
The possibility of a fall into rope protection and subsequent suspension exists in some industrial situations. The action to take for the first aid management of rescued victims has not been clear, with some authors advising against standard first aid practices. To clarify the medical evidence relating to harness suspension the UK Health and Safety Executive commissioned an evidence-based review and guideline. Four key questions were posed relating to the incidence, circumstances, recognition and first aid management of the medical effects of harness suspension. A comprehensive literature search returned 60 potential papers with 29 papers being reviewed. The Scottish Intercollegiate Guideline Network (SIGN) methodology was used to critically review the selected papers and develop a guideline. A stakeholders’ workshop was held to review the evidence and draft recommendations. Nine papers formed the basis of the guideline recommendations. No data on the incidence of harness suspension syncope were found. Pre-syncopal symptoms or syncope are thought to occur with motionless suspension as a consequence of orthostasis leading to hypotension. There was no evidence of any other pathology, despite this being hypothesised by others. No evidence was found that showed the efficacy or safety of positioning a victim in a semi-recumbent position. In any case of harness suspension, the standard UK first aid guidance for recovery of a semiconscious or unconscious person in a horizontal position should be followed. Other recommendations included areas for further research and proposals for standard data collection on falls into rope protection.

2. Amula V, Extracorporeal Resuscitation in Childhood Cardiac Arrest. AAP Grand Rounds 2010: 24(4); 49

Cardiac arrest occurs in 2% to 6% of children in pediatric critical care units, and survival to discharge after resuscitation varies from 25% to 33% following in-hospital cardiac arrest. Investigators used data contributed by 285 hospitals to the American Heart Association’s National Registry of CardioPulmonary Resuscitation (NRCPR) from January 2000 through December 2007 to assess patient outcome after extracorporeal cardiopulmonary resuscitation (E-CPR). The NRCPR registry uses a standardized form to report patient characteristics, details of the cardiac arrest event, processes of care, and outcomes. A cardiopulmonary arrest (CPA) was defined as an arrest requiring chest compressions and/or defibrillation. E-CPR was defined as a CPA treated with extracorporeal life support. This study included children less than 18 years of age who had an in-hospital cardiac arrest, refractory CPR, and then rescue by E-CPR.

Guideline 12.7: Management after resuscitation in paediatric advanced life support
To compare standard high flow oxygen treatment with titrated oxygen treatment for patients with an acute exacerbation of chronic obstructive pulmonary disease in the prehospital setting. Design: Cluster randomised controlled parallel group trial. Setting: Ambulance service in Hobart, Tasmania, Australia. Participants: 405 patients with a presumed acute exacerbation of chronic obstructive pulmonary disease who were treated by paramedics, transported, and admitted to the Royal Hobart Hospital during the trial period; 214 had a diagnosis of chronic obstructive pulmonary disease confirmed by lung function tests in the previous five years. Interventions High flow oxygen treatment compared with titrated oxygen treatment in the prehospital (ambulance/paramedic) setting. Main outcome measure: Prehospital or in-hospital mortality. Results: In an intention to treat analysis, the risk of death was significantly lower in the titrated oxygen arm compared with the high flow oxygen arm for all patients (high flow oxygen n=226; titrated oxygen n=179) and for the subgroup of patients with confirmed chronic obstructive pulmonary disease (high flow n=117; titrated n=97). Overall mortality was 9% (21 deaths) in the high flow oxygen arm compared with 4% (7 deaths) in the titrated oxygen arm; mortality in the subgroup with confirmed chronic obstructive pulmonary disease was 9% (11 deaths) in the high flow arm compared with 2% (2 deaths) in the titrated oxygen arm. Titrated oxygen treatment reduced mortality compared with high flow oxygen by 58% for all patients (relative risk 0.42, 95% confidence interval 0.20 to 0.89; P=0.02) and by 78% for the patients with confirmed chronic obstructive pulmonary disease (0.22, 0.05 to 0.91; P=0.04). Patients with chronic obstructive pulmonary disease who received titrated oxygen according to the protocol were significantly less likely to have respiratory acidosis (mean difference in pH 0.12 (SE 0.05); P=0.01; n=28) or hypercapnia (mean difference in arterial carbon dioxide pressure −33.6 (16.3) mm Hg; P=0.02; n=29) than were patients who received high flow oxygen. Conclusions: Titrated oxygen treatment significantly reduced mortality, hypercapnia, and respiratory acidosis compared with high flow oxygen in acute exacerbations of chronic obstructive pulmonary disease. These results provide strong evidence to recommend the routine use of titrated oxygen treatment in patients with breathlessness and a history or clinical likelihood of chronic obstructive pulmonary disease in the prehospital setting. Trial registration: Australian New Zealand Clinical Trials Register ACTRN12609000236291.

Chest compression-only bystander cardiopulmonary resuscitation (CPR) may be as effective as conventional CPR with rescue breathing for out-of-hospital cardiac arrest. Objective: To investigate the survival of patients with out-of-hospital cardiac arrest using compression-only CPR (COCPR) compared with conventional CPR. Design, Setting, and Patients: A 5-year prospective observational cohort study of survival in patients at least 18 years old with out-of-hospital cardiac arrest between January 1, 2005, and December
31, 2009, in Arizona. The relationship between layperson bystander CPR and survival to hospital discharge was evaluated using multivariable logistic regression. Main Outcome Measure Survival to hospital discharge. Results Among 5272 adults with out-of-hospital cardiac arrest of cardiac etiology not observed by responding emergency medical personnel, 779 were excluded because bystander CPR was provided by a health care professional or the arrest occurred in a medical facility. A total of 4415 met all inclusion criteria for analysis, including 2900 who received no bystander CPR, 666 who received conventional CPR, and 849 who received COCPR. Rates of survival to hospital discharge were 5.2% (95% confidence interval [CI], 4.4%-6.0%) for the no bystander CPR group, 7.8% (95% CI, 5.8%-9.8%) for conventional CPR, and 13.3% (95% CI, 11.0%-15.6%) for COCPR. The adjusted odds ratio (AOR) for survival for conventional CPR vs no CPR was 0.99 (95% CI, 0.69-1.43), for COCPR vs no CPR, 1.59 (95% CI, 1.18-2.13), and for COCPR vs conventional CPR, 1.60 (95% CI, 1.08-2.35). From 2005 to 2009, lay rescuer CPR increased from 28.2% (95% CI, 24.6%-31.8%) to 39.9% (95% CI, 36.8%-42.9%; P < .001); the proportion of CPR that was COCPR increased from 19.6% (95% CI, 13.6%-25.7%) to 75.9% (95% CI, 71.7%-80.1%; P < .001). Overall survival increased from 3.7% (95% CI, 2.2%-5.2%) to 9.8% (95% CI, 8.0%-11.6%; P < .001). Conclusion: Among patients with out-of-hospital cardiac arrest, layperson compression-only CPR was associated with increased survival compared with conventional CPR and no bystander CPR in this setting with public endorsement of chest compression-only CPR.

Guideline 7: Cardiopulmonary resuscitation

5. Bulger EM, May S, Brasil KJ, Schreiber M, Kerby JD, Tisherman SA, et al., Out-of-Hospital Hypertonic Resuscitation Following Severe Traumatic Brain Injury: A Randomized Controlled Trial. JAMA 2010; 304(13); 1455-64

Hypertonic fluids restore cerebral perfusion with reduced cerebral edema and modulate inflammatory response to reduce subsequent neuronal injury and thus have potential benefit in resuscitation of patients with traumatic brain injury (TBI). Objective: To determine whether out-of-hospital administration of hypertonic fluids improves neurologic outcome following severe TBI. Design, Setting, and Participants: Multicenter, double-blind, randomized, placebo-controlled clinical trial involving 114 North American emergency medical services agencies within the Resuscitation Outcomes Consortium, conducted between May 2006 and May 2009 among patients 15 years or older with blunt trauma and a prehospital Glasgow Coma Scale score of 8 or less who did not meet criteria for hypovolemic shock. Planned enrollment was 2122 patients. Intervention A single 250-mL bolus of 7.5% saline/6% dextran 70 (hypertonic saline/dextran), 7.5% saline (hypertonic saline), or 0.9% saline (normal saline) initiated in the out-of-hospital setting. Main Outcome Measure: Six-month neurologic outcome based on the Extended Glasgow Outcome Scale (GOSE) (dichotomized as >4 or ≤4). Results: The study was terminated by the data and safety monitoring board after randomization of 1331 patients, having met pre-specified futility criteria. Among the 1282 patients enrolled, 6-month outcomes data were available for 1087 (85%). Baseline characteristics of the groups were equivalent. There was no difference in 6-month neurologic outcome among
groups with regard to proportions of patients with severe TBI (GOSE ≤4) (hypertonic saline/dextran vs normal saline: 53.7% vs 51.5%; difference, 2.2% [95% CI, -4.5% to 9.0%]; hypertonic saline vs normal saline: 54.3% vs 51.5%; difference, 2.9% [95% CI, -4.0% to 9.7%]; P = .67). There were no statistically significant differences in distribution of GOSE category or Disability Rating Score by treatment group. Survival at 28 days was 74.3% with hypertonic saline/dextran, 75.7% with hypertonic saline, and 75.1% with normal saline (P = .88). Conclusion: Among patients with severe TBI not in hypovolemic shock, initial resuscitation with either hypertonic saline or hypertonic saline/dextran, compared with normal saline, did not result in superior 6-month neurologic outcome or survival. Trial Registration clinicaltrials.gov Identifier: NCT00316004

Guideline 8.11: Head injury


Background: Although explosion injuries caused by terror attacks or in war are evaluated in many studies, limited information about civil explosion injuries can be found in the literature. Methods: In a retrospective study of 71 civil gas explosion injuries treated in a single burn center during a 16-year period, we evaluated trauma mechanisms, patterns of injury, and clinical outcome. Results: More than 50% of all gas explosions injuries occurred in private households. The mortality correlated significantly with higher burned total body surface area (TBSA), higher abbreviated burn severity index (ABSI) score, accompanying inhalation injuries, and lung contusions. Although mean ABSI score and burned TBSA were similar in men and women (6 vs. 7 and 22% vs. 21%), the female mortality from gas explosions was noticeably higher, albeit not statistically significant due to small patient numbers (32% vs. 17%). Although mean burned TBSA, ABSI scores, and intensive care unit lengths of stay in patients with burns from gas explosions were comparable and not significantly different compared with all burn patients treated in our burn center (TBSA: 22% vs. 17%; ABSI: 6 vs. 6; and intensive care unit lengths of stay: 12 vs. 11 days), the mortality from gas explosions was significantly higher (21% vs. 12%, = 0.04). Conclusions: The mortality from gas explosion-related burns correlated significantly with burned TBSA, ABSI score, accompanying inhalation injuries, and lung contusions. Despite comparable ABSI scores, the mortality from gas explosion-related burns was significantly higher than the mortality for all burn victims.

