</td>
<td>20/29 (68.96%)</td>
</tr>
<tr>
<td>Open airway</td>
<td>29/32 (90.62%)</td>
<td>26/32 (81.25%)</td>
</tr>
<tr>
<td>Assess breathing</td>
<td>30/31 (96.77%)</td>
<td>27/31 (87.09%)</td>
</tr>
<tr>
<td>Call for help</td>
<td>28/31 (90.32%)</td>
<td>29/31 (93.54%)</td>
</tr>
<tr>
<td>Chests compressions</td>
<td>30/32 (93.75%)</td>
<td>31/32 (96.87%)</td>
</tr>
<tr>
<td>Hands in the centre</td>
<td>26/29 (89.66%)</td>
<td>27/29 (93.10%)</td>
</tr>
<tr>
<td>of the chest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straight arms</td>
<td>27/27 (100%)</td>
<td>25/27 (92.59%)</td>
</tr>
<tr>
<td>Adequate</td>
<td>20/30 (66.66%)</td>
<td>24/30 (80.00%)</td>
</tr>
<tr>
<td>compression rhythm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rescue breathing</td>
<td>32/32 (100%)</td>
<td>31/32 (96.87%)</td>
</tr>
<tr>
<td>Correct breathing technique</td>
<td>30/32 (93.75%)</td>
<td>29/32 (90.62%)</td>
</tr>
<tr>
<td>Sequence</td>
<td>32/32 (100%)</td>
<td>31/32 (96.87%)</td>
</tr>
</tbody>
</table>

**Conclusions:** The degree of interobserver concordance when employing the assessment template between teachers and BLS instructors was high. The template may be a useful tool to help teachers evaluate their students resuscitation skills.

**Further reading**


**http://dx.doi.org/10.1016/j.resuscitation.2014.03.156**

**AP108**

**Layperson trainees improve their resuscitation knowledge and their confidence in providing bystander CPR in ERC-accredited BLS/AED courses**

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**Purpose:** To assess the knowledge of laypersons participating in courses in Basic Life Support (BLS) and use of Automated External Defibrillators (AED).

**Methods:** We trained 249 candidates (150 women, age 37 ± 12 years) in BLS/AED courses accredited by the European Resuscitation Council. Trainees were relatives of patients with coronary artery disease, and completed 15-point questionnaires before and after the course. Responses were analysed with the McNemar and Wilcoxon tests. Courses were offered for free.

**Results:** All trainees passed. Of the 249 candidates, 102 (41%) were the patient’s offspring and 48 (19%) the spouse, 152 (61%) had a University education, 230 (92%) spoke English, 188 (76%) had heard about resuscitation and 26 (10%) had attempted to resuscitate an arrest victim, but only 55 (22%) had any previous training. Before the course, only 16% of trainees considered their knowledge of resuscitation to be adequate, compared to 94% after (p < 0.0001). Before, 27% correctly replied that survival from out-of-hospital arrest was 5–10% but 51% after (p = 0.04). Only 53% knew the emergency EU number (112) before the course but 89% after (p < 0.0001). Before, 35% of trainees were willing to resuscitate a relative and 24% willing to resuscitate a stranger, compared to 92% and 77%, respectively, after (p < 0.0001 for both). Before, 48% knew that Athens International Airport is equipped with AEDs but only 11% considered operating them, compared to 97% and 96%, respectively, after (p < 0.0001 for both). Finally, all candidates supported the training of laypersons in resuscitation, 91% agreed that Greek legislation must allow non-doctors to defibrillate, and 75% considered buying an AED at home.

**Conclusions:** Layperson relatives of patients at risk for cardiac arrest who are trained in BLS/AED courses improve their knowledge of resuscitation, willingness to resuscitate a relative or a stranger, and confidence in using an AED in a public place.

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**AP109**

**Chest compression in resuscitation – Actual performance and self-assessment of final-year medical students**

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**Objective:** Chest compression performance is considered to be an important factor influencing patient’s outcome following cardiac arrest. In this study we evaluated the chest compression performance of 53 final-year medical students at the University Hospital of Heidelberg in a simulated basic life support scenario. Results were compared to the participants’ self-assessment of their CPR skills.

**Methods:** After a brief theoretical refresher course on basic life support, participants had to perform chest compressions in a 2 min compression-only scenario. Chest-compression quality was measured with a blackened automated feedback device; self-assessment of participants CPR-Skills was evaluated using a questionnaire with a six point likert scale. After data collection, chest compression quality and self-assessment were compared.

**Results:** Overall, only four participants (8%) showed a sufficient chest-compression performance with a chest compression depth between 50 and 60 mm and compression rate between 100 and 120 min⁻¹. Nevertheless, nearly half of the contestants (49%) rated themselves as confident towards their CPR skills but did not perform sufficient chest compression. There was no significant correlation between confidence and overall performance (0.1), or confidence towards chest compression depth (0.1) and chest compression frequency (−0.09).

**Conclusions:** The overall chest compression quality among final-year-medical-students is poor. There is no correlation between self-assessment of CPR skills and actual performance. Feeling self-confident but performing insufficient chest compressions seems to be common even among healthcare professionals and could affect patients’ outcomes.

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AP110

Public CPR training event in Bologna during the “Viva!” week in Italy

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Purpose of the study: The Italian Resuscitation Council (IRC) organized a CPR public training event in collaboration with 118 EMS and AUSL di Bologna during the “Viva!” week. The quality of chest compression (CC) was tested trough a CPR competition. The aim was to assess if a public and brief training is effective in teaching good quality CC.

Materials and methods: Several training stations equipped with a Mini-Anne (Laerdal Medical, Norway), AED Plus (Zoll Medical, US) and instructors were available in the Town Hall square for about 10 h to train bystanders in CC only CPR. The sequence was introduced by using a poster called “Life in your hands”, depicting in 8 simple steps how to recognize a cardiac arrest, alert 118 and perform CC and defibrillation. Afterwards, trained people were asked to participate in a competition called “The best 2 min CPR ever” to test their acquired skills. Data regarding CC quality were collected by the Resusci Anne Wireless Skill Reporter (Laerdal Medical, Norway) over a 2 min CC only performance.

Results: A total of 500 people were trained in an average training time of 10 minutes per person. Out of them, 80 participants (53% male and 47% female, age 28 ± 19 years) agreed to undergo competition for CC data collection. Over the 2 min CC interval, the mean total compressions delivered were 231 ± 18, mean compression depth was 47 ± 10, mean compression rate was 116 ± 9, mean % of adequate compression depth was 50 ± 39, adequate compression rate was 61 ± 31%, and compressions with complete release were 37 ± 12%. The overall CPR score was 81 ± 18%, 40% (n = 32/80) performed over 90% accuracy.

Conclusions: Public and brief training in the context of an awareness campaign for general population can be effective in teaching CC to lay people.

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AP111

Efforts by medical students joined in Taskforce QRS to increase survival chances in South-Netherlands

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Background and purpose: Sudden cardiac arrest (SCA) is a major health problem both in Europe and worldwide. In order to improve the survival chances for SCA victims an initiative was started in 2006 by medical students of the Maastricht University. This initiative is named Taskforce QRS (Qualitative Resuscitation by Students). Aims are to accomplish more awareness for SCA and the importance of cardiopulmonary resuscitation (CPR), to train CPR in secondary schools, to raise the number of volunteers in the Resuscitation Network System (RNS) and to increase the CPR skills of medical professionals.

Materials and methods: CPR-training is provided to secondary school students and students of Maastricht University. To improve CPR-skills of doctors, medical students receive CPR training, many of them being trained as CPR-instructors, and an elective course “Resuscitation Medicine” is organized. To raise governmental support administrators are trained, including mayors, aldermen and members of the Provincial Council and Central Government. All participants are encouraged to join the RNS. To increase awareness a yearly CPR-relay is held where secondary school students, medical students, professionals and RNS-volunteers practice ten hours non-stop CPR.

Results: Up to now 150 medical students are trained as CPR-instructor under the auspices of the Dutch Resuscitation Council. A total of about 5000 secondary school students were trained and 1500 medical students and 1000 Health Sciences students of Maastricht University. The course “Resuscitation Medicine” is running since 5 years and a total of 300 medical students have successfully participated. The CPR-Relay has been held since 8 years.

Conclusion: These activities, especially when receiving widespread continuation, will lead to increased awareness of the SCA problem and more CPR-skills within the community, among decision makers and medical professionals and hopefully to improved outcomes in SCA.

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AP112

Exploring general population’s perception of importance and basic knowledge of cardiac arrest

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Purpose of the study: Basic Life Support (BLS) by laypersons is an important part of cardiopulmonary resuscitation (CPR) and improves outcome after out-of-hospital cardiac arrest. Our aim is to assess the knowledge and disposition of general population providing BLS.

Materials and methods: A questionnaire-based cross-sectional study was carried out in people who attended to an Emergency Department (excluding <18 year old and health workers). Variables analyzed: age, sex and answers on knowledge, attitude and skills related to BLS. Data were compared using the t-test for quantitative variables and Chi-square test for the qualitative variables. A p-value of 0.05 was considered statistically significant. Data analyzed using SPSS20.0.

Results: 340 questionnaires were eligible. Sex: 189 (56.8%) women. Mean age 44.43 ± 14.99. Age stratification: 136 (43.0%) from 18 to 40, 145 (45.9%) between 41 and 65, 35 (11.1%) those >65 years. Knowledge: 223 (68.2%) knew the Emergency Number, 38 (12.4%) CPR sequence and 224 (65.9%) heard about an Automated External Defibrillator (AED). Skills: 223 (65.6%) capable to provide BLS, 76 (22.5%) found BLS health worker’s exclusivity and 311 (92.0%) thought general population must get involved. Training: 97 (28.6%) attended BLS program, 39 (11.5%) were CPR participants, 322 (94.7%) BLS must be taught in schools. In the (18–40) group 102 (77.1%) knew the European Emergency number (p < 0.05), and reject BLS exclusivity of Health Workers 118 (86.8%) (p < 0.001). 103 (75.7%) found BLS training a matter of interest (p < 0.001). The group between (41–65) knew AED 106 (73.1%), 52 (35.9%) attended BLS course and 59 (40.7%) considered themselves trained enough to provide BLS. All three p < 0.05. No significant differences between sexes were found.

Conclusions: Respondents find prehospital cardiac arrest as a health problem. Surprisingly many don’t know BLS algorithms and have poor CPR skills. The younger people are more conscious of the scope of the problem but the middle-aged group is more competent and knows how to use AED. Despite awareness in population, the lack of training makes us consider BLS education should be released from the school.

References


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AP113

To some it comes as a shock... An automated external defibrillator (AED) used by elementary school children

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Background: Evidence shows that cardiopulmonary training can be taught to a wide range of children including the use of an AED.1 No studies have discussed at what age we should encourage AED use, given the theoretical risk of harm to themselves.2 In a small group children (mean age 13 ± 2 years) 93% deployed the AED correctly.3

Purpose of the study: To investigate what is the optimal timing to include the use of an AED in the cardiopulmonary training.

Materials and methods: Cohort study, 31 elementary schools in Nijmegen. We provided 2150 children (age 9–12 years) a resuscitation lesson including the use of an AED. Six months later 1875 of them participated at a successful world record attempt. 1862 schoolchildren answered questionnaires.

Results: Before the lesson half knew what an AED was. Chest compressions were performed well in 80%, inflations in 62%. Most children (80%) found the AED used easy. A shock was given correctly in 86%. Only 4.3% found the lesson to be a bit scary. They responded with 57% that they would be able to find an AED in their own neighbourhood.

Conclusion: The time is ripe to start teaching basic life support and the usage of an AED to our elementary schoolchildren.

References


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AP114

Developing a sustainable community based CPR program for schools: The “el ABC que Salva Vidas” model (Eng = the ABC that saves lives)

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Introduction: Training teachers is an effective way of spreading CPR knowledge in school communities and strengthening the Chain of Survival. The “EL ABC que salva vidas” is a nonprofit association dedicated to spreading CPR knowledge in the community in Navarra, Spain.

Purpose of study: to introduce a design-based program to train school teachers to spread CPR knowledge in the school community.

Materials and methods: A see one-learn one-do one-teach one approach was developed employing design thinking tools to introduce a sustainable three-phase CPR program in schools. Thirty-five experienced health care professionals volunteered and received training for the project. The first phase consisted of CPR training of teachers from schools throughout the province, followed by
practical workshops on fundamental aspects on quality CPR that teachers were expected to confidently convey to the school community. Instructor–professor ratios were 1:4–6. Peer assessments were carried out to ensure learning objectives were accomplished.

In the third phase teachers carried out a school project, after which evaluation of the process and problems they encountered and consequent iterations to the course were made. Diverse didactic material (powerpoints, dvds, posters, stickers) was provided along with 145 manikins on a free rental basis throughout the academic year. Teachers informed on successive training through an online questionnaire. The association offered continued support whenever needed.

**Results:** Between 2011 and 2013, 190 teachers were trained in 7 courses. Teachers reported training of 10,835 people in their school communities, the majority students, the rest included other teachers and personnel, and parents. 76% of the teachers actually continued offering CPR training in their schools one year after.

**Conclusions:** When appropriate training and materials are made available, teachers are willing to learn and spread CPR in their school communities on a long term basis.

**Further reading**


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**AP115**

The ‘Learning conversation’ as a style of feedback in resuscitation courses

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This paper explores the history behind the introduction and use of the learning conversation as a mechanism of providing effective feedback to candidates on resuscitation courses. The central aim of the learning conversation is to promote and support greater self-awareness of the individual student in order to develop competence and team leadership through critical inquiry. Learning, particularly in the context of resuscitation is demonstrated by the utilisation of “planned experience which brings about a change of behaviour,” and the process is facilitated by feedback whether during skills teaching, in workshops or in simulation. The learning conversation is an empathic, respectful listening and advising conversation between a group of adults, facilitated to ensure that key learning emerges from this process that informs future practice and behaviours. A mnemonic has been developed to facilitate acquisition of the skills involved. Faculty development will be needed to continue to develop the full implementation of the learning conversation as a feedback tool on resuscitation courses, animating the principles of adult learning.

**References**


**AP116**

Use of checklists facilitates guideline adherence in prehospital emergency care

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**Background:** High quality emergency medical care requires transfer of evidence based knowledge into practice. The implementation of Standard Operating Procedures (SOP) alone is not sufficient to ensure adherence to guidelines. Checklists have proven to reduce perioperative mortality significantly. Our study investigated the usability of checklists in order to improve quality and safety in prehospital emergency care.

**Methods:** Three checklists based upon SOP were introduced: General principles of prehospital care, Acute Coronary Syndrome (ACS), Acutely exacerbated Chronic Obstructive Pulmonary Disease (COPD). Immediately before transport medical history, diagnostic and therapeutic procedures were retrieved. Data of 740 respective emergency missions were recorded prospectively before and after implementation of checklists and compared by chi square test (significance level p < 0.05).

**Results:** Records concerning patients’ history [pre-existing diseases 69.1 vs. 74.1%; medication: 55.8 vs. 68.0%; allergies: 6.2 vs. 27.7%], diagnostic measures [oxygen saturation: 93.2 vs. 98.1%; auscultation: 11.1 vs. 19.9%] and basic procedures [application of oxygen: 73.2 vs. 85.3%; iv-access: 84.6 vs. 92.2%] improved significantly. Subanalysis of ACS cases revealed significant increase of 12 lead ECG use [74.3 vs. 92.4%], administration of oxygen [84.2 vs. 98.6%], ASA [71.7 vs. 81.9%], heparine [71.1 vs. 84.0%], beta blockers [35.5 vs. 53.3%] and morphine [26.8 vs. 44.6%]. In the COPD subgroup oxygen supply [78.8 vs. 98.5%] and intravenous application of ß2-mimetics [71.7 vs. 81.9%] increased significantly.

**Conclusions:** Introduction of checklists into prehospital emergency care may help to improve adherence to current guidelines. Additional efforts such as repetitive team trainings must be made in order to further raise quality and safety of care.

**References**


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A review of the resuscitation training and equipment in a UK hospital without a Resuscitation Officer

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Background: Ours is a 400 bed hospital providing acute medical and surgical services. Approximately 250 in-hospital emergency calls are made annually. There has been no Resuscitation Officer employed for more than 2 years. Each hospital should employ at least one resuscitation officer.1 Resuscitation skills decline within 6–12 months of training.2 Regular resuscitation training is a vital part of emergency service provision. We examined the current resuscitation training status of clinical staff and assessed the maintenance status of our resuscitation trolleys.

Methods: An observational study was conducted to determine life support provider status of nurses and doctors throughout the hospital, through completion of a short questionnaire. Ten resuscitation trolleys were reviewed to ascertain if they were appropriately maintained.

Results: Fifty staff members responded (37 nurses and 13 doctors). Fifty-eight per cent of respondents had not received resuscitation training in the previous year. Furthermore, 24% indicated that they felt unprepared to deal with arrest or peri-arrest situations. The layout and stocking of resuscitation trolleys was inconsistent as no universal checklist was used throughout the hospital. Each trolley was maintained appropriately according to its own checklist.

Conclusion: In our survey the majority of clinical staff had not undergone any resuscitation training in the last year. Almost quarter felt unprepared to deal with emergency situations. Lack of resuscitation training and non-standardised layouts of resuscitation trolleys are, undoubtedly, major patient safety concerns. These deficiencies might be addressed by the appointment of a Resuscitation Officer.

References

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Restart a Heart Day: The Danish Way 2013

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Purpose of the study: The first European Restart a Heart Day was organized by the Danish Resuscitation Council (DRC) and the foundation TrygFonden on October 16th 2013, with the purpose to create awareness of OHCA and the importance of bystander CPR and use of AEDs.

Material and methods: The goal was to provide Danes with knowledge of CPR and the use of AEDs, www.hjertestarter.dk, and the AED app. Additionally, Danes were encouraged to take an ERC-approved CPR-AED course. The combination of research presentation and citizen engagement provided the background for the strategic planning of the day. www.hjertestarterdagen.dk was created to enable Danes to view upcoming free events with CPR and AED demonstrations. Pamphlets and posters were made available free of charge for organizers to market the events. Furthermore, a nationwide competition encouraged Danes to locate AEDs not yet registered in the national network for public use. An updated publication of the Danish Cardiac Arrest Registry served as a communicative icebreaker toward the media focusing on the fact that CPR techniques. We need to use other ways for dissemination of these techniques. Multiple authors acknowledge the great development capability that allows Smartphones. They claim that these devices can improve resuscitation skills, in both health workers and untrained citizens with very low costs. Our main objective is to increase the intervention rate by witnesses in OHCA. So we've created an application for mobile phones: “CPR Assistant.”

Material and methods: The application has been developed strictly following the ILCOR 2010. The development of scientific content has been carried out by the first two authors of this communication; both instructors in CPR from the PNRC of SEMICYUC. The application, on its first run, asks you to set it. It allows us to adapt to the level of prior knowledge and training in CPR techniques. It can be setting to work with sequences “only massage” or “massage and mouth to mouth.” The app recommended activating the mode “only massage” if a course has not been done previously. It also includes a learning module of B-CPR. It is designed with simple drawings, animations, voices and texts, clear and understandable for any citizen. It is available in Spanish and English. Once activated, leads you step by step through visual and auditory messages. It provides the call to emergency medical services when necessary and displays our GPS location on the screen.

Results: It has been checked in 10 volunteers without detecting usability problems. It was distributed freely among the students of the “RESTART to HEART” day in Spain. It is available for Android and IPhone.

Conclusions: This application can provide to citizens an important support for a fast and effective intervention in emergency medical situations, especially in OHCA. Its spread is a fundamental part of its utility.

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bystander CPR has increased from 19 to 58 percent since 2001. This astonishing development was highlighted to motivate more Danes to learn CPR. The media campaign included successfully resuscitated persons, bystanders and leading Danish resuscitation scientists. They stressed the importance of learning CPR and emphasized the lack of publicly accessible AEDs.

**Results:** One hundred free events were available across Denmark, 10,000 people learned CPR and use of AED. 9833 unique visitors on hjertestarterdagen.dk, 543 media mentions (TV, radio and printed media), 240 competition contestants, 300 more AEDs were included on www.hjertestarter.dk, 102,637 AED app downloads (up 310 percent from 2012).

**Conclusion:** Combining new scientific results with a well-planned media strategy and citizen engagement can motivate and encourage Danes to learn CPR and to register more AEDs available for public use.

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**AP120**

**Training the next generation: A feasibility study establishing a region-wide sustainable near-peer life support training scheme targeted at secondary school students in the UK**

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Prompt and effective bystander cardiopulmonary resuscitation (CPR) increases survival from out of hospital cardiac arrest (OHCA).1 Survival following OHCA differs between areas with varying socio-economic status and, given that survival rates from cardiac arrest are greater in areas across Europe where bystander CPR is more prevalent, the availability of life support training may be a contributing factor.2 We have previously demonstrated that peer-led life support education is effective within a University setting.3 We hypothesised that near-peer teaching aimed at secondary school pupils could redress socioeconomic imbalances in BLS training and thus response rates to OHCA.

We ran a pilot programme to determine the feasibility of establishing near-peer teaching as an effective approach for the dissemination of life support skills to secondary school students of poorer socioeconomic status.

Five schools from disadvantaged areas within the West Midlands, UK, were enrolled in a pilot scheme extending from November 2012 to May 2013. A single teaching session lasting approximately two hours was delivered in each of these schools. Forty-five medical students, who had previously trained as European Resuscitation Council (ERC) BLS instructors, received additional training from the BHF (British Heart Foundation). They then delivered sessions for a total of 507 students as part of the BHF’s Heartstart programme. Qualitative feedback collected from pupils, instructors and teachers was strongly positive. Instructors commented that they found teaching enjoyable and rewarding, whilst teachers and pupils were keen for further teaching sessions. A number noted that greater space to practise skills would assist in improving teaching sessions.

We have demonstrated that near-peer teaching targeted at secondary school students and delivered by trainee healthcare professionals is feasible and popular. In addition, it may provide an opportunity to equilibrate imbalances in BLS training amongst groups of differing socioeconomic status.

**References**


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**AP121**

**Secondary school students tend to overestimate their CPR-skills**

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**Purpose of the study:** To increase survival after sudden cardiac arrest more people should be able to provide cardiopulmonary resuscitation (CPR). Annual short CPR training sessions in secondary schools can contribute to achieve that goal. This study reports on the students self-perceived skills and the objectively measured values in a test scenario.

**Materials and methods:** Included were 85 secondary school students participating in a Meuse-Rhine Euregion CPR training program EMuRgency. Training consisted of 1½ hour hands-on training: each student having an own manikin with medical students as CPR-instructors. Before and after the CPR training a questionnaire was completed on self-assessment of their CPR confidence. After the training students performed CPR on a manikin in a test-scenario.

**Results:** Demographic variables included: mean age: 13.9 (SD:0.8), male: 49.4%, educational level being classified as: 1.higher year, 1st year: 36.4 mm, 2nd year: 43.6 mm, 3rd year: 47.3 mm = 0.001). 50 and 60 mm. Average compression depth increased by school year, 1st year: 50.5, 2nd year: 55.6, 3rd year: 57.8 (p = 0.001).

**Conclusions:** Even a short CPR training increases confidence about resuscitation skills in secondary school students, but also leads to overestimation as found when tested two weeks after. However an improvement is observed per higher school year as...
suggested by increased compression depth. Repeated training will improve resuscitation performance, becoming more in line with the already high self-perceived ability for CPR.

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AP122

Evaluation of the effectiveness of a training programme CPR

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Introduction: Hospital cardiac arrests represent a health, social and economic problem of great magnitude. The training program for hospital cardiopulmonary resuscitation (CPR) pursues objectives of optimal care of any situation of cardiac arrest occurring in the hospital, training staff to provide effective care to patients requiring CPR.

Objectives: Describe the training strategy in the hospital and on the evaluation of the training plan in cardiopulmonary resuscitation.

Material and methods: Annual training plan design, design of three types of courses, Adult and Pediatrics, following the model of formation of the National Plan of CPR of the Spanish Society of Intensive Care Medicine and Coronary Units. Prioritization of training activities. Evaluation of the effectiveness of training as stipulated Kirkpatrick.

Results:
Courses: (from 2010 to 2013).
ADULTS: 66 basic life support and 11 advanced life support, 926 people trained.
PEDIATRICS: 7 basic life support, 86 people trained and 10 advanced life support, 127 people trained.
NEONATOLOGY: 4 intermediate life support, 51 people trained.

Rating:
Satisfaction: 4.6 overall rating (scale 1–5)
Assessment of learning through pre-course and post-course tests theoretical.
Practice evaluation: test that evaluates the acquisition of skills.
Evaluation of transfer: analyzing four variables:

(1) Start time in caring for the PCR: decreased 2.8 min (2010) to 1.2 min (2013).
(2) Warning time care team: decreased 4.4 min (2010) to 3.8 min (2013)
(3) Time for your care team: decreased 3.2 min (2010) to 2.3 min (2013)
(4) Time to start the 1st defibrillation: increased 3.7 min (2010) to 5.5 min (2013)

Conclusions: Evaluating the effectiveness of training allows us to identify areas for improvement, redesign programs based on identified needs and continue to improve the process of care in the cardiac arrest.

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AP123

Restart a heart day in the Czech Republic

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Introduction: The ERC Guidelines recommend that all citizens are taught CPR.1 In Denmark, there was an increase in survival following cardiac arrest that was significantly associated with a concomitant increase in bystander CPR.2 As part of the strategy to increase bystander CPR rates, the ERC has announced that the 16th October will now be Annual Cardiac Arrest Awareness Day and will be named ‘Restart a Heart Day’.3 This is a short report about activities that were organized for laypeople in the Czech Republic.

Methods: In 2012, the Czech Resuscitation Council took an active part in obtaining support from the Members of the European Parliament that finally accepted suggestion for the EU Declaration to increase cardiac arrest awareness.3 Once the final term for the Day was set, the National Council organized an online survey to find the best translation of its name into the Czech language, and produced leaflets and merchandise material. After selection of optimal locations, preparations of public events were started.

Results: The first important event, Children Saving Lives, was organized during the Czech Congress of Anaesthesiology in Brno, and was awarded national record in number of children performing CPR. In co-operation with local ambulance services, the Restart a Heart Day took place in Prague, Hradec Králové and Brno. Two press conferences resulted into several press releases, TV and radio spots. The social media (facebook, e-newsletter, websites) were also used to spread information.4,5 The Save a Life Campaign using instructional window stickers and videos continued in co-operation with public transportation companies and shopping malls.

Conclusion: The Restart a Heart Day increased overall interest of laypeople, politicians, and media in CPR, hundreds of adults and children learned at least how to call an ambulance and perform chest compressions.

References

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AP124

A simulation-based post-cardiac arrest care and therapeutic hypothermia training course to improve self-efficacy and facilitating performance of hospital educators

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Purpose: Simulation training has been recommended as a specific intervention for lack of self-efficacy of healthcare providers in therapeutic hypothermia (TH) implementation for post-cardiac arrest syndrome. The aim of this study was to evaluate whether a simulation-based post-cardiac arrest care and TH training course for hospital educators improve the participants' self-assessed knowledge, competence, and confidence for each learning objective at the end of the course and impact on their facilitating performance at the provider training courses.

Materials and methods: A pilot full-day, simulation-based post-cardiac arrest care and TH training course for hospital educators was developed and applied to physician and nursing educators. The course was consisted of a lecture, 4 small group workshop sessions, and 4 patient simulation sessions. The participants' self-assessed knowledge, competence, and confidence for each learning objective were assessed before and after the course using a survey. The participants' facilitating performance during small-group workshop session at 4-hour provider training courses were recorded and assessed by two independent raters independently using a checklist for pre-defined 10 core educator's activities.

Results: A total of 32 hospital educators (14 physicians and 18 nurses) participated in two pilot courses. Overall satisfaction level to the courses was very positive [13 (41%) rated as “good” and 18 (56%) rated as “excellent”]. Their self-assessed knowledge, competence, and confidence for each learning objective were significantly improved at the end of the course compared to those before the course (p < 0.05, respectively). The facilitating performance score (mean ± SD) of the educators during small-group workshop session at the provider training courses were 72.1 ± 19.3 in physician educators and 76.3 ± 9.7 in nurse educators.

Conclusions: A simulation-based post-cardiac arrest care and TH training course may be a useful way to improve hospital educators' self-efficacy for post-cardiac arrest care and TH and their facilitating performance at the provider training courses.

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AP125

VIRTRAPP: Improving learning and knowledge retention in resuscitation application

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Introduction: The widespread teaching of various classes specialising in basic and advanced Life Support Techniques to non-medical personnel shows that after a period of between 2 months and 2 years, there is a certain rate of loss of recall of the acquired knowledge.

Purpose: The purpose of this study was to evaluate the learning loss existing among members of the Emergency Response Unit and apply a more dynamic and didactic alternative through implicit learning.

Material and methods: This involves the creation and evaluation of the “Virtual Training Resuscitation Application (VIRTRAPP)” in the form of a game where the research activity has been directed at its effectiveness in the learning intervention in order produce changes. It was performed in 130 of the possible 157 candidates through the natural observational method and simple design comparison with pre and post measurements. All individuals were evaluated in the handling of the action sequences including basic life support and assembly of oxygen therapy equipment as well as the corresponding theory in accordance with the Emergency Response Unit for employee entrance exam.

Results: A minor loss of memory recall was detected in both the theory and practice exams performed in 2013.

