Please note that guideline numbers refer to the new ANZCOR guidelines (December 2010)


   Chest compression quality is a determinant of survival from out-of-hospital cardiac arrest (OHCA). ERC 2005 guidelines recommend the use of technical devices to support rescuers giving compressions. This prospective randomized study reviewed influence of different feedback configurations on survival and compression quality. Materials and methods: 312 patients suffering an OHCA were randomly allocated to two different feedback configurations. In the limited feedback group a metronome and visual feedback was used. In the extended feedback group voice prompts were added. A training program was completed prior to implementation; performance debriefing was conducted throughout the study. Results: Survival did not differ between the extended and limited feedback groups (47.8% vs 43.9%, p = 0.49). Average compression depth (mean ± SD: 4.74 ± 0.86 cm vs 4.84 ± 0.93 cm, p = 0.31) was similar in both groups. There were no differences in compression rate (103 ± 7 vs 102 ± 5/min, p = 0.74) or hands-off fraction (16.16% ± 0.07 to 17.04% ± 0.07, p = 0.38). Bystander CPR, public arrest location, presenting rhythm and chest compression depth were predictors of short term survival (ROSC to ED). Conclusions: Even limited CPR-feedback combined with training and ongoing debriefing leads to high chest compression quality. Bystander CPR, location, rhythm and chest compression depth are determinants of survival from out of hospital cardiac arrest. Addition of voice prompts does neither modify CPR quality nor outcome in OHCA. CC depth significantly influences survival and therefore more focus should be put on correct delivery. Further studies are needed to examine the best configuration of feedback to improve CPR quality and survival. Registration ClinicalTrials.gov (NCT00449969), http://www.clinicalTrials.gov.

Guideline 8: Cardiopulmonary resuscitation

2. Bolle SR, Johnsen E and Gilbert M, Video calls for dispatcher-assisted cardiopulmonary resuscitation can improve the confidence of lay rescuers - surveys after simulated cardiac arrest. J Telemed Telecare 2010: Online first); December 7

   Many mobile phones allow two-way video communication, which permits callers to hear and see each other. If used during medical emergencies, bystanders can receive supervision and guidance from medical staff based on visual information. We investigated whether video calls from mobile phones could improve the confidence of lay rescuers. High school students (n = 180) were randomly assigned in groups of three to communicate via video calls or via ordinary mobile phone calls. They received real-time guidance from
experienced nurse dispatchers at an emergency medical dispatch centre during 10-min scenarios of simulated cardiac arrest. Each student answered a questionnaire to assess understanding, confidence and usefulness of the technology. The mean age was 17.3 years in the video group and 17.9 years in the audio group. There were 27% male participants in the video group and 34% male participants in the audio group. Seventy-three percent of the students in the video group and 71% in the audio group reported previous cardiopulmonary resuscitation training. Rescuers who had not used video phones had a greater tendency to comment on immature video call technology, while some who had used video phones complained about poor sound quality during video calls. The majority of rescuers in both groups believed that video calls were superior to audio calls during medical emergencies, and this proportion was significantly higher in the video group (P = 0.0002). We found that visual contact and supervision through video calls improved rescuers’ confidence in stressful emergencies.

Guideline 8: Cardiopulmonary resuscitation


Objective: To describe the clinical features and laboratory findings in patients with definite red-bellied black snake (RBBS; Pseudechis porphyriacus) bites, including correlation with results of venom assays. Design, patients and setting: Prospective cohort study of patients with definite RBBS bites, recruited to the Australian Snakebite Project from January 2002 to June 2010. Main outcome measures: Clinical and laboratory features of envenoming; peak venom concentrations and antivenom treatment. Results: There were 81 definite RBBS bites; systemic envenoming occurred in 57 patients (70%) and local envenoming alone occurred in one patient. Systemic envenoming was characterised by local envenoming in 55 patients (96%), systemic symptoms in 54 patients (95%), anticoagulant coagulopathy with a raised activated partial thromboplastin time (aPTT) in 35 patients (61%) and myotoxicity in seven patients (12%). One patient required non-invasive ventilation for severe myotoxicity that resulted in muscle weakness. Three patients developed local ulceration. There were no deaths. Twenty-two envenomed patients (39%) received tiger snake or black snake antivenom, and administration within 6 hours of the bite was associated with normalisation of the aPTT. Eight patients (36%) had immediate hypersensitivity reactions to antivenom, including one case of anaphylaxis. The median peak venom concentration in 37 systemically envenomed patients with serum available was 19 ng/mL (interquartile range, 12–50 ng/mL; range, 3–360 ng/mL), which did not correlate with clinical severity. In 17 patients who received antivenom and had venom concentration measured, no venom was detected in serum after the first antivenom dose, including nine who were given one vial of tiger snake antivenom. Conclusion: RBBS envenoming caused local effects, systemic symptoms, anticoagulant coagulopathy and, uncommonly, myotoxicity. One vial of tiger snake or black snake antivenom appears to be sufficient to remove venom and neutralise reversible effects, but
hypothesis that the benefit of mild therapeutic hypothermia is mediated through modulation of the inflammatory response. Methods: During our prospective observational study from Aug 2008 to October 2009, 196 OHCA patients were enrolled. 173 were eligible for inclusion; 115 died in Emergency Department (ED), 38 died in intensive care unit (ICU) and 20 survived to discharge. Patients had blood sampled on arrival in the ED and at 24 h, 72 h and 5 days. A small subgroup of patients had blood sampled prehospital during the initial resuscitation phase. Serum levels of cytokines important in the regulation of inflammation (interleukin 6 (IL-6), IL-8, IL-10) were measured along with markers of neutrophil activation (elastase and CD 11b). All patients who reached the ICU had MTH induced and were maintained at 32–34°C for 24 h.

Results Levels of the pro-inflammatory cytokine IL-8 were significantly higher at 24 h after return of spontaneous circulation in patients who died in ICU, compared to those who survived to discharge (478.1 pg/ml (CI 171.1 to 831.1) cf 108.0 pg/ml (CI 44.8 to 171.1) p=0.03). Serum levels of the ‘anti’-inflammatory cytokine IL-10 were also much higher in non-survivors (CI 80.9 pg/ml (22.3 to 139.4) cf CI 10.2 pg/ml (3.6 to 16.8) p=0.002). IL-10 predicted survival 24 h with an area under the Receiver Operating Characteristic of 0.91 (CI 0.77 to 1.0, p<0.001), and a sensitivity of 100%, specificity 75% at a cut off of 32 pg/ml, LR 4.0. Indicators of neutrophil activation, were markedly elevated in all patients on arrival in the ED. Discussion: OHCA is associated with massive systemic inflammation. We have shown that this begins much earlier than previously described, and that levels of both the classically pro-inflammatory and counterregulatory chemokines predict survival. Our findings are consistent with the hypothesis that MTH works, at least in part, by modulating the inflammation.

Guideline 11.8: Therapeutic hypothermia after cardiac arrest


Most nontraumatic out-of-hospital cardiac arrest (NTOHCA) patients who fail in prehospital resuscitation receive continued cardiopulmonary resuscitation in the emergency department (ED). Initial blood pH, which can be assessed rapidly in the ED, was examined to see whether it is a strong survival predictor for these patients. A 1-year retrospective study included consecutive 225 NTOHCA patients at a medical center in northern Taiwan who presented through the emergency medical services system. On arrival
at the ED, these patients received continued cardiopulmonary resuscitation, and their initial blood pH data were assessed. The pH value was positively correlated with variables such as return of spontaneous circulation, witnessed arrest, short prehospital time (≤20 minutes), and survival. The best cut-off value of initial blood pH, revealed by the receiver operating characteristic curve, was 7.068. The lowest pH value of the survivors was 6.856. The results of logistic regression model analysis shows that the odds ratios of survival was 10.0 (95% confidence interval [CI], 2.1–47.7) for patients with initial blood pH ≥ 7.068, 5.3 (95% CI, 1.48–18.9) for those with nonasystole rhythm, 4.0 (95% CI, 1.1–14.8) for those with prehospital time ≤20 minutes, and 9.1 (95% CI, 2.3–35.2) for those without NaHCO3 administration during resuscitation, respectively. A cut-off value of an initial blood pH of 7.068 can serve as a predictor for survival among NTOHCA patients. In addition, patients whose initial blood pH is lower than 6.85 in the ED may not survive until hospital discharge.


