
Study objectives: We sought to examine the association between area deprivation and outcomes of out-of-hospital cardiac arrest in Korea. Methods: Data were obtained from the emergency medical service (EMS) system. A nationwide OHCA cohort database from January 2006 to December 2007 was constructed via hospital chart review and ambulance run sheet data. We enrolled all EMS-assessed OHCA victims and excluded cases without available hospital outcome data or residential address. The Carstairs index was used to categorize districts according to level of deprivation into five quintiles, from (Q1, the least deprived) to (QS, the most deprived). Main outcomes were survival to hospital discharge, survival to admission, and return of spontaneous circulation (ROSC). Results: 34,227 patients were included. Initial rhythm, witnessed status, attempted bystander cardiopulmonary resuscitation (CPR), CPR by EMS, CPR in the emergency department (ED), and elapsed time interval significantly varied according to area deprivation level (p<0.001). OHCA outcomes were consistently worse in the most deprived areas. The adjusted OR (95% CI) for survival to hospital discharge was 0.58 (0.45-0.77) in the most deprived areas compared to the least deprived areas. Conclusion: Community deprivation was strongly associated with survival among out-of-hospital cardiac arrest patients in Korea.


Aims: Chest compression quality is a determinant of survival from out-of-hospital cardiac arrest (OHCA). ERC 2005 guidelines recommend the use of technical devices to support rescuers giving compressions. This prospective randomized study reviewed influence of different feedback configurations on survival and compression quality. Materials and methods: 312 patients suffering an OHCA were randomly allocated to two different feedback configurations. In the limited feedback group a metronome and visual feedback was used. In the extended feedback group voice prompts were added. A training program was completed prior to implementation; performance debriefing was conducted throughout the study. Results: Survival did not differ between the extended and limited feedback groups (47.8% vs 43.9%, p=0.49). Average compression depth (mean+/-SD: 4.74+/-.86cm vs 4.84+/-.93cm, p=0.31) was similar in both groups. There were no differences in compression rate (103+/-7 vs 102+/-5min^-1, p = 0.74) or hands-off fraction (16.16%+/-0.07 to 17.04%+/-0.07, p=0.38). Bystander CPR, public arrest location, presenting rhythm and chest compression depth were predictors of short-term survival (ROSC to ED). Conclusions: Even limited CPR-feedback combined with training and ongoing debriefing leads to high chest compression quality. Bystander CPR, location, rhythm and chest compression depth are determinants of survival from out of hospital cardiac arrest. Addition of voice prompts does neither modify CPR quality nor outcome in OHCA. CC depth significantly influences survival and therefore more focus should be put on correct delivery. Further studies are needed to examine the best configuration of feedback to improve CPR quality and survival.

Guideline 8 Cardiopulmonary resuscitation

Objective: Intranasal fentanyl's (INF) effectiveness is established using highly concentrated INF (HINF). Standard concentration INF (SINF) is more widely available. We aimed to illustrate the equivalence of SINF to HINF. Methods: Double-blinded randomized controlled trial was used within a children's hospital ED. Children aged 3 to 15 years with fractures were randomized to SINF or HINF. Outcome measures included pain scores at time zero and 10 minutes until 30 min. Additional analgesic agents were not used. Results: Data in 189 children (91 HINF, 98 SINF) were obtained. Pre-analgesia median VAS was 80.0 mm (interquartile range [IQR] 60.0–95.5) in SINF, 77.5 mm (IQR 60.0–100) in HINF. At 10 min median VAS was 49.5 mm (IQR 26.5–68.5) and 43.0 mm (IQR 15.2–66.0), respectively, at 20 min 27.5 mm (IQR 18.5–56.5) and 35.0 mm (IQR 9.0–57.0) and at 30 min 20.0 mm (IQR 10.0–46.0) and 21.5 mm (IQR 4.75–51.0). Each agent demonstrated significant decrease in pain scores (median decrease 40 mm, P = 0.000). Additional analgesia was given in 67 (42 SINF, 25 HINF) (P = 0.028). The decrease in pain scores between children < and ≥50 kg in SINF was significant both overall (P = 0.005) and between 10 and 20 min (P = 0.003). There was no difference in HINF at any time by weight. Conclusions: The two concentrations of INF were equivalent in reducing pain, with a trend to increased oral additional agents in the more dilute solution. The widespread use of this readily available analgesic in the standard concentration can be supported, particularly in patients <50 kg.


Background: Helicopter transport (HT) is frequently used for interfacility transfer of injured patients to a trauma center. The benefits of HT over ground transport (GT) in this setting are unclear. By using a national sample, the objective of this study was to assess whether helicopter transport impacted outcomes following interfacility transfer of trauma patients.

Methods: Patients transferred by HT or GT in 2007 were identified using the National Trauma Databank (version 8). Injury severity, resource utilization, and survival to discharge were compared. Stepwise logistic regression was used to determine whether transport modality was a predictor of survival after adjusting for covariates. Regression analysis was repeated in subgroups with Injury Severity Score (ISS) ≤15 and ISS >15.

Results: There were 74,779 patients transported by helicopter (20%) or ground (80%). Mean ISS was higher in patients transported by helicopter (17 +/- 11 vs. 12 +/- 9; p < 0.01) as was the proportion with ISS >15 (49% vs. 28%; odds ratio [OR], 2.53; 95% confidence interval [CI], 2.43-2.63). Patients transported by helicopter had higher rates of intensive care unit admission (54% vs. 29%; OR, 2.86; 95% CI, 2.75-2.96), had shorter transport time (61 +/- 55 minutes vs. 98 +/- 71 minutes; p < 0.01), and had shorter overall prehospital time (135 +/- 86 minutes vs. 202 +/- 132 minutes; p < 0.01). HT was not a predictor of survival overall or in patients with ISS ≤15. In patients with ISS >15, HT was a predictor of survival (OR, 1.09; 95% CI, 1.02-1.17; p = 0.01).

Conclusions: Patients transported by helicopter were more severely injured and required more hospital resources than patients transported by ground. HT offered shorter transport and overall prehospital times. For patients with ISS >15, HT was a predictor of survival. These findings should be considered when developing interfacility transfer policies for patients with severe injuries.


Oxygen (O2) is widely recommended in international guidelines for treatment of acute myocardial infarction (AMI), but there is uncertainty about its safety and benefits. A systematic review and meta-analysis were performed to determine whether inhaled O2 in AMI improves pain or the risk of death. Cochrane CENTRAL Register of Controlled Trials, MEDLINE, MEDLINE In-Process, EMBASE, CINAHL, Lilacs and PASCAL were searched from start date to February 2010. Other sources included British Library ZETOC, Web of Science, ISI Proceedings, relevant conferences and expert contacts. Randomised controlled trials
of inhaled O2 versus air in patients with suspected or proven AMI of < 24 h onset were included. Two authors independently reviewed studies to confirm inclusion criteria met, and undertook data abstraction. Quality of studies and risk of bias was assessed according to Cochrane Collaboration guidance. Main outcomes were death, pain, and complications. Measure of effect used was the RR. Three trials (n=387 patients) were included. Pooled RR of death on O2 compared to air was 2.88 (95%CI 0.88 to 9.39) on ITT analysis and 3.03 (95%CI 0.93 to 9.83) in confirmed AMI. While suggestive of harm, this could be a chance occurrence. Pain was measured by analgesic use. Pooled RR for the use of analgesics was 0.97 (95%CI 0.78 to 1.20). Evidence for O2 in AMI is sparse, of poor quality and pre-dates advances in reperfusion and trial methods. Evidence is suggestive of harm but lacks power and excess deaths in the O2 group could be due to chance. More research is required. (Original protocol registered with the Cochrane Collaboration)

Objective: Animal studies describe cardiovascular collapse (CVC; hypotension or reoccurrence of cardiac arrest) after return of spontaneous circulation (ROSC) from cardiopulmonary arrest. Few studies describe CVC in humans. This study aimed to determine the occurrence of cardiovascular collapse (CVC) in human out-of-hospital cardiopulmonary arrest (OHCA). Methods: Using observational data from a site of the Resuscitation Outcomes Consortium, the study analysed treated, non-traumatic OHCA achieving initial ROSC. CVC was defined as post-ROSC hypotension (systolic blood pressure ≤80 mmHg), post-ROSC administration of epinephrine, vasopressin or dopamine, or post-ROSC recurrent cardiac arrest. The time period from initial ROSC to emergency department (ED) arrival was measured. The prevalence of and elapsed time to post-ROSC CVC was determined, censoring cases at the point of ED arrival and comparing clinical characteristics between CVC and non-CVC cases. Results: Of 1081 treated OHCA, ROSC occurred in 58 (5%; 95% CI 4% to 7%). CVC occurred in three cases of 58 ROSC (5%; 95% CI 1% to 14%), all due to recurrent cardiac arrest. The median ROSC to ED arrival time was 6 min (IQR 3–13 min). ROSC to CVC times were 1, 2 and 8 min. Patient sex, age, initial ECG rhythm, endotracheal intubation, bystander cardiopulmonary resuscitation and bystander automated external defibrillation were similar between CVC and non-CVC cases (p=0.11–1.00). Conclusions: In this series of treated OHCA, only a small fraction of patients experienced CVC after ROSC.

Hanging is a rare but devastating cause of out of hospital cardiac arrest (OHCA). The characteristics and outcomes of hanging associated OHCA in the paediatric age group are described. Methods: The Victorian Ambulance Cardiac Arrest Registry was searched for patients aged less than 18 years where the precipitant cause of OHCA was hanging. Results were cross-checked with the coronial database. Results: During the years 2000–2009, there were 680 paediatric cardiac arrests of which 53 (7.8%) were precipitated by hanging with an incidence of 4.4 per million paediatric patients (<18 years) per year. Median age was 16 (IQR 14–17) years and 58.5% were males. Five were unintentional hangings; median age 3 (IQR 2–4) years. The youngest deliberate hanging associated OHCA was aged 10 years. Most hangings occurred in a house (85%) and bystander cardiopulmonary resuscitation (CPR) was performed in 30%. Asystole was the most common initial cardiac arrest rhythm seen in 50 cases (94%) while three patients had pulseless electrical activity. The emergency medical services (EMS) attempted resuscitation in 18 patients (34%), inserting an endotracheal tube in 13 patients. The majority (n=41) were not transported; seven patients were transported with return of spontaneous circulation (ROSC) and five patients were transported with ongoing CPR. Victims who had bystander CPR were more likely to have EMS attempted resuscitation (p<0.001). Only patients who had received bystander CPR achieved ROSC (p<0.001). Three patients survived to hospital discharge; two survivors suffered severe neurological injury (Cerebral Performance Category Scale 3–4).
Conclusion: Non-intentional hanging is rare but deliberate hanging with suicidal intent represents a significant proportion of OHCAs in patients under 18 years of age. A focus on prevention is key, as outcomes are poor, with survivors likely to suffer a severe neurological insult.