Conclusions: The implementation of the VIRTRAPP project was kept as an interactive and didactic learning accepted by the members of the Emergency Response Unit while obtaining better retention of the learned material.

Keywords: Cardiopulmonary resuscitation; Learning; Memory; Recall

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AP126

Prior to CPR training, courage of secondary school students predominates their self-perceived ability to provide CPR, but results depend on school type

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Purpose of the study: To provide cardiopulmonary resuscitation (CPR) both ability and courage of a bystander are needed. Studies in adults suggest lack of courage to start CPR as a threshold for many bystanders of a circulatory arrest. The study at hand, done in secondary school students, investigated both requirements, as self-perceived, before start of a CPR training.

Materials and methods: A total of 3844 school students of seven schools in the Dutch province of Limburg participated in a Meuse–Rhine Euregion CPR training program EMuRgency. A thirty items questionnaire regarding self-perceived ability and courage was completed before start of CPR training by 3825 students.

Results: Demographic variables included: mean age: 14.6 (SD: 1.5), male: 48.6%, educational level being divided as: 1. preparatory vocational training (7%), 2. higher level education (43%), 3. preparatory scholarly education (32%), 4. gymnasium (18%). Of the whole group 67.5% felt sufficiently courageous but only 32.4% felt able to provide CPR. Perceived courage increased at higher educational levels 1: 59%, 2: 69%, 3: 66%, 4: 70% (p = .008). However perceived ability decreased: 1: 47%, 2: 36%, 3: 29%, 4: 25% (p = .000). No differences were found related to gender or study year.

Conclusions: Before a CPR training the self-perceived courage of secondary school students to provide CPR is higher than their self-perceived ability, results depend on school type. These findings are of relevance when considering resuscitation programs in secondary schools.

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AP127

A randomized control trial comparing the use of the sandwich technique and learning conversation feedback mechanisms in teaching basic life support

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Introduction: Feedback delivery is known to influence the quality of an educational experience. Whilst a plethora of techniques exist for its provision, the European Resuscitation Council (ERC) has for many years solely advocated the sandwich technique (ST) for use with basic life support (BLS) candidates. Its alternative, the learning conversation (LC), has however recently been gaining favour amongst other resuscitation bodies. Despite this, there remains an apparent paucity of research into their comparative effectiveness and we therefore sought to determine which out of the sandwich technique and learning conversation is superior for delivering feedback to BLS candidates.

Methods: First year healthcare students within the University of Birmingham were voluntarily recruited to a randomized controlled trial between September and December 2013. Of 283 who enrolled, 143 candidates were in the ST arm. Candidates received eight hours tuition from 48 ERC-accredited BLS instructors, at a candidate:instructor ratio of 3:1 or less. Subsequent to training, candidates were required to undergo a competency-based assessment. All Instructors received four hours of feedback training. Validated questionnaires were distributed to instructors and candidates following the course and their subjective perceptions of the feedback were compared using visual analogues scales ranging from 0-10. Assessment results were also reviewed for both arms of the study.

Results: Whilst objective exam results were comparable across both arms of the study, a significantly greater proportion of ST candidates considered that too much time was spent providing them with feedback (12.6% vs 1.4%; p < 0.05). Furthermore, LC instructors reported greater satisfaction with students’ improvement following feedback in comparison to the ST group (7.3/10 vs 6.5/10; ns), however ST instructors reported greater understanding of their feedback technique (8.6/10 vs 7.1/10; ns).

Conclusion: The learning conversation technique does not appear to enhance the competency of BLS candidates undergoing training, but is better received by candidates themselves.

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AP128

Today’s child can save a life tomorrow

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Introduction: Maruri is a village of Bizkaia (Basque Country) of 950 inhabitants which supports an important population in transit in recreational areas whose geographical dispersion (15.80 km²) makes difficult ambulance’s access. This has promoted an altruistic initiative between Town Hall and a nurse to train the child population in cardiopulmonary resuscitation (CPR) and first aid maneuvers.

Aims: Teach children how to: Recognize unconsciousness; Warn 112, inform and ask for adequate resources; Learn CPR and transmit procedures to various emergencies; Demonstration to parents of acquired skills; A survey to the parents. Second workshop (2 h): Alert 112: when and how; Chest compressions to the rhythm of Macarena song; Procedures to various emergencies; Demonstration to parents of acquired skills; A survey to the parents.

Methodology: Send advertisement with the slogan “Today’s child can save a life tomorrow”. Preparation: in previous days, the parents of these children put the song Macarena at home. Workshops: Classroom and practice; Participants: 17 students age between 6 and 12. First workshop (2 h): Alert 112: when and how; Chest compressions to the rhythm of Macarena popular song; Procedures to various emergencies; Demonstration to parents of acquired skills; A survey to the parents. Second workshop (2 months later. Lasted 2 hours): Repetition: when and how to warn the 112; Medicine and cures; Check for breathing or moving; Training CPR (30/2) on mannequins with music; Involve, transmit and guide parents in CPR (they did not know CPR). Test on knowledge acquired (2½ months after the first workshop).
Results: Survey (parents): 100% optimal evaluation; parents said their children learned. Test (children): 94–100% knew how to respond: body-, arms- and hands-position in CPR, where and how fast to press; 88% knew “how warm and when to start CPR.”

Conclusion: Children demonstrated they knew: When and how to warn; Basic techniques of CPR; Rate of compressions with music; Transmit Adult CPR technique.

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AP129

Introducing non-technical skills teaching to the Resuscitation Council (UK) Advanced Life Support Course

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Purpose of study: Delivery of high quality cardiopulmonary resuscitation (CPR) is one of the key factors to resuscitation success and patient survival. High quality CPR encompasses both technical skills (for example; chest compressions, delivery of a safe and appropriate defibrillating shock), as well as non-technical skills. Non-technical skills (NTS) encompasses situational awareness, decision making, task management, leadership and team working. Previous research has demonstrated that superior leadership skills correlate with the quality of CPR, shorter ‘hands off’ time, minimal pre-shock pauses and a reduced time to first shock.2 The International Liaison Committee on Resuscitation (ILCOR) recommends that ‘specific teamwork training, including leadership skills, should be included in courses’.3 A 2012 nationwide survey of UK Advanced Life Support (ALS) instructors and providers concluded that NTS should be incorporated in the Resuscitation Council’s ALS course.4

Materials and methods: An online NTS module was produced with a lecture, a sample case study and the modified Team Emergency Assessment Measure (TEAM) tool.3 The learning outcomes focused on the importance of NTS in the resuscitation team and the interplay between technical and non-technical skills. CASTeach scenarios were rewritten with NTS discussion points. Additional NTS teaching was implemented into the ALS course without any increase in course duration.

Results: A total of 181 candidates were trained on eight pilot courses between May to October 2013. Feedback from candidates and instructors was overwhelmingly positive with the new elements scoring 5.3 out of 6 for quality and 94% of candidates agreed that the course improved their NTS. Debriefing of candidates’ technical and non-technical performance provides powerful learning tools.

Conclusion: Non-technical skills teaching have been introduced into the updated Resuscitation Council (UK) ALS course with positive feedback from both candidates and trainers. There remains a need to further enhance the teaching of non-technical skills in resuscitation outside the setting of training courses.

AP130

From rescuer to rescued: A unique narrative account of a medical student’s survival following out-of-hospital cardiac arrest

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There is a paucity of literature concerning the personal impact of cardiac arrests on healthcare professionals; whether they are rescuer or the rescued. Uniquely, we detail the account of a medical student’s cardiac arrest and that of his colleague who performed bystander cardiopulmonary resuscitation (CPR).

At the University of Birmingham, over 650 first-year healthcare students each year receive unique student-led training in basic life support (BLS). Three years after receiving this training, a clinical medical student within our institution was presented with the need to use his skills to support his friend and fellow medical student, a 20-year old male who had sustained an out-of-hospital cardiac arrest. Detailing this event, he recalls his response: ‘Airway open. No proper breathing. No pulse. We started CPR as a default, my BLS instructor’s advice of ‘Do simple things well and quickly’ echoing in my mind. EMS arrived, a welcome sight! Finally, a shockable rhythm, a glimmer of hope, more CPR, defibrillation and yes! A pulse!’

Twelve months later, the medical student at the subject of this arrest details considering himself ‘extremely fortunate to have had BLS-trained friends present’, identifying that ‘their actions bought (him) the precious minutes (he) needed to survive’. In noting the impact of his arrest he states: ‘I have now recommenced my studies. Never underestimating the scale of the event that changed both our lives, my friend and I remain bound by unspoken ties, determined still to continue living life on our terms. Only time will tell whether I can truly put the past behind me, but one thing is for sure; I will be forever indebted to those who have established BLS as a cornerstone of our medical teaching’.

Analysis of this narrative provides valuable insight into the psychological sequelae of cardiac arrests.

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AP131

Advanced medical simulation as a tool to assess the leadership and teamwork in emergencies
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Introduction: High fidelity simulation (HFS) is a useful tool to train and strengthen the patient safety in Urgencies and Emergencies. Optimal leadership and teamwork (TW) ensure best practices and patient safety, avoiding adverse events. Our objective was to assess the leadership and TW by means of HFS.

Methods: A simulated clinical scenario of a cardiac arrest was designed and developed by 42 emergencies teams in a HFS system. Each scenario was recorded and assessed.

The leadership was assessed with the “Behaviors of Team Leader for Effective ACLS” and “leader behavior description questionnaire” – including the assessment of 12 items, scored between 0 (not done), and 2 (done consistently). The TW performance was assessed with the “Mayo high performance teamwork scale”. The score was from 0 (never or rarely) to 2 (consistently).

Results: The results scored under one, or the most relevant problems detected are detailed.

Leadership: Identifies and respond to errors: (0–2): 0.9. Used closed-loop communication: 29.6%. Motivate: 29%. Effectively summarizes and reevaluate: 26%.

TW: Verbalize their activities: 0.8. Team Member (TM) repeats the order: 0.57. TM acknowledges their lack of understanding and look for clarifications: 0.82. TM persists in seeking a response when the order is not clear, or may contain an error: 0.77.

Conclusions: We detected weaknesses in the communication, both in leadership and teamwork areas. The leadership was not enough assertive, and showed lacks in motivation the team, as well as in the use of closed-loop communication. TW weaknesses were also focused in the field of communication, including deficiencies to verbalize and secure their activities, and as well as to communicate the misunderstanding of the orders.

HFS was useful to detect the improvement areas in this professional population: next training programs must be addressed to strengthen both the abilities of communication of the leader and between TM.

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AP132

Cardiopulmonary resuscitation knowledge of future teachers: Should be taught basic life support during the educational system?
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Purpose of the study: Analyze the knowledge of cardiopulmonary resuscitation (CPR) of future teachers of pre-school, primary and secondary education, as well as their inclination to acquire their knowledge.

Materials and methods: A questionnaire on the CPR was distributed by 8 University faculties of Galicia (Spain). The criterion for inclusion was to study infant, primary or secondary education. The questionnaire was answered by 300 students.

Results: The 50% of the sample consider that their knowledge of CPR is enough, but there are pointed out low rates of correct answers in terms of depth and compression rate (cm/min−1) both in adults and children (adult CPR depth: 10%; adult CPR rate: 18%; children CPR depth: 8%; children CPR rate: 19%). The 68% had been trained in first aid, but of those who were trained, the 75% less than 20 h in their whole lives. The 97% consider that the first aid is very important for their training. The 94% believe that throughout the educational system, there should be a specific subject in first aid and lifesaving, and the 82% of them that it should be mandatory.

Conclusions: The theoretical knowledge of the students surveyed is not very satisfactory. This is a barrier against the strong existing current that training in CPR is necessary to school and therefore, teachers should possess relevant training. Not receiving training in basic life support at school or university education is at odds with the beliefs of future teachers, who consider that it is of vital importance throughout the educational and training system to acquire it. A percentage of 86% of students surveyed by Kanstad et al., and 40% of the teachers surveyed by Mpotos et al. think in the exact same way.

References

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AP133

LISSA a serious game to teach CPR and use of AED
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Purpose of the study: LISSA is a serious game designed to teach and learn CPR and the DEA use. The present study describes the use of LISSA as a complement to CPR training plans.

Methods: LISSA exploits video game technology to link in a single framework computer-based case simulations with e-learning functionalities. LISSA actions turn around a CPR scenario that reproduces with 3D realism an emergency situation which requires CPR procedures. Instructors, using a set of pre-defined elements stored in a main database, define the emergency situation. To solve the emergency situation, the learner has to apply CPR procedures in a game mode. LISSA provides on-line feedback to the learner and a final report when time expires or game is over. The instructor can follow-up the learner work and give advice. We tested LISSA in a sample course of 30 students. They were instructed in a 3 h course, with LISSA and also with a Laerdal qcrp manikin. A CPR test was prepared to assess their CPR knowledge after using LISSA and at the end of the session. Students also responded a usability test.

Results: From the tests we detected that LISSA is a good complement to learn and refresh CPR and use of DEA.

Conclusions: LISSA is a functional and easy of use game that satisfies CPR instructor and learner needs. It is a good complement to manikin-based learning and suitable for refreshing CPR knowledge and use of DEA.

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AP134

Analysis of knowledge and opinion of nurses at ILS courses in Croatia

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Purpose: To analyse the progress in theoretical knowledge of nurses with different levels of education before and after European Resuscitation Council (ERC) Immediate Life Support (ILS) courses. Also we analyse participants opinion about the course.

Methods: We analysed data from 210 participants at 10 ILS courses in Croatia (January 2012–December 2013). The pre-course and post-course theoretical knowledge were assessed using ERC 40-question MCQ. Participants’ opinion of the course were analysed using ERC evaluation form (Table 1). Also, the participants could add their free comments about the course.

Results: Bachelor nurses achieved pre-course = 85% and post-course = 92% (p < 0.001), while registered nurses had pre-course = 84% and post-course = 89% (p < 0.001). In the course evaluation, 90% of the participants rated the course components in statements 1, and 3.1–3.8 as very well, while 73% rated the statement 2 as very well. All candidates would recommend ILS course to their colleagues. Half of the participants commented the course, and their leading comment was that the course should be extended to two days.

Conclusion: Bachelor nurses showed higher improvement in theoretical knowledge than registered nurses, so, in our opinion, this course should be integrated in their education programme and/or licensing exam in Croatia. All participants had very positive attitudes towards ERC ILC course.

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AP135

Assessment of e-learning teaching (Moodle platform) in immediate life support (ILS) by the Spanish Resuscitation Council (CERCP). Results of a satisfaction survey for course instructors

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Objective: The teaching of life support knowledge can benefit, as many other disciplines, of ‘e-learning’ technologies. The CERCP designed an immediate life support (ILS) course containing an on-line learning module. The aim of this study is to assess the instructors’ perceptions about the usefulness of the e-learning module (Moodle platform) as a tool of online teaching in an ILS course.

Methods: Satisfaction questionnaires were sent to all the instructors participating in the homologation course for ILS instructors of the CERCP, to test their opinion about the distance teaching and the face-to-face period. Percents were used to describe categorical variables and means and standard deviation (SD) to describe quantitative data.

Results: 86 out of 108 instructors answered the questionnaire (79.6%). 73.2% considered the access to the Moodle platform simple or very simple. The time assigned was considered as adequate by 57% and short by 28% of the participants. 74.4% judged positively the usefulness of the distance teaching period in the development of the face-to-face period. The overall score for the course was 83.9/100 (SD = 18.3).

Conclusions: Although a fourth of the instructors considered the access was difficult and the time inadequate, the overall degree of positive assessment of the e-learning period as well as the full course is high. In our opinion, this methodology is suitable to be used in ILS courses. Nuvials X, Fonseca FJ, Almagro V, Molina R, Martinez M, Aceo V. are also members of the CERCP’s ILS Working Group.

Further reading

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Epidemiology & Outcome

AP136

Factors associated with survival from out-of-hospital cardiac arrests (OHCAs) in remote time-distance region: Potential benefit of conventional bystander cardiopulmonary resuscitation (BCPR) on bystander’s own initiative

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Aim: To identify the factors associated with survival from bystander-witnessed OHCAs in remote time-distance region.

Methods: Data for 210,134 bystander-witnessed OHCAs having complete dataset for analysis but no involvement of physician were extracted from the all Japan database of 797,422 OHCAs collected prospectively between 2005 and 2011. Of these OHCAs, 15,020 cases having a 90–99.5% value of response time [RT, interval between call and emergency medical technician (EMT) arrival at patient = 14–30 min] was defined as OHCAs in remote region and analysed for factors associated with one-month neurologically favourable survival.

Results: The rate of dispatcher-assisted CPR (DA-CPR) provided on cases without BCPR on bystander's own initiative was as high as 57.3% (7010/12,241) in remote region. However, the survival rate in this region was extremely low (0.9%); that in close region (RT = 2–5 min) and standard region (RT = 6-10 min) was 6.6 and 3.6%, respectively. When BCPR was classified into five groups, the rate in no BCPR (N = 7043), conventional BCPR following DA-CPR (N = 3538), conventional BCPR following DA-CPR (N = 1660), compression-only BCPR following DA-CPR (N = 1535) and conventional BCPR on bystander's own initiative group was 0.3, 0.9, 1.4, 1.1 and 3.2%, respectively; OR (95% CI) with no BCPR group as reference, 3.00 (1.76–5.23), 4.68 (2.61–8.42), 3.57 (1.87–6.72) and 10.6 (6.34–18.2), respectively. These differences among five BCPR groups were unchanged even when aetiology of arrest was presumed cardiac. After adjustment for patient age and initial rhythm, adjusted OR (95% CI) for survival with conventional CPR on bystander's own initiative group as reference were 0.13 (0.07–0.21) for no CPR, 0.30 (0.19–0.49) for compression-only CPR following DA-CPR, 0.47 (0.27–0.78) for conventional CPR following DA-CPR and 0.35 (0.19–0.63) for compression-only CPR on bystander’s own initiative group.

Conclusions: Conventional CPR on bystander's own initiative has potential benefit for survival from OHCAs in remote time-distance region.

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AP137

Dispatching professional teams to the scene of out-of-hospital cardiac arrest in addition to emergency medical service – interim analysis from SOS-KANTO 2012

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Backgrounds: Japan tried to complement Emergency Medical Service (EMS) for out-of-hospital cardiac arrest (OHCA) by additionally dispatching doctor ambulance or firefighters team to the scene of OHCA. We hypothesized that these additional dispatching can improve outcome in patients with OHCA.

Subjects and methods: This was a case control study based on the interim cohort of SOS-KANTO (A survey of survivors of OHCA in the Kanto region of Japan) 2012, a prospective, multicenter and observational study of subjects with OHCA. We included subjects with witnessed OHCA from the overall subjects in SOS-KANTO 2012. Propensity score estimated from the information at the detection of OHCA subjects such as situation at the scene and patient’s demographic data extracted matched pairs with or without doctor ambulance dispatch and those with or without firefighters dispatch. Intergroup comparison demonstrated the activity time at the scene and proportion of neurologically favorable outcome at the hospital discharge.

Results: Of a total of 6019 subjects registered in interim cohort of SOS-KANTO 2012, we included 1699 subjects with witnessed OHCA and 34 (2.0%) and 336 (19.8%) subjects with doctor ambulance and firefighters dispatch after propensity score matching, respectively. Intergroup comparison of subjects with or without doctor ambulance (N = 34 versus 34) failed to show significant difference in EMS activity time at the scene (15 versus 16 min, P = 0.844) or proportion of neurologically favorable outcome (5.9% versus 5.9%, P = 1.000). In subjects with or without firefighters dispatch, intergroup comparison (N = 336 versus 336) showed significant increase in EMS activity time at the scene (20 versus 17 min, P = 0.010) but proportion of neurologically favorable outcome (10.1% versus 7.7%, P = 0.344).

Conclusion: No significant differences for the subject’s outcome were noted because the interim analyses (N = 6019) were underpowered. We expected that the final SOS-KANTO 2012 cohort (N > 18,000) might provide more definitive results for the analyses.

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AP138

Resuscitation with Automated External Defibrillators (AED) in Uruguay

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Background: Uruguayan population is 3,200,000. Survival to hospital admission (SHA) of Out of Hospital Cardiac Arrest (OHCA) case series reported by Pre Hospital Emergency Medical System (PHMS) was 21–22.5%. The 18,360 Public Access Defibrillation Law was enacted in September 2008. It requires places with large numbers of people to install AED, and all organizations nationwide to train 50% of its staff in Cardiopulmonary Resuscitation (CPR). Today
there are 1572 AED installed across the country (80% were installed in the last 4 years).

**Purpose:** To communicate the presentation features and survival of OHCA victims that were assisted with bystander CPR and AED before the arrival of PHEMS in Uruguay.

**Method:** Case series study of all OHCA victims assisted with bystander CPR and AED before the arrival of PHEMS from January 1, 2005 to December 31, 2014. Data was obtained from AED event log, interviews with those involved and clinical records. Univariate analysis using Chi-square test for categorical variables and t test for continuous variables were performed.

**Results:** 45 events were reported. Data was obtained from 41. Mean age was 61.2 years. 37 cases (90.2%) were males. 38 events (92.7%) were witnessed. 30 cases (73.2%) received bystander CPR before 2 min. The initial rhythm was ventricular fibrillation (VF) in 30 cases (73.2%), pulseless electrical activity in 6 (14.6%) and asystole in 5.2 cases (13.4%) were assisted by lay trained and 15 (36.6%) by health personnel. Return of spontaneous circulation (ROSC), SHA and survival at discharge (SHD) rates were 61.4% (25 patients), 56.1% (23) and 41.5% (17) respectively. 29 cases received shocks (2.9 shocks per patient). ROSC, SHA and SHD for VF cases were 70%, 66.7% and 50% respectively. Neurologically favorable survival at discharge is 4.4%. 338 of these 650 patients (4%) died within 30 days of the contact with MECU. The percentage of patients dying within 24 h of the contact with MECU and a total of 26 patients (4%) died within 30 days of the contact with MECU. The average age in these two groups was 81 and 77 years. 15% received medical treatment by the emergency physician. In the fraction of patients that died within 30 days this percentage amounted to 31. 36% patients dying within 24 h were subjected to medical treatment by the MECU.

**Conclusion:** The emergency physician might miss a spot – but failure by the MECU to establish a firm diagnosis does not necessarily result in perilous outcome.

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**AP140**

Copeptin level after cardiac arrest is associated with one-year mortality

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**Background:** The identification of out of hospital cardiac arrest survivors (OHCA) who are at increased risk of long-term mortality remains challenging. We aimed to study the prognostic value of copeptin for 1 year mortality in a large cohort of OHCA patients.

**Methods and results:** Between 2009 and 2012, 298 consecutive CA patients (70.3% male of median age 60.2 [49.9, 71.4] years) from the PROCAT registry were admitted in a tertiary cardiac arrest center. Copeptin was assessed at admission and day-3. Pre and intra-hospital factors associated with one-year mortality (1YM) were analyzed by multivariate Cox proportional analysis.

After multivariate analysis, higher admission copeptin was associated with 1-year mortality with a threshold effect (HR 5th vs. 1st quintile = 1.64, 95%CI 1.05–2.58, p = 0.03). After multivariate analysis, day-3 copeptin was associated with one-year mortality but in a dose dependent manner (HR2nd vs.1st quintile = 1.87, 95%CI 1.00; 3.49, p = 0.05; HR3rd vs.1st quintile = 1.92, 95%CI 1.02; 3.65, p = 0.00, HR4th vs.1st quintile = 2.12, 95%CI 1.14; 3.93, p = 0.02 and HR5th vs.1st quintile = 2.75, 95%CI 1.47; 5.15, p < 0.01; p for trend <0.01). For both admission and day-3 copeptin, association with 1-year mortality existed for CA of cardiac origin only (p for interaction = 0.05 and xx respectively). When admission and day-3 copeptin were mutually adjusted in multivariate analysis, day-3 copeptin only remained associated with 1-year mortality in a dose dependent manner (p for trend = 0.01).

**Conclusion:** High admission and day-3 copeptin levels were associated with 1-year mortality, especially in CA of cardiac origin. Day-3 copeptin was superior to admission copeptin to predict 1-year mortality. Day-3 copeptin may identify CA survivors at increased risk of mortality and should incite physicians to set up preventive measures in such high-risk patients.

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Cardiac arrest by drowning: What special features?

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Introduction: Cardiac arrest after drowning (DCA) has been poorly studied and it is unclear if the prognosis of these victims is better or worse than medical cardiac arrest. The aim of this study is to describe and compare the management and survival of DAC with medical cardiac arrest.

Material and method: French multicentric (221 EMS), prospective, comparative study based on the data gathered in the RÉAC registry framework between July 1, 2011 and December 10, 2013. Results: Among 20239 CA registered during this period, 194 were DCA and 17955 were medical CA. DCA occurred in a younger population (47.7 ± 25 vs 67.1 ± 21 y; p < 10⁻⁴). They also less frequently occurred in the presence of a witness (37.7% vs 57.1%; p < 10⁻⁴). The other variables concerning care and prognostic are set out in Table 1.

Discussion: DCA were more frequently in asystole and benefited more of a specialized cardio-pulmonary resuscitation (CPR) provided by a medical staff in pre-hospital. One third of them were admitted to the hospital with a recovery of spontaneous cardiac activity. DCA Day 30 survival was similar to other medical CA survival.

Conclusion: In spite of a high initial asystole frequency, DCA are more frequently admitted to the hospital with a ROSC than medical CA. However Day 30 survival is similar.

Table 1
Drowning cardiac arrests care and outcome compared with other medical cardiac arrests.

<table>
<thead>
<tr>
<th></th>
<th>DCA (n=194)</th>
<th>Medical CA (n=17955)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMS arrival delay (min)</td>
<td>23 min ± 14 min</td>
<td>20 min ± 18 min</td>
<td>p = 10⁻⁴</td>
</tr>
<tr>
<td>Bystander BLS initiated</td>
<td>30.9%</td>
<td>38.7%</td>
<td>p = 10⁻⁴</td>
</tr>
<tr>
<td>BLS initiated at EMS arrival</td>
<td>87.6%</td>
<td>80.1%</td>
<td>p = 0.211</td>
</tr>
<tr>
<td>ACLS (EMS)</td>
<td>76.4%</td>
<td>63.2%</td>
<td>p = 10⁻⁴</td>
</tr>
<tr>
<td>Initial cardiac pace (asystole)</td>
<td>90.2%</td>
<td>81.7%</td>
<td>p = 10⁻⁴</td>
</tr>
<tr>
<td>ROSC delay (min)</td>
<td>18 min ± 17 min</td>
<td>16 min ± 20 min</td>
<td>p = 0.092</td>
</tr>
<tr>
<td>ROSC (yes)</td>
<td>39.2%</td>
<td>14.4%</td>
<td>p &lt; 10⁻⁴</td>
</tr>
<tr>
<td>Transport with non heart beating</td>
<td>16.1%</td>
<td>13.2%</td>
<td>p = 0.009</td>
</tr>
<tr>
<td>Admission survival</td>
<td>33%</td>
<td>11.2%</td>
<td>p &lt; 10⁻⁴</td>
</tr>
<tr>
<td>Day 30 survival</td>
<td>6.7%</td>
<td>4.6%</td>
<td>p = 0.249</td>
</tr>
</tbody>
</table>

BLS: basic life support; ACLS: advanced cardiac life support; ROSC: return of spontaneous circulation.

Outcome reporting in cardiac arrest randomised controlled trials

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Background: It is known there is heterogeneity in outcome reporting in the field of cardiac arrest research. This review was conducted to determine the extent of this problem and identify the outcomes that are currently reported in randomised controlled trials. We plan to use the outcome measures extracted as a starting point for the development of a core outcome set.

Methods: Randomised Controlled Trials (RCTs) conducted in the cardiac arrest population between 2002 and 2012, irrespective of arrest location, were identified by applying a search strategy to four databases. Titles, abstracts and short-listed studies were independently assessed for eligibility by two reviewers. Data was extracted from all included articles by the one reviewer. Data extraction focussed on: what outcome measures were reported and how they were reported.

Results: From the 3263 articles identified in the initial search, 61 matched the inclusion criteria. More than 100 different outcome measures were identified. There was wide variation in the focus of measurement, the method of assessment, and the time point at which assessment occurred. Current assessment in clinical trials of cardiac arrest focuses on: survival (39.9%), body function (36.1%), activities (15.4%) and processes of care (8.7%). There was little focus on patient-centred assessment such as the impact of cardiac arrest on quality of life. Only one trial included a patient reported outcome measure.

Conclusions: This review indicates the wide variety of outcomes reported in cardiac arrest RCTs. These finding suggest that future cardiac arrest research would benefit from the implementation of a core outcome set, by reducing the heterogeneity in reporting between trials.

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Purpose of the study: Survival after out of hospital cardiac arrest strongly correlates with fast onset of basic life support, often initiated by lay people. To achieve this, ILCOR 2010 guidelines advocate the use of telephone-CPR (T-CPR). Long term success of T-CPR implementation depends on use of comprehensive quality management measures. Aim of our study was to develop a data set suitable for integration into the German Resuscitation Registry® to allow for benchmarking of T-CPR quality in German dispatch centres.

Materials and methods: In order to develop consensus on a T-CPR data set a four-step Delphi process was initiated among a group of six German experts in emergency medical dispatch science. During steps 1–3 participants were required to select twelve variables out of a list of 52, and during step 4 ten variables out of 38, respectively. The communication process took place via E-mail communication steered by the senior author (CW).