Trauma is the leading cause of loss of life expectancy worldwide. In the most seriously injured patients, coagulopathy is often present on admission. Therefore, transfusion strategies to increase the ratio of plasma (FFP) and platelets (PLT) to red blood cells (RBC), simulating whole blood, have been introduced. Several studies report that higher ratios improve survival in massively bleeding patients. Here, the aim was to investigate the potential effect of increased FFP and PLT to RBC on mortality in trauma patients. METHODS: In a retrospective before and after study, all trauma patients primarily admitted to a level-one Trauma Centre, receiving blood transfusion, in 2001-3 (n = 97) and 2005-7 (n = 156), were included. In 2001-3, FFP and PLT were administered in accordance with the American Society of Anesthesiologists (ASA) guidelines whereas in 2005-7, Hemostatic Control Resuscitation (HCR) entailing pre-emptive use of FFP and PLT in transfusion packages during uncontrolled haemorrhage and thereafter guided by thrombelastograph (TEG) analysis was employed. The effect of transfusion therapy and coagulopathy on mortality was investigated. RESULTS: Patients included in the early and late period had comparable demography, injury severity score (ISS), admission hematology and coagulopathy (27% vs. 34% had APTT above normal). There was a significant change in blood transfusion practice with shorter time interval from admission to first transfusion (median time 3 min vs.28 min in massive bleeders, p < 0.001), transfusion of higher ratios of FFP:RBC, PLT:RBC and PLT:FFP in the HCR group but 30-day mortality remained comparable in the two periods. In the 2005-7 period, higher age, ISS and Activated Partial Thromboplastin Time (APTT) above normal were independent predictors of mortality whereas no association was fund between blood product ratios and mortality. CONCLUSION: Aggressive administration of FFP and PLT did not influence mortality in the present trauma population.
The aim of this prospective study was the comparison of four emergency medical service (EMS) systems--emergency physician (EP) and paramedic (PM) based--and the impact of advanced live support (ALS) on patients status in preclinical care. Methods The EMS systems of Bonn (GER, EP), Cantabria (ESP, EP), Coventry (UK, PM) and Richmond (US, PM) were analysed in relation to quality of structure, process and performance when first diagnosis on scene was cardiac arrest (OHCA), chest pain or dyspnoea. Data were collected prospectively between 01.01.2001 and 31.12.2004 for at least 12 month. Results: Over all 6277 patients were included in this study. The rate of drug therapy was highest in the EP-based systems Bonn and Cantabria. Pain relief was more effective in Bonn in patients with severe chest pain. In the group of patients with chest pain and tachycardia >=120 beats/min, the heart rate was reduced most effective by the EP-systems. In patients with dyspnoea and SpO2 < 90% the improvement of oxygen saturation was most effective in Bonn and Richmond. After OHCA significant more patients reached the hospital alive in EMS systems with EPs than in the paramedic staffed (Bonn = 35.6%, Cantabria = 30.1%; Coventry = 11.9%, Richmond = 9.2%). The introduction of a Load Distributing Band chest compression device in Richmond improved admittance rate after OHCA (21.7%) but did not reach the survival rate of the Bonn EMS system. Conclusions: Higher qualification and greater training and experience of ALS unit personnel increased survival after OHCA and improved patient's status with cardiac chest pain and respiratory failure.

8. Garwe T, Cowan LD, Neas B, Cathey T, Danford BC and Greenawalt P, Survival Benefit of Transfer to Tertiary Trauma Centers for Major Trauma Patients Initially Presenting to Nontertiary Trauma Centers. Acad Emerg Med 2010: 17(11);1223-32
Recent evidence suggests a measurable reduction in mortality for patients transferred from a nontertiary trauma center (Level III or IV) to a Level I trauma center, but not for those transferred to a Level II trauma center. Whether this can be generalized to a predominantly rural region with fewer tertiary trauma care resources is uncertain. This study sought to evaluate mortality differences for patients initially presenting to nontertiary trauma centers in a predominantly rural region depending on transfer status. Methods: This was a retrospective cohort study of patients initially presenting to 104 nontertiary trauma centers in Oklahoma and meeting the state’s criteria for major trauma. Patients dying within 1 hour of emergency department (ED) arrival at the nontertiary trauma center were excluded. The exposure variable of interest was admission status, which was categorized as either transfer to a tertiary (Level I or II) trauma center within 24 hours or admission to a nontertiary trauma center. Propensity scores were used to minimize the selection bias inherent in the decision to admit or transfer a patient for higher-level care. Multiple logistic regression was used to generate three propensity score models: probability of transfer to either a Level I or II, Level I only, and Level II only. Propensity scores were then included as a covariate in multivariable Cox regression models assessing outcome
differences between admitted and transferred patients. The outcome of interest was 30-day mortality, defined as death at either the nontertiary trauma center or the tertiary trauma center within 30 days of arrival at the initial Level III/IV center’s ED. Results: A total of 6,229 patients met study criteria, of whom 2,669 (43%) were transferred to tertiary trauma centers. Of those transferred, 1,422 patients (53%) were transferred to a Level I trauma center. Crude mortality was lower for patients transferred to tertiary trauma centers compared to those remaining at nontertiary trauma facilities (hazard ratio [HR] = 0.59; 95% confidence interval [CI] = 0.48 to 0.72). After adjusting for the propensity to be transferred, Injury Severity Score (ISS), presence of severe head injury, and age, transfer to a tertiary trauma center was associated with a significantly lower 30-day mortality (HR = 0.38; 95% CI = 0.30 to 0.50) compared to admission and treatment at a nontertiary trauma center. The observed survival benefit was similar for patients transferred to a Level I trauma center (HR = 0.36; 95% CI = 0.20 to 0.4) and those transferred to a Level II center (HR = 0.45; 95% CI = 0.33 to 0.61). Conclusions: This study suggests a survival benefit among patients initially presenting to nontertiary trauma centers who are subsequently transferred to tertiary trauma centers compared to those remaining in nontertiary trauma centers, even after adjusting for variables affecting the likelihood of transfer. Although this survival benefit was larger for patients treated at a Level I trauma center, Level II trauma centers in a region with few tertiary trauma resources demonstrated a measurable benefit as well.

The quality of cardiopulmonary resuscitation (CPR) is a critical determinant of outcome following out-of-hospital cardiac arrest. The aim of our study was to evaluate the quality of CPR provided by emergency medical service providers (Basic Life Support (BLS) capability) and emergency medical service providers assisted by paramedics, nurse anesthetists or physician-manned ambulances (Advanced Life Support (ALS) capability) in a nationwide, unselected cohort of out-of-hospital cardiac arrest cases. Methods: We conducted a prospective, observational study of out-of-hospital cardiac arrest with non-traumatic etiology (>18 years of age) occurring from the 1st to the 31st of January 2009 and treated by the primary Danish emergency medical service operator, covering approximately 85% of the population. One hundred and ninety-one cases were eligible for analysis. Follow-up was up to one year or death. Quality of CPR was evaluated using measurements of transthoracic impedance. Results: The majority of patients were treated by ambulances with ALS capability (54%). Interruptions in CPR related to loading of the patient into the emergency medical service vehicle were substantial, but independent of whether patients were managed by ALS or BLS capable units (222 s versus 224 s, P = 0.76) as were duration of interruptions during rhythm analysis alone (20 s versus 22 s, P = 0.33) and defibrillation (24 s versus 26 s, P = 0.07). Conclusions: Nationwide, routine monitoring of transthoracic impedance is feasible. CPR is hampered by extended
interruptions, particularly during loading of the patient into the emergency medical service vehicle, rhythm analysis and defibrillation.