Guideline 8.5: Burns

The aim of this study was to determine if differences in clinical diagnosis versus autopsy findings concerning the cause of death in polytrauma fatalities would be detected in 19 cases of fatal polytrauma from a Level 1 trauma centre. METHODS: Clinical diagnoses determining the cause of death in 19 cases of fatal polytrauma (2007 - 2008) from a Level 1 trauma centre were correlated with autopsy findings. RESULTS: In 13 cases (68%), the clinical cause of death and the cause of death as determined by autopsy were congruent. Marginal differences occurred in three (16%) patients while obvious differences in interpreting the cause of death were found in another three (16%) cases. Five fatalities (three with obvious differences and two with marginal differences) were remarked as early death (1-4 h after trauma) and one fatality with marginal differences as late death (>1 week after trauma). Obvious and marginal discrepancies mostly occurred in the early phase of treatment, especially when severely injured patients were admitted to the emergency room undergoing continued cardiopulmonary resuscitation, i.e. limiting diagnostic procedures, and thus the clinical cause of death was essentially determined by basic emergency diagnostics. CONCLUSIONS: Autopsy as golden standard to define the cause of death in fatal polytrauma varies from the clinical point of view, depending on the patient’s pre-existing condition, mechanism of polytrauma, necessity of traumatic cardiopulmonary resuscitation, survival time, and thus the possibility to perform emergency diagnostics. An autopsy should be performed at least in cases of early fatal polytrauma to help establishing the definite cause of death. Moreover, autopsy data should be included in trauma registries as a quality assessment tool.


Objective: To examine the effect of clinician designation on emergency department (ED) fast track performance. Design and Setting: A retrospective audit of patients managed in the fast track area of an ED in metropolitan Melbourne, Australia. Participants: Patients triaged to ED fast track from 1 January 2008 to 31 December 2008 (n=8714). Main Outcome Measures: Waiting times in relation to Australasian triage scale (ATS) recommendations and ED length of stay (LOS) for non-admitted patients were examined for each clinician group. Results: Compliance with ATS waiting time recommendations was highest (82.5%) for emergency nurse practitioners/candidates and lowest (48.2%) for junior medical officers. Median ED LOS was less than 3 h for non-admitted patients, and 85.8% of non-admitted fast track patients (n=6278) left the ED within 4 h. Patients managed by emergency nurse practitioners/candidates had the shortest ED LOS (median 1.7h) and patients managed by junior medical officers and locum medical officers the longest ED LOS (median 2.7h) (χ²=498.539, df=6, p<0.001). Conclusions: Clinician designation does impact on waiting times and, to a lesser extent, ED LOS for patients managed in ED fast track systems. Future research should focus on obtaining a better understanding of the relationship between clinician expertise, time-based performance measures and quality of care.
Patients with acute atrial fibrillation with a history of mild structural heart disease could be considered for rhythm conversion.

Methods: Patients received intravenous flecainide, propafenone, or amiodarone on presentation and a second dose after 6 hours if atrial fibrillation persisted. No randomization was used, and drugs were given at the discretion of the treating physician. Primary end point was rhythm conversion within the first 6 hours from presentation. Secondary end points included rhythm conversion, time to rhythm conversion, and adverse drug effects within 24 hours. Results: Among the 378 patients enrolled, 37 (10%) recovered sinus rhythm before therapy was given. Of the remaining 341 patients, 43 (13%) received flecainide, 187 (55%) received propafenone, and 111 (32%) received amiodarone. Baseline clinical characteristics were homogeneous among groups. Rhythm conversion was obtained in 87% of treated patients overall. Within 6 hours, the primary end point was achieved in a higher proportion in the flecainide and propafenone groups (72% and 55%, respectively) as compared with the amiodarone group (30%; P < .001). The mean time to the end point overall was shorter in the flecainide and propafenone groups (178 ± 227 and 292 ± 285 minutes, respectively) as compared with the amiodarone group (472 ± 269 minutes; P < .001). Length of in-hospital stay in the amiodarone group was significantly higher (26.1 ± 22.4 hours) compared with the flecainide and propafenone groups (8.9 ± 10.3 and 11.0 ± 13.8 hours; respectively; P = .001). No significant differences were found in adverse drug effects. Conclusions: Flecainide and propafenone achieve rhythm control in a higher proportion of patients as compared with amiodarone within a 6-hour management.

Guideline 11.11: Managing acute dysrhythmias


Children presenting to emergency departments (ED) with acute severe asthma unresponsive to initial medical therapy may require endotracheal intubation and mechanical ventilation. There is little data on complications during the acute management of children with life-threatening asthma, particularly at hospitals where specialist paediatric staff are lacking. It was hypothesised that a better understanding of complications, particularly associated with intubation and mechanical ventilation, would improve acute management in ED, aid quality improvement initiatives at district general hospitals (DGH) and form the basis for educational interventions from regional paediatric critical care units. Methods: A retrospective case note review was performed for all children referred to a regional intensive care retrieval service with status asthmaticus over a 2-year period. Initial treatment, patient-related factors, indication for endotracheal intubation and the type and occurrence of adverse events during acute management at the DGH
were studied. Bivariate and multivariate analyses were undertaken to identify factors associated with the occurrence of complications. Results: 51 (85%) of the 60 children transferred to a paediatric intensive care unit for acute severe asthma required intubation. 36 (70.5%) experienced one or more complications during intubation and in the early phase of mechanical ventilation. The most common complications were hypotension (requiring fluid resuscitation and/or inotropic support) and severe bronchospasm with acute hypercarbia. The indication for intubation significantly affected the chances of a complication occurring during stabilisation. Conclusions: There is considerable morbidity in asthmatic children who are referred to paediatric intensive care. The majority of complications may be anticipated and prevented resulting in improved management at DGH.

We compare the quality of ECG recordings obtained with conventional and prewired electrodes in an emergency setting. This was a prospective, randomized, open comparison study in an emergency medical services setting. Participants were patients undergoing ECG between April and May 2007 (n=105). Two 12-lead ECG recordings were made in random order with conventional and prewired electrodes. Artifacts, ie, signal noise (>0.4 seconds of recording affected) and baseline instability (>1-mV variation), were analyzed and scored by 3 blinded reviewers. Results were expressed as number of affected leads, score/lead (0 to 3 scale for signal noise; 0 to 4 scale for baseline instability), and number of leads that were totally artifact free. Time to make recordings was measured. Recordings were nearly as easy and took 20% less time with prewired than with conventional electrodes (118 [interquartile ratio (IQR) 90 to 150] versus 144 [IQR 120 to 182]). With prewired electrodes, fewer leads were affected by noise (1 [IQR 0 to 3] versus 3 [IQR 0 to 6]) and baseline instability (0 [IQR 0 to 2] versus 2 [IQR 0 to 4]). The mean score/lead was lower for both noise (1 [IQR 0 to 3] versus 3 [IQR 0 to 8]) and instability (0 [IQR 0 to 2] versus 2 [IQR 0 to 5]); the number of artifact-free leads was greater (38 [36%] versus 19 [18%]). There was no significant difference between electrode types in the prevalence of P-wave and QRS complex abnormalities. Recordings with prewired electrodes took significantly less time. Signal noise and baseline instability were significantly reduced. The time saved was not at the expense of the quality of the recording.

Controversies exist as to whether one should rely on the ‘scoop and run’ or ‘stay and play’ approach in the case of penetrating trauma in the prehospital setting. Optimal prehospital care is much debated and the extent to which advanced life support (ALS) measures should be performed remains unclear. This study aimed to report the outcome of penetrating torso trauma in relation to the on-scene time and ALS procedures performed prehospitaly. It was hypothesised that a longer on-scene time could predict a
higher mortality after penetrating torso trauma. Methods: This was an observational cohort study of penetrating trauma patients treated by the Mobile Emergency Care Unit in Copenhagen with a 30-day follow-up. Between January 2002 and September 2009, data were prospectively registered regarding the anatomical location of the trauma, time intervals and procedures performed in the prehospital setting. Follow-up data were obtained from a national administrative database. The primary end point was 30-day survival. Results: Of the 467 patients registered, 442 (94.6%) were identified at the 30-day follow-up, of whom 40 (9%) were dead. A higher mortality was found among patients treated on-scene for more than 20 min (p=0.0001), although on-scene time was not a significant predictor of 30-day mortality in the multivariate analysis; OR 3.71, 95% CI 0.66 to 20.70 (p=0.14). The number of procedures was significantly correlated to a higher mortality in the multivariate analysis. Conclusion: On-scene time might be important in penetrating trauma, and ALS procedures should not delay transport to definite care at the hospital.

The aim of this study was to evaluate (a) the differences between men and women in symptom profile, allocated life support level (LSL), and presence of acute myocardial infarction (AMI), life-threatening condition (LTC), or death and (b) whether a computer-based decision support system could improve the allocation of LSL. Patients: All patients in Goteborg, Sweden, who called the dispatch center because of chest pain during 3 months (n = 503) were included in this study. Methods: Age, sex, and symptom profile were background variables. Based on these, we studied allocation of LSL by the dispatchers and its relationship to AMI, LTC, and death. All evaluations were made from a sex perspective. Finally, we studied the potential benefit of using a statistical model for allocating LSL. Results: The advanced life support level (ALSL) was used equally frequently for men and women. There was no difference in age or symptom profile between men and women in relation to allocation. However, the allocation of ALSL was predictive of AMI and LTC only in men. The sensitivity was far lower for women than for men. When a statistical model was used for allocation, the ALSL was predictive for both men and women. Using a separate model for men and women respectively, sensitivity increased, especially for women, and specificity was kept at the same level. Conclusion: This exploratory study indicates that women would benefit most from the allocation of LSL using a statistical model and computer-based decision support among patients who call for an ambulance because of acute chest pain. This needs further evaluation.