Results: Consensus on ten variables (e.g. patient age; duration of call; reasons for not applying T-CPR; use of written instructions; provision of rescue breaths) was reached with a consistency index of 0.941 (full consensus at 1.0).

Conclusions: The Delphi process resulted in a high level of consistency. Implementation of the data set allows for a better understanding of key success factors. Thereby the T-CPR concept may be refined in order to save even more lives.

References

http://dx.doi.org/10.1016/j.resuscitation.2014.03.192

Purpose of the study: In Portugal, Medical Emergency and Resuscitation Vehicles (MERV) provide Advanced Life Support (ALS) in the pre-hospital setting. In 2010, the ALS algorithm changed. There are few studies that compare the effectiveness of these changes in pre-hospital care. We aim to compare practices and outcomes of ALS in pre-hospital setting, before and after the implementation of the 2010 guidelines.

Methods: Retrospective study. MERV database and inpatients clinical files were reviewed, from 2002 to the first half of 2013.

Results: 1961 pts were assisted for cardiopulmonary arrest (CPA) in pre-hospital setting. The pts assisted before and after 2010 were similar with respect to gender (67.9% vs. 69.8% male) and age. Main causes for CPA: medical (91.7% before 2010 vs. 92% after), and trauma in 7.5% vs. 7.3%. Before 2010, 80% had CPA before the arrival of the ALS team vs. 74.6% after 2010. The percentage of pts with witnessed CPA increased (20–25.4%). The number of pts with BLS maneuvers prior to the arrival of the ALS team increased (76.5–80.8% after 2010). The most common CPA rithms were non-shockable (84.4% vs. 83.8%). Adrenaline was the most used drug (97.5% vs. 95.9%). There was a significant decrease of the use of atropine (94% before 2010 to 38.8% after 2010), 20.4% in 2003 to 3.6% in 2013. Mortality was similar before and after the implementation of the guidelines (78.3% vs. 79.9%). Return of spontaneous circulation (ROSC) was also identical: 21.6% vs. 20.1%.

Conclusion: Despite a favorable evolution of the percentage of pts under prior BLS and a decrease of pts with CPA prior to the arrival of the ALS team, there was no change in survival with implementation of the new guidelines, which may favor maintaining the trend of simplifying ALS, without worsening the outcomes.

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Purpose of the study: MET-criteria have been used in the emergency department as a prognostic tool to predict unexpected hospital death or ICU admission. It includes measurements of
respiratory rate, SpO2, pulse, blood pressure, GCS and nurse concern. In prehospital emergency medicine, these vital signs can be used as a triage tool on scene to direct early treatment to those patients who may need critical care. We aimed to determine, whether there is association between positive MET-criteria measured during the prehospital care and patient outcome.

Materials and methods: The data was collected retrospectively from adult patients treated by critical emergency physician on scene and transported to the university hospital in Turku and Tampere University Hospital (TAUH) areas. Prehospital vital signs were stated abnormal if they fulfilled the dichotomized MET-criteria used in TAUH and were grouped as respiratory failure, circulatory failure, loss of consciousness and paramedic concern. The primary outcome measure was hospital mortality. The secondary outcome measures were Emergency Severity Index (ESI) – classification, need for ICU treatment and duration of ED stay, ICU stay and hospital stay.

Results: 610 patient records were analysed. Hospital mortality was 11.0%. Prehospital MET-score and ASA-class were strong independent predictors for hospital mortality (Table 1). Non-survivors had higher ESI-class ($p < 0.0001$), higher prehospital MET-score ($p < 0.0001$) and longer duration of ICU stay ($p < 0.0001$). There was also association between prehospital MET-score and the ESI-class ($p < 0.0001$), the duration of stay in the ED ($p < 0.0001$), the need for ICU-treatment ($p < 0.0001$), the duration of stay in the ICU ($p < 0.0001$) and length of hospital admission ($p < 0.0001$).

Conclusions: MET-score measured during the prehospital care is a strong independent predictor for patient outcome and serves as a risk assessment tool even before arriving to hospital. Patients with positive prehospital MET-criteria should be treated cautiously even when their vital signs might have returned normal at admission.

References

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AP146
Cardiac arrest in pre-hospital care setting – 10 years of experience
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Purpose of the study: Cardiopulmonary arrest (CPA) is frequent in pre-hospital environment. Basic/advanced life support (BLS/ALS) and early defibrillation are critical for successful resuscitation. In Portugal, Medical Emergency and Resuscitation Vehicles (MERV) provide advanced life support (ALS) in pre-hospital setting. We aim to evaluate the outcomes of a MERV of a Portuguese city.

Methods: Retrospective study of 29,358 patients (pts) assisted by a MERV from 2002 to the first half of 2013. Databases of MERV activity and pts’ files were reviewed.

Results: Out of the 29,358 pts assisted in 10.5 years, 1961 (6.7%) were assisted for CPA and submitted to ALS. 68.5% were males. 43.6% were 55 to 75 years old (yo); 23.3% were between 35 and 55 yo and 21.8% over 75 yo. Cardiac arrest had medical cause in 91.9% of pts. 7.5% were trauma pts. 78.7% of pts had CPA medical team arrival (1544 pts). Most pts had prior BLS (77.8%). MERV arrival time was 5–10 min in 62.6% of the cases and <5 min in 25%. Initial rhythm: shockable (VF/VT) in 308 pts (15.7%), and non-shockable (PEA/assystole) in 84.3%. Epinephrine was administered in 97.2% (1906) of the pts (84.3% had PEA/assystole). Immediate mortality: 77.8% (1526 pts). Return of spontaneous circulation (ROSC): 435 pts (22.2%). 45 (9.6%) survived up to 6 months but some patients’ follow up was lost due to hospital transfers. At least 5 pts were alive at the date of completion of the study.

Conclusions: Demographics and percentage of ROSC in our study are similar to international data as well as 6 months survival rates are similar to some prior studies. To our knowledge, this is the first Portuguese study on survival of CPA on pre-hospital care setting. We consider that more studies in this area are necessary.

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AP147
Neurological outcome at discharge after in hospital cardiac arrest
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Objectives: Review the neurological outcome at discharge in patients resuscitated from in hospital cardiac arrest.

Methods: A retrospective cohort analysis from a database, comparing patients resuscitated after in hospital cardiac arrest in a tertiary centre, from January 1, 2000 to December 31, 2006 Vs another cohort of patients with similar characteristics in a different time, from January 1, 2007 to December 31, 2013. We choose this cut-off point because it is when we adopted the new recommendation of post CPR care, including moderate therapeutic hypothermia, Percutaneous coronary intervention, and minimally interrupted cardiac massage. We compared the neurological outcome at discharge and ICU survival depending on the first rhythm monitored during CPR. A good neurological status was considered a score of 1 or 2 on the CPC-Pittsburgh Glasgow Coma Scale at discharge.

Results: During this period, we admitted 353 patients resuscitated from in hospital cardiac arrest. 198 of these patients were admitted during the first period of the study and 155 in the second. Their baseline characteristics, such as age, gender, time spent in the hospital at the time of cardiac arrest and initial rhythm were similar. The neurological outcome at discharge for both groups was similar (OR 1.12 IC 95% from 0.51 to 1.48) Independently of the initial rhythm. The ICU survival did not reach statistical significance either (OR 1.05 IC 95% 0.65–1.71). It is worth mentioning, that from the 353 patients that suffer in hospital cardiac arrest, only 161 (45%) were resuscitated and admitted to the ICU, presenting good neurological status at discharge 65 (18, 4%). In the shockable rhythm, this percentage increases to 44.2% and 9.4% in the non shockable rhythm.

Conclusions: In our environment, the implementation of the latest protocols for post CPR care, did not relate to a better neuro-
logical outcome or ICU survival in patients that suffered in hospital cardiac arrest.

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AP148

Risk factors predisposing of traffic accidents with motoboys

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Objective: The aim of this study is to identify the profile of the class and predisposing causes of accidents involving couriers during the exercise of their profession.

Methods: We analyzed 1044 couriers who filled out a questionnaire from August 2012 to February 2013 in São Paulo.

Results: Data were analyzed showing that most of these professionals were aged 26–33 years, performed on average more than 10 deliveries a day, they traveled more than 150 km per day, had 10 deliveries a day, they traveled more than 150 km per day, had a monthly average of 2–3 minimum wage per month, 81.2% had 69.8 ± 13.6 years: 52 (37%) in the cardiology wards (0.08% admissions) and 90 (63%) in surgical wards (0.50% admissions). Of those, 84 presented with asystole, 56 with ventricular fibrillation or pulseless ventricular tachycardia (VF/VT), and 2 in pulseless electrical activity (PEA). Adrenaline (epinephrine) was administered to 49% of VF/VT and 82% of asystole cases. In total, 111 pts (78.1%) survived the initial resuscitation attempt (IRA) and 63 (44%) survived to discharge (31% of the cardiology pts and 52% of the surgical pts). We intubated 102 pts, of whom 75% survived the IRA and 34% to discharge. Survival from the IRA and to discharge was 70% and 29%, respectively, for asystole, and 88% and 66% for VF/VT. Both IRA pts survived to discharge. CAT arrival time was less than 1 min for 106 (74.6%) of arrests.

Conclusions: Survival from in-hospital cardiac arrest to discharge in our institution was 44%. Telemetry monitoring, defibrillator presence on inpatient floors, and prompt arrival of trained cardiologist arrest team to the patient’s bedside contributed to successful resuscitation attempts.

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AP149

Survival from inpatient cardiac arrest in a tertiary referral hospital for Cardiology and Cardiothoracic Surgery

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Purpose: To estimate survival from inpatient cardiac arrest at our specialised Institution, a referral hospital for Cardiology and Cardiothoracic Surgery.

Methods: We recorded cardiac arrests over a 52-month period, using the Utstein style for cardiac and surgical patients (pts) distributed on 3 floors. The arrival time of the arrest team (CAT) was calculated from the “code blue” call. All our pts are on telemetry so the initial rhythm is accurately recorded. Our institution’s CAT includes the on call Registrars and SHOs, anaesthesiologist, and nurses, all trained in Advanced or Immediate Life Support. Biphasic defibrillators are available on every floor.

Results: During the 52-month period, there were 81,178 admissions (63,503 in the Cardiology wards and 17,675 in surgical wards). We recorded 142 inpatient arrests (38 women, mean age 69.8 ± 13.6 years): 52 (37%) in the cardiology wards (0.08% admissions) and 90 (63%) in surgical wards (0.50% admissions). Of those, 84 presented with asystole, 56 with ventricular fibrillation or pulseless ventricular tachycardia (VF/VT), and 2 in pulseless electrical activity (PEA). Adrenaline (epinephrine) was administered to 49% of VF/VT and 82% of asystole cases. In total, 111 pts (78.1%) survived the initial resuscitation attempt (IRA) and 63 (44%) survived to discharge (31% of the cardiology pts and 52% of the surgical pts). We intubated 102 pts, of whom 75% survived the IRA and 34% to discharge. Survival from the IRA and to discharge was 70% and 29%, respectively, for asystole, and 88% and 66% for VF/VT. Both IRA pts survived to discharge. CAT arrival time was less than 1 min for 106 (74.6%) of arrests.

Conclusions: Survival from in-hospital cardiac arrest to discharge in our institution was 44%. Telemetry monitoring, defibrillator presence on inpatient floors, and prompt arrival of trained cardiologist arrest team to the patient’s bedside contributed to successful resuscitation attempts.

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AP151

Searching of adjustable factors that influence the resuscitation outcome – single center experience

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Purpose of the study: The purpose of this study is to evaluate the influence of certain variable factors over the return of spontaneous circulation (ROSC) and discharge survival for cardiac arrest patients.

Materials and methods: Over a period of 2 years (2011–2012), 195 cases of cardiac arrest have been analyzed through an Utstein-based reporting system. All the cases were finalized in an emergency department, by highly trained resuscitation teams. No therapeutic hypothermia was available. The statistic methods used involved the SPSS program.

Results: For the out of hospital cardiac arrests (OHCA), the Emergency Medical System response time had a median of 9.5 min, regardless of the day of the week or time of the day. However, we found prolonged collapse – CPR time in OHCA, as no layperson CPR had been noted. The cause of cardiac arrest influence the survival, the trauma related cases not showing any ROSC. A specific characteristic of the study group is the late time when the patients decided to call for help, as over 40% of the patients let pass several hours or days before addressing the emergency system. This fact proved to be a surviving factor. Another factor that we can adjust and that seems to increase survival is the post resuscitation blood pressure (BP). In our group we found a positive correlation between the values of the BP and the distance survival.

Conclusions: Important factors influencing the results of resuscitation can be modulated to ensure better survival. Traumatisms rates may be lowered down by safety procedures, and individual and laypersons actions may raise chances for ROSC and long-term outcome of resuscitation. Immediate post-resuscitation care remains an important field that needs permanent attention.

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AP152

Process cost: The out-of hospital cardio-respiratory arrest with doctors on-scene

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Objective: Assessment of cardio-respiratory arrest cost outside the hospital with doctors on-scene.

Methods: Observational study through experts’ opinion poll. Sample: Cardio-respiratory arrest (CRA) during the first trimester in 2013 excluding cases when resuscitation is not initiated. Variables: age, gender, CRA etiology, 7 day survival and survival without residual disease, cost of Medical supplies single use, medication, personnel (amount per hour per professional and time) and structural cost. Variable results Total CRA cost Statistical quantitative: measures of center and dispersion, qualitative percentages. Contrast of normality, Kolmogorov–Smirnov (normal distribution: mean and standard deviation (SD)) without normal distribution: median and interquartile ranges (IQR) and inferential measures (95% confidence intervals) ACCES, Excel, SPSS: v17.Data confidentiality.

Results: n = 75 CRA, 84% (63) physicians, 81.3% (61) male. Mean age 61 years old (DE: 17.87). Seven day survival 25.3% (19), mean age: 56 years (DE: 14.87), without residual disease 8% (6), mean age 57.6 years. Cost of drugs: median 11.68€ (IQR: 36.13–7.22). Cost of Medical supplies single use, median 64.35€ (IQR 111.62–50.05) Personnel cost mean 793.77€ (DE 255.24). Total CRA cost mean 953.66€ (DE 254.70) (895.06–1.012.26 IC95%).

Conclusions: The total cost of outside hospital treatment in our sample is 953.66€, mean age of survivors without further disease is 57; considering that life expectancy in Spain is around 83 years, the annual cost of extra life years is less than 38€ Therefore we consider that the required investment is very efficient. The significance of this study, despite the limitations of methodology (experts’ opinion poll), resides in the fact that there are no published data regarding the cost of CRA procedures outside the hospital enviroment.

Further reading


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AP153

Results of a training and response program of in-hospital cardiac arrest

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Objective: To analyze the impact of a training program on instrumental life support (ILS), and an organized model of alert and response system of in-hospital cardiac arrest (IHCA).

Methods: Prospective intervention study completed in a general hospital over a period of 4 years with, nursing training through ILS courses, implementation of a warning signs system in hospitalization wards and, establishment of a response system to IHCA. IHCA and Intensive Care staff urgent attention registry, with a before and after analysis. Variables of interest: average success rate in knowledge and skills tests, before, at end, and 6 months after courses, and registry of variables according to Utstein style.

Results: A total of 111 IHCA, incidence 1.59/1000 patients (0.22/1000 hospital days). Survival at hospital discharge 23.4%. 883 requests for urgent attention to inpatients. It increased the percentage of IHCA in unmonitored areas, although no significant differences or changes in survival, and there was a drop of urgent attention requests. 111 nurses were formed, with significantly improved knowledge and resuscitation skills (p < 0.05) after...
courses, with deterioration at 6 months, mainly ventilation and defibrillation skills ($p < 0.05$).

**Conclusions:** The program showed the IHCA arrest real situation, improving skills of nursing staff in their care, noting where they require more emphasis and recycling, and improving recognition and care of more ill patients in unmonitored areas.

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AP154

Death in the field post out-of-hospital cardiac arrest (OCHA): An analysis of one-year’s ambulance data in Leinster, Ireland

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**Purpose:** Ambulance data are collected routinely in Ireland but are not always systematically analysed or reported. Cardiovascular disease is the leading cause of premature death in Ireland with an estimated 50% of these deaths occurring out of hospital. This study aimed to review existing ambulance data to generate information on the demographics of those who suffer these emergencies, circumstances of their collapse and outcome post out-of-hospital cardiac arrest.

**Methods and materials:** A retrospective review was undertaken of all ambulance patient-care report forms (PRFs) filed for the year 2008. Data required for Utstein templates were extracted on all cardiac arrests cases. For data protection reasons, this study’s outcome was status at transfer to hospital care. The setting is operational area for the Region’s ambulance division, an area of 46,380 km², with population 1,499,705 (Central Statistics Office 2006) which covers three counties and has a population of 1,499,705 according to the 2006 National Census.

**Results:** A total of 32,128 PRFs were reviewed; of the 282 arrests, 214 were identified as adult cardiac arrest of presumed cardiac aetiology (0.7% of total calls). In 2008 30% ($n = 65/214$) of treated OHCA were declared dead in the field, 54.7% were transferred to hospital with ongoing CPR and 15% were alive with ROSC. There were subtle differences in predictors associated with being alive vs. being dead as outcome. When logistic regression controlled for age, distance from ambulance base, bystander-CPR and cardiac-arrest rhythm, female-gender and rural-location were independent predictors of being declared dead in the field. Those who had a witnessed arrest were half as likely to be dead.

**Conclusion:** This study provides valuable information for EMS planning, particularly in light of directives on response-time indicators from the Irish Health Information and Quality Authority and the challenges that these indicators present for pre-hospital care in low population-density rural areas.

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AP155

Early survival from out-of-hospital cardiac arrest (OCHA) in Ireland: An analysis of one year’s Ambulance Data in Leinster

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**Purpose:** Ambulance data are collected routinely in Ireland but are not always systematically analysed or reported. Cardiovascular disease is the leading cause of premature death in Ireland with an estimated 50% of these deaths occurring out of hospital. This study aimed to review existing ambulance data to generate information on the demographics of those who suffer these emergencies, circumstances of their collapse and predictors of and outcome post OCHA.

**Methods and materials:** A retrospective review was undertaken of all ambulance patient-care report forms (PRFs) filed for the year 2008. Data required for Utstein templates were extracted on all cardiac arrests cases. For data protection reasons, this study’s outcome was status at transfer to hospital care.

**Setting:** The operational area for the Region’s ambulance division, an area of 46,380 km², with population 1,499,705 (Central Statistics Office 2006) which covers three counties and has a population of 1,499,705 according to the 2006 National Census.

**Results:** A total of 32,128 PRFs were reviewed; of the 282 arrests, 214 were identified as adult cardiac (0.7% of total calls). In 2008 just 15% of OCHA treated cases were alive at transfer to hospital care. When logistic regression analysis controlled for age, gender and distance from ambulance base of attending crew, only early CPR and a shockable cardiac-arrest rhythm were independent predictors of survival and were associated with a three and sevenfold increase in the odds of being alive respectively. A second model without a shockable-arrest rhythm as a predictor revealed that having a witnessed-arrest increased survival fourfold. Thus a witnessed arrest was crucial to being alive but this effect was mediated by its association with a shockable cardiac-arrest rhythm.

**Conclusion:** The usual Utstein factors predicted early-survival. This study supports the argument (Stiell et al., 1999) that predictors impact directly and indirectly on outcome after out-of-hospital cardiac arrest.

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Ethics

AP156

Doctors’ experiences of Do Not Attempt Cardiopulmonary Resuscitation (DNACPR) decision making: A meta-ethnography

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**Aims:** The aim of this study is to use meta-ethnography to analyse and synthesise qualitative data that considers doctors experiences and attitudes towards DNACPR decision making.

**Background:** DNACPR decisions identify patients who would not benefit from having cardiopulmonary resuscitation attempted. With recent high profile media interest and published recommendations there is a need for a greater understanding about doctors’ attitudes towards DNACPR decisions, and the barriers which they perceive when making such decisions.

**Methods:** A comprehensive literature search was conducted including MEDLINE, EMBASE, PsychINFO, CINAHL, Cochrane Library, PubMed, Web of Science and bibliographical reviews of retrieved studies (February 2002–2013). All retrieved articles were reviewed to identify published qualitative research focusing on doctor’s experience/attitudes of DNACPR decision making in Adults. The original search identified 377 studies. After exclusions nine relevant studies were identified. Two researchers independently reviewed and critically appraised the studies. Key themes and concepts were extracted from each study. Techniques of meta-ethnography were followed to synthesise the findings.
Result: Four major themes were identified that highlight common issues and concerns experienced by doctors: ethical concerns, decision making, conflicts and communication. A line of argument synthesis produced a decision-dilemma model that describes the challenges faced in three distinct phases of DNACPR decision making: pre decision, making the decision and post decision.

Conclusions: Doctors experience a range of common concerns and issues which may affect the decision making process. DNACPR decisions are influenced by balancing conflicting clinical and ethical demands. This information is well placed to inform future training and policy to provide support for doctors when making DNACPR decisions.

Reference


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AP157

“End of life” procedures and Advanced Health Care Directives in the Andalusian Health Emergency Agency (EPES). 2013 review

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Introduction: “All people aspire to live in dignity. Live in dignity is and should be considered as an aspiration for all human race. In Spain, the legal system is intended to simultaneously define and protect this aspiration. But death is part of life. Dying is the final act of the personal biography of every human being and can’t be separated from that as something different. Therefore, the imperative of decent life also extends to death. A dignified life requires a dignified death”. This is a part of the preamble of the Law 2/2010 of Rights and Interests of the Person in the Dying Process and from EPES we consider it very revealing for making progress and advancing in critical care in this field, as previous resuscitation ERC guides and related relevant documentation have pointed out.

Objectives:

1. Show how the current proceeding about the “Advanced Health Care Directives” (AHCD) at the “End of Life” was modified, in order to incorporate bioethical aspects that orient in end-of life decision making to CCUEs and EMS personnel.
2. Explain how this process was developed with the engagement of all the professionals from the Emergencies–Call–Centers (CCUEs) and the Emergencies Medical Services (EMS) personnel involved, towards properly and regularly assessed flows of information.

Method and material: Descriptive. Developments of the AHCD to the procedure “End of Life” and his application in EPES. The procedure was discussed and agreed on by the Ethics Committee EPES, submitted and approved by the general corporation and disseminated amongst professionals. It is indeed already part of our quality system and is incorporated into Salud Responde and CCUEs management of procedures through several triage telephonic guides and out-of-hospital ALS patient management. Doctors and nurses had been trained from early 2013 to act according to the lex artis in these types of situations. In the emergency health assistance provided by the SEM personnel, accurate patients were labelled with the V66.7 clinical code (ICD) and the nursing care provided recorded with the intervention Dying Care NIC 5260.

Conclusions: The change in the AHCD application procedures to the “End of Life” has become into 6 guides of telephonic triage to assist in decision making for cases of certain situations in palliative care when the end of life has to be nearly considered, and resuscitation efforts might be considered or not. The vision adopted needs further developing to enable emergency personnel in improving critical care in this situations, avoiding suffering, pain and ensuring the individual wills and needs are properly addressed, giving meaning to every single vital project.

Further reading

1. Ley 2/2010, de 8 de abril, de Derechos y Garantías de la Dignidad de la Persona en el Proceso de la Muerte.

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AP158

Ethical approaches of candidates participating ERC ALS provider courses in Turkey

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Purpose of the study: Ethical decisions on resuscitation may be affected by personal, international-regional, legal, religious, social and cultural factors. In this study we aimed to determine the ethical approaches of the candidates in ERC ALS provider courses that have been organized in Turkey.

Materials and methods: Candidates (n = 121) that have been participated ERC ALS provider courses in Turkey between June 2013 and January 2014 were included in the study. Study data were collected with a questionnaire (total 15 questions). The questions were prepared to determine the knowledge and opinions about ethical concepts and approaches. The survey study has been realized before the ethical lecture of ERC ALS course.

Results: The candidates participating the questionnaire were male in 46.4% and female in 53.6%; physician in 75% and other healthcare personnel in 25%. Religious beliefs were Moslem in 93.4%, atheist in 3.3%, Jewish in 1.6% and other in 1.7%. 88% of the participants know the meaning of DNR and working unit is effective on decision (p = 0.024). 51.3% believed that age is not a determining factor for DNR decision and 71.4% believed that CPR applied patients may be organ donor. 67% did not have information about legal aspects of DNR and did not believe autonomy.

Conclusion: Resuscitaion should be started fastly and efficiently, but inappropriate or “stop CPR” situations must be recognized. This study revealed lack of knowledge of ERC ALS provider course candidates and emphasized the requirement of
ethic lecture. Regarding the country values, lectures must aim to inform and direct the candidates accompanied with scientific and legal realities.

Age: 
Gender: 
Profession: 
Years of profession: 
Your geographical region: 
Your institution: 
Your unit: 
Religion: 
a) Muslim b) Christian c) Jewish d) Atheist e) Others:

1. Do you know what is meant by the concept of “Do Not Resuscitate”?
   a) Know 
   b) Don’t know 
   c) Partly Know 
2. Do you agree with the concept of “Do Not Resuscitate”?
   a) Certainly disagree 
   b) Disagree 
   c) Undecided 
   d) Agree 
   e) Certainly agree 
3. Decision of “Do Not Resuscitate” should only be made by physician
   a) Certainly disagree 
   b) Disagree 
   c) Undecided 
   d) Agree 
   e) Certainly agree 
4. Decision of “Do Not Resuscitate” should be made by patient
   a) Certainly disagree 
   b) Disagree 
   c) Undecided 
   d) Agree 
   e) Certainly agree 
5. Decision of “Do Not Resuscitate” should be made by physician and patient together
   a) Certainly disagree 
   b) Disagree 
   c) Undecided 
   d) Agree 
   e) Certainly agree 
6. Age is a factor in “Do Not Resuscitate” decision
   a) Certainly disagree 
   b) Disagree 
   c) Undecided 
   d) Agree 
   e) Certainly agree 
7. Decision of “Do Not Resuscitate”, only limits the life saving interventions during CPR
   a) Certainly disagree 
   b) Disagree 
   c) Undecided 
   d) Agree 
   e) Certainly agree 
8. Do you have information about the legal aspects of “Do Not Resuscitate” decision?
   a) Know 
   b) Don’t know 
   c) Partly Know 
9. Decision of “Do Not Resuscitate” is legal in our country
   a) Know 
   b) Don’t know 
   c) Partly Know 
10. Personal values determines the decision of “Do Not Resuscitate”
   a) Certainly disagree 
   b) Disagree 
   c) Undecided 
   d) Agree 
   e) Certainly agree 
11. Personal belief determines the decision of “Do Not Resuscitate”
   a) Certainly disagree 
   b) Disagree 
   c) Undecided 
   d) Agree 
   e) Certainly agree 
12. Personal experiences determines the decision of “Do Not Resuscitate”
   a) Certainly disagree 
   b) Disagree 
   c) Undecided 
   d) Agree 
   e) Certainly agree 
13. Personal expectations determines the decision of “Do Not Resuscitate”
   a) Certainly disagree 
   b) Disagree 
   c) Undecided 
   d) Agree 
   e) Certainly agree 
14. Decision of “Do Not Resuscitate” should not affect the other medical interventions suitable for patient
   a) Certainly disagree 
   b) Disagree 
   c) Undecided 
   d) Agree 
   e) Certainly agree 
15. CPR applied patients can be organ donor
   a) Certainly disagree 
   b) Disagree 
   c) Undecided 
   d) Agree 
   e) Certainly agree

Further reading

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Implementation

“Getting resus at the forefront”: A qualitative study of the mechanisms of cardiac arrest debriefing

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Background: Cardiac arrest debriefing is associated with improved CPR (cardiopulmonary resuscitation) delivery.1 As a complex intervention,2 it seems likely that cardiac arrest debriefing affects a number of behaviours, but the exact mechanisms by which it works are poorly understood. The aim of this study was
to develop an understanding of the mechanisms by which cardiac arrest debriefing impacts on practice.

Methods: Tape-recorded semi-structured interviews were undertaken with clinicians, stratified for professional role, who had experience of cardiac arrest debriefing following their involvement at a cardiac arrest. In addition, field notes were collected of debriefing meetings and other events during the study period. Data were inputted into NVivo computer software (NVivo Version 10, QSR International, Victoria, Australia). Following a period of data immersion, data were thematically analysed. This work was a sub-study of the CPR Quality Improvement Initiative study.1

Results: Thirteen semi-structured interviews and 41 sets of field notes were thematically analysed. Four emergent themes were identified: the impracticality of debriefing; the individual and feedback-managing the ‘ego’; finding solutions through discussion; and the cultural effect of cardiac arrest debriefing. Findings were used to develop a model. The model describes six key mechanisms (reflection on performance; vicarious learning; psychological benefit; opening up the feedback process; moderating the use of assistive technologies; and altered perception of cardiac arrest) that exert an effect through two modalities (discussion with colleagues and feedback on performance). For debriefing to be effective, the process must be underpinned by a no-blame culture.

Conclusion: Cardiac arrest debriefing is a complex intervention that can affect cardiac arrest performance through six distinct mechanisms, via two key modalities. Different models of debriefing may affect modalities to varying extents, which may alter the effectiveness of these debriefing approaches.

References

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AP160

Clinician perceptions of the usefulness of cardiac arrest debriefing: A questionnaire study

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Background: The way in which clinicians perceive cardiac arrest debriefing may impact on its effectiveness. A recent systematic review identified a lack of data on how clinicians view cardiac arrest debriefing.1 The aim of this study was to describe clinician responses to cardiac arrest debriefing.