*Guideline 8: Cardiopulmonary resuscitation*


Mechanical chest compression devices, such as the AutoPulse®, have been developed to overcome problems associated with manual CPR (M-CPR). Animal and human studies have shown that AutoPulse CPR improves hemodynamic parameters over M-CPR. However, human studies conducted in the prehospital setting have conflicting results as to the AutoPulse’s efficacy in improving survival. The Circulation Improving Resuscitation Care (CIRC) Trial is designed to evaluate the effectiveness of integrated AutoPulse-CPR (iA-CPR) (i.e., M-CPR followed by AutoPulse®-CPR) in a randomized controlled trial that addresses methodological issues that may have influenced the results of previous studies. Methods: This paper describes the methodology of the CIRC trial. Results: Unlike previous trials the CIRC trial studies iA-CPR where emphasis is placed on reducing "hands-off" time. The trial has six unique features: (1) training of all EMS providers in a standardized deployment strategy that reduces hands-off time and continuous monitoring for protocol compliance. (2) A pre-trial simulation study of provider compliance with the trial protocol. (3) Three distinct study phases (in-field training, run-in, and statistical inclusion) to minimize the Hawthorne effect and other biases. (4) Monitoring of the CPR process using either transthoracic impedance or accelerometer data. (5) Randomization at the subject level after the decision to resuscitate is made to reduce selection bias. (6) Use of the Group Sequential Double Triangular Test with sufficient power to determine superiority, inferiority, or equivalence. Conclusion: This unique, large, multicenter study comparing the effectiveness of iA-CPR to M-CPR will contribute to the science of the treatment of out-of-hospital cardiac arrest as well as to the design of future trials.

11. Liu Y, Cheng YT, Chang JC, Chao SF and Chang BS, Extracorporeal membrane oxygenation to support prolonged conventional cardiopulmonary resuscitation in adults with cardiac arrest from acute myocardial infarction at a very low-volume centre. Interact CardioVasc Thorac Surg 2010: Online first; December 20

We aimed to analyse the outcomes of the deployment of extracorporeal membrane oxygenation assisted cardiopulmonary resuscitation (E-CPR) 11 times for acute myocardial infarction (AMI) in 10 adult patients at a very low-volume (VLV) centre, where perfusionists or surgeons are not always available. We conducted a three-year retrospective chart review. E-CPR was performed 13 times in 12 adult patients who had cardiac arrest events and who underwent conventional CPR for longer than 10 min. We excluded
other aetiologies that led to E-CPR. All 11 selected episodes of E-CPR were diagnosed as AMI. Seven patients (63.6%) were successfully weaned off extracorporeal membrane oxygenation (ECMO). Four patients survived to discharge without neurological deficits or other postE-CPR complications (36.3%). Seven patients died after E-CPR, and with one patient, there was no return of spontaneous beating during E-CPR (0.9%). Three patients died of unstable haemodynamics despite revascularisation of the coronary circulation. Three patients were successfully weaned off ECMO; however, they died subsequently of multiple organ dysfunction, unstable haemodynamic changes and septic shock from nosocomial infections, respectively. The outcome of E-CPR in adults with AMI was compared with previous studies at high-volume centres. Mortality or morbidity rates are not higher at a VLV centre.


Ambulance diversion is a dangerous repercussion of emergency department (ED) crowding and can reflect fragmentation and a lack of coordination in designating optimal patient offload sites for prehospital providers. The objective of this study was to evaluate whether proactive destination selection through the Regional Emergency Patient Access and Coordination (REPAC) program would enhance capacity and ED flow management. Methods: The REPAC system provides a dashboard that synthesizes real-time capacity and acuity data for all three adult EDs in the city of Calgary, assigning a color code to reflect receiving status. It assigns destination for the next patient transported by emergency medical services (EMS) by categorizing ED sites as having either a favorable (green/yellow) status or unfavorable (orange/red) status. Three time windows were analyzed: a 6-month window prior to REPAC implementation (pre), the first 6-month window immediately following (post1), and the second 6-month period following (post2). Primary outcomes of interest were the proportion of time spent in favorable versus unfavorable status and EMS avoidances for all adult ED sites in the region (percentage of total time with any center on EMS bypass). Information on total number of ED visits, percentage of patients arriving by EMS transports, admission rates, patient acuity (Canadian Triage and Acuity Score), age, and length of stay (LOS) for admitted and discharged patients was collected. The Kruskal-Wallis test was employed for primary outcome analysis. Results: Implementation of the REPAC system resulted in an increase in the proportion of total time region hospitals reported favorable status (57.5% vs. 64.1%) pre versus post1, an effect that was accentuated at 1 year (post2, 78.7%; p < 0.001 for both comparisons). There was a concomitant decrease in EMS avoidances as a result of the REPAC system, 4.4% to 1.8% (pre vs. post1), also further improved at 1 year to 0.6% (p < 0.001 for both comparisons). Conclusions: Proactive EMS destination selection through a real-time integrated electronic surveillance system enhances regional capacity and flow management while significantly reducing ambulance diversions.

13. Meaney PA, Nadkarni VM, Atkins DL, Berg MD, Samson RA, Hazinski MF, et al., Effect of Defibrillation Energy Dose During In-
Hospital Pediatric Cardiac Arrest. Pediatrics 2010: Online first; December 20
To examine the effectiveness of initial defibrillation attempts. We hypothesized that (1) an initial shock dose of 2 +/- 10 J/kg would be less effective for terminating fibrillation than suggested in published historical data and (2) a 4 J/kg shock dose would be more effective. Patients and Methods: This was a National Registry of Cardiopulmonary Resuscitation prospective, multisite, observational study of in-hospital pediatric (aged <= 18 years) ventricular fibrillation or pulseless ventricular tachycardia cardiac arrests from 2000-2008. Termination of ventricular fibrillation or pulseless ventricular tachycardia and event survival after initial shocks of 2 J/kg were compared with historic controls and a 4 J/kg shock dose. Results: Of 266 children with 285 events, 173 of 285 (61%) survived the event and 61 of 266 (23%) survived to discharge. Termination of fibrillation after initial shock was achieved for 152 of 285 (53%) events. Termination of fibrillation with 2 +/- 10 J/kg was much less frequent than that seen among historic control subjects (56% vs 91%; P < .001), but not different than 4 J/kg. Compared with 2 J/kg, an initial shock dose of 4 J/kg was associated with lower rates of return of spontaneous circulation (odds ratio: 0.41 [95% confidence interval: 0.21-0.81]) and event survival (odds ratio: 0.42 [95% confidence interval: 0.18-0.98]). Conclusions: The currently recommended 2 J/kg initial shock dose for in-hospital cardiac arrest was substantially less effective than previously published. A higher initial shock dose (4 J/kg) was not associated with superior termination of ventricular fibrillation or pulseless ventricular tachycardia or improved survival rates. The optimal pediatric defibrillation dose remains unknown.

Section 12: Paediatric advanced life support

The objective was to evaluate the use of a single 2 μg/kg dose of intranasal fentanyl as analgesia for painful orthopedic injuries in children presenting to a pediatric emergency department (ED). Methods: This was a prospective, non-blinded interventional trial, in a convenience sample of patients 3 to 18 years of age seen in a tertiary care pediatric ED. All had clinically suspected fractures and were treated between July and November 2006. Eligible patients had moderate to severe pain based on initial pain scores using the Wong Baker Faces Scale (WBS) for patients aged 3–8 years or the Visual Analog Scale (VAS) for patients aged 9–18 years. All enrolled patients received fentanyl via intranasal atomization. Pain scores were obtained at baseline and at 10, 20, and 30 minutes after intranasal fentanyl administration. Satisfaction scores were obtained using a 100-mm VAS. Vital signs and adverse events were recorded. Results: Eighty-one patients were enrolled, 28 in the VAS group and 53 in the WBS group. The mean patient age was 8 years. Fracture locations included forearm, 38 (47%); supracondylar, 16 (20%); clavicle, 7 (9%); tibia/fibula, 5 (6%); and other, 15 (18%). In the WBS group, the median pain scores decreased from five faces (interquartile range [IQR] = 4–6) at baseline to three faces (IQR = 2–5) at 10 minutes, two faces (IQR = 1–4) at 20 minutes, and two faces (IQR = 1–3) at 30 minutes. The mean pain score
in the VAS group at baseline was 70 mm (95% confidence interval [CI] = 63 to 77 mm). In this group, the pain scores decreased by a mean of 21 mm (95% CI = 14 to 28 mm) at 10 minutes, 25 mm (95% CI = 15 to 34 mm) at 20 minutes, and 27 mm (95% CI = 16 to 37 mm) at 30 minutes. Mean satisfaction scores were 79 mm for providers, 74 mm for parents, and 62 mm for patients. No adverse events were recorded. Conclusions: Intranasal fentanyl at a dose of 2 μg/kg provides effective analgesia for pediatric ED patients with painful orthopedic trauma within 10 minutes of administration.