Experimental studies have shown that induction of hypothermia before reperfusion of acute coronary occlusion reduces infarct size.
Previous clinical studies, however, have not been able to show this effect, which is believed to be mainly because therapeutic temperature was not reached before reperfusion in the majority of the patients. We aimed to evaluate the safety and feasibility of rapidly induced hypothermia by infusion of cold saline and endovascular cooling catheter before reperfusion in patients with acute myocardial infarction. Methods and Results—Twenty patients with acute myocardial infarction scheduled to undergo primary percutaneous coronary intervention were enrolled in this prospective, randomized study. After 4+/−2 days, myocardium at risk and infarct size were assessed by cardiac magnetic resonance using T2-weighted imaging and late gadolinium enhancement imaging, respectively. A core body temperature of <35°C (34.7+/−0.3°C) was achieved before reperfusion without significant delay in door-to-balloon time (43+/−7 minutes versus 40+/−6 minutes, hypothermia versus control, P=0.12). Despite similar duration of ischemia (174+/−51 minutes versus 174+/−62 minutes, hypothermia versus control, P=1.00), infarct size normalized to myocardium at risk was reduced by 38% in the hypothermia group compared with the control group (29.8+/−12.6% versus 48.0+/−21.6%, P=0.041). This was supported by a significant decrease in both peak and cumulative release of Troponin T in the hypothermia group (P=0.01 and P=0.03, respectively). Conclusions—The protocol demonstrates the ability to reach a core body temperature of <35°C before reperfusion in all patients without delaying primary percutaneous coronary intervention and that combination hypothermia as an adjunct therapy in acute myocardial infarction may reduce infarct size at 3 days as measured by MRI. Clinical Trial Registration—URL: http://www.clinicaltrials.gov. Unique identifier: NCT00417638.

Emergency physicians were trained to perform echo in life support (ELS)—that is, limited transthoracic echocardiography during advanced life support (ALS) management of cardiac arrest. Methods: Data were collected on the adequacy of views obtained and timing of the scan, as well as the clinical findings of pericardial effusion and ventricular wall motion. Any intervention performed as a result of the scan was also noted. ELS was performed on 50 patients during cardiac arrest. Results: Adequate views were obtained in 47 (94%) scans, and 45 (90%) were obtained within the 10s rhythm check. Twenty patients (40%) had ventricular wall motion (VWM), three (6%) had pericardial effusions and six patients (12%) had an intervention performed as a direct result of the scan. These included pericardiocentesis, thrombolysis and insertion of a chest drain. The presence of VWM had a positive predictive value of 55%. The absence of VWM resulted in a negative predictive value of 97% for predicting return of spontaneous circulation (ROSC). Conclusion: It is concluded that ELS is feasible and that the scan findings may guide further interventions.

Normal vital signs are typically associated with improved outcomes in trauma patients. Whether this association is true for geriatric patients is unclear. Methods: A Level 1 trauma center retrospective chart review of vital signs on presentation (heart rate [HR] and blood pressure) in young (aged 17–35 years) and geriatric (aged 65 years or older) blunt trauma victims from September 2003 to September 2008 was performed. Generalized nonlinear using piecewise regression for the linear portion of standard logistic models was used to model risk of mortality as a function of HR and blood pressure. Independent models were selected for elderly and young trauma patients based on blood pressure and HR. Models of the same complexity were then fit within each gender and age. Results: There were 2,194 geriatric and 2,081 young patients. Two hundred fifty-one (11.4%) geriatric and 49 (2.4%) young patients died. At all points of “normality,” the mortality of the geriatric patients was higher than the young group. Mortality increases considerably in the elderly patients for HRs >90 beats per minute (bpm), an association not seen until HR of 130 bpm in the young group. Mortality significantly increases with systolic blood pressure (SBP) <110 mm Hg in the geriatric patients but not until a SBP of 95 mm Hg in the young patients. HR and mortality association was most variable in the male geriatric patients. Conclusions: Vital signs on presentation are less predictive of mortality in geriatric blunt trauma victims. Geriatric blunt trauma patients warrant increased vigilance despite normal vital signs on presentation. New trauma triage set points of HR >90 or SBP <110 mm Hg should be considered in the geriatric blunt trauma patients.


We assess survival from out-of-hospital cardiac arrest after community-wide implementation of 2005 American Heart Association guidelines. This was an observational multiphase before-after cohort in an urban/suburban community (population 840,000) with existing advanced life support. Included were all adults treated for cardiac arrest by emergency responders. Excluded were patients younger than 16 years and trauma patients. Intervention phases in months were baseline 16; phase 1, new cardiopulmonary resuscitation 12; phase 2, impedance threshold device 6; and phase 3, full implementation including out-of-hospital-induced hypothermia 12. Primary outcome was survival to discharge. Other survival and neurologic outcomes were compared between study phases, and adjusted odds ratios with 95% confidence intervals (CIs) for survival by phase were determined by multivariate regression. One thousand three hundred sixty-five cardiac arrest patients were eligible for inclusion: baseline n=425, phase 1 n=369, phase 2 n=161, phase 3 n=410. Across phases, patients had similar demographic, clinical, and emergency medical services characteristics. Overall and witnessed ventricular fibrillation and ventricular tachycardia survival improved throughout the study
phases: respectively, baseline 4.2% and 13.8%, phase 1 7.3% and 23.9%, phase 2 8.1% and 34.6%, and phase 3 11.5% and 40.8%. The absolute increase for overall survival from baseline to full implementation was 7.3% (95% CI 3.7% to 10.9%); witnessed ventricular fibrillation/ventricular tachycardia survival was 27.0% (95% CI 13.6% to 40.4%), representing an additional 25 lives saved annually in this community. In the context of a community-wide focus on resuscitation, the sequential implementation of 2005 American Heart Association guidelines for compressions, ventilations, and induced hypothermia significantly improved survival after cardiac arrest. Further study is required to clarify the relative contribution of each intervention to improved survival outcomes.


We determine whether droperidol, midazolam, or the combination is more effective for intramuscular sedation in violent and acute behavioral disturbance in the emergency department (ED). We conducted a blinded randomized controlled trial of intramuscular sedation for violent and acute behavioral disturbance, comparing droperidol (10 mg), midazolam (10 mg), and droperidol (5 mg)/midazolam (5 mg). Inclusion criteria were patients requiring physical restraint and parenteral sedation. The primary outcome was the duration of the violent and acute behavioral disturbance, defined as the time security staff were required. Secondary outcomes included time until additional sedation was administered, staff and patient injuries, further episodes of violent and acute behavioral disturbance, and drug-related adverse effects. From 223 ED patients with violent and acute behavioral disturbance, 91 patients were included; 33 received droperidol, 29 received midazolam, and 29 received the combination. There was no difference in the median duration of the violent and acute behavioral disturbance: 20 minutes (interquartile range [IQR] 11 to 37 min) for droperidol, 24 minutes (IQR 13 to 35 minutes) for midazolam, and 25 minutes (IQR 15 to 38 minutes) for the combination. Additional sedation was required in 11 (33%; 95% confidence interval [CI] 19% to 52%) droperidol patients, 18 (62%; 95% CI 42% to 79%) midazolam patients, and 12 (41%; 95% CI 24% to 61%) in the combination group. The hazard ratio for additional sedation in the midazolam versus droperidol group was 2.31 (95% credible interval 1.01 to 4.71); for the combination versus droperidol, 1.18 (95% credible interval 0.46 to 2.50). Patient and staff injuries and number of further episodes of violent and acute behavioral disturbance did not differ between groups. There were two adverse effects for droperidol (6%; 95% CI 1% to 22%), 8 for midazolam (28%; 95% CI 13% to 47%), and 2 for the combination (7%; 95% CI 1% to 24%). An abnormal QT occurred in 2 of 31 (6%; 95% CI 1% to 23%) droperidol patients, which was not different from the other groups. Intramuscular droperidol and midazolam resulted in a similar duration of violent and acute behavioral disturbance, but more additional sedation was required with midazolam. Midazolam caused more adverse effects because of over-sedation, and there was no evidence of QT prolongation associated with droperidol compared with midazolam.

Cardiopulmonary resuscitation (CPR) may induce a systemic inflammatory response not necessarily due to sepsis. The purpose of this study was to examine short-term changes in WBC, PMN and bands associated with CPR in subjects with no discernible infection.

METHODS: We conducted a retrospective analysis of 864 CPR from 2001 to 2009, inclusive. From these, 194 subjects in whom a negative septic workup (blood, urine, sputum, wound cultures etc., five days before and after CPR) were included in the study. We evaluated WBC, PMN and bands in the period from the day before CPR (Day -1), during or immediately after CPR (Day 0) and the two days post-CPR (Day +1 and Day +2). The Kruskal-Wallis test with Dunn’s test post hoc were used to assess statistical significance (α = 0.05; two-tailed p ≤ 0.05 required). Data below are medians with inter-quartile ranges (IQR) in parentheses. RESULTS: WBC increased significantly (p < 0.05) after CPR, with Day -1: 10.60 cells/mm$^3$ (7.40 - 13.33 cells/mm$^3$) and Day 0: 15.45 cells/mm$^3$ (12.50 - 21.18 cells/mm$^3$). During the same period both PMN and bands demonstrated significant increases with PMN on Day -1: 70% (60 to 79%) to Day 0: 84% (75 to 89%, p < 0.05); bands on Day -1: 0% (0 to 1.0%) to Day 0: 7.0% (3.0 to 13.3%; p < 0.05). In the two-day period post-CPR, WBC decreased slightly to 13.10 cells/mm$^3$ (9.75 to 18.95 cells/mm$^3$; p > 0.05). A similar trend was observed for PMN, which decreased to 80% (70.5 to 86%, p > 0.05). Bands, however, decreased significantly from Day 0 to Day +1: 3% (0 to 7%; p < 0.05) and Day +2: 1% (0 to 3%; p < 0.05).

CONCLUSION: CPR results in a systemic inflammatory response and can manifest as a significant increase in WBC, PMN and bands. This response subsides to varying extents in the 2-day period following CPR. CLINICAL IMPLICATIONS: Post-CPR, subjects may not require antibiotics, as the increase in PMN turnover likely results from the activity of pro-inflammatory cytokines.

Poster Abstract only


Factors that affect prognosis in successfully resuscitated out-of-hospital cardiopulmonary arrest (OHCA) patients in the intensive care unit (ICU) who survived the initial 24h period of post-resuscitation have not been established. This study was conducted to evaluate the clinical prognostic factors associated with 90-day survival in patients who were successfully resuscitated from OHCA.

Methods: This study was conducted at a tertiary large university hospital. Clinical data were obtained from the medical records of 224 adult non-traumatic patients who were successfully resuscitated from OHCA and who survived the initial 24h post-resuscitation phase. Univariate and multivariate analyses were performed to identify independent predictors associated with 90-day survival.

Results: Significant adverse prognosticators included liver cirrhosis (HR 4.36, 95% CI 1.76 to 10.79), prolonged cardiopulmonary resuscitation (CPR) duration >20min (HR 1.95, 95% CI 1.27 to 3.00) and underlying malignancy (HR 1.64, 95% CI 1.06 to 2.54).
Favourable prognostic factors included the best Glasgow Coma Scale within 24–48h after return of spontaneous circulation >5 (HR 0.16, 95% CI 0.04 to 0.68), mean arterial pressure on ICU admission >100mmHg (HR 0.81, 95% CI 0.43 to 0.94) and the presenting rhythm of pulseless electrical activity (HR 0.44, 95% CI 0.1 to 0.63). A high burden of comorbidities (by Charlson score >5) was associated with significantly poorer 90-day survival (HR 1.60, 95% CI 1.03 to 2.49). Conclusions: Underlying comorbidities have a significant influence on survival. CPR duration, post-resuscitative blood pressure and early neurological recovery may serve as practical clinical predictors of short-term survival.