Background: Although the level of evidence of improvement is significant in cardiac arrest patients resuscitated from a shockable rhythm (ventricular fibrillation or pulseless ventricular tachycardia [VF/Vt]), the use of therapeutic mild hypothermia (TMH) is more controversial in nonshockable patients (pulseless electric activity or asystole [PEA/asystole]). We therefore assessed the prognostic value of hypothermia for neurological outcome at hospital discharge according to first-recorded cardiac rhythm in a large cohort.

Methods and Results: Between January 2000 and December 2009, data from 1145 consecutive out-of-hospital cardiac arrest patients in whom a successful resuscitation had been achieved were prospectively collected. The association of TMH with a good neurological outcome at hospital discharge (cerebral performance categories level 1 or 2) was quantified by logistic regression analysis. TMH was induced in 457/708 patients (65%) in VF/Vt and in 261/437 patients (60%) in PEA/asystole. Overall, 342/1145 patients (30%) reached a favorable outcome (cerebral performance categories level 1 or 2) at hospital discharge, respectively 274/708 (39%) in VF/Vt and 68/437 (16%) in PEA/asystole (P<0.001). After adjustment, in VF/Vt patients, TMH was associated with increased odds of good neurological outcome (adjusted odds ratio, 1.90; 95% confidence interval, 1.18 to 3.06) whereas in PEA/asystole patients, TMH was not significantly associated with good neurological outcome (adjusted odds ratio, 0.71; 95% confidence interval, 0.37 to 1.36). Conclusions: In this large cohort of cardiac arrest patients, hypothermia was independently associated with an improved outcome at hospital discharge in patients presenting with VF/Vt. By contrast, TMH was not associated with good outcome in nonshockable patients. Further investigations are needed to clarify this lack of efficiency in PEA/asystole.


Objectives: In cardiac arrest patients (in hospital and pre hospital) does resuscitation produce a good Quality of Life (QoL) for survivors after discharge from the hospital? Methods: Embase, Medline, The Cochrane Database of Systematic Reviews, Academic Search Premier, the Central Database of Controlled Trials and the American Heart Association (AHA) Resuscitation Endnote Library were searched using the terms ('Cardiac Arrest' (MeSH) OR 'Cardiopulmonary Resuscitation' (MeSH) OR 'Heart Arrest' (MeSH)) AND ('Outcomes' OR 'Quality of Life' OR 'Depression' OR 'Post-traumatic Stress Disorder' OR 'Anxiety OR 'Cognitive Function' OR 'Participation' OR 'Social Function' OR 'Health Utilities Index' OR 'SF-36' OR 'EQ-5D' as text term.

Results: There were 9 inception (prospective) cohort studies (LOE P1), 3 follow up of untreated control groups in randomised control trials (LOE P2), 11 retrospective cohort studies (LOE P3) and 47 case series (LOE P4). 46 of the studies were supportive with respect to the search question, 17 neutral and 7 negative. Discussion: The majority of studies concluded that QoL after cardiac arrest is good. This review demonstrated a remarkable heterogeneity of methodology amongst studies assessing QoL in cardiac arrest survivors. There is a requirement for consensus development with regard to quality of life and patient centred outcome assessment in this population.

Introduction: Some major trauma patients in metropolitan Perth (area 5000km2) are initially transported to a secondary hospital (non-trauma centre), rather than directly to a tertiary hospital (trauma centre). They are subsequently transferred to a tertiary hospital. We compared outcomes from these different systems of care. Methods: Major trauma (Injury Severity Score, ISS>15) data from the Trauma Registries, 1 July 1997-30 June 2006. Two groups were studied: group 1 (metropolitan major trauma transported directly to a tertiary hospital) and group 2 (metropolitan major trauma transported initially to a secondary hospital and then to a tertiary hospital). The primary endpoint was death. Results: Group 1 (n=2005) and group 2 (n=1078) mean age (43.9+/-.24.3 yrs vs. 39.1+/-.24.3 yrs, P<.0001) both with a median ISS=24 (P=0.084). Group 2 had significantly more head/neck injuries (p<.0001) and significantly less thoracic, abdominal and pelvis/extremities injuries (p<.0001). There were also a significantly greater total number of regions injured in group 1 vs. group 2 (p<.0001). Mean times to definitive care were 59min vs. 4.5±th, respectively (p<.0001). After adjusting for age, ISS, RTS, total regions injured and time, the OR for death in group 2 was 0.99 (95% CI 0.58-1.68). Conclusion: There is an equivalent risk of major trauma death in these two systems of care. In our metropolitan area, we were unable to demonstrate a mortality benefit associated with time.


This project tested the hypothesis that computer-aided decision support during the first 30 minutes of trauma resuscitation reduces management errors. Design: Ours was a prospective, open, randomized, controlled interventional study that evaluated the effect of real-time, computer-prompted, evidence-based decision and action algorithms on error occurrence during initial resuscitation between January 24, 2006, and February 25, 2008. Setting: A level I adult trauma center. Patients Severely injured adults. Main Outcome Measures The primary outcome variable was the error rate per patient treated as demonstrated by deviation from trauma care algorithms. Computer-assisted video audit was used to assess adherence to the algorithms. Results A total of 1171 patients were recruited into 3 groups: 300 into a baseline control group, 436 into a concurrent control group, and 435 into the study group. There was a reduction in error rate per patient from the baseline control group to the study group (2.53 to 2.13, P = .004) and from the control group to the study group (2.30 to 2.13, P = .04). The difference in error rate per patient from the baseline control group to the concurrent control group was not statistically different (2.53 to 2.30, P = .21). A critical decision was required every 72 seconds, and error-free resuscitations were increased from 16.0% to 21.8% (P = .049) during the first 30 minutes of resuscitation. Morbidity from shock management (P = .03), blood use (P < .001), and aspiration pneumonia (P = .046) were decreased. Conclusions: Computer-aided, real-time decision support resulted in improved protocol compliance and reduced errors and morbidity. Trial Registration clinicaltrials.gov Identifier: NCT00164034


INTRODUCTION: Mild therapeutic hypothermia (MTH) has been shown to result in better neurological outcome after cardiopulmonary resuscitation (CPR). Percutaneous coronary intervention (PCI) may also be beneficial in patients after out-of-hospital cardiac arrest. METHODS: Selected cohort study of 2973 prospectively documented adult out-of-hospital cardiac arrest (OHCA) patients within the German Resuscitation Registry between 2004 and 2010. Data were analyzed by backwards-stepwise binary logistic regression to identify the impact of MTH and PCI on both 24h-survival and neurological outcome that was based on cerebral performance category (CPC) at hospital discharge. Odds ratios (OR (95%CI)) were calculated adjusted for the following confounding
factors: age, location of cardiac arrest, presumed etiology, bystander CPR, witnessing, first electrocardiogram (ECG) rhythm, and thrombolysis. RESULTS: The 'Preclinical care' data set included 2973 OHCA patients with 44% initial return of spontaneous circulation (ROSC) (n=1,302) and 35% hospital admission (n=1,040). 711 out of these 1040 OHCA patients (68%) were also registered within the 'Postresuscitation care' data set. Checking for completeness of data sets required the exclusion of 127 'Postresuscitation care' cases, leaving 584 patients with complete data for final analysis. In patients without PCI (n=430), MTH was associated with increased 24h-survival (8.24 (4.24 to 16.0), P<0.001) and the proportion of patients with CPC 1 or 2 at hospital discharge (2.13 (1.17 to 3.90), P<0.05) as an independent factor. In normothermic patients (n=405), PCI was independently associated with increased 24h-survival (4.46 (2.26 to 8.81), P<0.001) and CPC 1 or 2 (10.81 (5.86 to 19.93), P<0.001). Additional analysis of all patients (n=584) revealed that 24h-survival was increased by MTH (7.50 (4.12 to 13.65), P<0.001) and PCI (3.88 (2.11 to 7.13), P<0.001), while the proportion of patients with CPC 1 or 2 was significantly increased by PCI (5.66 (3.54 to 9.03), P<0.001), but not by MTH (1.27 (0.79 to 2.03), P=0.33), although unadjusted Fisher exact test suggested a significant effect of MTH (unadjusted OR 1.83 (1.23 to 2.74), P<0.05). CONCLUSIONS: PCI may be an independent predictor for good neurological outcome (CPC 1 or 2) at hospital discharge. MTH was associated with better neurological outcome, although subsequent logistic regression analysis did not show statistical significance for MTH as an independent predictor for good neurological outcome. Thus, postresuscitation care on the basis of standardized protocols including coronary intervention and hypothermia may be beneficial after successful resuscitation. One of the main limitations may be a selection bias for patients subjected to PCI and MTH.

Guideline 11.8 Therapeutic hypothermia after cardiac arrest


Aim: The Advanced Trauma Life Support (ATLS) system classifies the severity of shock. The aim of this study is to test the validity of this classification. Methods: Admission physiology, injury and outcome variables from adult injured patients presenting to hospitals in England and Wales between 1989 and 2007 and stored on the Trauma Audit and Research Network (TARN) database, were studied. For each patient, the blood loss was estimated and patients were divided into four groups based on the estimated blood loss corresponding to the ATLS classes of shock. The median and interquartile ranges (IQR) of the heart rate (HR) systolic blood pressure (SBP), respiratory rate (RR) and Glasgow Coma Score (GCS) were calculated for each group. Results: The median HR rose from 82 beats per minute (BPM) in estimated class 1 shock to 95†BPM in estimated class 4 shock. The median SBP fell from 135†mm Hg to 120†mm Hg. There was no significant change in RR or GCS. Conclusion: With increasing estimated blood loss there is a trend to increasing heart rate and a reduction in SBP but not to the degree suggested by the ATLS classification of shock.


Objective: To investigate whether real-time audio and visual feedback during cardiopulmonary resuscitation outside hospital increases the proportion of subjects who achieved prehospital return of spontaneous circulation. Design: A cluster-randomised trial. Subjects: 1586 people having cardiac arrest outside hospital in whom resuscitation was attempted by emergency medical services (771 procedures without feedback, 815 with feedback). Setting: Emergency medical services from three sites within the Resuscitation Outcomes Consortium in the United States and Canada. Intervention: Real-time audio and visual feedback on cardiopulmonary resuscitation (CPR) provided by the monitor-defibrillator. Main outcome measure: Prehospital return of spontaneous circulation after CPR. Results: Baseline patient and emergency medical service characteristics did not differ between groups. Emergency
medical services muted the audible feedback in 14% of cases during the period with feedback. Compared with CPR clusters lacking feedback, clusters assigned to feedback were associated with increased proportion of time in which chest compressions were provided (64% vs 66%, cluster-adjusted difference 1.9 (95% CI 0.4 to 3.4)), increased compression depth (38 vs 40 mm, adjusted difference 1.6 (0.5 to 2.7)), and decreased proportion of compressions with incomplete release (15% vs 10%, adjusted difference −3.4 (−5.2 to −1.5)). However, frequency of prehospital return of spontaneous circulation did not differ according to feedback status (45% vs 44%, adjusted difference 0.1% (−4.4% to 4.6%)), nor did the presence of a pulse at hospital arrival (32% vs 32%, adjusted difference −0.8 (−4.9 to 3.4)), survival to discharge (12% vs 11%, adjusted difference −1.5 (−3.9 to 0.9)), or awake at hospital discharge (10% vs 10%, adjusted difference −0.2 (−2.5 to 2.1)).