Methods: We delivered weekly cardiac arrest debriefing meetings as part of the CPR Quality Improvement Initiative study.2 Two short paper-based questionnaires were developed. Questionnaire one evaluated clinician’s immediate response to debriefing. Questionnaire two assessed the subjective effect of debriefing on knowledge and practice. Clinicians were eligible to complete questionnaire one every time they attended a meeting. Clinicians completed questionnaire two once only. Questionnaires contained both Likert-style and free-text questions. Data were analysed using SPSS (SPSS v21.0, IBM, New York, USA).

Results: Between November 2011 and May 2013, 74 debriefing meetings were held. 323 clinicians attended. Most only attended one meeting (n = 208, 64.40%). Mean attendance per meeting was 12.59 ± 4.67 (range 3–24); Questionnaire one was distributed at 45 meetings between May 2012 and May 2013. 375 questionnaires were completed (response rate: 65.56%). Most respondents agreed or strongly agreed that meetings were relevant to clinical practice (n = 364, 97.07%), that they felt comfortable contributing to discussions (n = 337, 90.35%), and would recommend meetings to others (n = 368, 98.66%). Questionnaire two was distributed at nine meetings. Forty-nine responses were received (response rate: 63.64%). Most respondents agreed or strongly agreed that their knowledge (87.76%, n = 43), confidence (73.47%, n = 36), and clinical practice (77.55%, n = 38) improved as a result of attending debriefing meetings.

Conclusion: In this study, clinicians described cardiac arrest debriefing as clinically relevant, and reported that it had a positive impact on knowledge, practice and confidence.

References

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AP161

Refractory cardiac arrest: Do we go beyond, do we increase the organ donation pool or both?

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Background: According with the last updated guidelines on resuscitation, the underlying cause of cardiac arrest (CA) should be identified, treated and, if possible, reversed. This target is sought for various pioneering programs worldwide with different strategies: extracorporeal cardiopulmonary resuscitation (ECPR), percutaneous coronary intervention (PCI) under ongoing resuscitation and intra-arrest cooling (hypothermia). All these procedures have a common target: to increase long-term survival outcomes of CA with good neurologic recovery. On the other hand, some countries have implemented programs for uncontrolled donation after circulatory determination of death (uDCDD), after considering the irreversibility of cardiac arrest and/or futility of resuscitation attempts. Both strategies are complementary and should coexist. A comprehensive approach to the refractory CA takes into account the specific event, the means available and the case-by-case circumstances of the patient. Thus, we would be able to go beyond the refractory CA firstly and, if not indicated, secondly we could increase the organ donation pool after confirming the irreversibility of CA.

Purpose of the study: To address the following question: Is possible to improve the current standard of treatment owed to victims of refractory CA before including them in an uDCDD program? This study aims to match both strategies seeking for a better survival outcome of refractory CA and, when not possible, raising the availability of vital organs for transplantation, reducing the growing waiting lists in a worldwide organ shortage trend

Materials and methods: A literature review of protocols approaching the refractory CA with these techniques and therapies:
ECLS, PCI and hypothermia. A literature review of currently active programs for uDCDD. A SWOT (Strengths, Weaknesses, Opportunities, and Threats) matrix analysis was then performed.

Results: 1. The standard of treatment received and the chances of survival of victims of refractory CA depend on whether they are classified as still patients or potential donors. 2. Selected patients who received ECLS, PCI and/or hypothermia increased their survival chance. 3. Victims of refractory CA who cannot benefit from any of these therapies and techniques would be effective potential donors.

Conclusions: Currently active uDCDD programs and protocols including recent improvements on resuscitation for refractory CA are compatible. Operational criteria to distinguish patients from potential donors should seek a balance between the technical imperative (to do whatever is possible), considerations about expected survival with quality of life, and costs/benefits. Uncontrolled DCDD programs can be performed in a way that does not hamper the legitimate interests of patients, potential organ donors, their families, the organ recipients, and the health professionals involved in these processes.

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AP162

Incorporating innovative technologies and addressing behavioral factors to improve Sudden Cardiac Arrest (“SCA”) response

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Purpose: Research has clearly documented the benefit of early provision of CPR and application of an AED to the victim of Sudden Cardiac Arrest (“SCA”). More Automated External Defibrillators (“AEDs”) are being purchased than ever before. However, recently published SCA consortium studies reveal that the SCA response rate by lay responders remains a dismal 2%. The authors implemented alternative training techniques and innovative technologies to determine whether they could improve the SCA response rate at a nation-wide federal agency.

Methods and materials: The authors implemented new training programs targeting 4 distinct segments of an organization with 45,000 employees located at multiple sites. Each training program was developed to prepare that segment uniquely to their responsibility to create a successful AED program, as defined by a successful SCA response. SCA response was defined as alerting trained responders and 911, immediate provision of CPR, and attaching the closest functioning AED to the SCA victim prior to the arrival of Emergency Medical Services (“EMS”). New technologies were provided to the appropriate segments to facilitate and ensure AED compliance and an immediate response from trained responders.

Results: Training programs were successfully implemented at the targeted populations. AED compliance was recorded on a monthly basis. Five (5) SCA events occurred over the study period. The average monthly AED compliance rate was 100%. The SCA response rate was 100%.

Conclusions: Providing basic AED/CPR training and placing AEDs in strategic locations produces an average 2% SCA response by lay responders. The addition of targeted training programs for essential personnel and specific technological tools can significantly improve cardiac arrest response rates, and therefore SCA survival.

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AP163

A systematic review of do-not-attempt-cardiopulmonary-resuscitation (DNACPR) orders: Summarising the evidence around decision making and implementation

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Purpose: This review aims to identify the factors contributing to, and the barriers acting against, decision making and implementation of DNACPR orders.

Materials and methods: A systematic search of key databases, including Medline, CINAHL, and Embase, was conducted for the period 2003–2013. Inclusion criteria consisted of all study designs, DNACPR decision-making and implementation, patients aged 18+ years and papers written in the English language. The search identified 3997 references, of which 47 papers met the inclusion criteria. A thematic analysis was conducted.

Results: Four overarching themes emerged: (a) making the DNACPR decision; (b) Communicating the decision to patients and families; (c) recording and implementing the decision within the wider health team; (d) the consequences arising from the DNACPR decision. Barriers preventing a DNACPR order from being carried out satisfactorily include: variation in the timing of the order; variation in acute versus community setting; unclear or lack of communication with the patient and family; unclear or lack of clear instructions for staff to follow during a cardiac arrest; poor understanding of future care planning, and unnecessary use of resources.

Conclusion: This systematic review of international literature has identified variation in practice yet similar problems in DNACPR decision-making and implementation. Major problems were identified in the literature relating to practice and which require further scrutiny. These include a need for: formal assessment of the wide variation in timing of decision making and future care planning across wards and specialties, which has sometimes resulted in the mismanagement of DNACPR procedures; training for and assessment of inclusive and skilful discussions around DNACPR decision-making; implementation and assessment of resuscitation orders which are highly visible on the wards and assist staff in their actions during cardiac arrest; training for, and assessment of, open team discussion and cohesion about resuscitation decisions.

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AP164

Results of the implementation of hands-only CPR for cardiac arrest care in Sao Paulo

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Introduction: Sao Paulo’s Subway carries about 4.5 million people per day. Since November 2009, the employees (lays rescuers) from Sao Paulo’s Subway facilities conduct continuous training (at least every two years) in cardiopulmonary resuscitation (CPR), instructed to perform hands only (HO) CPR and handling of the automatic external defibrillator (AED). Previously (September 2006 to October 2009), patients were treated by conventional CPR and
obtained a survival rate of 22%, with minimal neurologic impairment one year after cardiac arrest (CA).

Objective(s): Calculate the rate of hospital survival in patients that suffered from cardiac arrest (CA) at Sao Paulo Subway after employees had received training in HO-CPR.

Methods: We studied a prospective series of cases of sudden cardiac arrest in Sao Paulo’s Subways from November 2009 to November 2012. Subway security officials were instructed to perform HO-CPR and to use AEDs. The outcome of each patient was followed through medical records of the hospitals to which patients were referred. Reading the AED registration of each patient was performed. The primary outcome was minimal neurologic impairment one year after an out-of-hospital cardiac arrest.

Results: Automated external defibrillators were used in 40 patients whose initial cardiac rhythm was ventricular fibrillation. The average age of victims was 60 ± 12 years and 29 (72%) were male. The percentage of patients who achieved sustained return of spontaneous circulation was 28 (70%), 24 (60%) of patients arrived alive at the hospital and 18 (45%) were discharged and survival one year after the event without neurological deficits. Comparing the periods of the September/2006—November/2009 with October/2009—November/2012, respectively, the rate of survival without neurological impairment was 22% versus 45% one year after the event (p = 0.0824).

Conclusion: We conclude that the implementation of the HO-CPR at the program of public access to defibrillation greatly increased the survival rate of victims who suffered CA in Sao Paulo’s Subways. This is the highest rate of survival of CA registered in public place from Latin America so far.

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AP165

Limited implementation of ERC 2010 resuscitation guidelines in Danish hospitals – A nationwide study

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Background: Survival following in-hospital cardiac arrest is poor. Effective resuscitation depends on implementation of up-to-date clinical guidelines. Resuscitation training and retraining is important to translate guidelines into clinical practice.

Aim: To investigate the implementation of ERC 2010 resuscitation guidelines and to review resuscitation training programme in Danish hospitals.

Materials and methods: All hospitals in Denmark with a cardiac arrest team were included. Psychiatric hospitals and hospitals serving out-patients only were excluded. It is mandatory for all hospitals to have a protocol describing (1) how resuscitation should be performed in each hospital and (2) a local resuscitation training programme. Protocols were collected (December 2012 through April 2013) and systematically reviewed for (1) adherence to ERC 2010 resuscitation guidelines and (2) resuscitation training programme, specifically the use of team training, course duration and retraining interval.

Results: In total 47 hospitals were included in the study; 38 hospitals (81%) and 36 hospitals (77%) described basic life support (BLS) and advanced life support (ALS) respectively. Overall 50% of hospitals adhered to ERC 2010 BLS guideline algorithm; 63% adhered to guidelines on chest compression depth and 58% on chest compression rate. Moreover 29 hospitals (81%) adhered to ERC 2010 ALS guidelines. The duration of BLS and ALS training were described by 21 hospitals (45%) and 19 hospitals (40%) respectively. BLS course duration was (median (interquartile range)) 2.0 h (1.0 ; 3.75) and ALS 6 h (2 ; 8). The use of team training was described by 13 hospitals (28%). Retraining intervals were (median (interquartile range)) 3 years (2 ; 3) for BLS and 2 years (1 ; 2) for ALS.

Conclusion: Implementation of the ERC 2010 guidelines on BLS is limited in Danish hospitals, while the majority of hospitals adhere to current ALS guidelines. There are differences in hospital resuscitation training course duration and retraining interval.

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AP166

Implementation of safe and effective defibrillation practice in Hungary: Hard paddles or self-adhesive electrodes?

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Defibrillation with self-adhesive pads is the gold standard method during resuscitation as allows minimal interruptions of chest compressions. Unfortunately the implementation of the new recommendations often requires the purchase of new equipment. We have conducted a nationwide survey by telephone interviews with senior clinicians in order to investigate the current position of the implementation and to identify possible obstacles. We have audited 56 hospitals and 92 departments across the country and interviewed the senior consultants of the Intensive Care Units (ICU) and Emergency Departments (ED). Only 6.5% of all responders were using self adhesive pads routinely at the time of the survey. According to 67.4% of respondents purchasing of new equipment was not likely within 2 years. The major obstacle was the perceived higher costs (59.8%) however the majority of clinicians (92.4%) were aware of the potential benefits of hands-free defibrillation.

Our results suggest that the implementation of the new guidelines are slower then expected due to the unavailability of hands-free defibrillators. Major obstacle is the perceived cost-efficiency concerns. The need for an interim recommendation for safe delivery of defibrillation using hard paddles might be considered to enhance the chance of survival for a large number of patients.

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**AP167**

**CPR integral program implementation in a 3rd level hospital**

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**Study Objectives:** We communicate how has been implemented an integral plan of CPR in a third level hospital with 825 beds. It was developed with a multidisciplinary approach (physicians and nurses from Intensive Care, Anaestheliology, Cardiology and Emergency room Departments).

**Material and methods:** The process started one year ago with the creation of a CPR Hospital Committee made up of two experts of each Department involved, the Medical Director, the director of Clinical Training and two nurses. Previous situation was analysed to suggest the strengths and weaknesses of the current CPR program.

**Reporting of results in sufficient detail to support the conclusions:** First step: allocation and conservation status of resuscitation trolley and defibrillators Second step: review of the cardiac arrest (CA) attention hospital protocol and adherence to the 2010 ERC Guidelines. Third step: review of the response times to CA and professionals involved theretofore and progressively many changes have been addressed in many fields in order to improve our CA outcomes. Attention to CA (CA response team was defined, location and equipment of resuscitation trolley and defibrillators was updated and a portable difficult airway case was also defined). Promotion of “do not resuscitate” orders in clinical history for those patients who require it. Development and promotion of a registration form that must be filled in any case that CA response team is activated (epidemiological data, time to defibrillation, first rhythm monitored, outcome. . .). Development of an educational program of CPR (final objective is that all the personnel receives appropriate training in CPR).

**Conclusions:** Development and implementation of an integral plan of CPR through a multidisciplinary team is a complex and challenging task that in spite of Hospital Medical Director and medical departments collaboration has not yet been completed.

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**Mechanical Devices**

**AP168**

**How to minimize “Hands-off Times” during Mechanical Chest Compression Device installation**

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**Purpose of the study:** During Out-of-Hospital Cardiac Arrest (OHCA) management, Advanced Life Support (ALS) teams use the Mechanical Chest Compression Device (MCCD) to take over the manual chest compression (CC). The MCCD is composed of two parts which can be installed in one or two times. We aimed to measure the Hands-off-Times (HOT) related to the installation of MCCD, depending on whether it was placed in 1 or 2 times, and retained the modality which minimized HOT.

**Materials and methods:** Observational prospective open study. MCCD installation in 1 or 2 times (modality 1, modality 2, respectively) was left to the discretion of the ALS team. The inclusion criteria were OHCA over 18 years of age who underwent a manual CC relayed by a MCCD LUCAS® that was installed by an ALS team. The thoracic impedance signal recorded with a specific software (CodeStat 9.0) permitted to measure 1. The HOT related to the LUCAS®’s pose; 2. The CC time between the two HOT in the case of modality 2. Median delays were compared by Wilcoxon rank-sum test.

**Results:** From January 1, 2012 to November 30, 2013, among 128 eligible patients, HOT could be measured in 77 cases (44 patients with modality 1: 33 patients with modality 2). Their median age was age was 51 years [interquartile range: 41–58] and 82% were men. The HOT are represented in Fig. 1. The chest compression time between the 2 HOT in the case of modality 2 was 12 s [6.4–18.4].

**Conclusions:** If HOT are currently shorter with modality 2 versus modality 1, the CC time between the 2 HOT seems too short to ensure satisfactory coronary and cerebral perfusions. We suggest installing the LUCAS™ 2 device in two stages with a minimum of 30 CC between the 2 HOT.

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**AP169**

**Implementation of the ABL-90 blood gas analyzer in a mobile emergency care unit**

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**Purpose of the study:** Point-of-care analyses are increasingly being implemented in the prehospital services. However, full blood gas analysis requires a more extensive set-up than the measurements of blood glucose and lactate already implemented in various prehospital services. Within the hospital, the ABL 90 (Radiometer,
Denmark) blood gas analyzer is fast and reliable. The ABL-90 is light and portable and data can be automatically sent to the patient data management system or even the physician’s PDA. A study was carried out in order to investigate the feasibility of the unit in a mobile emergency care unit.

**Materials and methods:** The response towards g-forces and vibration had to be assessed before implementing the unit in the ME CU. A dummy with the same dimensions and weight as the ABL-90 was constructed. An accelerometer was placed on top of the dummy, measuring g-forces during several regular ambulance runs. Furthermore, the shock response spectrum of the unit was calculated. Upon establishing the extent of g-forces exerted and calculating the shock response spectrum, further testing was carried out.

**Results:** Although g-forces exerted were rather low (1.5–1.95 g in all directions), initial findings demonstrated that the ABL-90 was unstable. An inlet of the apparatus proved to be responsible for discontinuation within the calibration system.

A re-designed cradle with added cushioning and a new inlet, designed to minimize the risk of a discontinued connection between the inlet and solution pack, enabled the ABL-90 to function.

**Conclusions:** This study has shown that a slightly modified ABL-90 works in a ME CU. As the apparatus has the potential for transmitting prehospital results to intra hospital patient data management systems, this finding opens up for improved diagnostic and treatment possibilities, both prehospital and in preparing emergency departments for patients before their arrival at the departments.

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**AP170**

**Extracorporeal life support for refractory cardiac arrest**

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**Background:** Extracorporeal life support (ECLS) has been recently introduced as a therapeutic option for refractory cardiac arrest (extracorporeal cardiopulmonary resuscitation – ECPR). The current evidence for this approach, however, remains insufficient.

**Methods:** We analyzed a group of patients treated with ECLS for refractory cardiac arrest in our institution.

**Results:** One hundred and seventeen patients underwent implantation of mini-invasive circulatory support in our institution with extracorporeal membrane oxygenation (ECMO) used in 82 cases. Major indication for the circulatory support system insertion was cardiogenic shock; however, in thirteen cases ECMO was implanted for refractory cardiac arrest. We have routinely used automatic chest compression system in these patients and the implantation was successful in all cases. Five patients were weaned from ECMO, two were transferred for LVAD implantation. Three patients survived with good neurologic outcomes, one patient had moderate neurological dysfunction, one patient had severe neurological dysfunction, and eight individuals deceased. We did not find any significant differences between survivors and non-survivors in the major characteristics including age or left-ventricle ejection fraction. We found important role of cerebral/peripheral oximetry in the monitoring of patients with ECLS.

**Conclusions:** ECLS is a promising therapeutic tool in the management of severely compromised patients with progressing cardiogenic shock or refractory cardiac arrest. For individuals with refractory cardiac arrest ECLS represents ultimately the last chance to survive.

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**AP171**

**Mechanical CPR devices in donors after cardiac death**

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Cardiopression mechanical devices are being used in many cases of donation after cardiac death to facilitate the transport and preservation in order to improve conditions for transplantation. The aim of this study was to compare long-term donor outcomes which is applied against devices which use manual compressions. We study 200 patients transferred by donors after cardiac death. The age group manual versus mechanical compression (40% vs. 43%; 95% −3.3 to 1.7, t = 0.6), gender (85% vs. 88% male) and arrival times to scene (13′54″ vs. 12′53″; 95% −1.14″−1.58″, t = 0.39) and hospital arrival (42″ vs. 65″; 95% −140″−60″, t = 0.6) are similar. In the manual group cardiocompression the average number of kidneys was 1.51 (SD 0.83) kidney donor while the mechanical cardiocompression group was 1.20 (SD 0.91) resulting in a statistically significant difference (95% 0.3–0.1 t = 0.04). Creatinine year right kidney was higher in the manual group (2.01 vs. 1.79 95% CI −0.75 to 1.37 t = 0.04). Creatinine year in the left kidney was lower in the manual group (1.77 vs. 1.93 95% CI −0.15 to 0.33 t = 0.63). The number of transplanted livers was 41 and objective year survival of 29 recipients (70%) of which 20 were transferred under mechanical compression. The number of lungs was extracted with an 18 year survival of 16 recipients (88%) of which 14 were transferred under mechanical compression. Mechanical compression devices seems to lower the number of kidneys from donors after cardiac death but the evaluation of these grafts and other long-term donors transferred is similar to manual compression.

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**AP172**

**Feasibility of a continuous non-invasive arterial pressure (CNAP) device in a prehospital setting**

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**Purpose of the study:** Blood pressure (BP) is one of the most important parameters in several clinical settings. Prehospital monitoring of BP can be a vital factor. The continuous non-invasive arterial pressure (CNAP) device provides beat-to-beat pressure readings by using a finger cuff calibrated to a regular oscillometric BP monitor. This study was performed to examine if the CNAP is easy to use and provides accurate data in a prehospital setting. We wanted to investigate if the CNAP is a feasible alternative to the traditional oscillometric BP monitor during ambulance transfer.

**Materials and methods:** We included adult patients who needed emergency admission to hospital. The measurement was
carried out from the time the patient entered the ambulance until the time the ambulance arrived at the hospital. Regular oscillometric BP monitoring was carried out simultaneously. Primary outcome was to investigate the feasibility of the CNAP device during ambulance transfer. This included secure mounting of the device and the time used until data was displayed by the CNAP. Complications related to measurements were noted. Secondary outcome was to compare the agreement of the CNAP and a traditional oscillometric BP measurement.

**Results:** The CNAP device could be securely mounted in the ambulances using a Weinmann Board and we observed no interactions with iv lines, oxygen tubes or other devices applied. Measurements were established with no or little delay compared to conventional oscillometric measurement. There was acceptable correlation between measurements. In one case the CNAP was not able to measure BP due to low BP. In another case BP could not be measured, probably due to the patient’s extremities being cold. No complication was observed.

**Conclusions:** During ambulance transfer the CNAP device is easy and fast to use. It provides valuable information on patients with unstable BP, however with some limitations.

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**AP173**

**A comparative evaluation on the outcomes of cardiac resuscitation by using manual CPR and mechanical CPR**

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**Purpose of the study:** Quality of CPR is a major factor affecting survival in cardiac arrest. As quality of manual CPR rarely meets standards, interest in chest compression devices increase. Two of the most tested mechanical CPR devices are LUCAS and AutoPulse (ZOLL). In a recently concluded trial that used AutoPulse it was shown that the AutoPulse is equivalent to high quality manual CPR performed by constantly re-trained personnel. The aim of this study is to test the efficacy of the AutoPulse, in out-of-hospital cardiac arrest (OHCA) and in-hospital cardiac arrest (IHCA) patients.

**Materials and methods:** In our prospective observational study we selected patients, aged between 18 and 85, both sexes excluding pregnant women. We compared AutoPulse (AP-CPR) with Manual CPR (M-CPR) in cardiac arrest patients. Effectiveness of each method was measured by ROSC, 6 h survival, blood pressure, end-tidal carbon dioxide (etCO2) and SpO2.

**Results:** We included in total 175 patients 58 M-CPR (44 OHCA, 14 IHCA) and 117 AP-CPR (51 OHCA, 66 IHCA). Patients receiving AP-CPR had significant higher ROSC and 6 h survival compared to M-CPR. ROSC 46% vs. 20.8 and 6 h survival 21% vs. 8%. Compared with M-CPR, AP-CPR produced higher mean, minimum and average values of etCO2 (25–58 mmHg and 20–32 mmHg).

**Conclusion:** Our results are in accordance with some of the earlier studies and indicate that the AutoPulse using a Load Distribution Band mechanism is more effective than manual CPR and are likely to play an increasingly important role in CPR events in both In Hospital as well as Out of Hospital Cardiac Arrest patients.

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**AP174**

**Mechanical external CPR during OHCA**

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**Introduction:** The mechanical CPR project was initiated to improve cardiac arrests outcomes from EMS patients. The project also aimed to integrate organ retrieval following cardiac arrest and ECMO.

**Devices and methodology:** For mechanical CPR we used the LDB (ZOLL, AutoPulse) and apart from the AED ECG recordings, the main observations focused on ROSC and survival. The secondary criteria included all adverse events due to Mechanical CPR.

**Results:** Over a period of 6 years we analyzed 2250 patients who suffered from OHCA. The average duration of all resuscitations was 28 min. Compared to the National Reference Data Base in France, patients receiving mechanical CPR showed slightly higher ROSC rates 17.9% vs. 14.7%. Survival to hospital discharge with AutoPulse in all rhythms categories was 10.6%. 58 patients were selected as organ donor allowing 30 kidney transplants, 3 hepatic transplants and 20 patients were connected to ECMO with an additional survival rate of 5%. From the 2250 patients, 19 (0.8%) had minor side effects (moderated hemoptysis). The hospitals reported 15 (0.6%) patients with thoraco-abdominal complications (5 resuscitation troubles).

**Conclusion:** In this observational study we conclude that the use of the LDB (ZOLL, AutoPulse) device contributes significantly to optimize CPR in an EMS environment. Mechanical CPR did not significantly improved survival rates but this may be due to fact like lack of early defibrillation and early CPR specifically in France. The use of the LDB is encouraging concerning ROSC, organ retrieval and ECMO use. Adverse events were rare and manageable, there for we consider the AutoPulse safe and effective. Our crew members (doctors and rescuers) benefit from the positive effects of Mechanical CPR as the AutoPulse is easy to use, deployment goes quickly and mechanical incidents/complications are minimal.

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**Paediatric Life Support**

**AP175**

**Different respiratory rates during resuscitation in a pediatric animal model of asphyxial cardiopulmonary arrest. Changes in ventilation and oxygenation values**

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**Objectives:** 10–12 respirations per minute (rpm) is the recommended respiratory rate (RR) for pediatric resuscitation. However, there are no data that support this recommendation. The aim of this study is to compare changes in ventilation and oxygenation with three RR (10, 20 and 30 rpm).

**Materials and methods:** An experimental model of asphyxia cardiopulmonary arrest (CA) in 46 piglets (median weight 9.5 kg) was performed. Resuscitation with three different RR was carried out. Mean artery pressure (MAP), arterial blood gases and end-tidal
CO₂ (etCO₂) values were obtained at 3, 9, 18 and 24 min after beginning of resuscitation. These measurements and PaCO₂ increase (∆PaCO₂) were compared between the three RR groups.

**Results:** 30 rpm group had higher PaO₂ (61 mmHg) at 3 min of resuscitation than 20 and 10 rpm groups (53 and 45 mmHg p = 0.05). However, no statistical differences between the three RR were found. PaCO₂ values decreased up to 9 min after CA in every group, but 20 and 30 rpm groups had lower PaCO₂ values than 10 rpm group at 3 min (58 and 55 mmHg vs 75 mmHg p = 0.08). After that, PaCO₂ values went up to 70 mmHg (10 rpm group), 53 mmHg (20 rpm group) and 39 mmHg (30 rpm group) at 24 min (p = 0.06). There were no statistical differences in ∆PaCO₂ between the three groups during the whole resuscitation. Pigs resuscitated with 30 rpm had lower etCO₂ at 3 and 9 min than pigs with 10 rpm (p = 0.01). There were no statistical differences in MAP.

**Conclusions:** During pediatric resuscitation there were no significant differences in either oxygenation or ventilation between 10, 20 and 30 rpm. However, higher oxygenation and lower ventilation values were obtained with higher RR as well as lower etCO₂ at 3 and 9 min.

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**AP176**

**Factors for survival after paediatric out-of-hospital cardiac arrest**

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**Purpose of the study:** The aim of this study is to analyze the characteristics and factor survival after out-of-hospital cardiopulmonary resuscitation (CPR) in children.

**Materials and methods:** Cross-sectional study with review of medical records of patients under 18 years old with CRA, resuscitated by Madrid Municipal Emergency and Civil Rescue & Protection Service (SAMUR) in the period 2006–2012. Data were recorded according to the Utstein style. Variables: age, sex, techniques, bystander CPR, survival, times of arrival, times of cardiopulmonary resuscitation (CPR). Statistical quantitative: measures of center and dispersion, qualitative percentages. Contrast of normality, Kolmogorov–Smirnov (normal distribution: Mean and standard deviation (SD) without normal distribution: Median and interquartile range (IQR)) ACCES, Excel, SPSS: v17. Data confidentiality.

**Results:** 43 children were assisted in CRA. Boys: 30 (70%), Mean age: 8.4 years (SD 7.15), girls: 6.15 years (SD 6.8) and boys: 9.67 years (SD 7.1). Average time of arrived: 8.2 min. Etiology of CRA: traumatic 26 (60.4%), medical 17 (39.5%). Bystander CPR: 16 (37.2%). Roscs: 25 (58.1%). Survival out of hospital 23 (53.4%). Mean age: 8.4 years (SD 7.1). Girls: 6.15 years (SD 6.8) and boys: 9.67 years (SD 7.15). Survival with good neurological outcome: 8 (18.6%) of these survivors 75% were performed bystander CPR and needed less time CPR. Survival rates individually associated with improved survival, included; early CPR, shorter duration CPR, and bystander CPR.

**Conclusion:** The analysis of our data suggest with higher rates of survival with good neurological outcome compared to those reported in national studies, and revealed that the best indicator of survival was bystander CPR and shorter duration CPR. Is important the correct structure of the resources allows for quick and adequate child care in CRA. Bystander CPR is one of the key elements to increase survival from out of hospital cardiac arrest. Initiatives such as public service messages, corporate and institutional programmes and government incentives may help to achieve these aims. All that is needed are their two hands.

**Further reading**


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**AP177**

**Pediatric cardiac arrest: Specific or similar to adult cardiac arrest?**

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**Introduction:** Few studies have described the pediatric cardiac arrest (PCA), the aim of this study is to describe the PCA managed by EMS in France and to compare them to the cardiac arrests (CA) occurring in adult population.

**Material and methods:** French multicentric (221 EMS), prospective, comparative study based on the data gathered in the REAC registry framework between July 1, 2011 and December 10, 2013.