We assess the methodological quality and prognostic accuracy of clinical decision rules in emergency department (ED) syncope patients. We searched 6 electronic databases, reviewed reference lists of included studies, and contacted content experts to identify articles for review. Studies that derived or validated clinical decision rules in ED syncope patients were included. Two reviewers independently screened records for relevance, selected studies for inclusion, assessed study quality, and abstracted data. Random-effects meta-analysis was used to pool diagnostic performance estimates across studies that derived or validated the same clinical decision rule. Between-study heterogeneity was assessed with the I2 statistic, and subgroup hypotheses were tested with a test of interaction. We identified 18 eligible studies. Deficiencies in outcome (blinding) and interrater reliability assessment were the most common methodological weaknesses. Meta-analysis of the San Francisco Syncope Rule (sensitivity 86% [95% confidence interval {CI} 83% to 89%]; specificity 49% [95% CI 48% to 51%]) and the Osservatorio Epidemiologico sulla Sincope nel Lazio risk score (sensitivity 95% [95% CI 88% to 98%]; specificity 31% [95% CI 29% to 34%]). Subgroup analysis identified study design (prospective, diagnostic odds ratio 8.82 [95% CI 3.5 to 22] versus retrospective, diagnostic odds ratio 2.45 [95% CI 0.96 to 6.21]) and ECG determination (by evaluating physician, diagnostic odds ratio 25.5 [95% CI 4.41 to 148] versus researcher or cardiologist, diagnostic odds ratio 4 [95% CI 2.15 to 7.55]) as potential explanations for the variability in San Francisco Syncope Rule performance. The methodological quality and prognostic accuracy of clinical decision rules for syncope are limited. Differences in study design and ECG interpretation may account for the variable prognostic performance of the San Francisco Syncope Rule when validated in different practice settings.

Guideline 8.21: Syncope


With the increasing popularity of skateboarding, trauma centers are experiencing increased number of skateboard injuries. The incidence and type of injuries and the effect of age on these variables are poorly described in the literature. Methods: Data from
National Trauma Databank during a 5-year period was used for this study. Injury Severity Score (ISS), injured body area, specific injuries, and outcomes were calculated according to age groups (younger than 10 years, 10–16 years, and older than 16 years).

Results: During the study period, there were 2,270 admissions due to skateboard-related injuries (0.1% of all trauma admissions). There were 187 patients (8%) younger than 10 years, 1,314 patients (58%) 10 years to 16 years, and 769 patients (34%) older than 16 years. The overall mortality was 1.1% and ranged from 0% in the age group younger than 10 years to 0.3% in the group 10 years to 16 years and 2.6% in the group older than 16 years (< 0.001). The incidence of severe trauma (Injury Severity Score ≥16) in the three age groups was 5.4%, 13.5%, and 23.7%, respectively (< 0.001). The incidence of traumatic brain injury in the three age groups was 24.1%, 32.6%, and 45.5%, respectively (< 0.001). The younger age group (younger than 10 years) was significantly more likely to suffer femur fractures and less likely to suffer tibia fractures than the older age groups. Helmets and use of a skateboard park were significant factors protecting against head injury. Conclusion: Skateboard-related injuries are associated with a high incidence of traumatic brain injury and long bone fractures. Age plays an important role in the anatomic distribution of injuries, injury severity, and outcomes. Our findings demonstrate that helmet utilization and designated skateboard areas significantly reduce the incidence of serious head injuries.


Early reperfusion portends better outcomes for ST-segment elevation myocardial infarction (STEMI) patients. This investigation estimates the proportions of STEMI patients transported by a hospital-based helicopter emergency medical services (EMS) system who meet the goals of 90-minute door-to-balloon time for percutaneous coronary intervention or 30-minute door-to-needle time for fibrinolysis. This was a multicenter, retrospective chart review of STEMI patients flown by a hospital-based helicopter service in 2007. Included patients were transferred from an emergency department (ED) to a cardiac catheterization laboratory for primary or rescue percutaneous coronary intervention. Out-of-hospital, ED, and inpatient records were reviewed to determine door-to-balloon time and door-to-needle time. Data were abstracted with a priori definitions and criteria. There were 179 subjects from 16 referring and 6 receiving hospitals. Mean age was 58 years, 68% were men, and 86% were white. One hundred forty subjects were transferred for primary percutaneous coronary intervention, of which 29 had no intervention during catheterization. For subjects with intervention, door-to-balloon time exceeded 90 minutes in 107 of 111 cases (97%). Median door-to-balloon time was 131 minutes (interquartile range 114 to 158 minutes). Thirty-nine subjects (21%) received fibrinolytics before transfer, and 19 of 39 (49%) received fibrinolytics within 30 minutes. Median door-to-needle time was 31 minutes (interquartile range 23 to 45 minutes). In this study, STEMI patients presenting to non–percutaneous coronary intervention facilities who are transferred to a percutaneous
coronary intervention–capable hospital by helicopter EMS do not commonly receive fibrinolysis and rarely achieve percutaneous coronary intervention within 90 minutes. In similar settings, primary fibrinolysis should be considered while strategies to reduce the time required for subsequent interventional care are explored.

Patients with moderate to severe head injury and abnormal coagulation studies have a significantly higher risk of brain injury. The objective of this study was to determine the association of clinical suspicion of coagulopathy and intracranial injury (ICI) among patients sustaining blunt head trauma, including minor injuries. As part of the NEXUS II blunt head injury study, enrolled patients were prospectively evaluated for ICI and suspicion of coagulopathy. We examined the relationship between suspicion of coagulopathy and the presence of any clinically significant or "therapeutically inconsequential" ICI based on head computed tomography (CT) scan results. The NEXUS II study enrolled 13,728 patients, including 493 with suspicion of coagulopathy. Significant ICI was present in 46 (9.3%; 95% confidence interval [CI] 6.9-12.2) patients with suspected coagulopathy, and in 460 of 9863 (4.7%; 95% CI 4.3-5.1) patients without such suspicion. "Therapeutically inconsequential" findings were found on head CT scan in 74 patients, and 7 of these had suspected coagulopathy. Interventions including intubation, intracranial pressure monitoring, or craniotomy were performed in 5 of these 7 (71%; 95% CI 29-96) individuals, compared with only 3 of 67 (4%; 95% CI 1-12) patients without suspicion of coagulopathy. Initial clinical suspicion of coagulopathy, independent of laboratory confirmation, is associated with a greater prevalence of significant ICI injury after blunt head trauma; it also substantially increases the risk of morbidity despite the presence of an apparent "therapeutically inconsequential" injury. CT scanning of the head should be performed initially based on clinical suspicion of coagulopathy.

Uncontrolled haemorrhage is the leading cause of potentially reversible early in-hospital death following trauma. Approximately 25% of trauma patients arriving in the emergency department have evidence of early coagulopathy. It is vital that staff within the emergency department understand the basic pathophysiological consequences of massive blood loss in trauma and are familiar with when and how to administer blood and specific blood components in trauma resuscitation. Methods: A structured questionnaire designed to test knowledge of the use of blood and blood components in trauma resuscitation was distributed to the emergency physicians attending a regional conference in the South West of England. The questionnaire consisted of 16 questions; both multiple choice and short answer format, referenced via Medline. Results: 32/32 questionnaires distributed were completed and returned.
Massive transfusion protocols existed in 4/11 hospitals surveyed. 5/32 doctors were able to define the term ‘massive transfusion’ while 9/32, 6/32 and 3/32 were consistent with current guidelines in their prescription of platelets, fresh frozen plasma, and cryoprecipitate. 20/32 were consistent with current guidelines in identifying optimal haemoglobin levels. When asked more specifically about blood component therapy, 18/32 correctly identified target fibrinogen levels, 27/32 knew that fibrinogen is a component of fresh frozen plasma or cryoprecipitate and 1/32 correctly identified that fibrinogen is a component of both. 10/32 identified indications for beriplex and 5/32 doctors correctly identified indications for the use of recombinant factor VIIa. 20/32 doctors guessed >50% of the answers and the remaining 12/32 guessed 50%.

Conclusions The survey found that emergency physicians lacked core knowledge about the use of blood and blood component therapy in the context of massive haemorrhage following trauma. Doctors were unaware of how to prevent and treat early coagulopathy. Educational resources specifically for use by emergency physicians are limited on this topic. The use of massive transfusion protocols—that standardised blood component therapy is automatically delivered at specific points within resuscitation—would not only guide doctors, but be a clear step towards minimising the complications associated with massive transfusion.


We assess whether midazolam reduces recovery agitation after ketamine administration in adult emergency department (ED) patients and also compared the incidence of adverse events (recovery agitation, respiratory, and nausea/vomiting) by the intravenous (IV) versus intramuscular (IM) route. This prospective, double-blind, placebo–controlled, 2×2 factorial trial randomized consecutive ED patients aged 18 to 50 years to 4 groups: receiving either 0.03 mg/kg IV midazolam or placebo, and with ketamine administered either 1.5 mg/kg IV or 4 mg/kg IM. Adverse events and sedation characteristics were recorded. Of the 182 subjects, recovery agitation was less common in the midazolam cohorts (8% versus 25%; difference 17%; 95% confidence interval [CI] 6% to 28%; number needed to treat 6). When IV versus IM routes were compared, the incidences of adverse events were similar (recovery agitation 13% versus 17%, difference 4%, 95% CI –8% to 16%; respiratory events 0% versus 0%, difference 0%, 95% CI –2% to 2%; nausea/vomiting 28% versus 34%, difference 6%, 95% CI –8% to 20%). Co-administered midazolam significantly reduces the incidence of recovery agitation after ketamine procedural sedation and analgesia in ED adults (number needed to treat 6). Adverse events occur at similar frequency by the IV or IM routes.