Conclusions: Real-time visual and audible feedback during CPR altered performance to more closely conform to guidelines. However, these changes in CPR performance were not associated with improvements in return of spontaneous circulation or other clinical outcomes. Trial Registration Clinical Trials NCT00539539

Guideline 11.1.1 Cardiopulmonary resuscitation for ALS providers


Background: Serious sequelae have been associated with injured patients who are hypothermic (<35°C) including coagulopathy, acidosis, decreased myocardial contractility and risk of mortality. Aim: Establish the incidence of accidental hypothermia in major trauma patients and identify causative factors. Method: Prospective identification and subsequent review of 732 medical records of major trauma patients presenting to an Adult Major Trauma Centre was undertaken between January and December 2008. Multivariate analysis was performed using logistic regression. Significant and clinically relevant variables from univariate analysis were entered into multivariate models to evaluate determinants for hypothermia and for death. Goodness of fit was determined with the use of the Hosmer-Lemeshow statistic. Main results: Overall mortality was 9.15%. The incidence of hypothermia was 13.25%. The mortality of patients with hypothermia was 29.9% with a threefold independent risk of death: OR (CI 95%) 3.44 (1.48-7.99), P=0.04. Independent determinants for hypothermia were pre-hospital intubation: OR (CI 95%) 5.18 (2.77-9.71), P<0.001, Injury Severity Score (ISS): 1.04 (1.01-1.06), P=0.01, Arrival Systolic Blood Pressure (ASBP)<100mmHg: 3.04 (1.24-7.44), P=0.02, and wintertime: 1.84 (1.06-3.21), P=0.03. Of the 87 hypothermic patients who had repeat temperatures recorded in the Emergency Department, 77 (88.51%) patients had a temperature greater than the recorded arrival temperature. There was no change in recorded temperature for four (4.60%) patients, whereas six (6.90%) patients were colder at Emergency Department discharge. Conclusion: Seriously injured patients with accidental hypothermia have a higher mortality independent of measured risk factors. For patients with multiple injuries a coordinated effort by paramedics, nurses and doctors is required to focus efforts toward early resolution of hypothermia aiming to achieve a temperature >35°C.


Objectives: To evaluate the association between emergency tracheal intubation difficulty and the occurrence of immediate complications and mortality, when standardised airway management is performed by emergency physicians. Methods: The present study was a substudy of the KETAmine SEDation (KETASED) trial, which compared morbidity and mortality after randomisation to one of two techniques for rapid sequence intubation in an emergency setting. Intubation difficulty was measured using the intubation difficulty scale (IDS) score. Complications recognised within 5 min of endotracheal intubation were recorded. We used multivariate logistic regression analysis to determine the factors associated with the occurrence of complications.
Finally, a Cox proportional hazards regression model was used to examine the association of difficult intubation with survival until 28 days. Results: A total of 650 patients were included, with mean age of 55+/-19 years. Difficult intubation (IDS >5) was recorded in 73 (11%) patients and a total of 248 complications occurred in 192 patients (30%). Patients with at least one complication had a significantly higher median IDS score than those without any complications. The occurrence of a complication was independently associated with intubation difficulty (odds ratio 5.9; 95% confidence interval [CI] [3.5; 10.1], p<0.0001) after adjustment on other significant factors. There was a positive linear relationship between IDS score and complication rate (R2=0.83; p=0.001). The Cox model for 28-day mortality indicated that difficult intubation (hazard ratio 1.59; 95% CI [1.04; 2.42], p=0.03) was a significant independent predictor of death. Conclusion: Difficult intubation, measured by the IDS score, is associated with increased morbidity and mortality in patients managed under emergent conditions.

Guideline 11.6 Equipment and techniques in adult ALS


Cardiac arrest is fatal and extremely stressful to patients, even if spontaneous rhythm is returned. The purpose of this study was to analyze the hormonal response after return of spontaneous circulation (ROSC). METHODS: This is the retrospective review of the chart and laboratory findings in single medical facility. The patients admitted to the intensive care unit after successful resuscitation after out-of-hospital cardiac arrest were retrospectively identified and evaluated. Patients with hormonal diseases, received cortisol treatment, trauma and pregnancy were excluded. Serum cortisol, adrenocorticotropin hormone (ACTH), and anti-diuretic hormone (ADH= vasopressin]) were analyzed and a corticotropin-stimulation test was performed. Mortality 1 week and 1 month after admission, neurologic performance category (CPC) 1 month after admission were evaluated. RESULTS: One hundred seventeen patients were evaluated in this study; there were 84 males (71.8%). One week and 1 month after admission, 87 (74.4%) and 65 patients (55.6%) survived, respectively. Relative adrenal insufficiency, and higher plasma ACTH and ADH levels were associated with shock-related mortality (P=0.046, 0.005, and 0.037, respectively), and ACTH and ADH levels were also associated with late mortality (P=0.002 and 0.004, respectively). Patients with relative adrenal insufficiency, ACTH [greater than or equal to] 5 pg/mL, and ADH [greater than or equal to] 30 pg/mL had a 2-fold increased risk (odds ratio [OR], 2.601 and 95% confidence interval [CI], 1.015-6.664; OR, 2.759 and 95% CI, 1.060-7.185; OR, 2.576 and 95% CI, 1.051-6.313, respectively) of a poor outcome (shock-related mortality). Thirty-five patients (29.9%) had a good CPC (1-2), and 82 patients (70.1%) had a bad CPC (3-5). Age [greater than or equal to] 50 years and an ADH [greater than or equal to] 30 pg/mL were associated with a bad CPC (OR, 4.564 and 95% CI, 1.794-11.612; OR, 6.568 and 95% CI, 1.918-22.483, respectively). CONCLUSIONS: The patients with relative adrenal insufficiency and higher blood levels of ACTH and ADH upon ROSC after cardiac arrest had a poor outcome. Effectiveness of administration of cortisol and ADH to patients upon ROSC after cardiac arrest is uncertain and additional studies are needed.

Guideline 11.7 Post-resuscitation therapy in adult ALS


Aim of the study: Quality of cardiopulmonary resuscitation (CPR) is a critical determinant of outcome following out-of-hospital cardiac arrest. The aim of our study was to evaluate the quality of CPR provided by emergency medical service providers (Basic Life Support (BLS) capability) and emergency medical service providers assisted by paramedics, nurse anesthetists or physician-manned ambulances (Advanced Life Support (ALS) capability) in a nationwide, unselected cohort of out-of-hospital cardiac arrest cases. Methods: We conducted a prospective, observational study of out-of-hospital cardiac arrest with Australian Resuscitation Council Research Updates: February 2011
non-traumatic etiology (>18 years of age) occurring from the 1st to the 31st of January 2009 and treated by the primary Danish emergency medical service operator, covering approximately 85% of the population. One hundred and ninety-one cases were eligible for analysis. Follow-up was up to one year or death. Quality of CPR was evaluated using measurements of transthoracic impedance. Results: The majority of patients were treated by an ambulance with ALS capability (54%). Interruptions in CPR related to loading of the patient into the emergency medical service vehicle were substantial, but independent of whether patients were managed by ALS or BLS capable units (222s versus 224s, P = 0.76) as were duration of interruptions during rhythm analysis alone (20s versus 22s, P = 0.33) and defibrillation (24s versus 26s, P = 0.07). Conclusions: Nationwide, routine monitoring of transthoracic impedance is feasible. CPR is hampered by extended interruptions, particularly during loading of the patient into the emergency medical service vehicle, rhythm analysis and defibrillation.


Background: Previous out-of-hospital fentanyl analgesia studies are limited by retrospective nature or low numbers. Study Objectives: This study sought to prospectively assess fentanyl safety in a large out-of-hospital group, to identify variables associated with post-fentanyl hypotension (HN; systolic blood pressure [SBP] < 90mmHg) or hypoxemia (HX; SpO2 < 90%). Methods: As part of a new protocol requiring documentation of peri-dose vital signs and adverse effects associated with fentanyl bolus doses, our Emergency Medical Services helicopter service assessed 500 consecutive patients receiving fentanyl from July through September 2006. By a priori plan, we assessed HN and HX descriptively (median with interquartile range, exact confidence intervals [CIs]) and with multivariate regression. Results: In 1055 patients, post-fentanyl HN was noted 52 times (4.9%), being a continuation of pre-fentanyl HN in 24 patients (46.2%); HN was new in 28 patients (2.7% of 1055, 95% CI 1.8-3.8%). Regression showed no association between dependent variables HN (assessed for 1055 doses) or HX (528 doses in non-intubated) and independent variables age, diagnosis, gender, scene/inter-facility mission, dose, or total transport dose. Pre- and post-fentanyl SpO2 means were unchanged: 98.8% (95% CI 98.5-98.9) vs. 98.6% (95% CI 98.3-99.0), respectively. Post-fentanyl HN was seen in patients with pre-fentanyl intubation (odds ratio [OR] 5.3, p = 0.002) and with pre-fentanyl low SBP (OR 40, p < 0.001). Conclusion: In a closely monitored out-of-hospital population, fentanyl incurs a low risk of significant hypoxemia. The risk of fentanyl-associated hypotension is also very low, but difficult to predict in the absence of acuity markers such as pre-existing hypotension.


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

21. Ley EJ, Clond MA, Srour MK, Barnajian M, Mirocha J, Margulies DR and Salim A. Emergency Department Crystalloid Resuscitation of 1.5 L or More is Associated With Increased Mortality in Elderly and Nonelderly Trauma Patients. J Trauma 2011; 70 (2)

Background: Recent evidence suggests a survival advantage in trauma patients who receive controlled or hypotensive resuscitation volumes. This study examines the threshold crystalloid volume that is an independent risk factor for mortality after trauma. Methods: This study analyzed prospectively collected data from a Level I Trauma Center between January 2000 and December 2008. Demographics and outcomes were compared in elderly (>70 years) and nonelderly (<70 years) trauma patients who received crystalloid fluid in the emergency department (ED) to determine a threshold volume that was an independent predictor for mortality. Results: A total of 3,137 patients who received crystalloid resuscitation in the ED were compared. Overall mortality was 5.2%. Mortality among the elderly population was 17.3% (41 deaths), whereas mortality in the nonelderly population was 4% (116 deaths). After multivariate logistic regression analysis, fluid volumes of 1.5 L or more were significantly associated with mortality in both elderly (odds ratio [OR]: 2.89, confidence interval [CI] [1.13,7.41], p = 0.027) and nonelderly patients (OR: 2.09, CI [1.31,3.33], p = 0.002). Fluid volumes up to 1 L were not associated with significantly increased mortality. At 3 L, mortality was especially pronounced in the elderly (OR: 8.61, CI [1.55,47.75] p = 0.014), when compared with the nonelderly (OR = 2.69, CI [1.53,4.73], p = 0.0006). Conclusion: ED volume replacement of 1.5 L or more was an independent risk factor for mortality. High-volume resuscitations were associated with high-mortality particularly in the elderly trauma patient. Our finding supports the notion that excessive fluid resuscitation should be avoided in the ED and when required, operative intervention or intensive care admission should be considered.