**Results:** Among 17899 AC registered 17557 were adult CA while 342 occurred in pediatric population. In children the traumatic etiology is more frequently recorded than in adults (19.9% vs 12.1%; p = 10 −4). Furthermore, PCA occurred less frequently in the presence of a witness (43.1% vs 54.4%; p < 10 −4). The other variables concerning care and prognostic are set out in Table 1.

**Discussion:** Cardio-pulmonary resuscitation (CPR) was more often started by a witness in PCA than in adult CA. Even if the asystole was the dominant initial pace in children the day 30 prognostic was statistically better than in adult population. Besides, almost a quarter of the victims of PCA were transported to the hospital with a non heart beating.

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**Table 1**

<table>
<thead>
<tr>
<th>Pediatric cardiac arrest care and outcome compared with adult cardiac arrest.</th>
<th>Pediatric CA (n=342)</th>
<th>Adult CA (n=17557)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMS arrival delay (min)</td>
<td>19 ± 12 min</td>
<td>21 ± 17 min</td>
<td>0.002</td>
</tr>
<tr>
<td>Bystander BLS initiated</td>
<td>41.2%</td>
<td>29.0%</td>
<td>&lt;10 −4</td>
</tr>
<tr>
<td>BLS initiated at EMS arrival</td>
<td>83.7%</td>
<td>81.4%</td>
<td>&lt;0.335</td>
</tr>
<tr>
<td>ACLS initiation (EMS)</td>
<td>80.4%</td>
<td>61.1%</td>
<td>&lt;10 −4</td>
</tr>
<tr>
<td>Initial pace (VF/pulseless VT)</td>
<td>41.3%</td>
<td>65.1%</td>
<td>&lt;0.063</td>
</tr>
<tr>
<td>ROSC delay (min)</td>
<td>19 ± 14 min</td>
<td>16 ± 19 min</td>
<td>0.165</td>
</tr>
<tr>
<td>ROSC (yes)</td>
<td>16%</td>
<td>13.7%</td>
<td>&lt;0.241</td>
</tr>
<tr>
<td>Non heart beating transport</td>
<td>21%</td>
<td>11.6%</td>
<td>&lt;0.004</td>
</tr>
<tr>
<td>Admission survival</td>
<td>14.1%</td>
<td>10.2%</td>
<td>&lt;10 −4</td>
</tr>
<tr>
<td>Day 30 survival</td>
<td>7.4%</td>
<td>4.6%</td>
<td>&lt;10 −4</td>
</tr>
</tbody>
</table>

BLS: Basic Life Support.
ACLS: Advanced Cardiac Life Support.
ROSC: Return of Spontaneous Circulation.
**Conclusion:** PCA have a less pejorative prognostic than adult CA. However further analysis must be carried out in order to identify the factors of good prognostic.

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**AP178**

European Paediatric Life Support (EPLS) course theoretical knowledge and skill retention: The Greek study

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**Purpose of the study:** The European Paediatric Life Support (EPLS) provider course aims at training doctors and nurses in the efficient and prompt management of cardiopulmonary arrest in children. EPLS is a two-day, European Resuscitation Council (ERC) course, involving teaching of theoretical knowledge and practical skills. The aim of the present study is to evaluate the retention of theoretical knowledge and certain skills of EPLS providers 4 months after the course.

**Materials and methods:** In total, 80 doctors and nurses who attended 3 EPLS provider courses, from May 2012 to December 2012, were asked to participate in the study and only 50 responded positively. Demographic data (age, sex, occupation) of the participants was collected. The ERC–approved EPLS written test was used to assess theoretical knowledge right after the course and after 4 months. The retention of certain skills (airway opening, bag-mask ventilation, chest compressions) was also examined.

**Results:** The theoretical knowledge significantly decreased (p < 0.001) four months after the course. Age, sex and occupational status (medical or nurse profession) had no effect in theoretical knowledge retention. Interestingly, certain skills such as application of airway opening maneuvers and effective bag-mask ventilation were retained 4 months after the course, while chest compression skill retention significantly declined (p = 0.012).

**Conclusions:** According to our findings, EPLS course theoretical knowledge uniformly declines, irrespectively of the provider characteristics, whereas retention of certain skills is evident 4 months after the course.

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**AP179**

Cardiac arrest in children: Increase in ventricular tachycardia/fibrillation, decrease in mortality!

Abstract withdrawn.

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**AP180**

Extremely poor outcome of prolonged cardiac arrest in children with hypothermic cardiac arrest after drowning: A nationwide retrospective cohort study

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2 van Heurnlaan 10, Vught, The Netherlands
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**Purpose:** To determine the outcome of children with hypothermic cardiac arrest after drowning, focussing on the outcomes of resuscitations longer than 30 minutes and the influence of season on outcome.

**Materials and methods:** All children (≤ 16 years old) who suffered a hypothermic (<34 °C) cardiac arrest after drowning and were admitted to the eight University Medical Centers in the Netherlands between 1993 and 2012 were included. Children who drowned in a heated swimming pool or who drowned because of a vehicle or boating accident were excluded. Outcome at one year after drowning was the main outcome measure. Good outcome was defined as survival with good performance or mild to moderate disability (Paediatric Overall Performance Category (POPC) ≤ 3).

**Results:** Of the 160 children with hypothermic cardiac arrest after drowning, 137 (86%) had return of spontaneous circulation (ROSC). However, only 17 children (11%) survived without severe neurological damage. Resuscitation longer than 30 min was performed in 98 (61%) children, with a median duration of ALS of 60 min. After prolonged resuscitation no child had good outcome: 87 (89%) died and the other 11 (11%) survived in persistent vegetative state or with severe neurological damage. Overall, season correlated strongly with outcome: children who drowned in winter had significantly better outcomes than those who drowned in spring, summer or autumn (29% (5/17) versus 8% (12/143), p = 0.013, OR 4.55 (95% CI 1.37–15.09)).

**Conclusions:** Resuscitation longer than 30 min did not result in good outcome in any child with hypothermic cardiac arrest after drowning. Hypothermic cardiac arrest after drowning in non-winter months was associated with poor outcome. Present results question the therapeutic value of prolonged resuscitation in hypothermic cardiac arrest in children after drowning, especially after drowning in non-winter months.

**Reference**


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Paediatric donation after cardiac death:
Another opportunity to save lives when resuscitation is not successful
Christina Scher Carriedo*, Natividad Garcia Ramos, Elena Moreno Lence, Jose Maria Blanco Garcia-Ochoa, Ervigio Torres Corral
Samur-pc, Madrid, Spain

Purpose: In selected cases of out-of-hospital patients who suffer a cardiorespiratory arrest (CRA) and unsuccessful resuscitation after advanced life support (ALS), there is another way to heal other patients: the procedure of Donation After Cardiac Death (DCD).

Materials and methods: We performed a cross-sectional analysis of CRA in children (from 24 h to 18 years) assisted by SAMUR-PC from 2006 to 2013. Data were recorded according to the Utstein style. The variables were age, gender, time of cardiopulmonary resuscitation (CPR), organs obtained, relatives agreement, reasons that avoided the organ donation and graft evolution in the recipient informed by the Hospital. Statistical: quantitative measures of centre and dispersion qualitative absolute frequencies.

Results: There were 41 cardiac arrests attended among children and 5 were activated as DCD after ALS. Cardiac arrest was due to trauma in 3 cases. The mean age was 15.8 years old (14–17). Mean ALS-time was 58 min 34 s (35 min to 74 min 19 s). In one case it was not possible to obtain the agreement of the family for organ donation. The organs were transplanted to adult patients in all cases (≥18 years).

Conclusions: Of 5 patients activated as pediatric DCD by SAMUR-PC, 2 became organ donor in the Hospital. In the same time frame, there are registered 9 infants DCD donors in Spain. Organ donation after cardiac death is a well-established and recognized field in the Spanish in- and out-of-hospital medical community. The cost–benefit ratio must not be quantified in terms of the cost of each donation process, but as the useful years recovered and the costs saved in long-term medical treatment for chronic patients who became healthy after organ transplantation.

Further reading

AP182
Out-of-hospital cardiorespiratory arrest in children with trauma
Elena Moreno Lence*, Natividad Garcia Ramos, Cristina Scher Carriedo, Jose Maria Blanco Garcia-Ochoa, Ervigio Torres Corral
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Purpose of the study: To analyze the characteristics, etiology and outcome of out-of-hospital cardiorespiratory arrest (CPR) secondary to trauma in children.

Materials and methods: Cross-sectional study with review of medical records of patients under 18 years with CRA secondary to trauma, resuscitated by Emergency out of hospital Service .period 2002–2010. According to the Utstein style. Variables were age, gender, times of cardiopulmonary resuscitation (CPR), return of spontaneous circulation sustained (more than 20 min) return of spontaneous circulation to 6 h (initial survival) and 7 days survival (final survival), and survival with restoration of vital functions without neurological damage after 7 days.

Results: 27 children. Boys: 19 (70, 4%). Mean age: 9.04 years (SD 5, 7). Arrival time average: 6.89 min. Etiology: Motor vehicle crashes: 6 (22.2%), pedestrians: 6 (22.2%), precipitated: 5 (18.5%), stab wound: 2 (7.4%), submersion injury-associated arrests: 5 (18.6%). Return of spontaneous circulation: 14 (50%), initial survival: 13 (48.1%) and final survival: 6 (22.2%) complete neurological: 4 (14.8%). Final survival was significantly higher in patients with submersion injury 5 (100%). Final survival was also higher in patients with time of cardiopulmonary resuscitation shorter than 20 min 13 (48.1%) than in the remaining patients 14 (51.9%) (p = 0.004) The four survivors had complete neurological recovery (CNR) had cardiac arrest secondary submersion injury.

Conclusions: The analysis of our data suggests that principal etiology of CRA is Motor vehicle crashes and pedestrians, mainly males nine years. Survival until hospital discharge in children with cardiopulmonary arrest secondary to trauma is short. Patients with submersion injury-associated arrest and those with a duration of cardiopulmonary resuscitation of less than 20 min showed better survival than the remaining patients. We conclude that the quality in out of hospital emergency medical care and adequate resources allows improving survival rates in pediatric CPR secondary to trauma.

Further reading

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Post Resuscitation Care

AP183

Comparison of injury phenotype between ventricular fibrillation and asphyxial cardiac arrest in a rat model

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Purpose of the study: Treatment of patients after cardiac arrest (CA) is independent of etiology although differences in outcome are known.¹² Three key CA etiologies include ventricular fibrillation (VF) and asphyxia. Asphyxial CA (A-CA) is suggested to produce particularly poor neurological outcomes. We tested the hypothesis that A-CA will produce a greater neurological impairment with equivalent no-flow durations while VF-CA will lead to greater hemodynamic impairment after return of spontaneous circulation (ROSC).

Materials and methods: CA in isoflurane-anesthetized male Sprague Dawley rats (total n = 50, including 10 shams) was induced and untreated for 5 min in both models. Resuscitation was attempted using standard protocols including manual chest compressions, epinephrine, bicarbonate, and defibrillation (after VF). In Aim I, rats were randomized to VF-CA vs. A-CA and hemodynamic parameters including cardiac output (CO) were measured via aortic flowprobe for 30 min after ROSC. In Aim II, rats were allowed to recover and neurologic deficit scoring (NDS) at day 8 post ROSC and hippocampal neuronal cell survival were measured. In Aim III, mitochondria in heart and brain were isolated 15 min after ROSC and respiratory control ratio (RCR) of complex I analyzed (Fig. 1).

Results: After ROSC, CO was lower in VF-CA vs. A-CA at 5, 15 and 30 min (p = 0.01). Significantly worse lactate, pH, and heart rate were also observed in VF-CA. NDS was significantly worse in A-CA vs. VF-CA groups in the first 3d after insult (p < 0.05). There was a trend toward greater hippocampal neuronal loss in A-CA vs. VF-CA (p = 0.17). Isolated mitochondria showed a trend toward greater dysfunction in heart after VF-CA vs. A-CA (p = 0.11).

Conclusions: In matched 5 min no-flow CA models, VF-CA produced worse acute cardiovascular outcomes, contrasting brain-related outcomes which were worse after A-CA. Our findings suggest that the primary therapeutic targets for post-resuscitation care may differ depending on CA etiology.

Fig. 1. (a) Neurologic deficit score, (b) CA1 neuronal survival, (c) cardiac output and (d) mitochondrial function. Legend: *** p < 0.001, ** p < 0.01, * p < 0.05.
References


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AP184

Therapeutic hypothermia in cardiac arrest and ventilation-associated pneumonia: Our 6 years experience on SDD protocol

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Purpose of the study: Therapeutic hypothermia (TH) improves neurological outcome after cardiac arrest (CA) but may yield an increased risk of infection.1,2 Davies et al.3 reported increased survival when patients treated with TH after out-of-hospital CA were given early systemic antibiotics when compared to those patients who received late antibiotics. The reported ventilator associated pneumonia (VAP) rate in the literature, in non-TH patients, ranges from 9% to 27%.4 The VAP rate in TTM trial5 was 21.22% both for normothermic and hypothermic patients. There is evidence that selective decontamination of the digestive tract (SDD) decreases the incidence of VAP.3 The present study served to investigate the incidence of ventilator-associated pneumonia on TH treated patients who were given SDD in our department.

Materials and methods: Data for all post cardiac arrest patients treated with TH and SDD in our ICU from January 2007 to December 2013 was analysed retrospectively. During the study period, all ventilated patients admitted to our ICU were treated with the SDD protocol: cefotaxime (home patients) or ceftazidime (BPCO, home facilities community or hospital patients): 6g continuous daily IV infusion for the first 5 days followed by oral or Nasogastric SDD thereafter until extubation. Pneumonia was defined by means of the “revised CPIS” (rCPIS) score in accordance with “The international sepsis forum consensus conference on definitions of infection in the ICU.” Diagnosis of pneumonia was certain if rCPIS > 4 calculated on day 3 and 5. Temperature was not taken into account as per these guidelines. VAP was diagnosed in all patients in which rCPIS was less than or equal to 4 on day 3 and those in whom rCPIS increased above 4 on the fifth day of admission. Daily data including white blood count, C-reactive protein, procalcitonin, chest X-ray, tracheal secretions and cultures were also recorded.

Results: 74 patients were admitted over the study period. 10 patients were excluded because their CPIS were greater than 4 on day 3. Of the 64 patients comprising the study group: 7 developed VAP (10.93%). The remaining 57 patients did not develop any clinical signs of pulmonary infection during their ICU stay which ranged from 1 to 7 days.

Conclusion: The rate of VAP in this study (10.9%) is less than the reported VAP rate of the TTM trial (21.2%) and similar to the rate of VAP for ICU patients not treated with therapeutic hypothermia. It is possible that use of SDD may reduce the increased risk of VAP previously reported with therapeutic hypothermia.

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AP185

Therapeutic hypothermia: Eight and a half years of experience from an intensive care unit

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Background: Therapeutic hypothermia (TH) after cardiac arrest (CA) is recommended by international guidelines since 2003, and its use has become spread out, but recent studies question its application, which makes this a theme of intense debate. Our intensive care unit (ICU) started TH in 2005 and since then the protocol has evolved according to new data available. The objective of the study is to describe the patients submitted to TH since then.

Methods: We performed a retrospective study in which we included every adult patients submitted to TH between the 1st of January 2005 and 31st of July 2013.

Results: In 3725 patients admitted to the ICU after CA, 139 performed TH, 68% male, with 61 ± 16 years old. The median stay in the ICU was 18 ± 26 days. Majority of CA cases were due to non-shockable rhythms (60%) and 45% occurred in out-of-hospital setting. An identifiable cause for CA was possible in 122 cases, with 40 of them of cardiac origin. HT was started in pre-ICU setting in 16 cases. After rewarming, the majority of the patients were submitted to neuroprognosis exams, among whom 46.8% had abnormalities in the EEG, 49.6% had signs of ischemia on MRI and 28.7% had absent N20 wave. The most frequent complications were the infectious disorders (66.2% of the cases, being pneumonia the most frequent one), followed by fever (59.7%), myoclonus (52.5%) and shock (44.6%). Of the 139 patients submitted to TH, 123 were alive at the end of TH, 82 after 8 days and 21 after 6 months of TH. When released from ICU Presented median modified Rankin Scale score of 5 and GCS of 8.

Conclusion: The numbers that we found makes us believe that we are on track, with our statistic similar to international data.

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The relationship between time-weighted mean oxygen tension and outcome in out-of-hospital cardiac arrest survivors treated with therapeutic hypothermia

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Purpose: There is a lack of studies to identify the relationship between oxygen tension and outcome in cardiac arrest survivors treated with therapeutic hypothermia (TH). We investigated the relationship of time-weighted mean oxygen tension (TWMO2) and outcome in cardiac arrest survivors treated with TH.

Materials and methods: This was a retrospective observational study including 177 out-of-hospital cardiac arrest (OHCA) survivors. For each patient, TWMO2 was calculated using the entire set of seven blood gas measurements (at the time of restoration of spontaneous circulation (ROSC), initiation of TH, initiation of maintenance, and every 6 h during maintenance) and seven periods of time between ROSC and the end of rewarming. The patients were divided into four categories according to quartile values of TWMO2.

The primary outcome was neurologic outcome at discharge and the secondary outcome was all causes of in-hospital mortality. We assessed neurologic outcome using the Cerebral Performance Categories (CPC) at hospital discharge. Neurologic outcome was dichotomised as either good neurologic outcome (CPC1 and CPC2) or poor neurologic outcome (CPC3 to CPC5). The odds ratio with 95% confidence interval (CI) was estimated.

Results: The median value of PaO2 was 139 (104.5–170.0) mmHg. Among a total of 1239 PaO2 values, 22 (1.8%) values were hypoxia (<60 mmHg) and 16 (1.3%) values were hyperoxia (>300 mmHg). Univariate logistic regression analysis showed that the third quartile and the fourth quartile had a significantly low odds ratio for poor neurologic outcome (0.353 (95% CI, 0.133–0.938) and 0.321 (95% CI, 0.121–0.850), respectively) and for in-hospital mortality (0.338 (95% CI, 0.132–0.870) and 0.387 (95% CI, 0.154–0.975), respectively). However, multivariate logistic regression analysis showed no significant relation between TWMO2 and outcomes.

Conclusions: In OHCA survivors treated with TH, oxygen tensions were well managed without high frequency of hyperoxia and hypoxia. Oxygen tension was not associated with neurologic outcome and in-hospital mortality.

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The out-of-hospital cardiac arrest score in the era of therapeutic hypothermia: An external validation in an Asian country

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Purpose: There was no validation study for the out-of-hospital cardiac arrest (OHCA) score in Asian countries. The value of the score in the era of therapeutic hypothermia (TH) is still controversial. The aim of this study was to externally validate the score in an independent population in an Asian country where withdrawal of life support by prognostication is not yet permitted.

Materials and methods: We performed a retrospective, observational study of the adult OHCA patients presenting to a tertiary hospital which TH has been actively implemented. The primary endpoint was poor neurologic outcome, defined as Cerebral Performance Category (CPC) of 3–5, at hospital discharge. The secondary endpoint was hospital mortality. Calibration and discrimination were assessed. Additionally, we assessed effect modification of TH and the score by inclusion of an interaction term in the model.

Results: Of a total of 152 OHCA patients, 107 (70.4%) had a poor neurologic outcome and TH was applied in 94 (61.8%). The probability of poor neurologic outcome and mortality increased stepwise with increasing the score. Calibration curves and goodness-of-fit test indicated good calibration of the score (p = 0.973 for poor neurologic outcome; p = 0.978 for mortality). The score showed good discrimination for poor neurologic outcome (AUC, 0.88; 95% CI 0.82–0.93) and for mortality (AUC, 0.741; 95% CI 0.66–0.81). No significant interactions between the score and TH were found for prediction of poor neurologic outcome (p = 0.198) and mortality (p = 0.132).

Conclusions: This study found good calibration and high discrimination of the OHCA score in an independent Asian population which TH has been actively implemented and withdrawal of life support is not applied. The OHCA score had a high positive predictive value and no interaction with TH. Therefore, the OHCA score could also perform well in identifying high-risk patients for poor outcomes in the era of TH.

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AP188
What about therapeutic hypothermia in out-of-hospital cardiac arrest, in a two-tiered emergency system? An observational study
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Purpose: A recent publication has reported the non-evidence of a benefit in Out-of-Hospital Cardiac Arrest (OHCA) Therapeutic Hypothermia (TH) managed by paramedics (Kim et al. JAMA 2014). We aimed to measure the effectiveness and tolerance of TH realized by Pre-hospital Emergency Physicians (PEP) in an urban area.
Materials and methods: TH was applied by PEP after recovery of spontaneous circulation (ROSC), in concordance with current guidelines. Data collected were: patient characteristics, main TH characteristics and temperature (T°) at the beginning of TH and on arrival at the hospital. Quantitative variables were expressed by median [Interquartile range], and qualitative variables by percentage.
Results: From 12 December 2012 to 16 November 2013, among 183 comatose survivors of OHCA with a stable ROSC, 30 (16.4%) underwent a TH. Among these 30 (100%), median age was 58 years [51–72], 75% were men, 54% occurred at home, 48% were in initial ventricular fibrillation (VF). The median delay “ROSC-start TH” was 30 min [21–44] and the delay “start TH-hospital arrival” 39 min [25–49]. The median amount of fluid (4 °C crystalloid) administered was 975 ml [900–1000]. T° decreased from 35.6 [35–36.3] at the beginning of TH, to 34.5 [33.9–35.2] on arrival at the hospital. When immediate coronary angiography was performed (n = 13), hospital could not systematically ensure continuation of pre-hospital TH. The pre-hospital complications were 1 hemoptysis and 2 pulmonary edema, with no case of recurrent OHCA.
Conclusions: Pre-hospital TH was rarely achieved despite its ease of implementation, with complications in 10% of cases. The potential benefit of pre-hospital TH on survival need to be measured in specific urban two-tiered emergency care systems which comprise PEP.

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AP189
The association between dyscarbia and outcome in out-of-hospital cardiac arrest survivors treated with therapeutic hypothermia
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Purpose: There is a lack of clinical evidence in terms of the association between carbon dioxide tension and outcomes in cardiac arrest survivors. We investigated the association of time-weighted mean carbon dioxide tension (TWMCO2) and outcomes in out-of-hospital cardiac arrest (OHCA) survivors treated with therapeutic hypothermia.
Materials and methods: This was a retrospective cohort study including 177 OHCA survivors. For each patient, TWMCO2 was calculated using the entire set of seven blood gas measurements (at the time of restoration of spontaneous circulation (ROSC), initiation of TH, initiation of maintenance, and every 6 h during maintenance) and seven periods of time between ROSC and the end of rewarming. The patients were divided into three groups according to the values of TWMCO2 (normocarbia, 35–45 mmHg; hypocarbia, <35 mmHg; hypercarbia, >45 mmHg). The primary outcome was in-hospital mortality and the secondary outcome was neurologic outcome at discharge. We assessed neurologic outcome using the Cerebral Performance Categories (CPC) at hospital discharge. Neurologic outcome was dichotomised as either good neurologic outcome (CPC1 and CPC2) or poor neurologic outcome (CPC3 to CPC5). The odds ratio with 95% confidence interval (CI) was estimated.
Results: The median value of PaCO2 was 38.2 (33.9–43.3) mmHg. Among a total of 1239 PaCO2 values, normocarbia, hypocarbia, and hypercarbia were 618 (49.8%), 380 (30.7%), and 241 (19.5%), respectively. Univariate logistic regression analysis showed that the hypocarbia had a significantly high odds ratio for in-hospital mortality (2.474 [95% CI, 1.129–5.424], p = 0.024) than normocarbia. Multivariate logistic regression analysis revealed that hypocarbia (2.926 [95% CI, 1.121–7.066], p = 0.017) and hypercarbia (4.673 [95% CI, 1.348–16.205], p = 0.015) had a significantly high odds ratio for in-hospital mortality than normocarbia.
Conclusions: In OHCA survivors treated with TH, dyscarbia (hypocarbia and hypercarbia) was frequent and dyscarbia was associated with in-hospital mortality.

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AP190
Impact of case volume on performance of targeted temperature management, incidence of adverse events, and neurologic outcome in comatose out-of-hospital cardiac arrest survivors treated with targeted temperature management: A propensity score matching analysis
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Aim of the study: This study aimed to determine the effect of case volume on targeted temperature management (TTM) performance, incidence of adverse events, and neurologic outcome in comatose out-of-hospital cardiac arrest (OHCA) survivors treated with TTM.
Methods: We used a web-based, multicenter registry (Korean Hypothermia Network registry) in which 24 hospitals throughout Republic of Korea participated to study adult (≥18 years) comatose OHCA patients treated with TTM from 2007 to 2012. The cutoff number for a high volume versus a low volume was calculated using a sensitivity analysis. The primary outcome was neurologic outcome at hospital discharge. The secondary outcomes were in-hospital mortality, TTM performance, and adverse events. We extracted propensity-matched cohorts to control for bias. A multivariate logistic regression analysis was performed to assess independent risk factors of primary outcome.
Results: Of the 930 patients, 901 were included in this study, of whom 544 (60.4%) survived to hospital discharge and 248 (27.5%) were discharged with good neurologic outcome. The cut-
off number between low volume and high volume hospital was 15.5 per year. The high volume hospitals started TTM significantly earlier following ROSC and had lower rate of hyperglycaemia, bleeding, hypotension, and rebound hyperthermia. However, good neurologic outcome and in-hospital mortality were comparable between high volume (27.7% and 44.6%, respectively) and low volume hospitals (21.1% and 40.5%) in the propensity matched cohort. The adjusted odds ratio in the high volume hospitals compared to low volume hospitals were 1.506 (95% confidence interval: 0.875–2.592) for poor neurologic outcome.

Conclusions: The higher case volume of TTM was significantly associated with early initiation of TTM and lower incidence of adverse events. However, the case volume had no association with the neurologic outcome and in-hospital mortality.

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AP191

Increasing bispectral indices during post-resuscitative therapeutic hypothermia can predict incidence of seizures after rewarming

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Background: Bispectral index (BIS) derived from patient’s forehead electroencephalogram provides brain function monitoring in subjects with general anesthesia, however, knowledge in relation to subjects with possible post-resuscitation encephalopathy is limited. We investigated the hypothesis that an increase in BIS related to latent seizures during therapeutic hypothermia with muscle relaxant and diagnostic accuracy of an increase in for incidence of seizures after rewarming.

Methods: We included post-resuscitated cardiac arrest subjects who hospitalized to the intensive care unit of the study hospital from August 2008 to March 2013 and who underwent induced therapeutic hypothermia in this retrospective observational study. We defined delta-BIS as difference in BIS between the first and the last 6 h during the induced hypothermia, and maximum-to-minimum BIS gap as difference in the maximum and minimum value during the induced hypothermia. Receiver operating characteristic (ROC) analysis compared area under curve (AUC) of delta-BIS and maximum-to-minimum BIS gap to predict category 1 or 2 in the Cerebral Performance Categories (CPC) or need for antiepileptic drug after rewarming.

Results: Eighty-eight patients were included in this study. A total of 42 patients (47.7%) were categorized 1 or 2 in CPC. A total of 25 patients (28.4%) needed antiepileptic drug therapy after rewarming. Both of delta-BIS (AUC of 0.610, 95% CI 0.491–0.729) and maximum-to-minimum BIS gap (AUC of 0.467, 95% CI 0.347–0.588) poorly predicted CPC 1 or 2. In contrast, both of delta-BIS (AUC of 0.857, 95% CI 0.770–0.942) and maximum-to-minimum BIS (AUC of 0.824, 95% CI 0.682–0.914) predicted the incidence of seizures which needed antiepileptic drug therapy (Fig. 1).

Conclusion: The increased BIS during hypothermia can be an indicator for latent seizures. Further studies to test use of antiepileptic medications in patients undergoing therapeutic hypothermia is expected to reduce worsening of neurological outcomes.

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AP192

Ultrafast whole body cooling induced by hypothermic total liquid ventilation attenuates shock after aortic cross clamping in rabbits

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Purpose of the study: Total liquid ventilation (TLV) provides ultrafast cooling and potent anti–ischemic effects in animal models of myocardial infarction and cardiac arrest. We determined whether it could also mitigate shock in an original model of multi-organ failure induced by abdominal ischemia-reperfusion.

Materials and methods: Anesthetized rabbits with cardiac output probes were submitted to 30 min of supraceliac aortic cross clamping and 300 min of reperfusion. They were randomly allocated to a normothermic procedure (Control group) or to hypothermic TLV (HTLV) at a target temperature of 32–34 °C. HTLV was started either 15 min before or 15 min after clamping (pre-clamp and per-clamp groups, respectively) or 15 min after declamping (post-clamp group). After 75 min of HTLV, TLV was also used for 30 min of controlled rewar ming before switch to conventional ventilation. After reperfusion, norepinephrine was infused to target a mean arterial pressure of 70 mmHg.