Clinical assessment and end-tidal CO2 (ETCO2) detectors are routinely used to verify endotracheal tube (ETT) placement. However, ETCO2 detectors may mislead clinicians by failing to identify correct placement under a variety of conditions. A flow sensor measures gas flow in and out of an ETT. We reviewed video recordings of neonatal resuscitations to compare a colorimetric CO2 detector (Pedi-Cap®) with flow sensor recordings for assessing ETT placement. Methods: We reviewed recordings of infants <32 weeks gestation born between February 2007 and January 2010. Airway pressures and gas flow were recorded with a respiratory function monitor. Video recording were used (i) to identify infants who were intubated in the delivery room and (ii) to observe colour change of the ETCO2 detector. Flow sensor recordings were used to confirm whether the tube was in the trachea or not. Results: Of the 210 infants recorded, 44 infants were intubated in the delivery room. Data from 77 intubation attempts were analysed. In 35 intubations of 20 infants both a PediCap® and flow sensor were available for analysis. In 21 (60%) intubation attempts, both methods correctly identified successful ETT placement and in 3 (9%) both indicated the ETT was not in the trachea. In the remaining 11 (31%) intubations the PediCap® failed to change colour despite the flow wave indicating correct ETT placement. Conclusion: Colorimetric CO2 detectors may mislead clinicians intubating very preterm infants in the delivery room. They may fail to change colour in spite of correct tube placement in up to one third of the cases.

Section 12: Paediatric advanced life support

16. Skulec R, Truhlár A, Seblova J, Dostál P and Cerný V, Pre-hospital cooling of patients following cardiac arrest is effective using even low volumes of cold saline. Critical Care 2010: 14(6);R231

Pre-hospital induction of therapeutic mild hypothermia (TH) may reduce post-cardiac arrest brain injury in patients resuscitated from out-of-hospital cardiac arrest. Most often, it is induced by a rapid intravenous administration of as much as 30 ml/kg of cold crystalloids. We decided to assess the pre-hospital cooling effectivity of this approach; using a target dose of 15-20 ml/kg of 4degrees C cold normal saline in the setting of the physician staffed Emergency Medical Service. The safety and impact on the
clinical outcome have also been analyzed. METHODS: We performed a prospective observational study with a retrospective control group. A total of 40 patients were cooled by an intravenous administration of 15-20 ml/kg of 4 degreesC cold normal saline during transport to the hospital (TH group). The pre-hospital decrease of tympanic temperature (TT) was analysed as the primary endpoint. Patients in the control group did not undergo any pre-hospital cooling. RESULTS: In the TH group, administration of 12.6+/−6.4 ml/kg of 4 degreesC cold normal saline was followed by a pre-hospital decrease of TT of 1.4+/−0.8 degreesC in 42.8+/−19.6 min (p<0.001). The most effective cooling was associated with a transport time duration of 38-60 min and with an infusion of 17 ml/kg of cold saline. In the TH group, a trend toward a reduced need for catecholamines during transport was detected (35.0 vs. 52.5%, p=0.115). There were no differences in demographic variables, comorbidities, parameters of the cardiopulmonary resuscitation and in other post-resuscitation characteristics. The coupling of pre-hospital cooling with subsequent in-hospital TH predicted a favourable neurological outcome at hospital discharge (OR 4.1, CI95% 1.1-18.2, p=0.046). CONCLUSIONS: Pre-hospital induction of TH by the rapid intravenous administration of cold normal saline has been shown to be efficient even with a lower dose of coolant than reported in previous studies. This dose can be associated with a favourable impact on circulatory stability early after the return of spontaneous circulation and, when coupled with in-hospital continuation of cooling, it can potentially improve the prognosis of patients. Trial registration: ClinicalTrials.gov NCT00915421.

Guideline 11.8: Therapeutic hypothermia after cardiac arrest


Primary percutaneous coronary intervention (PCI) is the preferred treatment for ST-elevation myocardial infarction (STEMI). The distance to primary PCI centres and the inherent time delay in delivering primary PCI, however, limit widespread use of this treatment. This study aimed to evaluate the impact of pre-hospital diagnosis on time from emergency medical services contact to balloon inflation (system delay) in an unselected cohort of patients with STEMI recruited from a large geographical area comprising both urban and rural districts. Methods and results: From February 2004 until January 2007, data on pre-hospital timing and transport distance were prospectively recorded. Patients were divided into groups depending on achievement of pre-hospital diagnosis and/or direct referral to a primary PCI centre. Seven hundred and fifty-nine consecutive STEMI patients were included. In patients with a pre-hospital diagnosis and direct referral, the system delay was 92 vs. 153 min in patients without pre-hospital diagnosis (P<0.001). Patients from rural areas were transported a median of 30 km longer than patients from urban areas; however, this prolonged the system delay by only 9 min. Conclusion: Pre-hospital electrocardiographic (ECG) diagnosis and direct referral for primary PCI enables STEMI patients living far from a PCI centre to achieve a system delay comparable with patients living in close
vicinity of a PCI centre.

There is paucity of data on off-road vehicle injuries in children in Australia. We performed a retrospective study from 1998 to 2003 to analyze the frequency and nature of injuries in children involved in off-road vehicle crashes in the state of New South Wales.
Methods: Medical records were identified from search of the trauma database and hospital medical records database for off-road (all-terrain) vehicles. Results: A total of 271 children were identified, 86% of whom were boys. The mean age was 10 years (range, 2-16 years); and the mean length of stay, 5.8 (9) days (range, 1-40 days). The mean injury severity score was 6 (5.9). Most were drivers (85%). Injury mechanism was falls in 161; collision with stationary object, 54; moving object, 4; rollovers, 7; and others, 8. Eighty-four percent were on 2 wheelers, whereas 11% were quad bikes, and the rest were on tricycles or other vehicles. Distribution of the body region injured was head and neck in 66 patients; face, 51; chest, 25; abdomen, 36; pelvis, 5; spines, 14; upper limbs, 96; and lower limbs, 116. Only 55% were helmeted at the time of the incident. Sixty-five percent of these children required surgical treatment. Most were fractures (98) followed by soft tissue injuries (49). Seventeen had post head injury sequelae requiring rehabilitation support, and 21 required multiple surgeries. There were 7 deaths during the study period in New South Wales.
Conclusions: Off-road motor vehicle injuries are a significant problem in children. There are no legal safety regulations for use of these vehicles. With the increasing sales of these vehicles, the incidence of injury may rise. There seems a need for education and legislation in relation to the safety issues concerned with these vehicles.