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

Objectives: To report time from the onset of symptoms to hospital presentation in Australian and New Zealand patients with subsequently confirmed acute coronary syndrome, and to identify factors associated with prehospital delay time in these patients. Methods: Patients with coronary artery disease enrolled in a randomized clinical trial testing an intervention to reduce delay in responding to acute coronary syndrome symptoms had been followed for 24 months. In cases of admission to the ED for possible acute coronary syndrome, medical records were reviewed to determine the diagnosis, prehospital delay time, mode of transport to the hospital and aspirin use before admission. Clinical and demographic data were taken from the trial database. Results: Patients (n= 140) had an average (SD) age of 67.3 (11.5) years; 36% were female. Two-thirds of patients went to hospital by ambulance and 89.3% had a final diagnosis of unstable angina. The median time from onset of symptoms to arrival at the ED was 2 h and 25 min (interquartile range 1:25–4:59); 12.1% arrived ≤ 1 h and 66% within 4 h. Multiple linear regression analysis showed that use of ambulance (Beta = 0.247, P= 0.012) and younger age (Beta = 0.198, P= 0.043) were independent predictors of shorter delay times. Conclusion: The time from the onset of symptoms to hospital presentation was too long for maximal benefit from treatment in most patients. Further efforts are needed to reduce treatment-seeking delay in response to symptoms of acute coronary syndrome.


Objective: To describe the treatment and assessment of emergency department nausea and vomiting (EDNV) in Australasia by fellows of the Australasian College for Emergency Medicine (FACEM). To determine the influence of various factors on FACEM anti-emetic choice. To compare the influence of drug effectiveness, side effects, cost and pharmacy directives on adult EDNV anti-emetic choice between FACEM choosing the two most common first-line agents. Methods: A cross-sectional survey of all FACEM practising in Australasian ED was conducted by mail-out in February 2009. Results: Of all FACEM surveyed 48.7% (532/1092) responded. The most common first-line drugs for adult EDNV were metoclopramide (87.3%, 453/519), 5HT3 antagonists (7.9%, 41/519) and prochlorperazine (2.3%, 12/519). For paediatric EDNV, the most common first-line agents were 5HT3 antagonists (86.2%, 307/356), metoclopramide (6.7%, 24/356) and promethazine (5.1%, 18/356). For most FACEM anti-emetic choice was highly influenced by perceived drug efficacy (96.1%) and side effects (82.5%), and 32.9% of FACEM were highly influenced by drug cost. Few FACEM reported ED anti-emetic protocols for adults (13.0%) or children (16.7%) in their ED. FACEM seldom used scales or tools to measure EDNV severity in adult (2.5%) or paediatric (3.4%) patients. Conclusions: Fellows of the Australasian College for Emergency Medicine anti-emetic choice in Australasian ED has been described. The main influences on anti-emetic choice were patient age, perceived drug efficacy and drug side-effect profiles.


Background: Since the promulgation of emergency department (ED) thoracotomy >40 years ago, there has been an ongoing search to define when this heroic resuscitative effort is futile. In this era of health care reform, generation of accurate data is imperative for developing patient care guidelines. The purpose of this prospective multicenter study was to identify injury patterns and physiologic profiles at ED arrival that are compatible with survival. Methods: Eighteen institutions representing the Western Trauma Association commenced enrollment in January 2003; data were collected prospectively. Results: During the ensuing 6 years, 56 patients survived to hospital discharge. Mean age was 31.3 years (15-64 years), and 93% were male. As expected,
survival was predominant in those with thoracic injuries (77%), followed by abdomen (9%), extremity (7%), neck (4%), and head (4%). The most common injury was a ventricular stab wound (30%), followed by a gunshot wound to the lung (16%); 9% of survivors sustained blunt trauma, 34% underwent prehospital cardiopulmonary resuscitation (CPR), and the presenting base deficit was >25 mequiv/L in 18%. Relevant to futile care, there were survivors of blunt torso injuries with CPR up to 9 minutes and penetrating torso wounds up to 15 minutes. Asystole was documented at ED arrival in seven patients (12%); all these patients had pericardial tamponade and three (43%) had good functional neurologic recovery at hospital discharge.

Conclusion: Resuscitative thoracotomy in the ED can be considered futile care when (a) prehospital CPR exceeds 10 minutes after blunt trauma without a response, (b) prehospital CPR exceeds 15 minutes after penetrating trauma without a response, and (c) asystole is the presenting rhythm and there is no pericardial tamponade.


Objective: To compare the effectiveness of cardiopulmonary resuscitation (CPR) with chest compression only and conventional CPR on outcomes after cardiopulmonary arrest out of hospital. Design: Nationwide population based observational study. Setting: A nationwide emergency medical service system in Japan. Population: All consecutive patients with out of hospital cardiopulmonary arrest, January 2005 to December 2007 in Japan, witnessed at the moment of collapse. Lay people attempted chest compression only CPR (n=20 707) or conventional CPR (mouth to mouth ventilation and chest compression) (n=19 328), and patients were transferred to hospital by ambulance. Main outcome measures: Factors associated with better outcomes (assessed with χ², multiple logistic regression analysis, odds ratios and their 95% confidence intervals): one month survival and neurologically favourable one month survival rates defined as category one (good cerebral performance) or two (moderate cerebral disability) of the cerebral performance categories. Results: Conventional CPR was associated with better outcomes than chest compression only CPR, for both one month survival (adjusted odds ratio 1.17, 95% confidence interval 1.06 to 1.29) and neurologically favourable one month survival (1.17, 1.01 to 1.35). Neurologically favourable one month survival decreased with increasing age and with delays of up to 10 minutes in starting CPR for both conventional and chest compression only CPR. The benefit of conventional CPR over chest compression only CPR was significantly greater in younger people in non-cardiac cases (P=0.025) and with a delay in start of CPR after the event was witnessed in non-cardiac cases (P=0.015) and all cases combined (P=0.037). Conclusions: Conventional CPR is associated with better outcomes than chest compression only CPR for selected patients with out of hospital cardiopulmonary arrest, such as those with arrests of non-cardiac origin and younger people, and people in whom there was delay in the start of CPR.

Guideline 8: cardiopulmonary resuscitation


INTRODUCTION: Retrospective studies have demonstrated a potential survival benefit from transfusion strategies using an early and more balanced ratio between fresh frozen plasma concentration (FFP) and packed red blood cell (pRBC) transfusions in patients with acute traumatic coagulopathy (ATC) requiring massive transfusion. These results have mostly been derived from non-head injured patients. The aim of the present study was to analyze whether a transfusion regime using a high FFP: pRBC ratio (FFP: pRBC >1:2) would be associated with a similar survival benefit in severely injured patients with traumatic brain injury (TBI) (AIS head ≥3) as demonstrated for patients without TBI requiring massive transfusion ≥10pRBCs). METHODS: A
Objective Blue Team (CBT) to respond to cardiac arrests at any time. This team is always led by an emergency physician, and includes specially trained nurses. Therefore, donor history of CA should not automatically preclude LuTX.


Objectives: Shortage of donors is one of the major limitations in lung transplantation (LuTX) and an aggressive expansion of criteria for donor selection has been proposed. This study evaluates the outcome of recipients of pulmonary grafts coming from resuscitated donors when compared with recipients of non-resuscitated donors. Methods: We retrospectively analyzed the donor and recipient charts of all double LuTX performed at our institution between 2000 and 2008 with regard to the performance of donor-cardiopulmonary resuscitation (CPR). Results: Out of 186 eligible transplants, 22 patients (11.8%) received lungs from donors who have suffered cardiac arrest (CA) and subsequent CPR. Mean duration of CPR was 15.2 +/- 11.3 min. Terminal laboratory profiles of CPR donors and non-CPR donors were similar as were ventilation time and PaO2/FiO2 ratio before organ harvesting or chest X-ray. CPR-donor status did not affect the following indices of graft function: length of postoperative ventilation, PaO2/FiO2 ratio up to 48 h and lung function up to 60 months. Length of intensive care and hospital stay, need for inotropic support and 30-day mortality were not significantly different for the transplantation of CPR or no-CPR donor lungs. One- and 3-year survival rates were comparable as well with 84.4% and 66.3% for CPR donors versus 88.5% and 69.8% no-CPR donors. Conclusions: This study indicates that transplantation of lungs from resuscitated donors may not affect outcome after LuTX. Therefore, donor history of CA should not automatically preclude LuTX.


Recent studies suggest that time of day affects survival from in-hospital cardiac arrest. Lower survival rates are observed during nights and on weekends, except in areas with consistent physician care, such as the Emergency Department. Since 1997, our hospital has utilized a standard, hospital-wide "Code Blue Team" (CBT) to respond to cardiac arrests at any time. This team is always led by an emergency physician, and includes specially trained nurses. Objective: To assess if time of day or week affects survival from in-hospital cardiac arrest when a trained, consistent, emergency physician-led CBT is implemented. Methods: This is an analysis of prospectively collected data on initial survival rates (return of spontaneous circulation >20 min) of all cardiac arrests that were managed by the CBT from 2000 to 2008. Cardiac arrests were also subcategorized based on initial cardiac rhythm. Survival rates were
compared according to time of day or week. Results: A total of 1692 cardiac arrests were included. There was no significant difference in the overall rate of initial survival between day/evening vs. night hours (odds ratio [OR] 1.04, 95% confidence interval [CI] 0.83-1.29), or between weekday vs. weekend hours (OR 1.10, 95% CI 0.85-1.38). This held true for all cardiac rhythms. Conclusion: At our institution, there is no significant difference in survival from cardiac arrest when a standardized "Code Blue Team" is utilized, regardless of the time of day or week.