Results: In the Control group, aortic cross clamping induced a steady fall of cardiac output and a severe vasoplegia, as reflected by a progressive increase in norepinephrine requirement (Fig. 1). In comparison, the Pre-clamp group exhibited a maintained cardiac output and a reduced norepinephrine requirement throughout hypothermia and after rewarming. Metabolic acidosis and acute kidney injury were also attenuated in Preclamp vs Control (bicar-
We investigated hospital outcome in patients with out-of-hospital cardiac arrest regaining consciousness immediately after ROSC (conscious survivors) and patients remaining in coma despite ROSC (comatose survivors). Consecutive patients with both, shockable and non-shockable initial rhythms from our cardiac arrest registry were included. From 2004-2012, a total of 105 “conscious” (19%) and 551 “comatose” (81%) survivors of cardiac arrest were admitted to our hospital. Immediate coronary angiography and PCI were used more often in “conscious” survivors (Table). “Comatose” survivors were treated with hypothermia in 88%. Except for 1 patient, all patients with return of consciousness immediately after ROSC survived to hospital discharge. This is in contrast with comatose patients after ROSC of whom only 60% survived to hospital discharge and only 37% regained acceptable neurologic recovery.

Accordingly, there are two very distinct subgroups of patients with resuscitated out-of-hospital cardiac arrest in terms of prognosis which should be separately reported. Conscious patients immediately after ROSC, which constitute up to 20% of patients, have excellent hospital survival providing that they undergo immediate coronary angiography and PCI if indicated.
AP195

Therapeutic hypothermia after sudden cardiac arrest: Is endothelial function compromised during treatment?
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Background: Cardiac arrest outside the hospital is associated with poor prognosis. Therapeutic hypothermia was shown to have a neuroprotective effect and can improve outcome. However, a possible effect of hypothermia on vascular function of peripheral arteries is not known. This study aimed to assess endothelial function during therapeutic hypothermia in a patient survivor of an out-of-hospital cardiac arrest.

Methods: Carotid artery distensibility, carotid blood flow and brachial flow-mediated vasodilation were evaluated using a non-invasive approach with ultrasound during hypothermia and after rewarming.

Results: Carotid artery distensibility and carotid blood flow evaluation during hypothermia (32.6 °C) and after rewarming (37.1 °C) were similar. Flow-mediated vasodilation of brachial artery was 20.8 ± 2.3% increased during hypothermia and 8.9 ± 3.5% after rewarming. The baseline brachial artery diameter was reduced during low temperature compared with normothermia.

Conclusion: Preserved endothelial function was observed in a patient after cardiac arrest during therapeutic hypothermia. This can be an important mechanism to preserve organ perfusion.

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AP196

Which patient should not be denied for primary percutaneous coronary intervention after out-of-hospital cardiac arrest?
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Introduction: In OHCA patients, decision-making on urgent coronary angiography remains challenging. Therefore, we examined the demographic differences in OHCA patients who underwent primary percutaneous coronary intervention (PCI) or not.

Materials and methods: With IRB approval, we prospectively collected demographic data between April 2011 and March 2013 of 57 OHCA patients. Utstein CPR data and medical charts were used to collect these data. Survivor is defined as survivor at hospital discharge. Mann–Whitney test, Student-t test and Pearson Chi-square were utilized for comparison of PCI and non-PCI data expressed as number (%), mean (±SD) and median (25th–75th percentile).

Results: Of the 57 patients, 43 were transferred for urgent coronary angiography and 26 underwent PCI. There was no difference in mean age and gender between the PCI group and the non-PCI group, respectively 62 yr (±13) and 63 yr (±15) (p = 0.900) and 19 (73%) and 22 (71%) male patients (p = 0.860). A significant difference was observed in asystole as initial rhythm (p = 0.042), active smoking (p = 0.031), maximum troponin value (p < 0.001) and ST-elevation on initial electrocardiography (ECG) (p < 0.003). Of the 14 patients, who initially were not transferred for coronary angiography, 5 (36%) were transferred later during the hospital stay and 3 underwent PCI in second time. No significant difference is observed in medical history of acute myocardial infarction, coronary artery bypass graft, presence of pacemaker, arterial hypertension, peripheral vascular disease, chronic kidney failure, diabetes, cerebrovascular accident, hypercholesterolemia and cardiomyopathy. Also, there was no significant difference in survival and need for intra-aortic balloon pump.

Conclusion: Patients with return of spontaneous circulation after OHCA with ST-elevation on ECG, high troponin and initial rhythm of ventricular fibrillation should be transferred to coronary angiography for PCI treatment.

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AP197

Therapeutic hypothermia after cardiopulmonary arrest in neonates and children: A prospective series
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Purpose of the study: Despite compelling evidence showing that therapeutic hypothermia (TH) improves outcome in neonatal hypoxic-ischaemic encephalopathy and in adults with ventricular fibrillation or tachycardia associated cardiac arrest (CA), there are lacking evidence in paediatric patients with return of spontaneous circulation (ROSC) CA. Due to differences in etiology and pathophysiology of CA across ages, results in neonates and adults must not be extrapolated to children. Furthermore, a new randomized trial on adults, concluded that there is no significant difference between a near-normal temperature (36 °C) and induced hypothermia. For these reasons it is important to establish whether children with cardiac arrest should be treated with TH.

Materials and methods: This observational prospective study was conducted in post-ROSC patients admitted to our PICU from January 2012 to December 2013. According to our protocol, using a servo-controlled cooling device, target temperature (32–34 °C) was gained quickly and maintained for 24/36 h.

Results: Thirteen patients were included, mean age was 73.8 months (IQR 1.6–171.5), RCP duration was 32 ± 14.5 min and the gap between RCP and the start of hypothermia was 3.2 ± 1.0 h. Length of mechanical ventilation was 180 hours (IQR 72–264), PICU stay was 13.3 days (IQR 3.5–23), VIS score was 30.1 ± 11.7. Eight patients survived with Glasgow Outcome Scale 3.5 ± 0.7. A significant inverse correlation was found between survival and VIS24 (r = 0.74, p = 0.013) and PRISM-III24 (r = 0.64, p = 0.043). At 3 months follow-up, Paediatric Cerebral Performance Category score was ≤2 in 5 patients.
**Conclusions:** This study supports TH in children with ROSC but further studies are needed to assess its safety and efficacy.

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**AP198**

**The patient journey through a hospital with high survival rates for ventricular fibrillation out-of-hospital cardiac arrest**

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**Background:** Little is known about the transition through hospital for patients presenting with ventricular fibrillation out-of-hospital cardiac arrest (VF-OHCA) beyond intensive care units (ICU). We aimed to describe the complete patient journey through a hospital with high survival rates for VF-OHCA.

**Methods:** Data were obtained from the Victorian Cardiac Arrest Registry (VACAR) and hospital audit for consecutive non-traumatic VF-OHCA patients admitted to a tertiary-referral hospital in metropolitan Melbourne (Australia) between September 2010 and August 2013.

**Results:** Over the study period, 97 VF-OHCA admissions were eligible: mean age = 62 years (SD = 18), 81% were male and 93% were previously independent. A prehospital return to spontaneous circulation (ROSC) >20 min was achieved in 89 (92%) and the median arrest duration was 19 min (range = 1–108). Treated re-arrrests after any ROSC occurred in 22% of patients prehospital, 4% in ED and 3% after admission. The 86 (89%) patients who survived in the ED were admitted to ICU (n = 69), cardiology ward (n = 15) or for palliation (n = 2). ED deaths were patients with ongoing CPR declared dead after arrival (n = 6), palliatively cared (n = 3) or unsuccessfully resuscitated re-arrests (n = 2). The majority of admitted cases received cardiac angiography/intervention (62%); −41% urgently) and all eligible ICU patients received therapeutic hypothermia. Survival to hospital discharge was 63% overall (71% in witnessed) and 71% in admitted patients (65% in ICU admissions and 94% in ward admissions). Most survivors (n = 62) were discharged to their usual residence after hospitalisation (80%, including two discharged home for palliation) or inpatient rehabilitation (16%), the remainder were unknown (2%) and one was discharged to a high-level-care home. Five patients donated organs.

**Conclusions:** We observed excellent survival rates for adult non-traumatic VF-OHCA, with most survivors discharged home. The next phase will examine the impact of introducing a post-arrest team and protocol to guide care from hospital arrival and will examine neurological outcomes.

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**AP199**

**Association of blood glucose at admission with therapeutic hypothermia after cardiac arrest**

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**Background:** It is well known that hyperglycemia is associated with poor outcomes in critically ill patients. We investigated the association between blood glucose level at admission and the outcomes of patients treated with therapeutic hypothermia after cardiac arrest.

**Methods:** A total of 883 cardiac arrest patients who were treated with therapeutic hypothermia were analyzed from the Korean Hypothermia Network (KORHN) retrospective registry. We examined the association of blood glucose at admission with survival and neurologic outcomes at hospital discharge. Neurologic outcomes were assessed with the Cerebral Performance Category (CPC), and favorable neurologic outcomes were defined as CPC scores of 1 and 2.

**Results:** The mean age of the sample was 56.7 ± 16.2 years, 69.5% of subjects were male, and the mean blood glucose at admission was 14.1 ± 7.0 mmol/L. After adjustment for sex, age, history of diabetes mellitus, hypertension, renal disease and stroke, time from arrest to ROSC, initial rhythm, witness status, bystander CPR, cause of arrest and cumulative dose of adrenaline, the associations between blood glucose and outcomes were as follows: for favorable neurologic outcomes, an OR of 0.955 (95% CI, 0.918–0.994); and for survival, an OR of 0.974 (95% CI, 0.952–0.996).

**Conclusion:** These results show that blood glucose level at admission is associated with survival and favorable neurologic outcomes at hospital discharge in patients treated with therapeutic hypothermia after cardiac arrest. Blood glucose level at admission could be a surrogate marker of ischemic insult severity during cardiac arrest. However, randomized, controlled evidence is needed to address the significance of tight glucose control during therapeutic hypothermia after cardiac arrest.

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**AP200**

**Nursing interventions in emergency medical service: CPR cases**

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**Introduction:** Competencies of the nurse in prehospitalary patient care in critical situation of CPR have traditionally focused on the development of technical skills with a predominantly biomedical approach. The conceptual change of prehospitalary critical care must be inspired in Nursing Process to recognize human needs, making responsible evidence based decisions to
provide high scientific, technical and human quality nursing care. In conclusion, we “can” and we “must” provide integral and holistic care in out-of-hospital emergencies.

Methods/material: Retrospective and descriptive study, analyzing nursing interventions (recorded under NIC Taxonomy) in CPR patients assisted by Emergency Medical Service EPES 061, Department of Jaen, during 2013. Total study population = 65 cases.

Objective: To evidence interventions recorded under NIC Taxonomy in CPR patients assisted by Emergency Medical Service EPES 061. Department of Jaen, during 2013. NIC = Nursing Interventions Classification.

Results: 65 medical records were analyzed (100%). The results show a significant prevalence of interventions that belong to the Domains: Physiological (basic and complex) and Security. However, we must recognize as notable other interventions like “Family support”, “Facilitate family presence” or “Protecting patient rights”, from Family and Health System domains. These nursing interventions appear in 72.9% of the analyzed records.

Conclusions: Although most of the recorded interventions result predictable (in fact, they are recommended as essentials for emergencies by the NIC Taxonomy) there is also a strong presence of interventions from another domains, which might result unthinkable to appear in the emergency context in previous stages. These nursing interventions show an integral and holistic out-of-hospital critical care provided to patients and families.

Further reading


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AP201

Epinephrine during cardiac arrest may worsen the outcome of resuscitated patients

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Background: Epinephrine is widely used during pre-hospital care for out-of-hospital cardiac arrest patients (OHCA). Although epinephrine can increase the likelihood of achieving successful return of spontaneous circulation (ROSC), the influence of this drug on recovery during the post-resuscitation phase is debatable. To address this question, we investigate the relationship between prehospital epinephrine use and functional survival among OHCA patients who achieved successful ROSC.

Methods and results: We included all non-traumatic OHCA with successful ROSC admitted in a cardiac arrest centre from January 2000 to May 2012. Epinephrine use was coded as (Yes/No) as well as according to dose (none, 1 mg, 2.5–5 mg >5 mg). Favourable discharge outcome was coded for patients with a Cerebral Performance Category (1 or 2). Analyses used multivariable logistic regression, propensity scoring and matching methods. Among the 1556 eligible patients, 1134 (73%) received epinephrine. Among them, 194 (1134 (19%) had a good outcome vs. 255/422(63%) in non-treated group (p < 0.001). Odds ratios associating use of epinephrine with good outcome were respectively 0.32 [0.22–0.47] after adjustment and 0.33 [0.19–0.58] in propensity-matched patients. The adverse association of epinephrine was observed among those who received hypothermia 0.31 [0.20–0.48] and among those not receiving hypothermia 0.37 [0.15–0.92]. Compared to patients who did not receive epinephrine, the adjusted odds ratio of intact survival was 0.48 [0.27–0.84] for 1 mg epinephrine dose, 0.30 [0.20–0.47] for 2–5 mg epinephrine dose, and 0.23 [0.14–0.37] for >5 mg epinephrine dose.

Conclusion: In this large cohort of patients who achieved ROSC, prehospital epinephrine was consistently associated with a lower chance of survival, an association that demonstrated a dose-effect and persisted despite post-resuscitation interventions. Taken in context with other studies, these findings support the need for additional investigation testing if and how epinephrine may provide long-term functional survival benefit.

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AP202

Intensified postresuscitation treatment in comatose survivors of out-of-hospital cardiac arrest—Difference between shockable and non-shockable rhythm

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We compared hospital outcome of consecutive comatose survivors of out-of-hospital cardiac arrest with shockable rhythm to comatose survivors with non-shockable rhythm, admitted to our hospital between 1995 and 2012. A total of 825 consecutive comatose survivors of OHCA were admitted. Overall, there were 580 patients with initially shockable rhythms (70%) and 245 with non-shockable rhythms (30%).

In patients with shockable rhythm postresuscitation treatment was essentially limited to vasopressors/inotropes between 1995 and 1997, and was gradually intensified with most striking increase after systematic introduction of hypothermia in 2004. Accordingly, in 2012, hypothermia was used in 100%, immediate coronary angiography performed in 93%, PCI in 57%, IABP inserted in 31% and vasopressors/inotropes implemented in 83%. During initial years, there were significant variations in survival and survival with CPC 1–2 which stabilized during the last 4 years at around 70% and 50%, respectively.

In patients with non-shockable rhythm utilization of immediate invasive coronary strategy and IABP also significantly increased after systematic introduction of hypothermia in 2004. In 2012, hypothermia was used in 79%, immediate coronary angiography performed in 74%, PCI in 47% and IABP inserted in 21% with concomitant use of vasopressors/inotropes in 100%. There was a considerable annual variation in survival and survival with CPC 1–2 during the study period. Survival and survival with CPC 1–2 was 28% and 33% (p = 0.48) before and 7% and 9% (p = 0.27) after introduction of hypothermia and intensified postresuscitation treatment.
With intensified hospital treatment, survival and survival with CPC 1–2 significantly improved in patients with shockable rhythm, but in patients with non-shockable rhythm however, it did not change significantly and was much lower than in the group with shockable rhythms.

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Prevention of Cardiac Arrest

AP203

Using Root Cause Analysis (RCA) following resuscitation to reduce futile attempts

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Purpose: Hospitals in the UK have set a key performance target, aimed at reducing the incidence of cardiac arrest. The 2012 NCEPOD “time to intervene” study1 identified in hospital survival rates from cardiac arrest to be 15% and made a recommendation that the CPR status of all acute admissions should be considered and recorded.

Method: Following review of the NCEPOD study it was agreed to implement an RCA process for all cardiac arrest attempts in general wards and departments (level one care areas). The Ward Sister and Lead Clinician are asked to review the patient episode, complete and return the RCA proforma within 30 days, to the Resuscitation Service. The RCA is reviewed by a Resuscitation Officer as a second tier reviewer and either accepted or returned for further investigation. As part of the RCA, investigators are asked “In your opinion, was this cardiac arrest call avoidable/unavoidable?”

Results: 105 completed RCA forms were received in 2013. The chart shows the number of 2222 calls categorised as unavoidable and avoidable events. The avoidable events were subdivided into failure to escalate care, failure to document a ceiling of care and no decision relation to Do Not Attempt Cardiopulmonary Resuscitation.

Conclusion: The RCA is helpful in identifying organisational or departmental based problems. Individual results are shared at department and team level, with the collated data presented quarterly to the Trust. Hopefully this will lead to the promotion of Consultant lead individualised patient care across our organisation. This should lead to a reduction of futile resuscitation attempts measured by a decrease in resuscitation team visits, allowing for an appropriate end of life plan of care. We would also expect this to improve our data within the National Cardiac Arrest Audit.2

References


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AP204

Basic life support skills of junior high school students before and after cardiopulmonary resuscitation training with a musical video: An intervention study

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Purpose: In this study, we evaluated if a brief, humorous CPR song and video could improve the knowledge of basic life support (BLS) for middle school students.

Materials and methods: This randomized, prospective, interventional controlled study, enrolled middle graders (ranging from 12 to 14 years of age) from two middle schools randomly chosen in Córdoba, Andalucia, Spain, the study included 604 teenagers (mean age 13.6 ± 1.4 years). Students were randomized into 2 groups: control group in which students completed a 2-h training course that provided theoretical background on sudden cardiac death (SCD) and a hands-on CPR tutorial knowledge prior to any class on CPR (control, N = 35) and intervention group (N = 87) in which students completed the 2-h training course plus a CPR song and video performed by local actors and providing a full summary of the CPR sequence beginning with safety checks and ending with CPR performed at the 30:2 compression-to-ventilation ratio, which closely follows the sequence of adult BLS described in the 2010 European Resuscitation Council guidelines. One and eight months later, we assessed the knowledge retention rate of the participants with a BLS performance score.

Results: Before the training, 19.5% of students performed chest compressions as compared to 99.2% post-training (p < 0.05). At the eight-month follow-up, 97% of students still performed correct chest compressions. On global knowledge of CPR, there were no significant differences between the intervention group and the control group in the trial pre intervention and month post-intervention. However, at 8 months there were significant differences with a p-value = 0.025 (intervention group 95% CI: 6.39–7.13 vs. control group 95% CI: 4.7–5.92) with a F value of 3.790 in the analysis of variance for repeated measures. In addition, significant differences in relation to questions about chest compressions at 8 months post intervention (p = 0.012; F = 4.578 of analysis of variance).

Conclusions: BLS training in high school seems highly effective considering the minimal amount of previous knowledge the students possess. We observed significant improvement and a good retention rate eight months after training in the intervention group. Our study shows that incorporating the song and video component in the CPR education increased its effectiveness. Increasing the number of trained students may minimize the reluctance to conduct bystander CPR and increase the number of positive outcomes after sudden cardiopulmonary collapse.

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The Medical Emergency Team in a university-affiliated hospital: The past, the present and the future

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Purpose of the study: To describe the evolution from our cardiac arrest team (CAT) to Medical Emergency Team (MET) and analyze all calls and its outcomes.

Materials and methods: Retrospective cohort study from January 1995 to July 2013.

Results: In 1994 the first national cardiac arrest team was organized in this hospital, although calls only started to be registered in 1995. This organization remained like this until 2010 when a MET system was implemented. Activation of the MET team was made by pre-determined and publicized criteria. Part of the implementation included mass training in BLS and early recognition of the activation criteria. Between 1995 and 2010, the CAT was activated 1820 times. Activation for non-cardiac arrest situations steadily increased, reaching 60% of all calls in the last 3 years which prompt the readjustment of the CAT to MET (Fig. 1) Since 2011 the MET was activated 630 times, only 25% were for CA, 464 activations were due to other criteria. The median time that the team stayed with the patient was 35 (20–50) min. After MET intervention: 30% stayed in the same place (ward), 9.2% were admitted into ICU, 7.8% were transferred to high dependency units. At hospital discharge 15% of patients who were attended due to CA scenarios and 44% of those that needed MET intervention due to other criteria were alive.

Conclusions: The evolution from cardiac arrest team to MET system was profitable as showed by a decrease in the number of activations for cardiac arrest. From those that survived, most of them remained in the ward. Following new technologies the implementation of an online register system will allow periodic audits and monitoring in order to continuously improve of the process.

Prognostication

PCT levels as predictors of neurological outcome in patients with cardiac arrest treated with therapeutic hypothermia: A retrospective study

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Background/objective: Procalcitonin (PCT) is a biomarker that is widely used to identify bacterial infections, confirm a diagnosis of sepsis, to monitor response to antibacterial therapy, and to assess general inflammatory response. Our goal was to assess the use of PCT levels as predictors of neurological outcome in patients who suffered cardiac arrest (CA) and underwent mild therapeutic hypothermia at 32 °C for a period of 24 h (TH).

Methods: 51 patients with CA who underwent TH were enrolled. 3 PCT measurements were obtained: (PCT-1 prior to TH, PCT-2 during TH and PCT-3 after TH). Neurological outcome was evaluated with the Cerebral Performance Category (CPC). The mean PCT was obtained in each measurement (PCT1, PCT2 and PCT3) and was correlated to neurological assessment after TH treatment was completed.

Results: 31.7% of our patients had CPC 1, 7.84% had CPC 2, and 58.82% had CPC > 3 and average PCT levels in patients with CPC 1 were: PCT 1 = 1.69; PCT 2 = 2.46; PCT 3 = 1.48. PCT levels in patients with CPC 2 were: PCT 1 = 0.59; PCT 2 = 0.21; PCT 3 = 1.57. PCT levels in patients with CPC > 3 were: PCT 1 = 3.81; PCT 2 = 5.4 and PCT 3 = 4.1.

Conclusion: Our study shows a significant correlation between PCT levels and neurological outcome in CA patients treated with TH. Lower PCT levels were correlated with CPC 1–2, while higher PCT predicted CPC > 3. PCT levels could potentially be used to predict neurological outcome in CA patients treated with TH after CA.

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Factors influencing the decision to complete a do not attempt cardiopulmonary resuscitation order

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Introduction: “Do not attempt cardiopulmonary resuscitation” (DNACPR) orders are completed based on multiple patient characteristics in anticipation of deterioration. The 2010 European Resuscitation Council (ERC) guidelines stipulate that “resuscitation should not be attempted in obviously futile cases.” The effect of age on outcome following attempted cardiopulmonary resuscitation is controversial. We were interested in the role that advancing age in patients...
age plays in the decision by clinicians to complete a DNACPR form based on perceived futility.

**Methods:** Medical, surgical and anaesthetic consultants from 12 hospitals in England were asked to decide if a DNACPR form should be completed based on perceived futility for a single patient case. To investigate the effect of age on these predictions, clinicians were randomly assigned to one of two versions of the patient case, varying in age but otherwise identical (60 years vs. 95 years). Rates of DNACPR order were compared between groups.

**Results:** Two hundred and ninety one questionnaires were returned. Overall, clinicians were significantly more likely to complete a DNACPR form for a 95-year-old patient than a 60-year-old patient, when all other factors are equal (66% vs. 6.8%, p < 0.001). This finding was not affected by speciality or experience of the consultant. Surgeons were found to be significantly less likely to complete a DNACPR order in the older patient compared to other consultants (45% vs. 71%, p < 0.05). Conversely, anaesthetists were generally more likely than other consultants to complete a DNACPR order in the younger patient (14.7% vs. 4%, p = 0.1).

**Conclusion:** We have found age to be a highly significant independent factor in a clinicians’ decision to withhold CPR. ERC guidelines suggest that age is only a weak independent predictor of outcome following cardiac arrest. We have also demonstrated a variation in practice between specialities. These findings have implications for both practice and policy.

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AP208

**Attendance timings are related to survival in out-of-hospital cardiac arrests**

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**Purpose:** To evaluate attendance timings, out- and in-hospital characteristics and survival upon admission and at discharge of cardiac arrests attended by a mobile intensive care unit in Asturias (Spain) in 2010.

**Materials and methods:** An observational trial was carried out involving a cohort of out-hospital cardiac arrests (OHCA) occurring in the health care area IV of the Principality of Asturias in 2010. All patients with OHCA and attended by a mobile intensive care unit were considered. Attendance timings were recorded: time of cardiac arrest, 112 phone call, BLS (basic life support), arrival of mobile intensive care unit, ALS (advanced life support), defibrillation, ROSC (recovery of spontaneous circulation) and total length of BLS, ALS, CPR (cardiopulmonary resuscitation) and cardiac arrest. Demographic data, etiology of cardiac arrest, in-hospital evolution and survival upon admission, at discharge and after one year were also registered. Bayesian method for statistical analysis was performed.

**Results:** A total of 120 patients underwent CPR by the mobile intensive care unit team. Sixty-six of these cases (55%) were caused by presumed heart disease. A total of 63 patients (52.5%) recovered spontaneous circulation, and 51 (42.5%) maintained circulation upon admission to hospital. Thirteen patients (10.8%) were discharged alive. After one year, 11 patients were still alive (9.2%) – 9 of them (7.5%) with a Cerebral Performance Category (CPC) score of 1. Short intervals of the four steps of the chain of survival were related to increased survival upon admission with a posterior probability > 80%. In the same way, the survival at discharge was better (probability > 90%), with the exception of cardiac arrest – defibrillation interval (77% probability, 95% credible interval (CrI) 5.81–2.62). Length of cardiac arrest and CPR was related to decreased survival upon admission and at discharge with a posterior probability > 99%. Adjustment by initial rhythm and witnessed cardiac arrest showed that length of cardiac arrest was related to worse survival at discharge (OR: 0.89; 95% CrI 0.82–0.95).

**Conclusions:** Short attendance timings of a mobile intensive care unit were related to better survival upon hospital admission and at discharge.

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AP209

**Neuron-specific enolase is a strong predictor of neurological outcomes in cardiac arrest survivors treated with endovascular hypothermia**

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**Objective:** Outcomes prediction after cardiac arrest remains challenging despite the rapid progress in the management of cardiac arrest survivors (CAS) during the past years. The prognostic value of neuron-specific enolase (NSE) in CAS treated with endovascular hypothermia is still not fully understood.

**Methods:** We analyzed a group of 97 CAS treated with endovascular hypothermia, in whom NSE levels were assessed during the first 96 h of hospitalization. Neurological outcomes (according to Cerebral Performance Category (CPC)) were evaluated at hospital discharge or at day 30 if patient still hospitalized.

**Results:** NSE was measured in 40 pts at day 1 (D1); in 63 pts at day 2 (D2); in 59 pts at day 3 (D3), and in 51 pts at day 4 (D4). The optimal cut off value for prediction of poor neurological outcomes (CPC 3–5) were >22.3 μg/l at D1 (sensitivity 59.1, specificity 94.4, area under the ROC curve [AUC] 0.779; 95% confidence interval [CI] 0.620–0.895; P = 0.0002), >27.6 μg/l at D2 (sensitivity 80.8, specificity 91.9, AUC 0.921, 95%CI 0.825–0.974; P < 0.0001), >24.2 μg/l at D3 (sensitivity 85.7, specificity 97.4, AUC 0.971, 95%CI 0.890–0.997, P < 0.0001) and >20.8 μg/l at D4 (sensitivity 93.8, specificity 94.3, AUC 0.975, 95% CI 0.887–0.999, P < 0.0001). The NSE value of >50.2 μg/l measured at any time during the first 96 h after cardiac arrest predicted poor neurological outcome with 100% specificity and 55% sensitivity.

**Conclusions:** NSE is a strong prognostic marker in CAS treated with endovascular hypothermia with highest predictive value at D3 and D4. The NSE level of >50.2 μg/l predicted poor neurological outcomes with 100% specificity.

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AP210

Acute pulmonary embolism as cause of cardiac arrest: Presentation and prognosis

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Background: Acute pulmonary embolism (APE) is a common life threatening emergency and often diagnosis is established only by autopsy.

Purpose: The aim of our study is to determine prognosis of cardiac arrest occurring during the initial management of APE.

Materials and methods: We conducted a prospective, cohort study, 1 January 2004–31 December 2010, including patients with cardiac arrest after APE admitted to the I st Medical Cardiology Clinic of “St. Spiridon” Hospital Iasi Romania. Clinical presentation, initial electrocardiogram rhythm, therapy, and early outcomes were analyzed.

Results: During the study period, we enrolled 78 patients with cardiac arrest after APE. The diagnosis of APE was confirmed by echocardiography during cardiopulmonary resuscitation or by autopsy. In 20 patients (25.64%), the diagnosis of APE was established only postmortem. Operating sequence of cardiopulmonary resuscitation was according to the guidelines of the European Resuscitation Council. Mean age of the patients was 62.05 ± 9 years. Delay symptoms-first medical contact was 45 ± 3 h. The most common symptom before installing cardiac arrest was: pulseless electrical activity in 37 (73.07%), asystole in 8 (16.66%) and ventricular tachycardia in 7 (8.97%) and ventricular fibrillation in 6 (7.69%) of the cases. Patients received treatment with mechanical ventilation in 78 (100%), epinephrine in 78 (100%), external defibrillation in 13 (16.66%), amiodarone in 13 (16.66%) and thrombolytic infusion in 7 (8.97%) of the cases. All 78 patients died during hospital stay (100%).

Conclusion: Accurate and immediate diagnosis of APE still remains a difficult challenge for clinicians. Mortality in cardiac arrest caused by APE is high.

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AP211

C-Reactive Protein is a biomarker for neurological outcome in patients undergoing therapeutic hypothermia

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Background/objective: To assess the predictive value of C-reactive protein (CRP) as a biomarker for neurological outcome in patients treated with therapeutic hypothermia (TH) after a cardiac arrest (CA).

Methods: 45 patients underwent TH after witnessed OHCA. CRP levels were measured on admission (CRP-1), prior to initiation of TH (CRP-2) and post TH (CRP-3). Neurological outcomes were assessed using the Cerebral Performance Categories Scale (CPC). We defined CRP as normal if level was < 1.0 mg/L, moderately elevated at levels between 1.0 and 3.0 mg/L and elevated at levels > 3.0 mg/L.