Ketamine is a dissociative agent used for sedation and intubation in various clinical settings. Despite its proven haemodynamic safety, ketamine has not been widely used in prehospital medicine. This study examined the use of ketamine in helicopter emergency medical services (HEMS). Methods: This prospective cohort study enrolled all patients transported by a single HEMS program in whom ketamine was used to facilitate intubation. Data were collected using standard forms by two independent trained research staff. Demographics, medical condition, intubation conditions, vital signs (pre and post drug administration) and complications were recorded. Proportions, medians with IQR, change scores and CIs are reported; differences were compared using paired t tests. Results: During the 2-year study period, 71 patients received ketamine to facilitate endotracheal intubation. Ketamine was used most often in men (52 (73%)), and the median age was 49 years (IQR: 31, 69). Most patients were adults (70 (99%)) with medical illnesses (42 (59%)); 37 (52%) intubations were performed at the sending hospital, and 30 (42%) were performed on scene. A paramedic performed the intubation in 58 cases (82%). The median ketamine dose was 80mg (IQR: 60, 100; 1mg/kg); 53 (75%) patients also received a paralytic agent. Mean arterial pressure (2.3mmHg; 95% CI: −8.0 to 3.3) and heart rate (0.45 beats/min, 95% CI: −4.9 to 4.0) changes failed to reach statistical or clinical significance. No differences were found between patients with suspected concomitant head injury and other patients with respect to ketamine dose, changes in vital signs and complications. Complications included: one (1.4%) interstitial IV, five (7%) failed intubations, five (7%) hypotension and four (6%) hypertension episodes, one (1%) bradycardia, two (3%) tachycardia and five (7%) deaths. Conclusions: Ketamine is an effective agent in facilitating intubation in a HEMS environment. Complications are similar to use in the controlled Emergency Department setting.


To assess whether prehospital initiation of high-dose tirofiban in addition to high-dose clopidogrel results in more adequate inhibition of platelet aggregation (IPA) and better clinical outcome after primary percutaneous coronary intervention (PCI). Methods: Pre-specified two-centre sub-study of the prospective, international, multicentre, placebo controlled Ongoing Tirofiban in Myocardial Infarction Evaluation trial 2 (On-TIME-2 trial). 648 of 964 (67%) patients in the On-TIME-2 trial with ST elevation myocardial infarction undergoing primary PCI were studied. Pre-PCI IPA after early prehospital initiation of high-bolus dose (25μg/kg) tirofiban was compared to placebo in addition to acetylsalicylic acid, unfractionated heparin and 600mg clopidogrel. Results: IPA was measured at a median of 60 min after study medication administration. In all four tests: Fe induced platelet
aggregation, ADP induced platelet aggregation, platelet function analyser (PFA)-100 (collagen–epinephrine and collagen–ADP cartridge) IPA was higher in patients pretreated with high-dose tirofiban (p<0.001 for all tests), even after >74min of pretreatment. Patients in the highest quartile of IPA had less residual ST segment deviation 1h post-PCI (p value for trend: p=0.001, 0.004, 0.001, 0.002 respectively). There was a significant relationship between PFA-100 (both cartridges) and major adverse cardiovascular events (MACE, p=0.028, p=0.035) and early thrombosis (p=0.009, p=0.007). Conclusions: 60min of prehospital initiated antiplatelet treatment including high-dose tirofiban resulted in higher levels of IPA compared to pretreatment with acetylsalicylic acid and high-dose clopidogrel alone, even after longer pretreatment times. Levels of IPA were significantly related to ST resolution and MACE, including stent thrombosis. This sub-study confirms the main findings of the On-TIME2 trial that clopidogrel alone is suboptimal, even at high dose and administered well in advance of primary PCI.

Falls from height are considered to be high risk for multisystem injury. Ground-level falls (GLF) are often deemed a low-energy mechanism of injury (MOI) and not a recommended triage criterion for trauma team activation. We hypothesize that in elderly patients, a GLF may represent a high-risk group for injury and concurrent comorbidities that warrant trauma service evaluation and should be triaged appropriately. Methods: This is a retrospective study based on the National Trauma Data Bank. All patients with MOI consistent with GLF were identified. Demographics, type and severity of injuries, and outcomes were analyzed. Results: We identified 57,302 patients with GLF. The group had 34% men, with mean age of 68 years ± 17 years and injury severity score of 8 ± 5. Overall mortality was 3.2%. There were 32,320 elderly patients (older than 70 years). The mortality in the elderly was significantly higher than the nonelderly (4.4% vs. 1.6%, < 0.0001). The elderly were more likely to sustain long-bone fracture (54.5% vs. 35.9%, < 0.0001), pelvic fracture (7.6% vs. 2.4%, < 0.0001), and intracranial injury (10.6% vs. 8.7%, p<0.0001). Multivariate analysis showed that Glasgow Coma Scale (GCS) score <15 (odds ratio, 4.98) and older than 70 years (odds ratio, 2.75) were significant predictors of mortality inpatients after GLF. Conclusions: Patients older than 70 years and with GCS score <15 represent a group with significant inhospital mortality.

Emergency department (ED) crowding increases ambulance diversion. Ambulance diversion disproportionately affects individuals who rely on ambulance transport. The purpose of this study is to determine which populations rely most on ambulance transport. We queried the National Hospital Ambulatory Medical Care Survey database for 1997 to 2000 and 2003 to 2005 for patients who
arrived by ambulance or personal transport. We performed bivariate analysis to assess the extent to which all patients and a subset of critically ill patients use ambulance transport relative to self-transport. In our sample, 30,455 (15%; 95% confidence interval [CI] 15% to 16%) patients arrived by ambulance and 162,091 (85%; 95% CI 84% to 85%) arrived by walk-in/self-transport. Overall, patients with Medicare insurance were more likely to rely on ambulance transport, at 34% (95% CI 33% to 35%), than the privately insured, at 11% (95% CI 10% to 11%). Among the critically ill, privately insured patients were less likely to rely on ambulance transport, at 47% (95% CI 42% to 52%), than those with Medicare insurance (61%; 95% CI 58% to 65%), the publicly insured (60%; 95% CI 52% to 67%), or the uninsured (57%; 95% CI 49% to 64%). Among the critically ill, patients aged 15 to 24 years and those older than 74 years were most likely to rely on ambulance transport, at 63% (95% CI 53% to 72%) and 67% (95% CI 62% to 71%), respectively. Fifty-seven percent (95% CI 54% to 59%) of the critically ill used ambulance versus 15% (95% CI 14% to 15%) of noncritical patients. Patients with Medicare insurance or public insurance, the uninsured, the elderly, and the critically ill disproportionately rely on ambulance transport to the ED. Ambulance diversion may disproportionately affect these populations.


Intraosseous access (IO) is a method for providing vascular access in out-of-hospital resuscitation of critically ill and injured patients when traditional intravenous access is difficult or impossible. Different intraosseous techniques have been used by our Helicopter Emergency Medical Services (HEMS) since 2003. Few articles document IO use by HEMS physicians. The aim of this study was to evaluate the use of intraosseous access in pre-hospital emergency situations handled by our HEMS. METHODS: We reviewed all medical records from the period May 2003 to April 2010, and compared three different techniques: Bone Injection Gun (B.I.G (R) - Waismed), manual bone marrow aspiration needle (Inter V - Medical Device Technologies) and EZ-IO(R) (Vidacare), used on both adults and paediatric patients. RESULTS: During this seven-year period, 78 insertion attempts were made on 70 patients. Overall success rates were 50% using the manual needle, 55% using the Bone Injection Gun, and 96% using the EZ-IO(R). Rates of success on first attempt were significantly higher using the EZ-IO(R) compared to the manual needle/Bone Injection Gun (p<0.01/p<0.001). Fifteen failures were due to insertion-related problems (19.2%), with four technical problems (5.1%) and three extravasations (3.8%) being the most frequent causes. Intraosseous access was primarily used in connection with 53 patients in cardiac arrest (75.7%), including traumatic arrest, drowning and SIDS. Other diagnoses were seven patients with multi-trauma (10.0%), five with seizures/epilepsy (7.1%), three with respiratory failure (4.3%) and two others (2.9%). Nearly one third of all insertions (n=22) were made in patients younger than two years. No cases of osteomyelitis or other serious complications were documented on the follow-up. CONCLUSIONS: Newer intraosseous techniques may enable faster and more reliable vascular access, and this can lower the threshold for intraosseous access on both adult and paediatric patients in critical situations. We believe that all emergency services
that handle critically ill or injured paediatric and adult patients should be familiar with intraosseous techniques.

Guideline 11.6: Medications in adult cardiac arrest


The purpose of this study was to determine the effect of different colour nail polishes and henna on the measurement of oxygen saturation and the differences among the measurements of three pulse oximetry devices. Material and methods: 33 healthy females with a mean age of 19±1.0 years and no complaints or known disease were included into the study. All the participants applied henna to one of their fingers a day before the study. Just before the study, one finger was left empty as control and the other fingers were dyed using various colours of nail polish (red, blue, beige, purple, brown, white, pink, green, colourless polish, light blue, light green and yellow). There were more than eight colour nail polishes and some fingers were used for the other colours after being completely cleaned. The same brand nail polishes were used for the study. Oxygen saturation measurements were done using three different pulse oximetry devices (device I, II, III) from the control, different colour nail polished and henna applied fingers. The measurements of different devices, different colour nail polishes, henna and control were statistically compared. Results: The mean saturations obtained from blue, beige, purple and white nail polished fingers were significantly lower than those of control and the other coloured fingers. In addition, the mean measurement of device II was significantly lower than those of other devices. Conclusion: The results suggest that blue, beige, purple and white nail polished fingers might cause pulse oximetry devices to make incorrect measurements.

33. Widdel L and Winston KR, Prognosis for Children in Cardiac Arrest Shortly After Blunt Cranial Trauma. J Trauma 2010: 69(4); 783-8

The goal of this investigation is to determine the success rate of aggressive cardiorespiratory resuscitation in children who experience blunt cranial trauma of sufficient magnitude to quickly cause cardiac arrest. Methods: The records of all the children who, within a 6-year period, suffered cardiac arrest at the scene of injury, during transport or in the emergency department of a level one pediatric trauma center, as a consequence of blunt cranial trauma, form the basis of this study. Results: One of the 40 children who met the inclusion criteria survived. Their ages ranged from 1 month to 16 years, and all had a Glasgow Coma Score of 3 at the scene of injury. Forty-two percent were passengers in motor vehicles, and 32% were victims of nonaccidental trauma. Eleven of the 17 children in the motor vehicle crash were not properly restrained. Eleven of the unrestrained children plus two who were properly restrained were ejected at the time of impact. The average cardiopulmonary resuscitation time was 36 (2–107) minutes. A sinus rhythm was established in 50% but was not sustained in most. The sole survivor was an 8-year-old boy who was ejected and
had asystole at the scene. At discharge, he was walking well but had cranial nerve deficits and learning disability. Conclusion: Survival in 40 consecutive children with documented cardiac arrest caused by blunt cranial trauma was 2.5%. This series, when combined with other published reports, is supportive of the position that aggressive resuscitation is rarely successful after 10 minutes and futile after 20 minutes.  