Objective: A recent increase in the number of infants presenting at autopsy with rib fractures associated with cardio-pulmonary resuscitation (CPR) precipitated a study to determine whether such a phenomenon was related to recent revision of paediatric resuscitation guidelines. Methods: We conducted a review of autopsy reports from 1997 to 2008 on 571 infants who had CPR performed prior to death. Results: Analysis of the study population revealed CPR-related rib fractures in 19 infants (3.3%), 14 of whom died in the 2006-2008 period. The difference in annual frequency of CPR-related fractures between the periods before and after revision of paediatric CPR guidelines was statistically highly significant. Conclusions: The findings indicate that CPR-associated rib fractures have become more frequent in infants since changes in CPR techniques were introduced in 2005. This has important implications for both clinicians and pathologists in their assessment of rib fractures in this patient population.

Study objective: Public accessible automated external defibrillators (AEDs) are increasingly made available in highly frequented places, allowing coincidental bystanders to defibrillate with minimal delay if necessary. Although the public, as the largest and most readily available group of potential rescuers, is assigned a key role in this concept of "public" access defibrillation, it is unknown whether bystanders are actually sufficiently prepared. We therefore investigate knowledge and attitudes toward AEDs among the public. Methods: Standardized interviews were conducted at the Central Railway Station of Amsterdam, the Netherlands, a highly frequented and AED-equipped public place with a high number of travelers and visitors from all over the world. Results: Surveys from 1,018 participants from a total of 38 nations were analyzed, revealing a considerable lack of knowledge among the public. Less than half of participants (47%) would be willing to use an AED, and more than half (53%) were unable to recognize an AED. Overall, only a minority of individuals have sufficient knowledge and would be willing to use an AED. Differences between subgroups were identified, which may aid to tailor public information campaigns to specific target audiences. Conclusion: Only a minority of individuals demonstrate sufficient knowledge and willingness to operate an AED, suggesting that the public is not yet sufficiently prepared for the role it is destined for. Wide-scale public information campaigns are an important next step to exploit the lifesaving potential of public access defibrillation.

Study objective: 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)
In addition, engineers should continue to focus on improving automotive design to minimize the risk of spinal injury to occupants. The design of airbag restraint systems should be evaluated so that they are not causative of serious injury. More protection for older occupants is needed and protection in both rollover and lateral crashes should remain a focus of the automotive industry. The design of airbag restraint systems should be evaluated so that they are not causative of serious injury. In addition, engineers should continue to focus on improving automotive design to minimize the risk of spinal injury to occupants in high severity crashes.


Background: Motor vehicle collisions (MVCs) are the leading cause of spine and spinal cord injuries in the United States. Traumatic cervical spine injuries (CSIs) result in significant morbidity and mortality. This study was designed to evaluate both the epidemiologic and biomechanical risk factors associated with CSI in MVCs by using a population-based database and to describe occupant and crashes characteristics for a subset of severe crashes in which a CSI was sustained as represented by the Crash Injury Research Engineering Network (CIREN) database. Methods: Prospectively collected CIREN data from the eight centers were used to identify all case occupants between 1996 and November 2009. Case occupants older than 14 years and case vehicles of the four most common vehicle types were included. The National Automotive Sampling System’s Crashworthiness Data System, a probability sample of all police-reported MVCs in the United States, was queried using the same inclusion criteria between 1997 and 2008. Cervical spinal cord and spinal column injuries were identified using Abbreviated Injury Scale (AIS) score codes. Data were abstracted on all case occupants, biomechanical crash characteristics, and injuries sustained. Univariate analysis was performed using a [chi]² analysis. Logistic regression was used to identify significant risk factors in a multivariate analysis to control for confounding associations.

Results: CSIs were identified in 11.5% of CIREN case occupants. Case occupants aged 65 years or older and those occupants involved in rollover crashes were more likely to sustain a CSI. In univariate analysis of the subset of severe crashes represented by CIREN, the use of airbag and seat belt together (reference) were more protective than seat belt alone (odds ratio [OR] = 1.73, 95% confidence interval [CI] = 1.32-2.27) or the use of neither restraint system (OR = 1.45, 95% CI = 1.02-2.07). The most frequent injury sources in CIREN crashes were roof and its components (24.8%) and noncontact sources (15.5%). In multivariate analysis, age, rollover impact, and airbag-only restraint systems were associated with an increased odds of CSI. Using the population-based National Automotive Sampling System’s Crashworthiness Data System data, 0.35% of occupants sustained a CSI. In univariate analysis, older age was noted to be a significant risk factor for CSI. Airbag-only restraint systems and both rollover and lateral crashes were also identified as risk factors for CSI. In addition, increasing delta v was highly associated with CSIs. In multivariate analysis, similar risk factors were noted. Of all the restraint systems, seat belt use without airbag deployment was found to be the most protective restraint system (OR = 0.29, 95% CI = 0.16-0.50), whereas airbag-only restraint was associated with the highest risk of CSI (OR = 3.54, 95% CI = 2.29-5.46). Conclusions: Despite advances in automotive safety, CSIs sustained in MVC continue to occur too often. Older case occupants are at an increased risk of CSI. Rollover crashes and severe crashes led to a much higher risk of CSI than other types and severity of MVCs. Seat belt use is very effective in preventing CSI, whereas airbag deployment may increase the risk of occupants sustaining a CSI. More protection for older occupants is needed and protection in both rollover and lateral crashes should remain a focus of the automotive industry. The design of airbag restraint systems should be evaluated so that they are not causative of serious injury. In addition, engineers should continue to focus on improving automotive design to minimize the risk of spinal injury to occupants in high severity crashes.

Background: In the prehospital environment, the failure of medical providers to recognize latent physiologic derangement in patients with compensated shock may risk under triage. We hypothesized that the shock index (SI; heart rate divided by systolic blood pressure [SBP]), when used in the prehospital setting, could facilitate the identification of such patients. The objective of this study was to assess the association between the prehospital SI and the risk of massive transfusion (MT) in relatively normotensive blunt trauma patients.

Methods: Admissions to a Level I trauma center between January 2000 and October 2008 with blunt mechanism of injury and prehospital SBP >90 mm Hg were identified. Patients were categorized by SI, calculated for each patient from prehospital vital signs. Risk ratios (RRs) and 95% confidence intervals (CI) for requiring MT (>10 red blood cell units within 24 hours of admission) were calculated using SI >0.5 to 0.7 (normal range) as the referent for all comparisons.

Results: A total of 8,111 patients were identified, of whom 276 (3.4%) received MT. Compared with patients with normal SI, there was no significant increased risk for MT for patients with a SI of <=0.5 (RR, 1.41; 95% CI, 0.90-2.21) or >0.7 to 0.9 (RR, 1.06; 95% CI, 0.77-1.45). However, a significantly increased risk for MT was observed for patients with SI >0.9. Specifically, patients with SI >0.9 to 1.1 were observed to have a 1.5-fold increased risk for MT (RR, 1.61; 95% CI, 1.13-2.31). Further increases in SI were associated with incrementally higher risks for MT, with an eightfold risk in patients with SI >1.3 (RR, 8.13; 95% CI, 4.60-14.36).

Conclusion: Prehospital SI > 0.9 identifies patients at risk for MT who would otherwise be considered relatively normotensive under current prehospital triage protocols. The risk for MT rises substantially with elevation of SI above this level. Further evaluation of SI in the context of trauma system triage protocols is warranted to analyze whether it triage precision might be augmented among blunt trauma patients with SBP >90 mm Hg.

35. Yam CH, Dawson JA, Schmölzer GM, Morley CJ and Davis PG. Heart rate changes during resuscitation of newly born infants <30 weeks gestation: an observational study. Arch Dis Child Fetal Neonat Ed 2011; 96 (2): F102-F7

The International Liaison Committee on Resuscitation recommends starting positive pressure ventilation (PPV) in the delivery room when heart rate (HR) <100 beats per min (bpm) and giving cardiac compressions when HR <60 bpm. Objective: To describe the effect of PPV on HR in infants <30 weeks gestation with HR <100 bpm in the first minutes after birth.

Study design: Retrospective observational study of infants, <30 weeks gestation, born between 14 February 2007 and 28 February 2009 with HR <100 bpm soon after birth. Methods: Infants with a HR <100 bpm receiving PPV at birth were eligible for the study. Video recordings and respiratory physiological data were obtained during delivery room resuscitation and analysed to determine if the rate of change in HR varied with measures of PPV, for example, expiratory tidal volume. Results: It took a median (IQR) 73 (24,165) seconds of PPV for infants' HR to rise above 100 bpm and a median (IQR) 243 (191,351) seconds to rise above 120 bpm. There were large fluctuations in HR after reaching 100 bpm and before reaching 120 bpm. In 18/27 (67%) of infants the HR did not remain stable until a threshold of approximately 150 bpm was reached. In 6/27 (20%) of the infants the rise in HR was almost instantaneous. In the remaining 21/27 (80%) HR rise was more gradual. There was a poor correlation between time of HR increase to 120 bpm and tidal volume (p=0.13).

Conclusion: It takes more than a minute for newly born infants <30 weeks gestation with a HR <100 bpm to achieve a HR above 100 bpm. In these infants HR does not stabilise until it reaches 120 bpm.

Objectives: To identify variation in patient, event, and scene characteristics of out-of-hospital cardiac arrest (OOHCA) patients assessed by emergency medical services (EMS), and to investigate variation in transport practices in relation to documented prehospital return of spontaneous circulation (ROSC) within eight regional clinical centers participating in the Resuscitation Outcomes Consortium (ROC) Epistry-Cardiac Arrest. Methods OOHCA patient, event, and scene characteristics were compared to identify variation in treatment and transport practices across sites. Findings were adjusted for site and standard Utstein covariates. Using logistic regression, these covariates were modeled to identify factors related to the initiation of transport without documented prehospital ROSC as well as survival in these patients. Setting: Eight Canadian and US sites participating in the ROC Epistry-Cardiac Arrest.

Population: Persons ≥20 years with OOHCA who (a) received compressions or shock by EMS providers and/or received bystander AED shock or (b) were pulseless but received no EMS compressions or shock between December 2005 and May 2007. Results: 23,233 OOHCA cases were assessed by EMS in the defined period. Resuscitation (treatment) was initiated by EMS in 13,518 cases (58%, site range: 36-69%, p<0.0001). Of treated cases, 59% were transported (site range: 49-88%, p<0.0001). Transport was initiated in the absence of documented ROSC for 58% of transported cases (site range: 14-95%, p<0.0001). Of these transported cases, 8% achieved ROSC before hospital arrival (site range: 5-21%, p<0.0001) and 4% survived to hospital discharge (site range: 1-21%, p<0.0001). In cases with transport from the scene initiated after documented ROSC, 28% survived to hospital discharge (site range: 18-44%, p<0.0001).

Conclusion: Initiation of resuscitation and transport of OOHCA and the reporting of ROSC prior to transport markedly varies among ROC sites. This variation may help clarify reported differences in survival rates among sites and provide a target for identifying EMS practices most likely to enhance survival from OOHCA.