Results: Of the 45 patients treated with TH, 33.3% had no neurologic deficits (CPC 1), 66% had mild neurological abnormalities (CPC 2) and 60% died or had severe neurological deficits (CPC 3–5). Of the patients with no neurological deficit, 6.6% had normal CRP-1 level, while the rest had abnormal CRP-2 and CRP-3 levels. None of the patients who had mild or severe neurological deficits had a normal CRP-1, 2 or 3. Of the patients without neurological deficits, 26.6% had moderately elevated CRP-1. Of the patients with mild neurological deficits, none had moderately elevated CRP-1, 2 or 3. Of the patients with CPC > 3, 11.1% had moderately elevated CRP-1 and all had an elevated CRP-2. All patients regardless of their CPC had elevated CRP-3.

Conclusions: Normal and (only) moderately elevated levels of CRP upon admission were associated with better neurological outcomes in patients with CA treated with TH. All CA patients had elevated CRP levels at later stages of hospital admission. We suggest that CRP may represent a new prognostic tool for patients with a CA that are treated with TH.

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AP212

Increased mean platelet volume and leukocytosis new predictors of mortality in acute pulmonary embolism

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Background: Acute pulmonary embolism is a life threatening disease and one of the main causes of in-hospital mortality. Hemogram which is widely available in clinical practice can indicate values of mean platelet volume, a simple and reliable indicator of platelet size that correlates with platelet activation, and also leukocytes count, marker of inflammatory response. These parameters are potentially useful biomarkers for in-hospital mortality in patients with acute pulmonary embolism.

Aim: The purpose of our study was to assess the level of leukocytosis and increase mean platelet volume in acute pulmonary embolism and establish the prognostic role of these parameters for in-hospital mortality in patients with acute pulmonary embolism.

Methods: We conducted a prospective, cohort study, between 1 January 2004 and 31 December 2010. The patients with acute pulmonary embolism, admitted in the Ist Medical Cardiology Clinic, in “St Spiridon” University Hospital, Iasi were included. The blood samples for hemogram were collected.

Results: The cohort consisted of 362 patients with acute pulmonary embolism. The mortality was 21.54% (No = 78 deaths). The diagnosis of acute pulmonary embolism was confirmed by echocardiography, by computer tomography or by autopsy. Mean values of leukocytes was 14859.54 mm−3, and for mean platelet volume was 14.3 fl−1. Multivariable analysis showed that increased mean platelet volume and leukocytosis were independent mortality predictors for in-hospital mortality in acute pulmonary embolism (p<0.05).

Conclusion: Increased mean platelet volume and leukocytosis are independent predictors for in-hospital mortality in acute pulmonary embolism.

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AP213

Prognostic evaluation in patients after CPR of cardiac cause by therapeutic hypothermia in coronary care unit of a Hospital University Cruces

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Purpose of study: Analyze prognosis and characteristics of patients who have suffered from a cardio-respiratory failure out of hospital undergoing therapeutic hypothermia.

Material and methods: Retrospective transverse study of 49 patients admitted from 2011 with CPR diagnosis subject to hypothermia fulfilling inclusion criteria.

Results: 38 men (77.55%) and 11 women (22.45%) were studied. The average person was 60.63 years old (11.78), 17 people were under 53 years (34.69), 15 between 53–65 (30.61), and 17 older than 65 (∗34.69). The admission time of 50% was 13 days (∗15,136). Time from the beginning of the CPR to the monitoring of 50% was 10 min (∗11,666). Time between monitoring beginning until hypothermia beginning in 50% was 20 min (∗20,174). 14 People died (28.57%) and 35 survived (71.43%).

Conclusions: Hypothermia is an option that should be considered in the context of a protocol for comprehensive care to this kind of patients that ranges from the first outpatient care to the overheating phase.

Further reading
3. Heard K, et al. A randomized controlled trial comparing the arctic sun to standard circulation until hypothermia beginning in 50% was 20 min (∗20,174).

Results: 38 men (77.55%) and 11 women (22.45%) were studied. The average person was 60.63 years old (11.78), 17 people were under 53 years (34.69), 15 between 53–65 (30.61), and 17 older than 65 (∗34.69). The admission time of 50% was 13 days (∗15,136). Time from the beginning of the CPR to the monitoring of 50% was 10 min (∗11,666). Time between monitoring beginning until hypothermia beginning in 50% was 20 min (∗20,174). 14 People died (28.57%) and 35 survived (71.43%).

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Conclusions: Hypothermia is an option that should be considered in the context of a protocol for comprehensive care to this kind of patients that ranges from the first outpatient care to the overheating phase.
Results: Eighty scenarios and 80 teams of 4 PCP were evaluated. All teams identified the situation and severity. However, most of them had some problem with treatment: 90% administered oxygen and placed pulse-oximeter in first 2 min, but only 50% proceeded to manually open the airway. In 97% of cases, epinephrine was the initial drug, and it was administered in the first 10 min; however 93% of groups administered epinephrine by subcutaneous route. 90% of groups administered two epinephrine doses, 60% three and 30% four doses. 80% of groups obtained a venous access, and 20% an intraosseous route. 97% of groups administered fluid bolus, and 80% corticosteroids.

Conclusion: PCP identify the severity of a simulated anaphylactic reaction. However, they need to improve their capability to perform a prompt and sequential treatment, according to evidence-based recommendations. Training programs in pediatric emergencies should reinforce hands on sessions; in this sense, advanced simulation can be a tool to be considered.

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AP217

Generation of chest compression artefacts on the ECG and the thoracic impedance signals in a manikin model

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Introduction: Chest compressions (CCs) during cardiopulmonary resuscitation (CPR) induce an artefact in the ECG recorded through the defibrillation pads impeding a reliable rhythm analysis. An experimental study with dogs identified the electrode-skin interface as the source of this noise. We hypothesized that generating the CC-artefact in a manikin model is feasible.

Methods: We fixed two conductive-resistive rubber sheets to the chest of a manikin in anterolateral position, and attached a defibrillation pad to each sheet. The chest resistance was adjusted to 100Ω with a resistor connected between the sheets. Ten volunteers delivered CCs to the manikin following basic-life-support guidelines while human ECG was injected in the conductive surface. We recorded the ECG and the thoracic impedance (TI) from the defibrillation pads, the compression depth (CD) and the compression acceleration. We registered four 60s records per volunteer, each with different underlying ECGs.

Results: Fluctuations on the ECG and on the TI were observed during CCs. The median peak-to-peak amplitude of the artefact was 0.89 mV (IQR, 0.69–1.15) and 0.44 Ω (IQR, 0.33–0.60) on the ECG and on the TI, respectively. The amplitude and waveform of the artefact depended on the rescuer, pad type, contact area and type of conductive material.

Conclusions: A CC-artefact could be generated in the ECG and the TI in a manikin model, supporting the hypothesis stated in Ref.1. Studies are needed to quantify the influence of the factors mentioned above in the artefact characteristics. A thorough comparison of the generated artefact with the one appearing in human cardiac arrest episodes is also required. The system could be used to concept-prove algorithms processing the ECG, the TI, the CD and/or the acceleration signals during CCs and as a realistic CPR-protocol training environment.

Reference

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AP218

Debriefing emergency nurses after high-fidelity simulation team training in resuscitation

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Purpose of Study: To evaluate the preferred sequence of debriefing emergency nurses after high-fidelity simulation team training in resuscitation.

Materials and methods: Emergency medicine physicians and nurses had traditionally trained separately for resuscitation in our emergency department. The use of high fidelity mannequin changed the training curricula. Since 2012, both groups of pro-
Period.

The expression of GDNF was detected by immunohistochemical analysis on the 1st, 4th, 7th, and 14th days of the post-resuscitation period. Purkinje cells (PC) of the cerebellum were determined by morphological analysis, cardiac vascular bundle, followed by resuscitation. Total density of PC went 10-min circulatory arrest evoked by intrathoracic clamping of the heart. There were revealed the increasing of GDNF expression in neuronal populations of Purkinje cells. One of the issues surfaced was the preferred sequence to debriefing. We tried four different sequences to debriefing: (1) short team debrief together, (2) short team debrief followed by separate debrief for physicians and nurses, (3) separate debrief for physicians and nurses, (4) debrief team together and nurses had an additional debriefing session with nursing educators at the end of the training session. A survey was conducted. Five nursing educators and thirty nurses who had undergone team resuscitation training participated.

Results: Among the nursing educators, three chose Sequence (2) as the preferred sequence of debriefing. This is followed by Sequence (4). For the nurses, 97% preferred Sequence (2), the remaining 3% chose Sequence (3). The 4 sequences each has their own merit. In our culture, Sequence (1) did not work out because the debrief tend to be centred on the physicians, nurses took background. The majority of nurses preferred Sequence (2) because the initial debrief concentrate on team dynamics, e.g. team work and communications, and the second part of debrief discuss deeper details of individual skill competencies by the nursing educators.

Conclusions: We found that the preferred method of debriefing was that of a short combined debrief together to iron out the major issues, followed by a separate debriefing by the nursing educators to highlight details pertinent to the nursing skill set for the emergency nurses.

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AP219

Association of glial cell line-derived neurotrophic factor (GDNF) protein expression with the neuronal death in post-resuscitation period

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Purpose of the study: To evaluate an expression level of GDNF protein in hypoxia-sensitive neuronal population of Purkinje cells and its relationship with the neuronal death in post-resuscitation period.

Materials and methods: 40 adult white rats both sexes underwent 10-min circulatory arrest evoked by intrathoracic clamping of cardiac vascular bundle, followed by resuscitation. Total density of Purkinje cells (PC) of the cerebellum was determined by morphometric analysis in the 1st, 4th, 7th, and 14th days of post-resuscitative period. The expression of GDNF was detected by immunohistochemistry.

Results: There were revealed the increasing of GDNF expression in the PC population in males on the 1st day after cardiac arrest: the number of positive neurons increased by 70.0%, while the number of negative neurons decreased by 35.4%. The total number of PC was not changed. On the 4th postoperative day GDNF expression decreased: the number of positive neurons fell to the control level and the number of negative neurons was reduced by 32.3%. Reducing the GDNF expression accompanied by neuronal death (the total number of PC decreased by 16.6%). Subsequently (7, 14th days) GDNF expression was not changed, and the process of neuronal death did not enhanced. Thus the number of positive neurons did not differ from controls, while the number of negative neurons was reduced. There were found similar changes in females. However the GDNF expression level shifts, as well as neuronal cell death developed later than in males.

Conclusions: The results demonstrated association between changes in the level of GDNF protein expression and development of neuronal death in the post-resuscitation period. Initial rise of GDNF expression in neuronal populations can prevent neuronal death. The decrease of GDNF expression accompanied by the neuronal loss. The results indicate that the GDNF protein level is an important factor for sustainability of neurons to ischemia-reperfusion.

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AP220

Use of the “resuscitation team leader evaluation” to evaluate the leaders in paediatric CPR simulations

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Introduction and objective: “Resuscitation Team Leader Evaluation (RTLE) is an evaluation tool for the leaders of the CPR simulation, developed and validated by Grant et al. It consists of 26 items, 12 evaluate leadership and communication (LCS) and 14 knowledge and skills (KCS).

Objective: To evaluate the “Resuscitation Team Leader Evaluation”.

Material and methods: Descriptive study from September 2013 to January 2014. In our emergency service, CPR simulations were carried out, the traditional simulation (Laerdal Resuci Baby® and Resuci Junior®) and the advanced simulation (Laerdal Simbaby®), with the intervention as leaders of 3rd-year Paediatric Residents (R3) and 4th-year paediatric residents (R4), graduates in Paediatric CPR by the Spanish Group of Paediatric and neonatal CPR (GERCPyN). Each leader was evaluated by two Paediatric CPR instructors (GERCPyN). The instructors completed the RTLE for each leader. Analysis realized with the SPSS® 21 software.

Results: Twenty-six leaders participated. On 14 occasions, R4, and on 12 occasions, R3. The number of evaluators was 5. The mean score of the RTLE was 66.67 (SD = 3.81), of the LCS 63.89 (SD = 6.09), of the KCS 64.1 (SD = 5.99). For the R4, the mean score of the RTLE was 70.21% (SD = 4.1) and for the R3 66.5% (SD = 3.7) (p = 0.025). The correlation coefficient between total scores and evaluators was r = 0.846; p < 0.001. The weighted kappa was > 0.5 in 18 of the 24 items of the RTLE. The worst item evaluated was “Obtain full cardiorespiratory monitoring and full set of vitals promptly” (κ = 0.75 over 3, SD = 0.682), the best item evaluated was “Obtain full cardiorespiratory monitoring and full set of vitals promptly” (κ = 2.65 over 3, SD = 0.556). The Cronbach’s alpha for the set of the RTLE was 0.167, due to the sample size.

Conclusion: RTLE can be used as an effective tool for the evaluation of the leaders in the CPR simulations. The validation to Spanish by an existing tool would be advisable.

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AP221

Systematic evaluation of the intervention in the myocardial infarction with ST-elevation by primary care physicians

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Objectives: Assess the knowledge and skills of the primary care physicians to recognize the critical condition of a simulated patient with hemodynamic instability due to a myocardial infarction with ST-elevation (STEMI), and to provide the initial treatment.

Methods: A simulated clinical scenario of a STEMI was designed and performed with the Laerdal Simman 3G human simulator system. Forty-two (42) emergency teams developed the scenario. Each scenario was recorded and assessed.

Results: 100% of rhythms were recognized adequately (mean time: 9.6 s). Time to first shock: 63 s. Time between shocks: 2 min -10 s. Median dosage was 200 Jl. Mean time to start chest compressions: 30 s (37.9% < 12 s). 30/2 sequenCE: 83.3%. Compressions depth: 35.72 mm, rate: 108.6 min-1. Hands on: 76%. Sequence of drugs (0-1-2 score) based on ERC recommendations was: 1.46. Troubles in Defibrillator management were detected in 9.6% of the shocks, mainly in relation with pressure applied to paddles (41%) or technical/acknowledge of defibrillator (41.9%).

Conclusions: To improve the prognosis of sudden cardiac death, the precocious recognition and defibrillation as well as a high-quality cardiopulmonary resuscitation (CPR) are essential. In our study, the physicians recognized immediately the critical condition (mean time 9.6 s), but showed lacks of ability to provide precocious defibrillation (mean time 63 s), and a high-quality CPR. According to this data, the aim of the training programs should be the improvement in providing precocious defibrillation, and an early and high-quality CPR. In addition, the new training programs must be addressed to strengthen both the team and patient safety, and the trainees must learned to choose always the most secure and effective techniques to provide the adequate treatment.

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AP222

Role of high versus low fidelity simulation training in BLS teaching and learning process

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Objective: Compare two teaching methods with low (LFS) and high fidelity clinical simulation (HFS), to acquire competencies in Basic Life Support (BLS).

Methods: Experimental uncontrolled study pre and post-test were done through 3 questionnaires that assess knowledge of BLS. Trial subjects were first and second year students at University of Cantabria Nursing School (UCNS) and second year students at University Complutense of Madrid Nursing School (UCMNS).

Previously to study initiation students complete a pretest, that follows with a theoretical and practical session with conventional simulators. Experimental group (second year UCNS) received a HFS session. Posttest I and II were done a week and 6 months after respectively. Quantities variables with media and standard deviation, and categorists with absolute value and percentage are described. T-student test was used to compare between groups.

Results: 202 pretest assessment were 9.96 ± 2.64 for first year UCNS, 11.61 ± 3.15 for second year UCNS and 8.61 ± 2.64 for second year UCMS. After theoretical and practical teaching, posttest I results (n = 245) improves to 15.08 ± 1.8 for first year UCNS, 14.91 ± 1.97 for second year UCNS and 13.94 ± 2.10 for second year UCMS. Finally, 6 months later posttest II (n = 228) showed 14.34 ± 2.64 for first year UCNS, 16.53 ± 1.85 for second year UCNS and 14 ± 2.37 for second year UCMS. Six months later experimental group shows significant better knowledge persistence compared with control groups (p < 0.001).

Conclusions: BLS education with LFS is effective in reaching BLS competency. Additionally, HFS significantly improves both BLS learning process and its persistence 6 months later, which in our opinion would be related with HFS methodology (fidelity to reality, team-work, reflection process, analysis and discussion through debriefing, etc.)

Keywords: Education; Basic Life Support; Clinical simulation; Nursing; Competency

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Special Circumstances

AP223

Out of hospital refractory cardiac arrest treated with V-A Extracorporeal Membrane Oxygenation: An Italian tertiary care center experience

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Purpose of the study: Extracorporeal Membrane Oxygenation (ECMO) support has been suggested to improve the survival rate in patients with refractory out-of-hospital cardiac arrest. Aim of this paper is to describe our experience with venous arterial ECMO in these patients.

Materials and methods: retrospective, single centre, observational study from January to December 2013. The enrollment criteria for ECLS was refractory ventricular fibrillation/tachycardia or refractory pulseless electrical activity in patients rescued with automated chest compression device by advanced life support team.

Results and conclusions: In a 12 months period, Extracorporeal Life Support with ECMO was performed on 23 patients (19 male; mean age 52 years, range 14–75) suffering from out-of-hospital cardiac arrest. Implantation was successful in 100% of cases, and only one patient required surgical exposure of the femoral artery as primary strategy without any attempt to percutaneous puncture due to very small size. Two patients required distal leg reperfusion; left ventricular unloading was facilitated with Intra Aortic Balloon Pump (12 pats.) or IMPPELLA 2.5 (1 pat.). Mean duration of ECMO was 2.1 days. Overall survival was 8.6% (2 pats: one with complete neurological recovery, and one with severe disability); mortality was
91.4%, with 6 patients (26%) being brain dead. In three cases consent was obtained for multigorgan donation. Overall success, including surveyons and eligible patients for donation was therefore 34.6%. In conclusion, ECLS should be considered as a strategy to manage refractory cardiac arrest.

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AP224

Prolonged resuscitation in the cath-lab and long term follow-up

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In 2010 we published our initial experience, using mechanical CPR (MCC) for prolonged resuscitation efforts during simultaneous PCI treatment, where we presented a survival rate of 25% in this patient group. In this abstract we report the results of the following 4 years of patients admitted to the cath-lab with maintained circulation who sometime during the intervention suffered cardiac arrest and were in need of prolonged resuscitation efforts with MCC using the LUCAS™ device (Physio-Control Inc./Jolife AB Sweden) during simultaneous PCI. This also includes a long term follow up of all patients discharged from the cath-lab from both time periods. In the second time period (April 2009–April 2013) 32 patients were included (22 STEMI, 4 Non-STEMI, 1 LBBB, 2 planned PCI, 1 angiogram, 1 stent occlusion, 1 IABP) where 37.5% were women and the median (range) age was 71 years (33–96). Twenty-one patients were in cardiogenic shock prior to the arrest. Twenty-four of the 30 PCIs attempted were successful. Twenty five PCI interventions were performed during MCC. The presenting rhythm and survival distribution (rhythm = n (survival = n)) were: VT/VF = 5 (4), PEA = 13 (4), Asystole = 5 (3) and Bradycardia/Severe hypotension = 9 (4) in patients discharged from the cath-lab with ROSC. The presenting rhythm and survival distribution were: VT/VF = 5 (2), PEA = 13 (2), Asystole = 5 (2) and Bradycardia/Severe hypotension = 9 (2) in patients discharged from hospital alive. We hereby confirm a 25% survival rate in patients discharged from hospital alive combining MCC and PCI for prolonged resuscitation efforts in the cath-lab. The survival time of those patients discharged from the cath-lab with ROSC from both time periods ranged between 0 and 3096 days and among the patients discharged from hospital alive, the 6 month survival was 50% and one year survival was 47%. The survival distribution for patients discharged from the cath-lab with ROSC can be seen in Fig. 1.

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AP225

Carbon monoxide poisoning: Prognostic factors for delayed neuropsychiatric sequelae

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Purpose: Delayed neuropsychiatric sequelae (DNS) which are thought to arise from delayed post-hypoxic leukoencephalopathy commonly occur after a recovery from acute carbon monoxide (CO) poisoning. The early identification of patients with a high risk of DNS might improve their quality of care. This study was conducted to determine the prognostic factors for DNS in patients with CO poisoning.

Method: This prospective study included 200 patients with the CO poisoning January 2009 to December 2013. Magnetic resonance imaging (MRI) was performed in patients of 163 at admission. To determine the prognostic factors for DNS in the CO poisoning, we compared with clinical variables between patients with (n = 52) and without DNS (n = 148). DNS was considered present when patient had clinical symptoms and signs of DNS within 3 month after exposure of CO poisoning.

Results: DNS were occurred at a rate of 26.0%. The prognostic factors for DNS were loss of consciousness, duration of unconsciousness, Glasgow coma scale (GCS), neurologic deficits, hypotension, elevated cardiac enzyme at admission, and MRI findings at admission in univariate analysis (p < 0.05), but independent prognostic factor for DNS was initial MRI findings in the multivariate analysis (OR = 16.977, 95% CI = 3.051–94.476). The MRI abnormal findings were significantly associated with DNS in all groups of normobaric oxygen therapy and hyperbaric oxygen therapy. MRI revealed abnormalities in the globus pallidus (12.0%), deep white matter (8.5%), cerebral cortex (1.0%), hippocampus (0.5%), and cerebellum (1.0%) in patients with CO poisoning. Among the MRI abnormalities, lesions in the deep white matter (OR = 24.719, p = 0.000) and globus pallidus (OR = 7.062, p = 0.001) were significantly associated with DNS. The patients with DNS had good prognosis (activity of daily living of 1 and 2 grade) of 86.5% and mortality of 5.8% after 6 months.

Conclusion: This study demonstrated the utility of early MRI for the prediction of DNS.

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AP226

Ability of a diabetic problems protocol to predict patient severity indicators determined by on-scene EMS crews
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Purpose: Diabetes mellitus is a leading cause of human disease, with 25.8 million Americans affected. Diabetes can cause chronic or sudden signs and symptoms, which often result in observers calling 911 for assistance. The Emergency Dispatcher’s Interpretation of these calls affects dispatch triage and pre-arrival patient care. The purpose of this study is to determine the relationship between the EMDs’ assigned Medical Priority Dispatch System (MPDS) determinant codes and patient severity indicators as determined by paramedic (or EMT) on-scene findings and treatments.

Materials and methods: This was a retrospective study involving six hospitals in Salt Lake City (SLC), Utah, USA. Upon receipt of Institutional Review Board approval from all six hospitals, data were collected over a two-year period (2000–2001). All calls assigned to the MPDS Diabetic Problems Chief Complaint Protocol were included. Dispatch data and patient care reports were collected and examined. The association between MPDS determinant codes and patient severity measures was assessed at a 0.05 significance level.

Results: 714 patient-cases were analyzed, of which 99.3% (709/714) had specific MPDS code information recorded. Callers who had an abnormal breathing (MPDS code 13-C-3) medical condition had the highest “first” blood glucose levels, pulse rate, and respiratory rate. 50.4% of patients assigned a 13-D-1 determinant code (Unconscious) received Dextrose 50% (D50) treatment; these patients had the lowest (most severe) GCS scores overall. The group of cases assigned to the Not alert determinant code yielded the second-highest acuity.

Conclusions: This study showed a high association between the acuity levels determined by EMDs using the MPDS Diabetic Problems Protocol and paramedic (and EMT) on-scene findings. Patients coded as 13-D-1 (Unconscious) were likely to be hypoglycemic, and a large majority of them received D50 treatment. However, patients coded as 13-C-3 (Abnormal breathing) were more likely to be hyperglycemic.

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AP227

Outcome accuracy of the Emergency Medical Dispatcher’s initial selection of a Diabetic Problems protocol
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Introduction: Diabetes mellitus can cause acute, sudden symptoms requiring emergency intervention. Emergency medical dispatchers (EMDs) must identify true diabetic complaints in order to determine the correct care. In 911 systems utilizing the Medical Priority Dispatch System (MPDS), EMDs determine a patient’s chief complaint by matching the caller’s response to an initial prescripted question to the appropriate chief complaint.

Purpose: To determine the percentage of EMD-recorded patient cases (using the MPDS Diabetic Problems protocol) that were confirmed by attending paramedics or the hospital as experiencing a diabetic-triggered event.

Materials and methods: This was a retrospective study involving six hospitals, one fire department, and one ambulance service in Salt Lake City, Utah USA. One year of dispatch data recorded under the Diabetic Problems protocol, with associated paramedic and hospital outcome data, were analyzed. The outcome measures were: the percentage of cases that had diabetic history, percentage of EMD-identified diabetic problems cases confirmed by EMS and/or hospital records as true diabetic-triggered events, and percentage of EMD-identified diabetic patients with other medical conditions. A diabetic-triggered event was defined as one where the patient’s emergency was directly caused by diabetes or its medical management. Descriptive statistics were used for categorical measures and parametric statistical methods assessed the differences between study groups, for continuous measures.

Results: Three-hundred ninety-three patient cases were assigned to the Diabetic Problems Chief Complaint protocol. Of the 367 (93.4%) patients who had a documented history of diabetes, 279 (76%) were determined to have had a diabetic-triggered event. Only 12 (3.6%) initially assigned to this protocol did not have a confirmed history of diabetes.

Conclusions: Using the MPDS to select the Diabetic Problems Chief Complaint, the EMDs correctly identified true diabetic-triggered events the majority of the time. Many patients had other medical conditions, which complicated the initial classification of true diabetic-triggered events.

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AP228

A single-centre retrospective analysis of experiences training basic life support candidates with physical disability
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Students with a physical disability are a rare but important group of medical students. There has long been debate regarding the ability of these students to perform requisite practical tasks such as cardiopulmonary resuscitation (CPR). The General Medical Council (GMC) has recently stipulated that UK physicians and medical students may direct others to perform CPR, if they are unable to do so themselves due to physical disability. There is, however, no guidance regarding identification and training of candidates with physical disability. We sought to analyse the experiences of candidates sitting a basic life support (BLS) course in order to establish a recommended approach to trainees with physical disability.

The training records of 1659 first year healthcare undergraduates enrolled on the University of Birmingham’s novel peer-led BLS course were retrospectively assessed over a three year period between 1st September 2010 and 31st August 2013. Candidates with a physical disability sufficient to preclude effective CPR delivery were identified and the nature of their disability categorised as...
permanent or, transient if full function was restored within twelve months. Changes made to the timing or delivery of each candidate’s training were recorded and correlated with examination results and used to develop a training and assessment guideline.

Eight healthcare students were identified, seven had a transient physical impairment and had only the timing of their training altered. One candidate, a 19 year old female, had permanent physical disability affecting her upper limbs and she was therefore trained – and assessed on her ability – to instruct a lay-person to deliver CPR.

Physical disability may commonly be encountered amongst healthcare professionals during BLS training, but is rarely permanent. In instances where permanent disability exists, we recommend that candidates' training should be adapted to permit them to instruct a lay-person to deliver CPR.

### Further reading


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### AP229

**Patient management of emergencies medical services in patients with implantable cardioverter defibrillator. What about professionals should know?**

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**Introduction:** Emergency Medical Service (EMS) attends to patients who have suffered cardiac arrest (CPR) with an implantable defibrillator (ICD). ICD have become in one of the most important therapy for patients with high risk of lethal arrhythmias. Therefore, this type of patients has increased in the last years. In cities, such as Madrid, there is high probability to attend a patient with these characteristics. Survival and mobility depend on a correct initial management by the EMS. It is necessary to achieve technical and functional knowledge of these devices. The difficulty increases when the patient in cardiac arrest carries an ICD.

**Purpose of study:** We propose the creation of a procedure for these patients to be treated by paramedics.

**Methodology:** Literature review.

**Results:** Treatment of cardiac arrest in patients with an ICD should be the same as in a patient without it. It should assess the placement paddles or pads on the antero posterior position, being the safest and most effective.

The teams should know:

- the device and its parts (pulse generator, electrodes or cables and programmer).
- Device Types (unicameral, bicameral and other)
- Its function (bradyocardia – pacemaker – and antitachycardia including defibrillator)
- Possible anatomical positions

- Standard precautions for patients with this device (microwave, induction plates, mobile phones, metal detectors, contact with magnets)

**Conclusions:** The ignorance of Emergency team of the device status (unable to “device interrogation”) causes that the events have occurred is unknown (including therapies). If ICD does not work well (battery depletion, damage to the generator or bad detection), basic and advanced CPR should be performed as if you would apply in a patient who was not carrying this device. The deactivation of an ICD (using a magnet if available) is recommended only in patients in cardiac arrest for avoiding the inconvenience of being shocked during resuscitation.

**Further reading**


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### AP230

**Can hyperbaric-oxygen therapy improve neurologic deterioration at the early stage of acute carbon monoxide poisoning?**

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**Background:** Neurologic deteriorations due to hypoxic brain injury are not uncommon in acute phase of carbon monoxide (CO) intoxication. The effect of hyperbaric oxygen (HBO) therapy in acute phase CO intoxication is still controversial. The purpose of this study is to analyze the effect of HBO therapy in acute phase neurologic deteriorations with CO intoxication.

**Method:** This study was conducted to a retrospective design from January 2009 to July 2013. We suggest the severity score for estimating acute phase neuropsychologic status with CO intoxication (Table 1). Enrolled patients were analysed according to ANS score.