Section 9.1: Trauma

The massive transfusion concept was introduced to recognize the dilutional complications resulting from large volumes of packed red blood cells. Definitions of massive transfusion vary and lack supporting clinical evidence. Damage control resuscitation regimens of modern trauma care are targeted to the early correction of acute traumatic coagulopathy. The aim of this study was to identify a clinically relevant definition of trauma massive transfusion based on clinical outcomes. We also examined if the concept was useful in that early prediction of massive transfusion requirements could allow early activation of blood bank protocols.
Methods: Datasets on trauma admissions over a one-year period were obtained from the trauma registries of five large trauma research networks. A fractional polynomial was used to model the transfusion-associated probability of death. A logistic regression model for the prediction of massive transfusion, defined as 10 or more units of red cell transfusions was developed.
Results: 5693 patient
records were available for analysis. Mortality increased as transfusion requirements increased but the model indicated no threshold effect. Mortality was 9% in patients who received 0 to 5 PRBC units, 22% in patients receiving 6 to 9 PRBC units and 42% in patients receiving 10 or more units. A logistic model for prediction of massive transfusion was developed and validated at multiple sites but achieved only moderate performance. The area under the receiver operating characteristic curve was 0.81, with specificity of only 50% at a sensitivity of 90% for the prediction of 10 or more PRBC units. Performance varied widely at different trauma centres, with specificity varying from 48% to 91%. CONCLUSIONS: There is no threshold for definition at which a massive transfusion specifically results in worse outcomes. Even with a large sample size across multiple trauma datasets, it was not possible to develop a transportable and clinically useful prediction model based on available admission parameters. The utility of massive transfusion as a concept in trauma has limited utility, and emphasis should be placed on identifying patients with massive hemorrhage and acute traumatic coagulopathy.

Section 9.1: Trauma

The "golden-hour" concept has led to emphasis on speed of patient delivery during pediatric inter-facility transport. Timely intervention, in addition to enhanced monitoring during transport, is the key to improved outcomes in critically ill patients. Taking the ICU to the patient may be more beneficial than rapid delivery to a tertiary care center. Methods: The Improved Monitoring During Pediatric Interfacility Transport trial was the first randomized controlled trial in the out-of-hospital pediatric transport environment. It was designed to determine the impact of improved blood pressure monitoring during pediatric interfacility transport and the effect on clinical outcomes in patients with systemic inflammatory response syndrome and moderate-to-severe head trauma. Patients in the control group had their blood pressure monitored intermittently with an oscillometric device; those in the intervention group had their blood pressure monitored every 12 to 15 cardiac contractions with a near-continuous, noninvasive device. Results: Between May 2006 and June 2007, 1995, consecutive transport patients were screened, and 94 were enrolled (48 control, 46 intervention). Patients in the intervention group received more intravenous fluid (19.8 +/- 22.2 vs 9.9 +/- 9.9 mL/kg; P = .01), had a shorter hospital stay (6.8 +/- 7.8 vs 10.9 +/- 13.4 days; P = .04), and had less organ dysfunction (18 of 206 vs 32 of 202 PICU days; P = .03). Conclusions: Improved monitoring during pediatric transport has the potential to improve outcomes of critically ill children. Clinical trials, including randomized controlled trials, can be accomplished during pediatric transport.

21. Yam CH, Dawson JA, Schmölzer GM, Morley CJ and Davis PG, Heart rate changes during resuscitation of newly born infants <30 weeks gestation: an observational study. Arch Dis Child Fetal Neonat Ed 2010: Online first; December 1
The International Liaison Committee on Resuscitation recommends starting positive pressure ventilation (PPV) in the delivery room when heart rate (HR) <100 beats per min (bpm) and giving cardiac compressions when HR <60 bpm. **Objective:** To describe the effect of PPV on HR in infants <30 weeks gestation with HR <100 bpm in the first minutes after birth. **Study design:** Retrospective observational study of infants, <30 weeks gestation, born between 14 February 2007 and 28 February 2009 with HR <100 bpm soon after birth. Methods: Infants with a HR <100 bpm receiving PPV at birth were eligible for the study. Video recordings and respiratory physiological data were obtained during delivery room resuscitation and analysed to determine if the rate of change in HR varied with measures of PPV, for example, expiratory tidal volume. **Results:** It took a median (IQR) 73 (24–165) seconds of PPV for infants' HR to rise above 100 bpm and a median (IQR) 243 (191–351) seconds to rise above 120 bpm. There were large fluctuations in HR after reaching 100 bpm and before reaching 120 bpm. In 18/27 (67%) of infants the HR did not remain stable until a threshold of approximately 150 bpm was reached. In 6/27 (20%) of the infants the rise in HR was almost instantaneous. In the remaining 21/27 (80%) HR rise was more gradual. There was a poor correlation between time of HR increase to 120 bpm and tidal volume (p=0.13). **Conclusion:** It takes more than a minute for newly born infants <30 weeks gestation with a HR <100 bpm to achieve a HR above 100 bpm. In these infants HR does not stabilise until it reaches 120 bpm. **Section 12: Paediatric advanced life support**

To identify variation in patient, event, and scene characteristics of out-of-hospital cardiac arrest (OOHCA) patients assessed by emergency medical services (EMS), and to investigate variation in transport practices in relation to documented prehospital return of spontaneous circulation (ROSC) within eight regional clinical centers participating in the Resuscitation Outcomes Consortium (ROC) Epistry-Cardiac Arrest. Methods: OOHCA patient, event, and scene characteristics were compared to identify variation in treatment and transport practices across sites. Findings were adjusted for site and standard Utstein covariates. Using logistic regression, these covariates were modeled to identify factors related to the initiation of transport without documented prehospital ROSC as well as survival in these patients. Setting: Eight US and Canadian sites participating in the ROC Epistry-Cardiac Arrest. Population: Persons >=20 years with OOHCA who (a) received compressions or shock by EMS providers and/or received bystander AED shock or (b) were pulseless but received no EMS compressions or shock between December 2005 and May 2007. Results 23,233 OOHCA cases were assessed by EMS in the defined period. Resuscitation (treatment) was initiated by EMS in 13,518 cases (58%, site range: 36-69%, p < 0.0001). Of treated cases, 59% were transported (site range: 49-88%, p < 0.0001). Transport was initiated in the absence of documented ROSC for 58% of transported cases (site range: 14-95%, p < 0.0001). Of these transported cases, 8%
achieved ROSC before hospital arrival (site range: 5-21%, p < 0.0001) and 4% survived to hospital discharge (site range: 1-21%, p < 0.0001). In cases with transport from the scene initiated after documented ROSC, 28% survived to hospital discharge (site range: 18-44%, p < 0.0001). Conclusion: Initiation of resuscitation and transport of OOHCA and the reporting of ROSC prior to transport markedly varies among ROC sites. This variation may help clarify reported differences in survival rates among sites and provide a target for identifying EMS practices most likely to enhance survival from OOHCA.

REVIEWS

The majority of general anaesthetics are now delivered with a supraglottic airway device (SAD) maintaining the airway. Efficacy and safety therefore matter. This is particularly so when SADs are used where a tracheal tube would traditionally have been used. For the majority of SADs, there is limited published evidence of efficacy or safety. Newer SADs have been designed to improve efficacy (airway seal) and safety (gastric access and protection from aspiration). It is difficult to prove increased safety of these devices compared with the classic laryngeal mask airway, but available evidence supports this claim. According to the NHS Purchasing and Supply Agency ‘Evidence Based Purchasing Guide’ (July 2008), there are 27 standard LM devices available. 2 The cLMA has over 2500 studies supporting it, whereas all others had only 18 between them. There were published comparative data for only three of more than 20 single-use standard laryngeal masks, and that evidence is largely based on lack of harm: benefit or equivalence to the cLMA has largely not been demonstrated. This article focuses on newer supraglottic airway devices (SADs), introduced in the last 10 yr, which offer potential benefits over the cLMA. Guideline 11.6: Equipment & techniques in adult ALS

The purpose of the trauma team is to provide advanced simultaneous care from relevant specialists to the seriously injured trauma patient. When functioning well, the outcome of the trauma team performance should be greater than the sum of its parts. Trauma teams have been shown to reduce the time taken for resuscitation, as well as time to CT scan, to emergency department discharge and to the operating room. These benefits are demonstrated by improved survival rates, particularly for the most severely injured patients, both within and outside of dedicated trauma centres. In order to ensure the best possible performance of the team, the leadership skills of the trauma team leader are essential and their non-technical skills have been shown to be particularly important.
Team performance can be enhanced through a process of audit and assessment of the workings of the team and the evidence currently available suggests that this is best facilitated through the process of video review of the trauma resuscitation. The use of human patient simulators to train and assess trauma teams is becoming more commonplace and this technique offers a safe environment for the future education of trauma team staff. Trauma teams are a key component of most programmes which set out to improve trauma care. This article reviews the background of trauma teams, the evidence for benefit and potential techniques of performance assessment. The review was written after a PubMed, Ovid, Athens, Cochrane and guideline literature review of English language articles on trauma teams and their performance and hand searching of references from the relevant searched articles.