Guideline 12: Paediatric life support


The purpose of the present study was to determine whether, in patients undergoing general anesthesia, those provided with a laryngeal mask airway (LMA) have a lower risk of airway-related complications than those undergoing endotracheal intubation. Materials and Methods: A systematic review of randomized prospective controlled trials was done to compare the risk of airway complications with an LMA versus an endotracheal tube (ETT) in patients receiving general anesthesia. Two independent reviewers identified 29 randomized prospective controlled trials that met the predetermined inclusion and exclusion criteria. The data for each individual outcome measure were combined to analyze the relative risk ratios (RRs). The Cochrane RevMan software was used for statistical analysis. Results: When an ETT was used to protect the airway, a statistically significant greater incidence of hoarse voice (RR 2.59, 95% confidence interval [CI] 1.55 to 4.34), a greater incidence of laryngospasm during emergence (RR 3.16, 95% CI 1.38 to 7.21), a greater incidence of coughing (RR 7.12, 95% CI 4.28 to 11.84), and a greater incidence of sore throat (RR 1.67, 95% CI 1.33 to 2.11) was found compared with when an LMA was used to protect the airway. The differences in the risk of regurgitation (RR 0.84, 95% CI 0.27 to 2.59), vomiting (RR 1.56, 95% CI 0.74 to 3.26), nausea (RR 1.59, 95% CI 0.91 to 2.78), and the success of insertion on the first attempt (RR 1.08, 95% CI 0.99 to 1.18) were not statistically significant between the 2 groups. Conclusions: For the patients receiving general anesthesia, the use of the LMA resulted in a statistically and clinically significant lower incidence of laryngospasm during emergence, postoperative hoarse voice, and coughing than when using an ETT. The risk of aspiration could not be determined because only 1 study reported a single case of aspiration, which was in the group using the ETT.

Palpitations, a common presenting complaint to the emergency department and other ambulatory settings can be a benign sensation or indicate dangerous arrhythmias. Although the cause can be found in up to 40% of patients during the initial encounter, the majority require further investigation. This review sought key historical and physical examination features for the diagnosis of cardiac arrhythmia in patients presenting with palpitations. The authors used a comprehensive search strategy and an independent assessment process but limited their search to English-language studies. In addition, the 2 most important contributing studies combined “arrhythmias” into one endpoint, making it difficult to assess which variables may help to detect more serious events such as ventricular tachycardia.

Guideline 11.11: managing acute dysrhythmias


Damage control resuscitation has become a topic of increasing relevance and popularity over the past several years. Hemorrhage accounts for 30% to 40% of trauma fatalities and is the leading cause of preventable death in trauma. Damage control resuscitation (DCR) is a treatment strategy that targets the conditions that exacerbate hemorrhage in trauma patients. New data from both civilian medical centers and military operations in the Iraq and Afghanistan conflicts have allowed for a reappraisal of the resuscitation techniques of the trauma victim. The emergence of the idea of DCR has fostered controversy regarding its overall efficacy, its associated mortality, and the scientific basis of such a strategy. This article attempts to answer some of the overarching questions associated with the acute care and resuscitation of the trauma patient. Topics reviewed and discussed will include DCR and surgery, transfusion ratios, permissive hypotension, recombinant factor VIIa (rFVIIa), hypertonic fluid solutions, and the destructive forces of hypothermia, acidosis, and coagulopathy. We will also investigate some of the implications of DCR as they pertain to the future of resuscitation and the optimization of trauma care in the future.


The proposals arising from the agreement reached between the Rudd government and the States and Territories (except Western Australia) in April 2010 represent the most fundamental realignment of health responsibilities since the creation of Medicare in
1984. They will change the health system, and the structures that will craft its future direction and design. These proposals will have a significant impact on Emergency Medicine; an impact from not only the system-wide effects of the proposals but also those that derive from the specific recommendations to create an activity-based funding mechanism for EDs, to implement the four hour rule and to develop a performance indicator framework for EDs. The present paper will examine the potential impact of the proposals on Emergency Medicine to inform those who work within the system and to help guide further developments. More work is required to better evaluate the proposals and to guide the design and development of specific reform instruments. Any such efforts should be based upon a proper analysis of the available evidence, and a structured approach to research and development so as to deliver on improved services to the community, and on improved quality and safety of emergency medical care.

Out-of-hospital cardiac arrest remains a major cause of mortality and morbidity despite progress in resuscitative practices. The number of survivors with severe neurological impairment at hospital discharge is similarly dismal. Recently, much attention has been directed toward the use of mild therapeutic hypothermia in the care of comatose survivors with postcardiac arrest syndrome. Recent research suggests mild hypothermia lowers mortality and improves neurological outcome after successful treatment of cardiac arrest. The current 2005 updated guidelines of International Liaison Committee on Resuscitation and European Resuscitation Council recommend the utilization of mild induced hypothermia in postresuscitation treatment. Hypothermia induction in order to avoid the pathophysiological mechanisms of euthermia and hyperthermia and subsequent complications are briefly discussed. Cooling methods, potential side effects and questions regarding implementation of therapeutic hypothermia recommendations in every day clinical practice and future investigation are also addressed.
Guideline 11.9: Therapeutic hypothermia after cardiac arrest

Whether cardiopulmonary resuscitation (CPR) should involve mouth-to-mouth ventilation with chest compressions or just compressions is an interesting question. Many members of the public are uncomfortable with giving rescue breaths (especially if there is vomiting) or have not been trained to give mouth-to-mouth ventilation. Many do not start CPR because they panic, or fear that they will cause harm or do CPR incorrectly. What we do know is that bystander CPR is important. In a meta-analysis, the pooled survival rate to hospital discharge after out-of-hospital cardiac arrest was 7·6% (95% CI 6·7–8·4)...
Guideline 7: Cardiopulmonary resuscitation
Fewer than 8% of adult out-of-hospital cardiac arrest (OOH-CA) victims survive to hospital discharge despite public education of event recognition, early notification of 9-1-1, bystander cardiopulmonary resuscitation, automated external defibrillator (AED) use, therapeutic hypothermia, and improvements in emergency medical service delivery. Densely populated urban areas such as New York, NY, and Chicago, Ill, where a large number of cardiac arrests occur, report even lower (1.4% to 2%) survival rates. Unlike other areas of cardiovascular health such as myocardial infarction, which has demonstrated a 3-fold decrease in acute mortality, the improvements in outcome from OOH-CA have remained modest over the last 25 years. Is this dismal survival and lack of progress a result of the biological lethality of the condition, or has inadequate research been done to define its pathogenesis, pathophysiology, and prevention and the optimal implementation of effective treatments? OOH-CA is obviously a life-threatening condition, yet it is a "treatable disease" in the sense that medical interventions can improve survival significantly. Moreover, a nearly 500% difference in survival rates exists across communities in the United States, suggesting that variability in the quality of resuscitation care is driving large differences in community survival rates. Collectively, these data suggest the potential for a major improvement in community survival rates that could save tens of thousands of lives. So where is the problem? Improving care and survival requires a commitment to sustained, high-quality, basic scientific and clinical research. Despite the devastating public health consequences of OOH-CA, the randomized clinical trial (RCT) base from..

ANIMAL / MANIKIN / CADAVER/ MODELS OF CARDIAC ARREST STUDIES

Tracheal intubation in patients with suspected neck injuries should achieve two contradicting goals—sufficient laryngeal exposure and the least cervical spine movement. Because the former involves displacements of the cervical vertebræe, intubation under immobilization is widely performed today to prevent exacerbation of spinal code injuries. The unique curving blade of the Airway Scope (AWS) is designed to fit the oropharyngeal anatomy. A camera at the tip of the blade displays the view of the larynx, but unlike the direct laryngoscope, it needs no line-of-sight of the oral, pharyngeal, and tracheal axis. Our purpose is to determine whether AWS could be a suitable airway device for the intubation of patients with potential neck injury. Methods: Thirty-six patients scheduled for surgery were randomly assigned to undergo intubation using either AWS or Macintosh laryngoscope (MLS). After general anesthetic induction, the patient's head was set in a neutral position, and an appropriately sized semi-rigid neck collar was placed. Measurements include intubation time, number of attempts, success rate, Cormack-Lehane classification, airway
optimization maneuver, Intubation Difficulty Scale scores, and complications. Results: Intubation time proved no statistical significance (mean ± SD, AWS, 62.9 seconds ± 26.0 seconds, MLS, 55.6 seconds ± 26.0 seconds; = 0.42). AWS scored less in Cormack-Lehane classification (median [range], AWS I [I-I], MLS IIIa [I-IIIb]; p< 0.0001), required fewer additional airway optimization maneuvers (p = 0.0003), and scored less in Intubation Difficulty Scale scores (AWS 0 [0–1], MLS 2 [0–5]; p < 0.0001). Conclusions: In neck-immobilized patients using semi-rigid cervical collars, AWS improves laryngeal exposure and facilitates tracheal intubation. AWS may be a suitable intubation device for trauma patients.

Guideline 11.7: Equipment and techniques in ALS


Control of the airway is a priority during cardiopulmonary resuscitation and/or following a failed intubation attempt. Supraglottic airway devices provide more effective airway management than bag-valve-mask-ventilation (BVMV) and can be effectively used by non-anaesthetists. Methods: 36 paramedic students were timed to ascertain how long it took them to place an Igel, laryngeal mask airway (LMA) or laryngeal tube airway (LTA) into a manikin. Following insertion, students were interviewed to see which device they preferred and why. Results: The Igel was consistently the fastest airway device, taking a mean of 12.3s (95% CI 11.5 to 13.1) to insert, the LTA took a mean time of 22.4s (95% CI 20.3 to 24.5) and the LMA 33.8s (95% CI 30.9 to 36.7). 63% of students would choose the Igel as their preferred intermediate airway device, stating ease of use and speed of insertion as the primary reasons. Conclusion: The ease and speed at which a supraglottic airway can be inserted means that it is a viable alternative to the use of the BVMV.