The aim of this prospective study was the comparison of four emergency medical service (EMS) systems--emergency physician (EP) and paramedic (PM) based--and the impact of advanced live support (ALS) on patients’ status in preclinical care. Methods: The EMS systems of Bonn (GER, EP), Cantabria (ESP, EP), Coventry (UK, PM) and Richmond (US, PM) were analysed in relation to quality of structure, process and performance when first diagnosis on scene was cardiac arrest (OHCA), chest pain or dyspnoea. Data were collected prospectively between 01/01/2001 and 31/2/2004 for at least 12 month. Results: Over all 6277 patients were included in this study. The rate of drug therapy was highest in the EP-based systems Bonn and Cantabria. Pain relief was more effective in Bonn in patients with severe chest pain. In the group of patients with chest pain and tachycardia ≥120 beats/min, the heart rate was reduced most effective by the EP-systems. In patients with dyspnoea and SaO2 <90% the improvement of oxygen saturation was most effective in Bonn and Richmond. After OHCA significant more patients reached the hospital alive in EMS systems with EPs than in the paramedic staffed (Bonn=35.6%, Cantabria=30.1%; Coventry=11.9%, Richmond=9.2%). The introduction of a Load Distributing Band chest compression device in Richmond improved admittance rate after OHCA (21.7%) but did not reach the survival rate of the Bonn EMS system. Conclusions: Higher qualification and greater training and experience of ALS unit personnel increased survival after OHCA and improved patients’ status with cardiac chest pain and respiratory failure.
Reviews

A cardiac arrhythmia simply defined is a variation from the normal heart rate and/or rhythm that is not physiologically justified. Recent years have witnessed important advances in our understanding of the electro-physiological mechanisms underlying the development of a variety of cardiac arrhythmias. This article discusses the mechanisms responsible for cardiac arrhythmias, which are generally divided into 2 major categories: (1) enhanced or abnormal impulse formation (i.e., focal activity) and (2) conduction disturbances (i.e., reentry)....

Guideline 11.9 Managing acute dysrhythmias

The National Emergency Medical Services Advisory Council (NEMSAC) conducted a literature review to answer such questions as: Do emergency medical services (EMS) make a difference? Do out-of-hospital interventions really improve patient outcomes? Can timely care provided in the out-of-hospital setting lead to reduced total health care expenditures? The article summarizes the evidence base documenting improved patient outcomes resulting from out-of-hospital interventions and regionalized EMS systems. It documents the definitive relationship between EMS-related improvements in patient outcomes and financial savings to the health care system for specific conditions. The strongest evidence demonstrating improved patient outcomes resulting from coordinated systems of out-of-hospital care was observed in the treatment of cardiovascular disease. Trained EMS providers are proficient in the capture and interpretation of 12-lead ECGs, and their participation in the triage decision-making process results in clinically meaningful reductions in the time to definitive care. Strong evidence was also found to document...

During a multiple casualty chemical, biological, radiological and nuclear incident it is imperative that triage is accurately undertaken to use resources effectively and give the greatest chance of survival to those who need it. This reflection explores an option to assist in this matter by proposing a colorimetric breathing detection system, while remembering that this it is untested, may be a useful aid.

Generalized tonic-clonic convulsions are the most common and dramatic type of seizure prompting calls to 911. Patients who experience a seizure but do not have a known seizure disorder challenge the prehospital provider in identifying an underlying cause for the event. Patients with seizures who are otherwise back to normal are at risk for recurrent seizures and would likely benefit from hospital evaluation. Seizures typically terminate spontaneously in
less than 5 minutes, but when protracted seizures represent a true medical emergency. Treatment of status epilepticus with benzodiazepines in the prehospital setting has the potential to dramatically affect patient outcomes. In all cases, the cornerstone of sound transport and treatment is sound Emergency Medical Services (EMS) system medical oversight. This article discusses the current controversies surrounding the prehospital evaluation and management of patients presenting to EMS with seizure.

Background: In field medical operations, rapid diagnosis and triage of seriously injured patients is critical. With significant bulk and cost constraints placed on all equipment, it is important that any medical devices deployed in the field demonstrate high utility, durability, and ease of use. When medical ultrasound was first used in patient care, machine cost, bulk, and steep learning curves prevented use outside of the radiology department. Now, lightweight portable ultrasound is widely employed at the bedside by emergency physicians. The techniques and equipment have recently been extrapolated out of the hospital setting in a wide variety of environments in an effort to increase diagnostic accuracy in the field. Objectives: In this review, deployment of lightweight portable ultrasound in the field (by emergency medical services, military operations, disaster relief, medical missions, and expeditions to austere environments) is examined. The feasibility of field deployment and experiences of clinicians using ultrasound in a host of environments are detailed. In addition, special technological considerations such as telematics and machine characteristics are reviewed. Conclusions: The use of lightweight portable ultrasound shows great promise in augmenting clinical assessment for field medical operations. Although the feasibility of the technology has been demonstrated in certain medical and trauma applications, further research is needed to determine the utility of ultrasound use for medical illness in the field.

Resuscitation is the most common procedure performed in neonatology. However, new contributions based on scientific evidence challenge the traditional procedures. Of these new contributions, the use of room-air instead of 100% oxygen and titration of the oxygen inspiratory fraction according to oximetry and heart rate represent a new approach in the resuscitation of both term and preterm newborns.

Treatment of non-traumatic cardiac arrest in the hospital setting depends on the recognition of heart rhythm and differential diagnosis of the underlying condition while maintaining a constant oxygenated blood flow by ventilation and chest compression. Diagnostic process relies only on patient’s history, physical findings, and active electrocardiography. Ultrasound is not currently scheduled in the resuscitation guidelines. Nevertheless, the use of real-time ultrasonography during resuscitation has the potential to improve diagnostic accuracy and allows the physician a greater confidence in deciding aggressive life-saving therapeutic procedures. This article reviews the current opinions and literature about the use of emergency ultrasound during resuscitation of non-traumatic cardiac arrest. Cardiac and lung ultrasound have a great potential in identifying the reversible mechanical causes of pulseless electrical activity or asystole. Brief examination of the heart can even detect a real cardiac standstill regardless of electrical activity displayed on the monitor, which is a crucial prognostic indicator. Moreover, ultrasound can be useful to verify and monitor the tracheal tube placement. Limitation to the use of ultrasound is the need to minimize the no-flow intervals during mechanical cardiopulmonary resuscitation. However, real-time ultrasound can be successfully applied during brief pausing of chest compression and first pulse-check. Finally, lung sonographic examination targeted to the detection of signs of pulmonary congestion has the potential to allow hemodynamic noninvasive monitoring before and after mechanical cardiopulmonary maneuvers.

Current neonatal guidelines endorse both the two-thumb and the two-finger techniques for performing chest compressions. It remains unclear whether one method is superior to the other in achieving consistent depth. **Objective:** To compare the compression depth, variability, rate and finger placement of the two-thumb and two-finger techniques using a compression to ventilation (CV) ratio of 3:1.**Methods** 25 subjects (physicians and neonatal nurses) participated with compressions performed on a manikin. Subjects were video recorded. Evaluations included continuous compression administered for 60 s, followed by 2 min of compressions using a 3:1 CV ratio for each of the two techniques. Results: Depth during 60 s of uninterrupted compressions was greater for the two-thumb than the two-finger technique (27.2±5.7 vs 22.1±4.6 mm; p=0.0008), variability was less (6.7%±3.2% vs 9.0%±2.8%; p=0.002) and rate was comparable (118±22 vs 116±24 compressions/min). With a 3:1 CV ratio, depth was greater for the two-thumb compared to the two-finger method (29±5.4 vs 23.7±5.8 mm; p=0.0009), variability was less (6.1%±2.9% vs 9.8%±3.1%; p=0.0002) and rate was comparable (192±26 vs 197±31 compressions/2 min). Correct positioning was accomplished more often with the two-thumb than the two-finger technique (21/25 vs 3/25; p=0.0005). **Conclusions:** The two-thumb technique is superior to the two-finger technique, achieving greater depth and less variability with each compression. The two-finger technique was incorrectly applied in most cases and deviations in technique may have contributed to the significant differences in depth.

**Guideline 13.6 Chest compressions during resuscitation of the newborn infant**


This study is to compare the effect of the [delta]-opioid receptor agonist, d-Ala2-d-Leu5 enkephalin (DADLE) with normothermic control and therapeutic hypothermia on post resuscitation myocardial function and 72-h survival in a rat model of cardiac arrest and resuscitation. **Methods:** Ventricular fibrillation (VF) was induced in 15 male Sprague-Dawley rats. After 8†min of untreated VF, cardiopulmonary resuscitation was performed for 8min before defibrillation. Animals were randomized to three groups of five: (a) normothermia; (b) hypothermia (32°C); and (c) normothermia with DADLE intravenous infusion (1mg/kg/h). Hypothermia and drug infusion were started after successful defibrillation. Myocardial functions, including cardiac output (CO), left ventricular ejection fraction (LVEF), and myocardial performance index (MPI) were measured echocardiographically together with duration of survival. **Results:** The 72-h survival was significantly greater in the hypothermic group than in both DADLE and normothermic group (p=0.02). However, the survival time of the DADLE treated animals was significantly longer than that of the normothermia group (51.8+/−18.9 vs 18.8+/−10.1h, p=0.01). DADLE group showed significantly better CO (PR 60min, p=0.049), better LVEF (PR 60min, p=0.044; PR 240min, p<0.001) and lower MPI (PR 60min, p=0.043; PR 240min, p=0.045) than normothermic group. Hypothermia group also showed significantly better CO (PR 60min, p=0.044; PR 240min, p=0.007), better LVEF (PR 60min, p=0.001; PR 240min, p<0.001) and lower MPI (PR 60min, p=0.003; PR 240min, p=0.012) than the normothermic group. **Conclusions:** DADLE attenuated post resuscitation myocardial dysfunction and increased short term survival time. However, the 72-h survival in the DADLE group was less than that in the hypothermia group.

**Guideline 11.8 Post resuscitation therapy in adult ALS**
Patients with suspected spinal cord injuries are immobilized to a backboard during ambulance and helicopter air transport. It has been well documented that patients who are immobilized to a backboard experience discomfort and eventually become susceptible to pressure ulcer formation. Because the patient lying on a backboard is subjected to high skin interface pressures, it is imperative to improve patient comfort and prevent pressure ulcer formation. Realizing the dangers of the potentially preventable pressure ulcers, our team of scientists, surgeons, and trauma nurses performed a comprehensive study of the Back Raft system that was designed to reduce patient discomfort and skin interface pressure. Pressure under the occipital, scapula, and sacral regions of the back was measured using the Tactilus pressure analyzer of 10 healthy volunteers immobilized on a backboard and a backboard with a Back Raft air mattress system. Discomfort levels of each volunteer were measured using a Visual Analog Scale. Data from this study indicated that the Back Raft significantly reduces discomfort as well as tissue interface pressure in the occipital, scapula, and sacral regions of the back. The implementation of an air mattress system analogous to the Back Raft would facilitate the prevention of pressure ulcer formation during prehospital care and transportation. In 2008, The Centers for Medicare and Medicaid Services enacted a policy in which the Centers for Medicare and Medicaid Services can refuse payment for hospital-acquired conditions. Pressure ulcers were among the hospital-acquired conditions within the final rule.