The objectives of the present review are to describe the agreement between variables on arterial and venous blood gas analysis (in particular pH, pCO2, bicarbonate and base excess) and to identify unanswered questions. MEDLINE search of papers published from 1966 to January 2010 for studies comparing arterial and peripheral venous blood gas values for any of pH, pCO2, bicarbonate and base excess in adult patients with any condition in an emergency department setting. The outcome of interest was mean difference weighted for study sample size with 95% limits of agreement. The weighted mean arterio–venous difference in pH was 0.035 pH units (n= 1252), with narrow limits of agreement. The weighted mean arterio–venous difference for pCO2 was 5.7 mmHg (n= 760), but with 95% limits of agreement up to the order of ±20 mmHg. For bicarbonate, the weighted mean difference between arterial and venous values was −1.41 mmol/L (n= 905), with 95% limits of agreement of the order of ±5 mmol/L. Regarding base excess, the mean arterio–venous difference is 0.089 mmol/L (n= 103). There is insufficient data to determine if these relationships persist in shocked patients or those with mixed acid-base disorders. For patients who are not in shock, venous pH, bicarbonate and base excess have sufficient agreement to be clinically interchangeable for arterial values. Agreement between arterial and venous pCO2 is too poor and unpredictable to be clinically useful as a one-off test but venous pCO2 might be useful to screen for arterial hypercarbia or to monitor trends in pCO2 for selected patients.

26. Silk AW and McTigue KM, Reexamining the Physical Examination for Obese Patients. JAMA 2010: Online first; Dec 29
The notion of the standard 70-kg patient is outdated; in the United States, the mean weight of men is now 88.3 kg and the mean weight of women is 74.7 kg. 1 The most recent national data show that 35% of adults are obese, 2 defined by a body mass index (BMI) of ≥30. These patients, like healthy-weight patients, rely on their primary care physicians for diagnosis of illness, but the physical examination is often particularly challenging. The primary techniques of the physical examination—inspection, palpation, auscultation, and percussion—are ways for physicians to try to confirm normal physiology and detect pathology. However, each of
these techniques is undermined when the viscera and vasculature are enveloped in a thick layer of adipose tissue. To ensure good care of obese patients, special emphasis must be made in teaching physicians to overcome these challenges.

**ANIMAL / MANIKIN / CADAVER/ MODELS OF CARDIAC ARREST STUDIES**


This study is to compare the effect of the [delta]-opioid receptor agonist, d-Ala2-d-Leu5 enkephalin (DADLE) with normothermic control and therapeutic hypothermia on post resuscitation myocardial function and 72-h survival in a rat model of cardiac arrest and resuscitation. Methods: Ventricular fibrillation (VF) was induced in 15 male Sprague-Dawley rats. After 8 min of untreated VF, cardiopulmonary resuscitation was performed for 8 min before defibrillation. Animals were randomized to three groups of five: (a) normothermia; (b) hypothermia (32 °C); and (c) normothermia with DADLE intravenous infusion (1 mg/kg h-1). Hypothermia and drug infusion were started after successful defibrillation. Myocardial functions, including cardiac output (CO), left ventricular ejection fraction (LVEF), and myocardial performance index (MPI) were measured echocardiographically together with duration of survival.

**Results**: The 72-h survival was significantly greater in the hypothermic group than in both DADLE and normothermic group (p = 0.02). However, the survival time of the DADLE treated animals was significantly longer than that of the normothermia group (51.8 ± 18.9 vs 18.8 ± 10.1 h, p < 0.01). DADLE group showed significantly better CO (PR 60 min, p = 0.049), better LVEF (PR 60 min, p = 0.044; PR 240 min, p < 0.001) and lower MPI (PR 60 min, p = 0.043; PR 240 min, p = 0.045) than normothermic group.

**Conclusions**: DADLE attenuated post resuscitation myocardial dysfunction and increased short term survival time. However, the 72-h survival in the DADLE group was less than that in the hypothermia group.


Purpose: Airway management for successful ventilation by laypersons and inexperienced healthcare providers is difficult to achieve. Bag-valve mask (BVM) ventilation requires extensive training and is performed poorly. Supraglottic airway devices (SADs) have been
successfully introduced to clinical resuscitation practice as an alternative. We evaluated recently introduced (i-gel(TM) and LMA-Supreme(TM)) and established SADs (LMA-Unique(TM), LMA-ProSeal(TM)) and BVM used by laypeople in training sessions on manikins. Methods: In this randomized controlled study, 267 third-year medical students participated with informed consent and IRB approval. After brief standardized training, each participant applied all devices in a randomized order. Success of device application and ventilation was recorded. Without further training, skill retention was assessed in the same manner 12 months later. Outcome parameters were the number of application attempts, application time, tidal volume and gastric inflation rate recorded at successful attempts, and subjective ease-of-use rating by the participants. Results: i-gel(TM) and LMA-Supreme(TM) were the most successful in the first attempt at both assessments and in the subjective ease-of-use rating. The shortest application time was found with BVM (8 ± 5 s in 2008 vs. 9 ± 5 s in 2009) and i-gel (10 ± 3 s vs. 12 ± 5 s). Tidal volumes were disappointing with no device reaching 50% volume within the recommended range (0.4-0.6 L). Gastric inflation rate was highest with BVM (18% vs. 20%) but significantly lower with all SADs (0.4-6%; p < 0.001 for 2008 and 2009). Conclusion: SADs showed clear advantages over BVM. Compared with LMA-Unique(TM) and LMA-ProSeal(TM), i-gel(TM) and LMA-Supreme(TM) led to higher first-attempt success rates and a shorter application time.

Guideline 11.6: Equipment & techniques in adult ALS


Small volume hypertonic saline resuscitation can be beneficial for treating hemorrhagic shock, but the mechanism remains poorly defined. We investigated the effects of hemorrhagic resuscitation with hypertonic saline on cardiac (CSNA) and renal (RSNA) sympathetic nerve activity, and the resulting cardiovascular consequences. Studies were performed on conscious sheep instrumented with cardiac (n=7) and renal (n=6) sympathetic nerve recording electrodes and a pulmonary artery flow probe. Hemorrhage (20 ml/kg over 20 min) caused hypotension and tachycardia followed by bradycardia, reduced cardiac output and abolition of CSNA and RSNA. Resuscitation with intravenous hypertonic saline (1.2 mol/L at 2 ml/kg) caused rapid, dramatic increases in mean arterial pressure (MAP), heart rate (HR) and CSNA, but had no effect on RSNA. In contrast, isotonic saline resuscitation (12 ml/kg) had a much delayed and smaller effect on CSNA, less effect on MAP, no effect on HR, but stimulated RSNA, although the plasma volume expansion was similar. Intra-carotid infusion of hypertonic saline (1 ml/min bilaterally, n=5) caused similar changes to intravenous administration, indicating a cerebral component to the effects of hypertonic saline. In further experiments, contractility (dP/dTmax), heart rate and cardiac output increased significantly more with intravenous hypertonic saline (2 ml/kg) than with Gelofusine® (6ml/kg) after hemorrhage; the effects of hypertonic saline were attenuated by the β-receptor

18 Australian Research Council – December 2010 Research Updates
antagonist propranolol (n=6). These results demonstrate a novel neural mechanism for the effects of hypertonic saline resuscitation, comprising cerebral stimulation of CSNA by sodium chloride to improve cardiac output by increasing cardiac contractility and rate, and inhibition of RSNA.