Guideline 11.7: Equipment and techniques in ALS


We applied independent component analysis (ICA) to cardiopulmonary resuscitation (CPR)-corrupted human multichannel emergency ECGs with the aim of reconstructing the original ECGs. Materials: Two ICA algorithms (EFICA and JADE) were selected. Data for ICA were acquired by simultaneously recording eight ECG channels during CPR on a porcine model. The algorithms' reconstruction performance was assessed by the Spearman correlation coefficient (SCC) and the shock advice algorithm of an AED. We then compared the performance of EFICA with the established second-channel adaptive matching pursuit method (AF). Results ICA was applied to 918 corrupted ECG multichannel signals. The sensitivity of the AED's shock/no-shock decision increased from 93.5% (corrupted signal) to 99.5/99.8% (JADE/EFICA) in the selected independent component; specificity increased from 50.5% to
78.9/83.2% (JADE/EFICA). The SCCs comparing the reconstructed with the original signal (JADE: 0.75 ± 0.15; EFICA: 0.76 ± 0.15, n = 918) were significantly higher than for the corrupted signal vs. the original (0.52 ± 0.22). The SCC is significantly higher (p < 0.01) using EFICA than AF (EFICA: 0.75 ± 0.16; AF: 0.72 ± 0.19, n = 718). For all signals at all SNR levels, specificity did not differ significantly between EFICA (83.6%) and AF (80.2%). EFICA proved to be superior especially at low corruption levels (SNR < -5 dB). Sensitivity was above 99.5% for both algorithms. Conclusion: We have demonstrated that CPR artefacts in the emergency ECG can be reduced using ICA. EFICA and JADE are at least as successful in this regard as are other published algorithms. In particular, non-shockable signals with low SNRs (<-5 dB) are reconstructed significantly better (p = 0.01) with EFICA than with AF.

Guideline 11.5: Electrical therapy for ALS


Injured lungs are sensitive to fluid resuscitation after trauma. Such treatment can increase lung water content and lead to desaturation. Hypertonic saline with dextran (HSD) has hyperosmotic properties that promote plasma volume expansion, thus potentially reducing these side effects. The aim of this study was to (1) evaluate whether fluid treatment counteracts hypotension and improves survival after non-hemorrhagic shock caused by lung contusion and (2) analyze whether resuscitation with HSD is more efficient than treatment with Ringer’s acetate (RA) in terms of blood oxygenation, the amount of lung water, circulatory effects, and inflammatory response. Methods: Twenty-nine pigs, all wearing body armor, were shot with a 7.62-mm assault rifle to produce a standardized pulmonary contusion. These animals were allocated into three groups: HSD, RA, and an untreated shot control group. Exposed animals were compared with animals not treated with fluid and shot with blank ammunition. For 2 hours after the shot, the inflammatory response and physiologic parameters were monitored. Results: The impact induced pulmonary contusion, desaturation, hypotension, increased heart rate, and led to an inflammatory response. No change in blood pressure was observed after fluid treatment. HSD treatment resulted in significantly less lung water (p< 0.05) and tended to give better Pao ( p= 0.09) than RA treatment. Tumor necrosis factor-α release and heart rate were significantly lower in animals given fluids. Conclusion: Fluid treatment does not affect blood pressure or mortality in this model of non-hemorrhagic shock caused by lung contusion. However, our data indicate that HSD, when compared with RA, has advantages for the injured lung.

The effectiveness and safety of non-invasive surface cooling was compared to invasive endovascular cooling in an animal model.

Methods: Eight healthy pigs (29-38 kg) were cooled twice, starting in the first 4 pigs with unique surface cooling pads followed by endovascular cooling. In the second 4 pigs the order was reversed. The goal was to quickly lower pulmonary artery temperature from 38 to 33 °C. A paired t-test was used to compare cooling rates (°C/h, mean ± standard deviation) between both cooling techniques.

Results: Mean non-invasive surface cooling rate (11.9 ± 3.8 °C/h) significantly exceeded mean invasive cooling rate (3.9 ± 0.7 °C/h; p < 0.001). The mean difference in cooling rates was 8.0 ± 3.6 °C/h. No surface cooling related adverse skin reactions were observed.

Conclusions: Surface cooling is a simple method for achieving fast cooling rates. In our animal model, non-invasive cooling was three times faster than rapid endovascular cooling without overshoot.

Guideline 11.9: Therapeutic hypothermia after cardiac arrest


Mask ventilation is considered a “basic” skill for airway management. A one-handed “EC-clamp” technique is most often used after induction of anesthesia with a two-handed jaw-thrust technique reserved for difficult cases. Our aim was to directly compare both techniques with the primary outcome of air exchange in the lungs.

Methods: Forty-two elective surgical patients were mask-ventilated after induction of anesthesia by using a one-handed “EC-clamp” technique and a two-handed jaw-thrust technique during pressure-control ventilation in randomized, crossover fashion. When unresponsive to a jaw thrust, expired tidal volumes were recorded from the expiratory limb of the anesthesia machine each for five consecutive breaths. Inadequate mask ventilation and dead-space ventilation were defined as an average tidal volume less than 4 ml/kg predicted body weight or less than 150 ml/breath, respectively. Differences in minute ventilation and tidal volume between techniques were assessed with the use of a mixed-effects model.

Results: Patients were (mean ± SD) 56 ± 18 yr old with a body mass index of 30 ± 7.1 kg/m. Minute ventilation was 6.32 ± 3.24 l/min with one hand and 7.95 ± 2.70 l/min with two hands. The tidal volume was 6.80 ± 3.10 ml/kg predicted body weight with one hand and 8.60 ± 2.31 ml/kg predicted body weight with two hands. Improvement with two hands was independent of the order used. Inadequate or dead-space ventilation occurred more frequently during use of the one-handed compared with the two-handed technique (14.5%; = 0.013). Conclusion: A two-handed jaw-thrust mask technique improves upper airway patency as measured by greater tidal volumes during pressure-controlled ventilation than a one-handed “EC-clamp” technique in the unconscious apneic person. Guideline 11.7: Equipment and techniques in ALS
47. Kurita A, Taniguchi T and Yamamoto K. The Effects of Carvedilol Administration on Cardiopulmonary Resuscitation in a Rat Model of Cardiac Arrest Induced by Airway Obstruction. Anesthes & Analg 2010: 111(5); 1207-10

Carvedilol is a nonselective β-adrenoceptor and selective α1-adrenoceptor blocker and is widely used in the treatment of patients with hypertensive and/or chronic heart failure because, unlike classic β-blockers, this drug has additional endothelium-dependent vasodilatory effects. We evaluated the effects of oral administration of carvedilol on cardiopulmonary resuscitation (CPR) in a rat model of cardiac arrest (CA) induced by airway obstruction. METHODS: Twenty-four rats were randomly assigned to 2 groups: control group (no medication) and treatment group (oral administration of carvedilol [10 mg/kg/d] for 5 days) (n = 12 per group). All the animals were anesthetized, and CA was induced by obstructing the airway. Three minutes after CA, the animals were revived by administering CPR. The rate of chest compressions (CCs) was 240 - 260 cc/min and the depth of CCs was adjusted to maintain the diastolic arterial blood pressure between 25 to 30 mm Hg in both groups. Epinephrine (0.02 mg/kg) was administered after 5 minutes of CPR. No other therapy was administered before, during, or after CA. RESULTS: The time interval between airway obstruction and CA in the treatment group was significantly longer than in the control group (230 ± 27 vs 203 ± 24 seconds; P < 0.05). The rate of return of spontaneous circulation in the treatment group was significantly higher than in the control group (92% vs 50%; P < 0.05). Acidosis and increased glucose and tumor necrosis factor-α concentration in the treatment group were significantly lower than in the control group. CONCLUSIONS: The results of our study showed that rats that had been administered oral carvedilol for several days were more resistant to CA induced by airway obstruction, and when CA did occur, were more likely to be resuscitated. These findings suggest that carvedilol may prolong the safe ischemic time induced by respiratory failure.


Optimal manual closed chest compressions are difficult to give. A mechanical compression/decompression device, named LUCAS, is programmed to give compression according to the latest international guidelines (2005) for cardiopulmonary resuscitation (CPR). The aim of the present study was to compare manual CPR with LUCAS-CPR. METHODS: 30 kg pigs were anesthetized and intubated. After a base-line period and five minutes of ventricular fibrillation, manual CPR (n=8) or LUCAS-CPR (n=8) was started and run for 20 minutes. Professional paramedics gave manual chest compressions alternating in 2-minute periods. Ventilation, one breath for each 10 compressions, was given to all animals. Defibrillation and, if needed, adrenaline were given to obtain a return of spontaneous circulation (ROSC). RESULTS: The mean coronary perfusion pressure was significantly (p<0.01) higher in the mechanical group, around 20 mmHg, compared to around 5 mmHg in the manual group. In the manual group 54 rib fractures occurred compared to 33 in the LUCAS group (p<0.01). In the manual group one severe liver injury and one pressure pneumothorax were also seen. All 8 pigs
in the mechanical group achieved ROSC, as compared with 3 pigs in the manual group. **CONCLUSIONS:** LUCAS-CPR gave significantly higher coronary perfusion pressure and significantly fewer rib fractures than manual CPR in this porcine model.


The 2005 guidelines for cardiopulmonary resuscitation (CPR) do not include a statement on performance of basic life support by a single healthcare professional using a bag–valve–mask device. Three positions are possible: chest compressions and ventilations from over the head of the casualty (over-the-head CPR), from the side of the casualty (lateral CPR), and chest compressions from the side and ventilations from over the head of the casualty (alternating CPR). The aim of this study was to compare CPR quality of these three positions. Methods: 102 healthcare professionals were randomised to a crossover design and performed a 2-min CPR test on a manikin for each position. Results: The hands-off time over a 2-min interval was not significantly different between over-the-head (median 31s) and lateral (31s) CPR, but these compared favourably with alternating CPR (36s). Over-the-head CPR resulted in significantly more chest compressions (155) compared with lateral (152) and alternating CPR (149); the number of correct chest compressions did not differ significantly (119 vs 122 vs 109). Alternating CPR resulted in significantly less inflations (eight) compared with over-the-head (ten) and lateral CPR (ten). Lateral CPR led to significantly less correct inflations (three) compared with over-the-head (five) and alternating CPR (four). Conclusions: In the case of a single healthcare professional using a bag–valve–mask device, the quality of over-the-head CPR is at least equivalent to lateral, and superior to alternating CPR. Because of the potential difficulties in bag–valve–mask ventilation in the lateral position, the authors recommend over-the-head CPR.

*Guideline 7: Cardiopulmonary resuscitation*

50. Schilleman K, Witlox RS, Lopriore E, Morley CJ, Walther FJ and te Pas AB, Leak and obstruction with mask ventilation during simulated neonatal resuscitation. Arch Dis Child Fetal Neonat Ed 2010: 95(6); F398-F402

Objectives: To evaluate mask technique during simulated neonatal resuscitation and test the effectiveness of training in optimal mask handling. Study design: Seventy participants (consultants, registrars and nurses) from neonatal units were asked to administer positive pressure ventilation at a flow of 8 l/min and a frequency of 40–60/min to a modified leak free, term newborn manikin (lung compliance 0.5 ml/cm H2O) using a Neopuff T-piece device. Recordings were made (1) before training, (2) after training in mask handling and (3) 3 weeks later. Leak was calculated. Obstruction (tidal volume <60% of optimal tidal volume) and severe obstruction (<30% of optimal tidal volume) were calculated when leak was minimal. Results: For the 70 participants, median (IQR) leak was 71% (32–95%) before training, 10% (5–37%) directly after training and 15% (4–33%) 3 weeks later (p<0.001). When leak was minimal, gas
flow obstruction was observed before, directly after training and 3 weeks later in 46%, 42% and 37% of inflations, respectively. Severe obstruction did not occur. Conclusions: Mask ventilation during simulated neonatal resuscitation was often hampered by large leaks at the face mask. Moderate airway obstruction occurred frequently when effort was taken to minimise leak. Training in mask ventilation reduced mask leak but should also focus on preventing airway obstruction.