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

Objective: The study investigated a possible neuro-protective potency of minocycline in an experimental asphyxial cardiac arrest (ACA) rat model. Clinically important survival times were evaluated thus broadening common experimental approaches. Methods: Adult rats were subjected to 5min of ACA followed by resuscitation. There were two main treatment groups: ACA and sham operated. Relating to minocycline treatment each group consisted of three sub-
groups: pre-, post-, and sans-mino, with three different survival times: 4, 7, and 21 days. Neurodegeneration and microgliosis were monitored by immunohistochemistry. Alterations of microglia-associated gene expression were analyzed by quantitative RT-PCR. Results: ACA induced massive nerve cell loss and activation of microglia/macrophages in hippocampal CA1 cell layer intensifying with survival time. After 7 days, minocycline significantly decreased both, neuronal degeneration and microglia response in dependence on the application pattern; application post ACA was most effective. After 21 days, neuroprotective effects of minocycline were lost. ACA significantly induced expression of the microglia-associated factors Ccl2, CD45, Mac-1, F4-80, and Tnfa. Independent on survival time, minocycline affected these parameters not significantly. Expression of iNOS was unaffected by both, ACA and minocycline. Conclusions: In adult rat hippocampus microglia was significantly activated by ACA. Minocycline positive affected neuronal survival and microglial response temporary, even when applied up to 18h after ACA, thus defining a therapeutically relevant time window. As ACA-induced neuronal cell death involves acute and delayed events, longer minocycline intervention targeting also secondary injury cascades should manifest neuroprotective potency, a question to be answered by further experiments.


**Background:** Some national resuscitation guidelines advocate using sustained initial inflations (2-3 s) for babies requiring resuscitation. Inflation times ≥10 s have been used for preterm infants.

**Objectives:** This study examines the ability of operators of varying experience to provide a sustained inflation using three different manual ventilation devices.

**Methods:** We compared a self-inflating bag, a flow-inflating bag and a pressure-limited T-piece device. Fifty clinical staff members from five professional groups gave a sustained inflation with a target peak pressure of 30 cm H₂O and target duration of 10 s to an internal leak-free manikin. We measured peak inflating pressure (PIP) and mean inflating pressure (MIP) during the sustained inflation, and the duration of inflating pressure (IP) >20 and 25 cm H₂O. Results: Median (IQR) duration of IP >25 cm H₂O was: self-inflating bag 2.5 s (0.8, 5.7), flow-inflating bag 10.6 s (8.4, 12.9) and the T-piece 10.7 s (8.9, 11.9). There was a weak correlation between experience using a self-inflating bag and longer inflation times (R = 0.290, p = 0.041). When compared with the T-piece, the flow-inflating bag had lower mean MIP (27.0 ± 1.8 vs. 28.8 ± 2.0 cm H₂O) and higher mean PIP (32.3 ± 3.7 vs. 29.8 ± 1.8 cm H₂O). There were no differences in performance between operator groups.

**Conclusion:** The T-piece provided consistent PIP during a single 10 s sustained inflation with less variation in pressure compared with the flow-inflating bag. Sustained inflations >3 s were difficult to achieve with a self-inflating bag.

**Guideline 13.4 Airway management and mask ventilation of the newborn infant**


**Background:** Recent resuscitation guidelines for infant cardiopulmonary resuscitation (CPR) emphasize that all rescuers should minimize interruption of chest compressions, even for endotracheal intubation. We compared the utility of the Miller laryngoscope (Mil) with Airtraq (ATQ) during chest compression in an infant manikin.

**Methods:** Twenty staff doctors in intensive care and emergency medicine performed tracheal intubation on an infant manikin with Mil and ATQ with or without chest compression.

**Results:** In Mil trials, no participants failed without chest compression, but 6 of them failed during chest compression (P+<10.05). In ATQ trials, all participants successfully secured the airway regardless of chest compression. Intubation time was significantly lengthened due to chest compression in Mil trials, but not in ATQ trials. The visual analog scale (VAS) for laryngoscope image did not significantly change due to chest compression for ATQ or Mil trials. In contrast, chest compression worsened VAS scores for tube passage through the
glottis in Mil trials, but not in ATQ trials. Conclusion: We conclude that ATQ performed better than Mil for endotracheal intubation during chest compression in infant simulations managed by expert doctors.


Background Intravenous (IV) infusion of ice cold saline is an effective method to initiate induction of mild therapeutic hypothermia (MTH) following resuscitation from out-of-hospital cardiac arrest (OOHCA). Intraosseous (IO) infusion of cold saline may be an alternative method to induce MTH. Objective: The goal of this study was to determine if IO infusion of cold saline is a comparable alternative to IV infusion for inducing MTH in a laboratory swine model of cardiac arrest.

Methods: Ten mixed breed swine were resuscitated from cardiac arrest and randomized post-resuscitation to infusion with ice-cold saline using either IO (n=5) or IV (n=5) access. The study endpoints were either a goal esophageal temperature of 34°C or the elapse of a 30min time period, simulating a long prehospital transport. Results: Four of five pigs in the IV infusion group achieved goal temperature within 30min compared to 0/5 in the IO infusion group (p=0.048). The mean esophageal temperature change was significantly higher in the IV group when compared to the IO group (p<0.001). Post-arrest hemodynamic parameters were similar between the two groups.

Guideline 11.8 Therapeutic hypothermia after cardiac arrest


Introduction: Endotracheal intubation (ETI) is the most widespread method for emergency airway management. Several studies reported that ETI requires considerable skill and experience and if performed incorrectly, may result in serious adverse events. Unrecognized tube misplacement or oesophageal intubation is associated with high prehospital morbidity. This study investigates the usability of supraglottic airway devices compared to ETI and the skill retention of 41 previously inexperienced paramedics following training using a manikin model.

Methods: 41 paramedics participated in this study. None had prior experience in airway management, apart from bag-valve ventilation. After a standardised audio-visual lecture lasting 45†min, the paramedics participated in a practical demonstration using the advanced patient simulator SimMan (Laerdal Medical, Stavanger, Norway). Afterwards, paramedics were instructed to perform airway-management using seven different techniques to secure the airway (ETI, Laryngeal mask unique [LMA], Proseal, Laryngeal tube disposable [LT-D], I-Gel, Combitube, and EasyTube) following a randomized sequence. Participants underwent reassessment after 3 months without any further training or practice in airway-management. Results: During the initial training session, ETI was successfully performed in 78% of cases, while 3 months later the success rate was 58%. For the supraglottic airway devices, five out of six were successfully used by all paramedics at both time points, the exception being Proseal. Our data show successful skill retention (success rate: 100%) after 3 months for five out of six supraglottic airway devices. Time to ventilation (T3) was significantly less for LMA, LT-D and I-Gel at all time points compared to ETI. Conclusion: ETI performed by inexperienced paramedics is associated with a low success rate. In contrast, supraglottic airway devices like LMA, LT-D, I-Gel, Combitube and EasyTube are fast, safe and easy-to-use. Within the limitations of a manikin-study, this study suggests that inexperienced medical staff might benefit from using supraglottic airway devices for emergency airway management.

Guideline 11.6 Equipment and techniques in adult ALS
Annualy, more than 127,000 people are killed and at least 2.4 million people injured in road accidents in Europe. Consequently, in half of all countries in the European Union a first aid and basic life support course has become mandatory for learner drivers. The aim of this study was to evaluate the effect of this course on participants’ knowledge and self-assessed first aid and basic life support skills. Methods: Participants were given a questionnaire before and after course. Results: In total, 115 participants (response rate 98%) were included in the study. Mean age was 20 years (46% female and 54% male). Out of 12 questions, the average number of correct answers increased from 5.6 before the course to 8.7 after the course (p<0.001). Upon completion of the course, 95% or more of the participants knew how to prioritise treatment of several casualties, knew how to relieve a foreign body airway obstruction, and knew the recommended compression-ventilation ratio during CPR (p<0.001 for all). Despite significant improvements after the course only 64% knew how to diagnose cardiac arrest, 44% knew when to activate an automatic external defibrillator and 23% were aware of when to activate the emergency medical services. Participants significantly increased their self-confidence in own skills after the course (p<0.001). Conclusion: A mandatory course for learner drivers significantly improves participants’ knowledge and their self-assessed skills in first aid and basic life support. However, improvements of the course should be considered on a number of key topics.
Guideline 10.1 Basic life support training

Recent literature states that many necessary skills of CPR and first aid are forgotten shortly after certification. The purpose of this study was to determine the skill and knowledge decay in first aid in those who are paid to respond to emergency situations within a workplace. METHODS: Using a choking victim scenario, the sequence and accuracy of events were observed and recorded in 257 participants paid to act as first responders in large industrial or service industry settings. A multiple-choice exam was also written to determine knowledge retention. RESULTS: First aid knowledge was higher in those who were trained at a higher level, and did not significantly decline over time. Those who had renewed their certificate one or more times performed better than those who had learned the information only once. During the choking scenario many skills were performed poorly, regardless of days since last training, such as hand placement and abdominal thrusts. Compressions following the victim becoming unconscious also showed classic signs of skill deterioration after 30 days. CONCLUSIONS: As many skills deteriorate rapidly over the course of the first 90 days, changing frequency of certification is not necessarily the most obvious choice to increase retention of skill and knowledge. Alternatively, methods of regularly "refreshing" a skill should be explored that could be delivered at a high frequency - such as every 90 days.
Guideline 10.1 Basic life support training

Resuscitation outcomes are related to care delivered by 'first responders', even for hospitalized patients. Third year medical students (clinical clerks) at McGill University are trained and certified in Advanced Cardiac Life Support (ACLS) for critically ill adult patients, but receive only minimal instruction, in the
form of a brief introductory lecture, on paediatric life support. Methods: We developed an interactive, case-based 4-h Paediatric Resuscitation Course based on the objectives and teaching methods of the Pediatric Advanced Life Support (PALS) course. Objectives were tailored to an appropriate level for medical students through the consensus of the two content-expert authors and two external expert physician-educators. Students completed equivalent pre and post course multiple-choice exams, using questions selected from the PALS course. In order to minimize 'guessing', subjects were penalized for incorrect answers. Upon completion of the course, students were anonymously surveyed on the perceived educational value of the resuscitation course. Results: 49 subjects voluntarily participated, in groups of 6-8 at a time, with 47 subjects completing the study protocol. Students' test scores significantly increased from the pre to post test (12.65/22 vs. 17.70/22; p<0.001). All students believed the course was delivered at an appropriate level for them, that it was a worthwhile use of their time, and that it should be a mandatory course in their clinical clerkship. Conclusion: Medical students can learn from appropriately designed paediatric resuscitation courses and believe it should be mandatory in their training.