Clot strength by Thrombelastography (TEG) is associated with mortality during trauma and has been linked to severity of tissue hypoperfusion. However, the optimal method for monitoring this important relationship remains undefined. We hypothesize that oxygen transport measurements will be associated with clot strength during traumatic shock, and test this hypothesis using a swine model of controlled traumatic shock. METHODS: N = 33 swine were subjected to femur fracture and hemorrhagic shock by controlled arterial bleeding to a predetermined level of oxygen debt measured by continuous indirect calorimetry. Hemodynamics, oxygen consumption, systemic central venous oxygenation (ScvO2), base excess, lactate, and clot maximal amplitude by TEG (TEG-MA) as clot strength were measured at baseline and again when oxygen debt = 80 ml/kg during shock. Oxygen transport and metabolic markers of tissue perfusion were then evaluated for significant associations with TEG-MA. Forward stepwise selection was then used to create regression models identifying the strongest associations between oxygen transport and TEG-MA independent of other known determinants of clot strength. RESULTS: Multiple markers of tissue perfusion, oxygen transport, and TEG-MA were all significantly altered during shock compared to baseline measurements (p < 0.05). However, only ScvO2 demonstrated a strong bivariate association with TEG-MA measured during shock (R = 0.7, p < 0.001). ScvO2 measured during shock was also selected by forward stepwise selection as an important covariate in linear regression models of TEG-MA after adjusting for the covariates fibrinogen, pH, platelet count, and hematocrit (Whole model R2 = 0.99, p [less than or equal to] 0.032). CONCLUSIONS: Among multiple measurements of oxygen transport, only ScvO2 was found to retain a significant association with TEG-MA during shock after adjusting for multiple covariates. ScvO2 should be further studied for its utility as a clinical marker of both tissue hypoxia and clot formation during traumatic shock.

CASE SERIES / CASE STUDIES / LETTERS / EDITORIALS

OBJECTIVE: To describe a successful case involving the use of tenecteplase during cardiac arrest for presumed pulmonary embolism (PE) and to systematically review the evidence from controlled trials supporting the efficacy and safety of thrombolysis during cardiac arrest. CASE SUMMARY: A 48-year-old male presented to the emergency department with an acute onset of shortness of breath that began approximately 2 hours prior to presentation. Prior to undergoing a computed tomography (CT) scan to rule out PE, the patient went into cardiac arrest, with an initial rhythm of pulseless electrical activity at a rate of 140 beats/min. Cardiopulmonary resuscitation (CPR) was initiated and, due to suspected PE, a bolus dose of tenecteplase 50 mg was administered immediately following a single 1-mg dose of epinephrine. CPR was continued and 4 additional 1-mg doses of epinephrine and three 1-mg doses of atropine were given. After 13 minutes of CPR, return of spontaneous circulation (ROSC) was achieved, with a blood pressure of 144/50 mm Hg. After the patient was stabilized, a CT scan demonstrated extensive bilateral pulmonary emboli in most segmental arteries. He was admitted to the intensive care unit where he was sedated, paralyzed, and treated with induced hypothermia for 24 hours. He was discharged from the hospital 2 weeks later on warfarin, with no noted neurologic deficits.

DISCUSSION: A systematic search of MEDLINE (1950-August 2010), Embase (1980-August 2010), and Google Scholar (to August 2010) was conducted to identify prospective controlled trials that investigated the use of thrombolytic medications to treat cardiac arrest. Five trials involving 1544 undifferentiated cases of cardiac arrest were found. Overall, some trials reported an improved rate of ROSC following administration of thrombolytics, but there was no overall mortality reduction in any trial. There was, however, an increased risk of bleeding events following administration of a thrombolytic drug. CONCLUSIONS: Controlled trials demonstrate that there is a lack of benefit and potential harm in administering thrombolysis in an undifferentiated patient with cardiac arrest. However, the case we present provides evidence that fibrinolysis may benefit selected patients with cardiac arrest in whom PE is confirmed or in whom there is high index of suspicion of PE.

Guideline 11.5: Medications in ALS

EDUCATION / ETHICS


This study evaluated the ability of young adults to respond to a simulated cardiac arrest using an automated external defibrillator (AED). Method: The study population was first-year medical students. None had received their mandatory training in emergency medicine. They role-played in pairs and entered a room in which a third person was lying on the floor and simulating unconsciousness and respiratory arrest. An AED and the corresponding poster-format instructions were clearly visible in the room,
next to a telephone. The actions of pairs of responders were recorded. Results: Interpretable results were obtained for 90 pairs of subjects. Most (96%) assessed vital signs and 20% performed this assessment correctly. Chest compressions were performed by 57%, 71% called emergency services, 4.5% removed the AED from the wall (but only one pair used it) and 8.9% did nothing. For 41% of the pairs, at least one member already had a cardiopulmonary resuscitation (CPR) certificate. The only statistically significant difference between students with and without a CPR certificate concerned use of the telephone to call emergency services.

Discussion: Despite the presence of an AED next to the telephone, the defibrillator was almost never used by the participants. Four out of ten pairs did not start chest compressions. The absence of any significant differences in performance between students with and without a CPR certificate casts doubt on the efficacy of the CPR training they had received. Conclusion: Results indicate the need for greater awareness of how to deal with cardiac arrest and the use of an AED when one is available.

**Guideline 7: External automated defibrillator in basic life support**


Widespread knowledge of cardiopulmonary resuscitation (CPR) is critical to improving survival in sudden cardiac death. We analyzed YouTube, an Internet video-site which is a growing source of healthcare information for source, content and quality of information about CPR. Methods: YouTube was queried using keywords "CPR", "Cardiopulmonary resuscitation", "BLS" and "Basic life support". Videos in English demonstrating CPR technique were included. Videos were classified by upload source, content, structure of course, subject for CPR demonstration, etc. Videos were scored for 'accuracy of demonstration' of CPR steps on a scale of 0-8 and for 'viewability'. Results: Of 800 videos screened 52 met the inclusion criteria with mean duration of 233 (±145) s and view count 37 (±77) per day. 48% (n = 25) videos were by individuals with unspecified credentials. No differences were noted in view count/day, 'accuracy of demonstration' and 'viewability' among videos based on source. No information was provided about scene safety assessment in 65% (n = 34) videos. Only 69% (n = 31/45) videos demonstrated the correct compression-ventilation ratio while 63.5% (n = 33), 34.6% (n = 18) and 40.4% (n = 21) gave information on location, rate and depth of chest compressions respectively. 19% (n = 10) videos incorrectly recommended checking for pulse. Conclusion: Videos judged the best source for CPR information were not the ones most viewed. Information on this platform is unregulated, hence content by trusted sources should be posted to provide accurate and easily accessible information about CPR. YouTube may have a potential role in video-assisted learning of CPR and as source of information for CPR in emergencies.

**Guideline 10.1: BLS training**

34. Reynolds T and Kong M-L, Shifting the learning curve. BMJ 2010; 341:c6260
Medicine has traditionally approached the problem of the learning curve by supervising trainees’ first attempts at new tasks and otherwise relying on them to call for help when they feel overwhelmed. But a growing movement within medical education argues that a better approach is to practise new skills in a realistic simulated environment before they are needed in a critical situation. “The huge benefit of simulation is that it shifts the steep and dangerous part of the learning curve away from patients,” says Ian Curran, consultant anaesthetist and clinical director of the Simulation Technology-enhanced Learning Initiative (STeLI), a workforce development project funded by the UK National Health Service’s London Deanery. “There always has to be a first time with a real patient so we must do all we can to ensure that these early encounters with real patients are as safe as possible.” Simulation ranges from task trainer models that teach a particular skill in isolation to full immersion in a replicated environment with manikins that mimic the physiological responses of real patients and are able to develop, for example, laryngeal oedema, pupillary dilation, or cyanosis. Use of simulation is growing worldwide...