Recent advances in telemedicine and robotically assisted telesurgery may offer advanced surgical care for the geographically remote patient. Similar advances in tele-anesthesia will be necessary to optimize peri-operative care for these patients. Although many preliminary investigations into tele-anesthesia are underway, none involves remote performance of anesthesia-related procedures. Here we describe simulated robotically assisted fiberoptic intubations using an airway simulation mannequin. Both oral and nasal approaches to fiberoptic intubation were successful, but presented unique opportunities and challenges inherent to the robot's design. Robotically assisted airway management is feasible using multipurpose surgical robotic systems.

52. Chamberlain D. Predictors of survival from out-of-hospital cardiac arrest. Heart 2010: 96(22); 1785-6
This year is the 50th anniversary of the introduction of modern resuscitation from cardiac arrest, made possible by the combination of closed chest compressions with external defibrillation and effective artificial ventilation. Inevitably this was restricted initially to hospitals, but within a few years the need to counter sudden death in the community led to the development of cardiac ambulances. The appreciation that lethal cardiac arrhythmias are not only due to acute myocardial infarction but can also occur unpredictably from a myriad of causes led to more complex responses. In most developed countries we now have public education on the need for rapid access to help, widespread training in cardiopulmonary resuscitation (CPR), means of early defibrillation where relevant and skilled aftercare—the so-called ‘chain of survival’. But daunting problems markedly limit success, irrespective of knowledge and training within the community. Even when death strikes suddenly and prematurely, many cases are complicated by severe underlying pathology that is not always amenable to prompt treatment. Even more importantly, only a very few minutes are available for effective resuscitation before apparently irreversible cerebral and cardiac changes make recovery impossible. Survival from out-of-hospital cardiac arrest (OOHCA) is therefore achieved only in a small minority, even of those ‘too young to die’. Investigating the predictors of success can help to prioritise efforts to improve results that are currently so dire.

Guideline 7: Cardiopulmonary resuscitation
53. Morley P. New international guidelines on resuscitation. BMJ 2010: 341; c6051
The most extensive review of the resuscitation literature ever attempted was published on 18 October. The review was performed by the International Liaison Committee on Resuscitation and it was based on 277 specific questions about resuscitation; the answers were drawn from 411 systematic reviews. The newly released resuscitation guidelines of various organisations throughout the world, including those of the European Resuscitation Council (ERC) and the American Heart Association (AHA), are based on this information...

In emergency situations, intraosseous cannulation represents an alternative route of vascular access when peripheral vein insertion is difficult. We present the first documented case of intraosseous systemic fibrinolysis in a patient with ST-segment elevation myocardial infarction. In this case, repetitive episodes of ventricular fibrillation occurred soon after first contact with emergency care providers. Given that the patient had difficult peripheral venous access, an intraosseous catheter was inserted. Fibrinolytics and antiarrhythmic drugs were administered though this line, resulting in resolution of coronary ischemia and electrical instability, without complications. Intraosseous cannulation represents a novel route for administration of systemic fibrinolysis in cases of difficult peripheral venous access in the out-of-hospital setting.

Hypothermic cardiac arrest is a relatively uncommon presentation to United States Emergency Departments. During 1979–2002, the Centers for Disease Control reported that an average of 689 deaths per year in the US were attributed to exposure to excessive natural cold. Severe hypothermia (<30°C) confers marked depression of critical metabolic and biochemical functions, but may also provide protection to the brain and other organs while resuscitation is undertaken. For all hypothermic patients, measures designed to prevent further heat loss and begin rewarming should be instituted, but should not delay routine Advanced Cardiac and Trauma Life Support procedures. Rewarming methods include passive rewarming (insulation, removal from environment), active external rewarming (heating blankets, radiant heat, warm water immersion), and active core rewarming (warm inhalation, warmed intravenous fluids, gastrointestinal irrigation, bladder irrigation, dialysis, thoracostomy lavage, and cardiopulmonary bypass).

This study describes the acquisition and retention of resuscitation skills by medical students during and following a vertically integrated training program incorporating an Immediate Life Support course (ILS): and the skills demonstrated by interns on entry to clinical practice. Methods: Yearly resuscitation workshops were held in the final 3 years of a 6-year undergraduate medical curriculum. These consisted of a basic life support course in year 4; a resuscitation workshop including shock-advisory defibrillation in year 5; and an ILS course in year 6. A medical student cohort was tested during the course and at the beginning of internship. Results: Before year 5 training, an average of 36.6% of students passed each criterion and this increased to 72.3% 10 weeks after training. Prior to the ILS course (approximately 6-18 months following year 5 training), this proportion had decreased to 35.2%; and on retesting as interns the proportion was 64.1%, with delay between ILS training and testing of between 3 and 9 months. The proportion of interns correctly performing airway opening, initial rescue breathing and ventilation technique was lower than other measured skills. Those with ILS training performed better in initial rescue breaths ($p = 0.03$), ventilation technique ($p = 0.04$), and recommencement of CPR without delay following defibrillation ($p = 0.02$). Conclusions: A vertically integrated undergraduate resuscitation course appears to reinforce the maintenance of resuscitation skills until internship. Skills are maintained for at least 6-9 months following an ILS course. This may be due to the ILS course embedding the skills more thoroughly.

Guideline 9.1.1: Cardiopulmonary resuscitation training


In December 2005 the new guidelines for resuscitation were released and a new curriculum for the teaching of basic life support (BLS) was adopted. The aim of the present study was to investigate the effectiveness of the new guidelines and teaching curriculum on the BLS skill retention of medical students 1 year following their initial training. Methods: The study was conducted in two consecutive academic years and compared BLS skill retention of two groups of medical students in their fourth year of medicine. The first group (group A) was taught the old guidelines with the old curriculum in the year 2005 and was re-assessed in 2006, and the second group (group B) was taught the new guidelines with the new curriculum in the year 2006 and was re-assessed in 2007. Results: Significantly more students in group B assessed signs of life, located the compression area correctly and performed good quality chest compressions compared with the group taught the old guidelines with the old curriculum. Conclusions: The most important BLS skill, good quality chest compressions, was retained by significantly more students who were taught the new
resuscitation guidelines according to the new curriculum.

Guideline 9.1.1: Cardiopulmonary resuscitation training


In the case of an emergency, fast and structured patient management is crucial for a patient's outcome. Every physician and graduate medical student should possess basic knowledge of emergency care and the skills to manage common emergencies. This study determines the effect of a simulation-based curriculum in emergency medicine on students' abilities to manage emergency situations. Methods: A controlled, blinded educational trial of 44 final-year medical students was carried out at Frankfurt Medical School; 22 students completed the former curriculum as the control group and 22 the new curriculum as the intervention group. The intervention consists of simulation-based training with theoretical and simulation-based training sessions in realistic encounters based on the Basic Life Support (BLS), Advanced Cardiac Life Support (ACLS) and adapted Advanced Trauma Life Support (ATLS) training. Further common emergencies were integrated corresponding to the course objectives. All students faced a performance-based assessment in a 10 station Objective Structured Clinical Examination (OSCE) using checklist rating within a maximum of 4 months after completion of the intervention. Results: The intervention group performed significantly better at all of the 10 OSCE stations in the checklist rating (p<0.0001 to p=0.016). Conclusions: The simulation-based intervention offers a positively evaluated possibility to enhance students' skills in recognising and handling emergencies. Additional studies are required to measure the long-term retention of the acquired skills, as well as the effect of training in healthcare professionals.


To compare the outcome of organs retrieved from patients brain dead due to cardiac arrest (CA) with that of organs retrieved from patients brain dead due to other causes (non-CA). Methods: Systematic review. Clinical studies comparing the outcome of patients and organs retrieved from donors brain dead after being resuscitated from cardiac arrest with that of patients and organs retrieved from donors brain dead not due to cardiac arrest were considered for inclusion. Full-text articles were searched on MEDLINE, EmBASE, Cochrane Register of Controlled Trials and Cochrane Register of Systematic Reviews. Main outcome measure: One-year patient or organ survival rate. Results: Four studies fulfilling inclusion criteria were found and three had sufficient quality to be included in final analysis. A total of 858 organs were transplanted from 741 donors. Since the transplanted organs (heart, liver, kidney, lung and intestine) were different in the three studies, meta analysis was not performed. There were no significant differences in 1-year survival rates between CA and non-CA groups. No significant differences were reported for 5-year survival
rates, early recovery of transplanted organ function, and organ rejection rates. Conclusion: Survival rates of kidneys, livers, hearts and intestines retrieved from CA donors were not significantly different from that of organs transplanted from non-CA donors. Patients brain dead after having been resuscitated from cardiac arrest can be considered as potential donors for organ transplantation.

Guideline 11.10: Legal and ethical issues related to resuscitation

AND....

60. Casarett D, Fishman JM, MacMoran HJ, Pickard A and Asch DA, Epidemiology and prognosis of coma in daytime television dramas. BMJ 2005: 331(7531); 1537-9

Objective: To determine how soap operas portray, and possibly misrepresent, the likelihood of recovery for patients in coma.

Design: Retrospective cohort study. Setting: Nine soap operas in the United States reviewed between 1 January 1995 and 15 May 2005. Subjects 64 characters that experienced a period of unconsciousness lasting at least 24 hours. Their final status at the end of the follow-up period was compared with pooled data from a meta-analysis. Results: Comas lasted a median of 13 days (interquartile range 7-25 days). Fifty seven (89%) patients recovered fully, five (8%) died, and two (3%) remained in a vegetative state. Mortality for non-traumatic and traumatic coma was significantly lower than would be predicted from the meta-analysis data (non-traumatic 4% v 53%; traumatic 6% v 67%; Fisher's exact test both P < 0.001). On the day that patients regained consciousness, most (49/57; 86%) had no evidence of limited function, cognitive deficit, or residual disability needing rehabilitation. Compared with meta-analysis data, patients in this sample had a much better than expected chance of returning to normal function (non-traumatic 91% v 1%; traumatic 89% v 7%; both P < 0.001). Conclusions: The portrayal of coma in soap operas is overly optimistic. Although these programmes are presented as fiction, they may contribute to unrealistic expectations of recovery.