**Results:** 10 patients were excluded due to ANS 4. 32 patients were ANS 0, and 175 patients were ANS 1, 2 and 3. For ANS 2 and 3 patients, HBO therapy is effective in the recovery of acute phase neurophysiologic deteriorations (p = 0.03). The development of delayed neurological sequelae (DNS) was not influenced whether the application of HBO therapy or not.

**Conclusion:** HBO therapy is effective for the recovery of acute phase neuropsychologic deteriorations for ANS 2 and 3 with CO intoxication.

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Validating a pragmatic definition of shock in adult patients presenting to the emergency department

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**Objective:** The importance of the early recognition of shock in patients presenting to emergency departments is well recognized but at present there is no agreed practical definition for undifferentiated shock. The main aim of this study was to validate an ‘a priori’ clinical definition of shock against 28-day mortality.

**Design, setting and subjects:** This prospective, observational, cross-sectional, single-centre study was conducted in Hong Kong, China. Data was collected between 1 July 2012 and 31 January 2013. An ‘a priori’ definition of shock was designed, whereby patients admitted to the resuscitation room or high dependency area of the Emergency Department were divided into one of three groups – no shock, possible shock and shock. The primary outcome was 28-day mortality. Secondary outcomes were in-hospital mortality or admission to the intensive or coronary care unit (ICCU).

**Measurements and main results:** One hundred and eleven patients (mean age 67.2 ± 17.1 years; male = 69 (62%)) were recruited of which 22 were classified as no shock, 54 as possible shock, and 35 as shock. Systolic blood pressure (SBP), mean arterial pressure (MAP), lactate and base deficit correlated well with shock classifications (P < 0.05). Patients who had ≥3 positively defined shock variables had a 100% poor composite outcome rate (5/5). Patients with two shock variables had a 66.7% (4/6) poor composite outcome rate.

**Conclusions:** A simple, practical definition of undifferentiated shock has been proposed and validated in a group of patients presenting to an emergency department in Hong Kong. This definition needs further validation in a larger population and other settings.

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How to improve the organ preservation maneuvers after unsuccessful CPR in non heart beating donors?

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**Introduction:** Our hospital has settled from 1989 an specific protocol to obtain donor from people who die in the street or at home from sudden or unexpected death. Even this program has been improving, we’ve observed a reduction in the amount of transplants although the number of donors remains stable. New variables need to be studied.

**Material and methods:** After 30 min of unsuccessful CPR maneuvers death is declared through cardiovascular criteria. The only preservation method until ECMO is cardiac massage and mechanical ventilation. In addition to general procedure we analyze: age, kind of cardiocompression, personal antecedents and warm and cold ischemia times.

**Results:** 46 donors were included during 2013. 54 kidneys were desesimated for transplant. We analyze quantitative variables through student. We found association between age and discharged kidneys (51 years for discharged kidney p = 0.004; IC 95% 3, 0–15.1) and for warm ischemia time (116 min for discharged kidneys, p = 0.03; IC 95% 0.5–17.4). No association was found between desesitated, weight, tall, abdominal and thoracic perimeters. Among real donor 57 kidneys were transplanted. Five were explanted (4 because ischemia reperfusion injury, 1 surgical injury). The rest remains normofunctional and free of complications.

**Discussion:** Although NHBD is an excellent way to expand the donors pool, the trend to reduce the number of organs transplanted has made us to consider the necessity to optimize the preservation maneuvers optimizing the CPR as preservation method.

**Conclusions:**

1) NHBD program constitutes 40% of the total donor amount of Madrid (34.5 d.p.m.p).

2) It is important to establish new variables to improve organ preservation: mechanical versus manual cardiocompression, amount of fluids, pH, capnography, LDH, number of desfibrilation, BMI, first detected cardiac rhythm.

3) The effectiveness of CPR is the cornerstone of NHBD program.

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AP233

Stress cardiomiopathy after ephinephrine administration in anaphylactic reaction

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Background: Stress cardiomiopathy (SCM) is a syndrome of transient cardiac dysfunction associated to acute emotional or physical stress. We present a case of a patient that developed SCM following treatment of an anaphylactic reaction.

Case report: A 19-year-old female patient with anaphylactic reaction after intravenous (IV) ceftriaxone (1 g) treated with hydrocortisone, clemastin, 0.5 + 0.5 mg intramuscular epinephrine and an erroneous 1 mg IV epinephrine in a Basic Urgency Service. On pre-hospital Emergency Medical Team arrival, patient was with extreme shortness of breath, dyspnea, taquicardia, labile blood pressures and coughing intense blood tinged frothy sputum by mouth and nose with crackles in all pulmonary areas. Treatment with Non Invasive Ventilation (NIV) in Continuous Positive Airway Pressure, furosemide, morphine, isosorbide dinitrate IV was initiated during transport to the Emergency Department of a tertiary unit. On admission, patient was slightly better, with less frothy sputum coughing, but was hypotensive. Electrocardiogram showed no ischemic signs, transthoracic ecocardiography revealed depressed left ventricle systolic function with apical and midventricular aci- nesses, basal hiperkinesis and ejection fraction (EF) of 15%, cardiac enzymes showed a smallest elevation. Support treatment was pro- vided in the intensive care unit, continuing NIV for 3 days. Cardiac Magnetic Resonance supported the diagnosis of SCM. At day 26 patient was discharged home with recovery of left systolic function (EF of 57%) and no abnormal wall movements.

Discussion: The cause of SCM is unknown but its association with stress suggests that the mechanism may be sympathetically mediated1. In this case, besides the anaphylactic reaction, the patient received 1 mg IV epinephrine. Pulmonary edema occurs in 15.9% of the reported cases2, and NIV was used to improve oxygenation and reduce the work of breathing avoiding the need for tracheal intubation. The treatment is supportive until recovery of cardiac function.

References


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AP234

Evaluating the role of USCOM for assessing shock in adult patients presenting to the emergency department

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Background and objectives: Our aim was to investigate whether Doppler cardiac output monitor (USCOM) variables predict shock in adult patients presenting to the emergency department (ED).

Methodology: Observational study in the ED of Prince of Wales Hospital in Hong Kong. Data collected between 1 July 2012 and 31 January 2013. USCOM patients were divided into one of five groups – no shock, possible shock, cold shock, normal peripheral shock and warm shock.

Results: 103 patients (mean age 67.2 ± 17.2 years; male 64) were recruited. Significant results are shown as follows.

|-------------------------|-----------------|----------------------|------------------|-----------------------------|-----------------|---|

1,2,3,4,5: Comparison of No Shock, Possible Shock, Cold Shock, Normal Peripheral Shock with Warm Shock group respectively, P < 0.05.

P < 0.05: Comparison of No Shock, Possible Shock, Cold Shock, Normal Peripheral Shock with Warm Shock group respectively, P < 0.05.

1: Comparison between Possible Shock & Normal Peripheral Shock group, P < 0.05.
Conclusion: Stroke work, SVR, PE/KE ratio derived from USCOM may help to assess shock patients.

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Stroke

AP235

Stroke mimics: A challenge for the emergency physician

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Objective: To study the number of patients diagnosed with stroke in the emergency department, determine the frequency and nature of stroke mimics and identify the key clinical features that distinguish between stroke and mimic at the bedside.

Method: Prospective study of 9 months. We included all patients evaluated in the ED and admitted with a diagnosis of stroke. A standard bedside clinical assessment was performed. The final diagnosis was determined by an expert panel, which had access to clinical features, brain imaging. The final diagnosis was made by a panel of experts with access to the clinical characteristics, imaging studies and other tests. Univariate and multivariate analysis identified features that help distinguish strokes of stroke mimics.

Results: We included 140 presentations by 144 patients. The final diagnosis was stroke in 103 of 140 (73.6%) and SM (n = 37) in 26.4%. Eleven items predicted the diagnosis in patients presenting with suspected stroke, age over 70 years, achieving a clinical classification, able to determine the exact onset, abnormal vascular findings, eye deviation, loss of vision and extensor plantar reflex favoring the diagnosis of stroke, seizures, neurological symptoms inconsistent with vascular territory and abnormal findings in other systems were likely in patients with SM.

Conclusion: The SI constituted one third of patients admitted from the emergency room with a diagnosis of stroke, etiology was varied, and achieving an adequate clinical history and physical examination is of utmost importance and can help less experienced physicians in the emergency department.

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AP236

Hydroquinone shows neuroprotective potential in rodent ischemic stroke model

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Purpose: Hydroquinone (HQ) occurs naturally in various plants and food, and is also manufactured for commercial use. Recently, it has been reported that HQ has potent antioxidant properties with radical scavenging activities. In this study, the neuroprotective effect of HQ against ischemic damage following transient focal and global ischemia was examined using 2,3,5-triphenyltetrazoliumchloride (TTC) staining, NeuN immunohistochemistry and F-J B histofluorescence.

Methods: Fig. 1.

Results: It was proven that pre- and post-treatment with 100 mg/kg of HQ protects neurons from ischemic damage. In addition, we also investigated effects of HQ on gliosis and endogenous antioxidants in the hippocampal CA1 region after transient cerebral ischemia using immunohistochemistry. Pre- and post-treatment with 100 mg/kg of HQ notably inhibited the glial activation and maintained the expression of endogenous antioxidants in the gerbil ischemic CA1 region.
Conclusion: Briefly, these results indicate that pre- and post-treatment with HQ can protect against ischemic damage induced by transient focal and global ischemia, and the neuroprotective effects of HQ may be closely associated with the attenuation of glial activation and the maintenance of the expression of endogenous antioxidants.

Keywords: Hydroquinone; Ischemic damage; Neuroprotective effects; Glial activation; Antioxidants

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Trauma/Disaster Med

AP237

Traumatic cardiac arrests in asystole at Emergency Medical Service (EMS) arrival: Pre-hospital resuscitation is not futile

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Introduction: The prognostic of traumatic cardiac arrest (TCA) patients is considered to be extremely pejorative and the resuscitation attempt to be futile when the victim presents an asystole at EMS arrival.1 The aim of this study is to describe, in the prehospital medical system in France, the TCA in asystole and to compare this population with non-traumatic cardiac arrests which initial pulse is also asystole at EMS arrival.

Material and method: French multicentric (221 EMS), prospective, comparative study based on the data gathered in the RéAC registry framework between July 1, 2011 and December 10, 2013.

Results: Among 15982 registered CA with asystole as initial rhythm, 13892 were medical CA and 2090 TCA. TCA occurred in younger patients (48 ± 21 vs 66.9 ± 21; p < 0.04). They also happen in a more masculine population than in non-traumatic CA (76.6% vs 62.8%; p < 10−4). The other variables concerning care and prognostic are set out in Table 1.

Discussion: Pre-hospital resuscitation manoeuvres was significantly less attempted in TCA victims and yet 8% of them are admitted to hospital with a spontaneous circulation. At Day 30, 2% of them survived.

Conclusion: We observe a survival odd significantly inferior in TCA victims than in non-traumatic CA population. However the survival rates of TCA patients in asystole suggest that pre-hospital resuscitation is not futile. Some complementary studies are requested to identify the factors of good functional prognostic.

Reference


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AP238

Development of acute respiratory distress syndrome (ARDS) in patients with chest trauma

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Purpose: Acute respiratory distress syndrome—ARDS is a specific form of acute lung injury and of itself is not a disease, but the pathophysiological syndrome. ARDS is a major contributor to morbidity and mortality in trauma patients, especially in a patient with chest trauma. The aim of the study was to identify risk factors for development of acute respiratory distress syndrome (ARDS) in patients with chest trauma.

Methods: This was a prospective observational study of 80 patients with chest trauma, alone or in association with injuries to other organs.

Results: ARDS developed in 15% of observed patients. From the total number, 76.5% of the patients had an abbreviated injury score AIS4 and AIS5, expressed injury with the risk to life or critically ill. Blunt injuries were present in 96.6% of cases. Car accidents were the most common mechanism of injury (60.2%). The mean ISS was 25.7 ± 11.0. On the basis, size of Spearman correlation coefficient can be concluded that the injury severity score (ISS) have a high correlation coefficient (0.640) determined on the basis of AIS chest injury. Patients who developed ARDS had significantly higher values APACHE II score (>20) vs patients who did not develop ARDS. Time spent on mechanical ventilation amounted to an average of 7.9 ± 4.2 days and in an ICU spent an average of 20.2 ± 11.2 days. Mortality of injured with developed ARDS was 55%. Multivariate analysis showed that ARDS was related to chest trauma diagnosis.

Conclusions: Risk of ARDS development in patients with chest trauma is related to the admission variables, including severe anatomical injuries and physiologic derangements and mechanism of injury. ISS and APACHE score was directly correlated with the development of ARDS in patients with chest trauma.

Keywords: Chest trauma; ARDS
AP239

Could be the traumatic cardiorespiratory arrest influenced by the time management of interventions? Experience of an Emergency Department upon Cowley’s “golden hour”

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Purpose of the study: As trauma represents an important cause of death all over the world and traumatic cardiac arrest have a poor prognosis, we tried to study if the classic algorithm of trauma management could be improved by strictly time allocation for each step. There are several mechanisms of cardiac arrest and some of them can be stabilized or improved in the so-called “golden hour”.

Material and method: We performed a comparative analysis of the management of two groups of traumatized patients with imminence of cardiac arrest. The four steps applied were resuscitation, primary survey, secondary survey and definitive treatment. There were included two groups of patients with severe trauma, one from the period January 2003–December 2006, consisting of 183 patients, treated classically, and the other from period January 2007–December 2012, consisting of 387 patients, treated with time scheduled algorithm, all of them admitted in the “St. Pantelimon” Emergency Department.

Results: The most frequent causes of trauma for both groups were hypovolemia; the ISS of the first group was 28.84 ± 14.56, and 29.27 ± 13.95 for the second. Hypovolemia due to cardiovascular lesions are the main cause of cardiac arrest in both groups, with more than 79% of cases. Echografic investigations as a complementary investigation for hemorrhagic lesions were accomplished in 13–21 min for first group and in 7–10 min for the second, as a part of primary survey. Survival rates in the first group were 2.54% and 3.44% in the second.

Conclusions: Resuscitation in trauma-related cardiac arrest has a poor outcome worldwide. Our figures show similar, but it seems that different coordination may improve these results. The main tool used to improve we consider to be the ultrasonography exam during the primary survey. Our study has certain limitations, but may represent a good starting point for trauma research.

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AP240

Requirements for helicopter landing sites in a concept of airborne primary rescue

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Purpose of the study: Due to demographic and structural change, provision of adequate medical emergency care is becoming increasingly difficult in sparsely populated areas. Aim of the federally funded PrimAIR project is to develop a helicopter based alternative to current ground based Emergency Medical Services (EMS) in Germany. Purpose of our study was to evaluate the present state of helicopter landing sites (HLS) in order to develop recommendations for coping with increasing numbers of air rescue missions.

Methods: A 23-item questionnaire was developed under the auspices of Asklepios Institute of Emergency Medicine and distributed by PrimAIR’s associated air medical partners: ADAC (German Automobile Association Air Rescue), Bundespolizei (Federal Police Air Rescue) and DRF (German Air Rescue).

Results: 37 questionnaires were returned including 33 landing sites localised next to a hospital, 20 of which were at ground level, n = 8 were located on hospital tops and n = 5 were helidecks. 29 of 33 (87.9%) HLS were licensed for 24/7 air traffic. Size of HLP was from 100 to 2000 m² (median 576 m²; mean 704 m²). Patient transport to the emergency department (ED) took an average of 5 min (minimum 1, maximum 10 min). Mean distance from HLS to the ED was 154 m (median 100, min. 19, max. 800 m) often requiring ambulancetransport. With an assumed increase of helicopter transport to 50% of emergency transports, 12 respondents (36.4%) considered their HLP to fully meet requirements, 8 (24.2%) negated this and another 8 considered it possible under certain conditions (5 missing data).

Conclusion: Transfer from HLS to the ED results in considerable delay of patient treatment. In addition HLS capacities at most German hospitals do not allow for a major increase of landings under the potential prerequisite of a primary airborne EMS concept.

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AP241

Effects of non-invasive femoral arteries occlusion on restoration of spontaneous circulation of trauma patients with acute blood loss

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Background: A previous study found, that the combination of standard CPR with non-invasive femoral arteries occlusion (NOFA) increases the probability restoration of spontaneous circulation in non-trauma patients.1 We hypothesized that the hemodynamic effects of NOFA at resuscitation of patients with hypovolemia and hemorrhage may be useful. The aim of the study was to assess the effectiveness of NOFA on resuscitation outcomes of trauma patients with acute blood loss.

Methods: Prospective clinical studies from January 2011 to December 2013 were conducted involving 17 trauma patients with cardiac arrest and blood loss more 30%. From this 8 patients was applied standard CPR, the other 9 patients − CPR + NFAO.

Results: The average age of patients in the group standard CPR was 34 ± 12, in the group CPR + NFAO − 41 ± 18. Restoration of spontaneous circulation was recorded in 4 patients of the standard CPR group and in 7 patients of the CPR + NFAO group. For survivors duration of resuscitation in the standard CPR group was 18 ± 10 min (P ≤ 0.05, n = 4), in the CPR + NFAO group 11 ± 7 min (P ≤ 0.05, n = 7).

Conclusions: This study supports the value of non-invasive femoral arteries occlusion on return of spontaneous circulation of trauma patients with acute blood loss. NOFA is a simple, easily to-perform and inexpensive procedure which warrants further investigation.
Reference


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General

AP242

Assessing the quality chest compressions in paediatric simulations

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Background: Studies in adults suggest that good quality chest compressions have an overall greater importance in the outcome of resuscitation than ventilation. Whilst ventilation remains important in paediatric resuscitation this does not diminish the necessity of good quality chest compressions.

Aim: To assess the quality of chest compressions provided by different paediatric health care personnel.

Method: 100 volunteers were assessed in 2011 (Year 1) and 74 of those returned for re-assessment in 2013 (Year 2). They were asked to perform chest compressions for 2 min at what they believed to be the correct rate and depth of compressions. A child manikin attached to a defibrillator via adhesive pads and accelerometer puck was used. Results were recorded and downloaded via code review software to a lap top for interrogation of speed and depth over the 2 min period. Volunteers were able to use a metronome if desired. Data collected included job title, clinical area and resuscitation training record:

Results: In year 1 the rates of chest compressions varied between 150 and 204 per minute. Half the volunteers chose to use the metronome which made no difference. Overall in year 1 the rates were too fast and the depths of compression were less than 1/3 depth of the chest i.e. inadequate. These volunteers had 1 further training session prior to being re-tested in year 2. The results in year 2 showed that the majority were now performing chest compressions at rates between 90 and 120 per minute and achieved compression depths of > 1/3 depth of the chest.

Conclusion: Analysis of depth of chest compressions as well as rate provides important feedback to paediatric health care providers and regular training will improve quality of chest compressions provided to critically ill children.

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AP243

Identifying the reversible causes of respiratory arrests on the paediatric wards

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Background: A high number of respiratory arrests were identified on the paediatric wards which appeared to be increasing in incidence. This was audited to determine causes and if any intervention was applicable.

Methods: We defined a respiratory arrest as any child who required positive pressure ventilations via a T-piece or BVM. We had 21 respiratory arrests on the wards in 2013 and reviewed data for any recurring themes.

Causes identified:

- 14 following seizures and administration of Lorazepam
- 3 displaced tracheostomy tubes
- 1 displaced nasopharyngeal airway post surgery
- 1 seizure secondary to hypoglycaemia
- 1 pulmonary hypertensive crisis
- 1 post surgical apnoea in neonate

Discussion: The majority of respiratory arrests were found to have occurred in patients who had a seizure requiring lorazepam. The total proportion of seizures treated with lorazepam that resulted in respiratory arrests on the neurological wards however is unknown and further work is underway to determine this but it appears to be a fairly large proportion. The team are also auditing to determine adherence to local status epilepticus protocol. This group of patients includes very complex neurological patients who may be more susceptible to the sedative properties of lorazepam. To reduce the incidence of respiratory arrests and ensure the safety of our patients whilst further work is ongoing we have introduced a management pathway which ensures airway support is readily available and anticipated for every child following seizures and lorazepam treatment.

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AP244

Chest compressions using load distributing band-CPR devices are more effective than manual compressions concomitant with emergency percutaneous coronary interventions

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Introduction: Cardiac arrest during procedures in the Cath Lab is excessively harmful, as manual chest compressions prevent the continuity of coronary angiography and coronary angioplasty and require the assistance of trained staff in cardiopulmonary resuscitation (CPR) quickly and accurately. Load Distributing Band-CPR (LDB-CPR) is a mechanical CPR device that consists of mechanical pneumatic band attached to a board that involves the patient’s chest and allows effective and continuous pneumatic compressions, allowing mechanical CPR simultaneously to coronary angiography and angioplasty.

Objectives: We assessed the hypothesis that mechanical CPR may be feasible during percutaneous coronary interventions and
more effective than manual CPR by the analysis of intra-coronary pressure curves.

**Methods:** The device was used in 8 consecutive cases of cardiac arrests (6 ventricular fibrillation refractory to attempts of defibrillation and standard treatment and 2 PEA) in the Cath Lab, allowing continuity of percutaneous coronary intervention concurrent with CPR. Intra-coronary curves were measured initially during manual chest compressions (manual CPR) and later, after the correct installation of LDB-CPR during mechanical compressions with this device (mechanical CPR).

**Results:** It was possible to complete coronary angiography with the device attached to the patient in all cases, and it was also possible to complete coronary angioplasty during mechanical CPR. In all cases, mechanical CPR provided uninterrupted chest compressions more effectively and always stable in stead of manual compressions. Although a mean blood pressure of 40 mmHg in both methods, mechanical CPR was able to maintain this pressure for a long time, but manual CPR had an important reduction in mean blood pressure after two minutes of CPR in all cases. Two patients progressed to discharge the hospital with good neurologic outcomes.

**Conclusion:** In conclusion, percutaneous coronary interventions are feasible concurrent with mechanical CPR using LDB-CPR in patients suffering cardiac arrest in the Cath Lab. The device provided uninterrupted chest compressions more effective than manual compressions, as well as allowed the freedom of the physicians to attempt other functions, different from CPR, during the procedures.

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**AP246**

**Chest injuries during resuscitation following the current guidelines: First results of the RECAPTA study**

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**Introduction:** The increase in the depth of chest compressions, as recommended in the current guidelines, has been associated with an increased survival of patients presenting out-of-hospital cardiac arrest (OHCA), although it may result in an increased incidence of severe chest injuries and lead to prolonged length of stay in the intensive care unit. The aim of this current registry is to determine the chest injuries produced by manual compressions performed according to the guidelines of current clinical practice.

**Methods:** Retrospective analysis of autopsy reports, obtained from the archives of the Institute of Legal Medicine of Catalonia from June to December of 2013. Patients who have not survived, and are registered in the randomized pilot study of the effectiveness of passive leg raising for OHCA during cardiopulmonary resuscitation, are included. The results are collected in the Clinical Pathology Registry of Tarragona (RECAPTA).

**Results:** The autopsy reports of 20 patients, which represent 27.3% of the patients participating in the pilot study, were analyzed. The mean age is 55.6 years old, 75% were men. 55.6% present at least one rib fracture and 18.8% present a sternum fracture. The mean number of rib fractures is 5.5. The average duration of resuscitation is 36.22 min. All individuals with sternal fracture also have rib fractures. 90% of rib fractures are bilateral, most are located in the anterior axillary line and most commonly affect the third, fourth and fifth ribs.

**Conclusion:** Chest injuries caused by chest compressions are common. Their high frequency is surprising, compared with other studies, which may be increased by the application of the current guidelines.

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**AP246**

**The unique cardiac arrest registry in the Canary Islands (Spain)**

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**Introduction:** In the Canary Islands (2,113,345 inhabitants and 10,143,135 visitors annually) over 1000 outpatient cardiac arrest (CA) events occur each year. There is lack of information on integrated attention to the CA in different care settings.

**Objective:** Creating a unique registry to the out-of-hospital and in-hospital cardiac arrest in the public health network in the Canary Islands.

**Material and methods:**

2008: establishment of the Working Group “ERCAN” with representatives of major scientific societies in adult and pediatric
CA, health technicians, Emergency Medical System, Red Cross and experts.

2009–2010: consensus meetings (videoconferencing or face to face) to design the main recording sheet according to the Utstein style.

2011: Training and test the record sheet by doctors during 3 months in outpatient and inpatient services. Modification and final closure of the registration model.

2012–2013: Beginning of the use of the registry: computerization by Web applications or new developments in electronic health records software. Integration of different applications to manage a standard record.

2014: creation of standard evaluation panel for analysis. Access to computerized record of 100% of the public health system. Publication of rules for compulsory registration.

Results: It has achieved a unique model of care record for in-hospital and out-of-hospital CA. Current coverage of the database would record more than 80% events. There is a low registration level, mainly due to incomplete or not filling the information and/or misinterpretation of some items record.

Conclusions: The standard record of CA is an homogeneous tool for all health professionals, especially useful in a fragmented territory. Computerization will analyze efficiently health care for the CA in order to develop improvement measures and reassess in health services.

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AP247

“A lesson for Life-Un Ora per la Vita”: Resuscitation for schoolchildren and young people

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Purpose of the study: The aim of the study that was realized in primary schools and youth organizations in the Province of Vicenza-Italy was to demonstrate the capability skills as well as the positive attitude and constructive behavior of children and young people (5–18 years) towards Hands-Only Reanimation and their capability to reproduce these skills after 12 months.

Materials and methods: In one class lesson (45 min) the theory of Cardiac Arrest followed by the “four steps of resuscitation” were explained (10 min): (1) Call and Shake the patient, (2) Control Consciuosness (Dolorous stimulus on the stern), (3) Emergency Service Call, (4) Start chest compression. The rest of the lesson (30 min) they were repeatedly trained and questions that occurred answered and discussed. At the end a questionnaire was distributed asking them to draw about what they learned observed and felt during the theoretical and practical parts of the lesson. A manikin, we used Anne (Laerdal) or an adult volunteer for the theoretical part and Mini Anne (Laerdal) or mattresses, cushions or class seats for the practical part. A Self-made man-big model of a telephone to simulate the emergency call.

Results: The skills of Hands-Only Reanimation where easily accepted by the 7170 children and young people between 5 and 18 year old involved in this study. The attitude of the children towards their role as First responders using the Hands-only Reanimation method was very positive. Their constructive behavior towards their “responsibility” to be able to Act: “to help saving lives” was highly appreciated by them.

Conclusion: Teaching and training the Hands-Only Reanimation technique is simple and highly accepted and appreciated by children and young people. Our simple method showed to be very efficient in encouraging children and young people to overcome barriers that may block them from assisting, as well as it showed efficiency being able to be reproduced after 12 months.

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AP248

Implementation of resuscitation committees in Canary Islands Health Service (Canary Islands, Spain)

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Introduction: The public health assistance network in the Canary Islands covers 2,113,345 people and over 10 million visitors every year. This service includes 9 hospitals, 105 health areas in Primary Health Care (PHC) and an Emergency Medical System (EMS). The creation of Resuscitation Committees (RC) is a relevant recommendation of the International Liaison Committee on Resuscitation (ILCOR).

Objective: To strengthen the cardiac arrest (CA) quality of care by publication of a recommendations document to advise the creation, development and functioning of RC in each of the manager teams of the Canarian Public Health Service.

Material and methods: 2008: establishment of the Working Group “GERCAN” with representatives of major scientific societies in adult and pediatric CA, health technicians, Emergency Medical System (EMS), Red Cross and experts.

2009–2010: consensus meetings (videoconferencing or face to face) to create a draft document including objectives, interdisciplinary composition, members election, duties, responsibilities and main activities to do.

2011: Preliminary version of the document was sent to reviewers from hospitals, PHC and EMS, in order to improve, update and ends the final version. 2012-2013: publication and dissemination of the document. Gradual creation of RC.

Results: A support tool for implementation of RC has been published. Document is open to all manager teams and professionals. Until December 2013, 9 RC have been implemented in hospitals and PHC, accounting for 75% of the target for all the Canary Islands Public Health Service.
Conclusions: Creation of RC has been supported by this document, acting as an agreed and interdisciplinary tool. The RC will be responsible for coordinating actions (cardiac arrest registry, training, organization, counseling, etc.) in order to improve CA quality of care in the Canary Islands.

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AP249

The resuscitative management of pulmonary haemorrhage

Purpose of the study: The poster presentation is regarding the management of pulmonary haemorrhage from the point of view of an anaesthetist taken from an airway, breathing and circulation format. It is a daunting situation which can leave even the most experienced of anaesthetists unsure how to proceed and what is the best method for the course of resuscitation and treatment. There is currently no consensus guidelines on how to manage these life threatening situations which can leave the patient in severe extremis and often leads to cardiac arrest from either severe airway, breathing or circulatory dysfunction. The overall end prognosis is generally poor. The purpose of this poster is to highlight this rare and interesting presenting problem and show the importance of early recognition and consideration of the options available.

Materials and method: Having been involved in several of these situations with varying degrees of success – some potential management of the resuscitative phase have been proposed. There are a multitude of differential diagnosis which may be important in the early resuscitative phase but these can often be unknown. Due to the rarity of this condition trials in this would be unlikely

Results: Although it is unclear to an extent what interventions would be most useful – this is a collective bundle as well as a set of options that one can consider and is partially dependent on the actual cause if that is known or a site of the primary problem suspected.

Conclusion: Putting some of these interventions together may lead to a successful outcome as the primary respiratory and circulatory injury will be reduced, plus there would be clear attempts to avoid the cardiac arrest situation in this relatively unfamiliar situation.

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