Guideline 10.1: BLS training


The primary purpose of this study was to compare two, shorter, self-directed methods of cardiopulmonary resuscitation (CPR) education for healthcare professionals (HCP) to traditional training with a focus on the trainee's ability to perform two-person CPR. Methods: First-year medical students with either no prior CPR for HCP experience or prior training greater than 5 years were randomized to complete one of three courses: 1) HeartCode BLS System, 2) BLS Anytime, or 3) Traditional training. Only data from the adult CPR skills testing station was reviewed via video recording by certified CPR instructors and the Laerdal PC Skill Reporter software program (Laerdal Medical, Stavanger, Norway). Results: There were 180 first-year medical students who met inclusion criteria: 68 were HeartCode BLS System, 53 BLS Anytime group, and 59 traditional group Regarding two-person CPR, 57 (84%) of Heartcode BLS students and 43 (81%) of BLS Anytime students were able to initiate the switch compared to 39 (66%) of traditional course students (p = 0.04). There were no significant differences in the quality of chest compressions or ventilations between the three groups. There was a trend for a much higher CPR skills testing pass rate for the traditional course students. However, failure to "clear to analyze or shock" while using the AED was the most common reason for failure in all groups. Conclusion: The self-directed learning groups not only had a high level of success in initiating the "switch" to two-person CPR, but were not significantly different from students who completed traditional training.

Guideline 10.1: BLS training
36. Shanmuganathan N, Li JY, Yong TY, Hakendorf PH, Ben-Tovim DI and Thompson CH, Resuscitation orders and their relevance to patients’ clinical status and outcomes. QJM 2010: Published ahead-of-print; December 17
Documented resuscitation orders have relevance in the management of a pulseless, unresponsive patient. Although useful, the frequency of their documentation in the case notes of newly admitted medical patients is not well established. Aim: To investigate the frequency of early clear documentation of resuscitation orders in patients’ admission notes. Design: Retrospective audit. Methods: The admission notes of 618 medical admissions to an Australian tertiary referral teaching hospital between January and December 2007 were reviewed to calculate the frequency of clear resuscitation documentation. Certain outcomes of each admission, such as in-hospital death, were obtained via hospital-based computerized records. Results: Within the first 24h of admission, discussions regarding resuscitation were not documented for 78% of patients. Of the 482 patients with no documented resuscitation orders, 5 patients died during their index admission. Of the 136 patients with documented resuscitation orders, 24 patients died during their index admission. As age or a measure of clinical debility increased, the absolute number and relative proportion of resuscitation discussions increased significantly (P<0.0001) and the number and proportion of patients deemed not for resuscitation also increased (P<0.0001). Conclusions: Those patients apparently targeted for discussion were older, more frail and acutely unwell. We propose widespread use of a clinical scoring system to identify those patients who need their resuscitation status clarified early in their admission prior to clinical deterioration.

Guideline 10.5: Legal and ethical issues related to resuscitation

To determine whether team performance in a simulated emergency is related to generic teamwork skills and behaviours. Methods Design - Cross-sectional analysis of data from the Simulation and Fire-drill Evaluation (SaFE) randomised controlled trial. Setting - Six secondary and tertiary Maternity Units in Southwest England. Participants - 140 healthcare professionals, in 24 teams. Assessment - Blinded analysis of recorded simulations. Main outcome measures - Correlation of team performance (efficiency conducting key clinical actions, including the administration of an essential drug, magnesium), and generic teamwork scores (using a validated tool that assesses skills and behaviours, by Weller et al). Results: There was significant positive correlation between clinical efficiency and teamwork scores across all three dimensions; skills (Kendall’s taub = 0.54, p < 0.001), behaviours (taub = 0.41, p = 0.001), and overall score (taub = 0.51, p < 0.001). Better teams administered the essential drug 2½ min more quickly (Mann-Whitney U, p < 0.001). Conclusions: The clinical conduct of a simulated emergency was strongly linked to generic measures of teamwork. Further studies are needed to elucidate which aspects of team working are critical for team performance, to better inform training programs for multi-professional team working.
38. Groves J, Bicycle weight and commuting time: randomised trial. BMJ 2010: 341; c6801
Objective: To determine whether the author’s 20.9 lb (9.5 kg) carbon frame bicycle reduced commuting time compared with his 29.75 lb (13.5 kg) steel frame bicycle. Design Randomised trial. Setting Sheffield and Chesterfield, United Kingdom, between mid-January 2010 and mid-July 2010. Participants One consultant in anaesthesia and intensive care. Main outcome measure Total time to complete the 27 mile (43.5 km) journey from Sheffield to Chesterfield Royal Hospital and back. Results The total distance travelled on the steel frame bicycle during the study period was 809 miles (1302 km) and on the carbon frame bicycle was 711 miles (1144 km). The difference in the mean journey time between the steel and carbon bicycles was 00:00:32 (hr:min:sec; 95% CI –00:03:34 to 00:02:30; P=0.72). Conclusions: A lighter bicycle did not lead to a detectable difference in commuting time. Cyclists may find it more cost effective to reduce their own weight rather than to purchase a lighter bicycle.

Objective: To compare the effects of drinking white wine or black tea with Swiss cheese fondue followed by a shot of cherry schnapps on gastric emptying, appetite, and abdominal symptoms. Design: Randomised controlled crossover study. Participants 20 healthy adults (14 men) aged 23-58. Interventions: Cheese fondue (3260 kJ, 32% fat) labelled with 150 mg sodium 13Carbon-octanoate was consumed with 300 ml of white wine (13%, 40 g alcohol) or black tea in randomised order, followed by 20 ml schnapps (40%, 8 g alcohol) or water in randomised order. Main outcome measures: Cumulative percentage dose of 13C substrate recovered over four hours (higher values indicate faster gastric emptying) and appetite and dyspeptic symptoms (visual analogue scales). Results Gastric emptying was significantly faster when fondue was consumed with tea or water than with wine or schnapps (cumulative percentage dose of 13C recovered 18.1%, 95% confidence interval 15.2% to 20.9% v 7.4%, 4.6% to 10.3%; P<0.001). An inverse dose-response relation between alcohol intake and gastric emptying was evident. Appetite was similar with consumption of wine or tea (difference 0.11, −0.12 to 0.34; P=0.35), but reduced if both wine and schnapps were consumed (difference −0.40, −0.01 to −0.79; P<0.046). No difference in dyspeptic symptoms was present. Conclusions: Gastric emptying after a Swiss cheese fondue is noticeably slower and appetite suppressed if consumed with higher doses of alcohol. This effect was not associated with dyspeptic symptoms. Trial registration ClinicalTrials.gov NCT00943696.

40. McCain RS, Harris AR, McCallion K, Campbell WJ and Kirk SJ, The barrier method as a new tool to assist in career selection:
covert observational study. BMJ 2010: 341

Objective: To determine if senior doctors’ parking habits and skills are associated with clinical specialty and, if so, whether observation of junior doctors’ parking could provide guidance in choice of specialty. Design: Covert observational study. Setting: Pass-card controlled consultants’ car park (parking lot), December 2009. Participants 103 consultants entering the car park on three consecutive mornings. Main outcome measures: The outcomes were specialty and sex of the consultants, manner of approaching the barrier (pass-card ready or not), and time taken to park, exit the vehicle, and walk to a designated point. Results: Approaches to the barrier and parking were recorded for 103 consultants (79 men, 24 women): 28 anaesthetists (22 men, six women), 29 physicians (internists, 18 men, 11 women), 14 radiologists (nine men, five women), and 32 surgeons (30 men, two women). The manner of approaching the barrier (card ready) differed by specialty but not by sex. The total time taken to park (seconds) differed significantly between specialties: surgery (median 68, interquartile range 61-71 seconds), anaesthesia (82, 76-91), radiology (86, 70-103), and general medicine (112, 96-136). The time taken to park was overall longer among women, but this was explained by their specialty (men and women matched by specialty did not differ). Conclusions: The total time taken to park and manner of approaching the barrier to gain entry to the car park differed across specialties. Surgical consultants were fastest, followed by consultant anaesthetists and consultant radiologists, with physicians slowest. Sex was not an influencing factor. If reproducible in studies of a similar nature the “barrier method” could allow for a low cost means of guiding junior doctors in career selection.