Purpose of study: To determine the effects of ageing and training experience on attitude towards performing basic life support (BLS). Methods: We gave a questionnaire to attendants of the courses for BLS or safe driving in authorised driving schools. The questionnaire included questions about participants' backgrounds. The questionnaire explored the participant's willingness to perform BLS in four hypothetical scenarios related to early emergency call, cardiopulmonary resuscitation (CPR) under their own initiative, telephone-assisted compression-only CPR and use of an automated external defibrillator (AED), respectively. Results: There were significant differences in gender, occupation, residential area, experience of BLS training, and knowledge of AED use among the young (17-29y, n=6122), middle-aged (30-59y, n=827) and elderly (>59y, n=15,743) groups. In all four scenarios, the proportion of respondents willing to perform BLS was lowest in the elderly group. More respondents in the elderly group were willing to follow the telephone-assisted instruction rather than performing CPR under their own initiative. Multiple logistic regression analysis confirmed ageing as an independent factor related to negative attitude in all scenarios. Gender, occupation, resident area, experience with BLS training and knowledge about AED use were other independent factors. Prior BLS training did not increase willingness to make an emergency call. Conclusion: The aged population has a more negative attitude towards performing BLS. BLS training should be modified to help the elderly gain confidence with the essential elements of BLS, including making early emergency calls.

Guideline 10.1 Basic life support training

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

Introduction: Surviving cardiac arrest depends on early cardiopulmonary resuscitation (CPR). Only one third of cardiac arrest victims receive prompt CPR in spite of well-attended Basic Life Support (BLS) courses. Our study aimed to investigate that how many lay rescuers, capable of performing CPR, would do so, and to analyse their impeding fears. Materials and methods: After each BLS course for lay rescuers (American Heart Association (AHA) CPR for family and friends), an anonymous questionnaire was distributed asking participants whether they would perform CPR on an adult or on a child in a real case of cardiac arrest. In the case of a negative response, we questioned them why. Results: A total of 1000 questionnaires were analysed. The sample group was predominantly made up of males (77.7%), Italians (82.2%), individuals aged between 26 and 35 years (41.2%) and individuals possessing a high-school diploma (61.8%). The percentages that would perform CPR on an unknown adult or child were different (86.2% vs. 73.9% p=0.005). The prevalent fears were regarding infection; being incapable, legal implications and causing damage and fear in general. The first three differ significantly in adult and paediatric cases. Subdividing the population according to sex, age and education did not demonstrate significant differences regarding willingness to perform adult or paediatric CPR. Conclusions: This descriptive study demonstrates that the percentage that would really perform CPR is too low, particularly in the case of a child. Part of the course should be dedicated to discussing these arguments to ensure that all those capable of performing good CPR would immediately do so.

Guideline 10.1 Basic life support training

This study aimed to evaluate the association of cardiopulmonary resuscitation (CPR) training with bystander resuscitation performance and patient outcomes after out-of-hospital cardiac arrest (OHCA). Methods: This was a prospective, population-based cohort study of all persons aged 18 years or older with OHCA of presumed intrinsic origin and their rescuers from January through December 2008 in Takatsuki, Osaka prefecture, Japan. Data on resuscitation of OHCA patients were obtained by emergency medical service (EMS) personnel in charge based on the Utstein style. Rescuers' characteristics including experience of CPR training were obtained by EMS personnel interview on the scene. The primary outcome was the attempt of bystander CPR. Results: Data were collected for 120 cases out of 170 OHCA of intrinsic origin. Among the available cases, 60 (50.0%) had previous CPR training (trained rescuer group). The proportion of bystander CPR was significantly higher in the trained rescuer group than in the untrained rescuer group (75.0% and 43.3%; p†=†0.001). Bystanders who had previous experience of CPR training were 3.40 times (95% confidence interval 1.31-8.85) more likely to perform CPR compared with those without previous CPR training. The number of patients with neurologically favorable one-month survival was too small to evaluate statistical difference between the groups (2 [3.3%] in the trained rescuer group versus 1 [1.7%] in the untrained rescuer group; p†=†0.500).
Conclusions: People who had experienced CPR training had a greater tendency to perform bystander CPR than people without experience of CPR training. Further studies are needed to prove the effectiveness of CPR training on survival.

Guideline 10.1 Basic life support training

Letters, editorials, case series and case studies

61. Jacobs IG. Chest compression or conventional CPR after out of hospital cardiac arrest? BMJ 2011; 342 d374
Definitive evidence is lacking, but either is better than no CPR. The proportion of people with cardiac arrest who receive bystander cardiopulmonary resuscitation (CPR) before the arrival of an ambulance remains suboptimal. This is disappointing considering the substantial effort over many decades to promote bystander CPR. Reasons for the public not starting resuscitation include fear of infection, fear of litigation, and the complexity of conventional CPR. Consequently, it might be possible to improve participation in community CPR by removing the rescue breathing component of conventional CPR. However, such a strategy would be acceptable only if outcomes were at least similar for compression only CPR to those seen for conventional CPR...

62. Rai MMD. Letter by Rai Regarding Article, "Bystander-Initiated Rescue Breathing for Out-of-Hospital Cardiac Arrests of Noncardiac Origin". Circulation 2011; 123 (7): To the Editor: I read with interest the study by Kitamura et al published in a recent issue of Circulation. This nationwide, population-based study found significantly higher rate of favorable neurological outcome in the conventional-cardiopulmonary resuscitation (CPR) group compared to the compression-only-CPR group for out-of-hospital cardiac arrest (OHCA) of noncardiac origin (NCO). However, two recent randomized controlled trials showed no benefit of rescue breathing in for OHCA. Even for NCO-OHCA, Rea et al found no significant difference in survival to hospital discharge or in neurological outcome between compression-only-CPR and conventional-CPR groups. Although important, these findings are not new...

We thank Dr Rai, Dr Arrich, and their colleagues for their relevant comments on our article. As Rai and colleagues pointed out, the recent randomized, controlled trial of dispatcher instructions to bystanders for performing cardiopulmonary resuscitation (CPR) failed to show statistical differences between chest compression-only and conventional CPR with rescue breathing in its subgroup analysis: the good neurological outcome after out-of-hospital cardiac arrests (OHCA) of noncardiac origin was 6.9% (13/188) in the conventional CPR group and 4.4% (9/204) in the compression-only CPR group (P0.28). This might be due to its small sample size, and the results are consistent with ours. Since survival after OHCA of noncardiac origin is generally low regardless of type of CPR, a large sample size is needed to address this issue, and our study covering the whole country and analyzing a large number of OHCA cases with noncardiac origin would be quite important. We would like to give some comments about the criticism on study design raised by Arrich...

64. Leman P. Audiovisual feedback and quality of CPR. BMJ 2011; 342 c7108 [Editorial]
Evidence so far shows no improvement in clinical outcomes. Effective cardiopulmonary resuscitation (CPR) is essential to maximise the chance of a successful outcome after cardiac arrest. In the linked cluster randomised trial (BMJ 2011; 342: d512), Hostler and colleagues assess the effect of real-time audio and visual feedback in people with an out of hospital cardiac arrest on whom resuscitation was attempted by emergency medical services....
Clinical assessment and end-tidal CO2 (ETCO2) detectors are routinely used to verify endotracheal tube (ETT) placement. However, ETCO2 detectors may mislead clinicians by failing to identify correct placement under a variety of conditions. A flow sensor measures gas flow in and out of an ETT. We reviewed video recordings of neonatal resuscitations to compare a colorimetric CO2 detector (Pedi-Cap) with flow sensor recordings for assessing ETT placement. Methods: We reviewed recordings of infants <32 weeks gestation born between February 2007 and January 2010. Airway pressures and gas flow were recorded with a respiratory function monitor. Video recording were used (i) to identify infants who were intubated in the delivery room and (ii) to observe colour change of the ETCO2 detector. Flow sensor recordings were used to confirm whether the tube was in the trachea or not. Results: Of the 210 infants recorded, 44 infants were intubated in the delivery room. Data from 77 intubation attempts were analysed. In 35 intubations of 20 infants both a PediCap and flow sensor were available for analysis. In 21 (60%) intubations, both methods correctly identified successful ETT placement and in 3 (9%) both indicated the ETT was not in the trachea. In the remaining 11 (31%) intubations the PediCap failed to change colour despite the flow wave indicating correct ETT placement. Conclusion: Colorimetric CO2 detectors may mislead clinicians intubating very preterm infants in the delivery room. They may fail to change colour in spite of correct tube placement in up to one third of the cases.
Guideline 13.4 Airway management and mask ventilation of the newborn

Five letters to the editor (Bottiger et al, Rea et al, Perkins & Handley, Descatha & Jost, Abe & Tokuda) commenting on Hupfl, Selig and Nagele's 2010 systematic review and meta-analysis of compression-only CPR versus standard CPR. Also included is the authors' reply.

One review of general interest, one are they serious? study.

'Among the many useful discoveries which this age has made, there are very few which better deserve the attention of the public that what I am going to lay before your Lordship.'(Reverend Edward Stone, 1763). These prophetic words, written by Reverend Edward Stone in a 1763 letter to George Parker, the second Earl of Macclesfield, describe the results of the first clinical trial recorded in medical history. Stone's report on the rediscovery of the medicinal value of willow bark among subjects suffering from malarial symptoms is considered a significant milestone in the development of aspirin. Although society now takes many of its beneficial effects for granted, aspirin did not suddenly appear for medicinal use after Reverend Stone’s discovery. Instead, its tumultuous journey was fueled by individual scientific curiosity, accidental discoveries, and intense business rivalry. No other drug is used by a greater number of people worldwide than aspirin, the benefits of which span centuries, beginning with the very first uses of willow bark by Egyptian physicians. Aspirin single-handedly transformed a coal-dye company into a pharmaceutical giant and has emerged as a cornerstone in the present-day therapies available for treating cardiovascular disease (CVD), pain, and inflammation. This article discusses the sentinel historical aspects of the discovery and clinical cardiovascular developments of aspirin, as well as its contemporary use in today’s medical arena.
Waitresses completed an on-line survey about their physical characteristics, self-perceived attractiveness and sexiness, and average tips. The waitresses’ self-rated physical attractiveness increased with their breast sizes and decreased with their ages, waist-to-hip ratios, and body sizes. Similar effects were observed on self-rated sexiness, with the exception of age, which varied with self-rated sexiness in a negative, quadratic relationship rather than a linear one. Moreover, the waitresses’ tips varied with age in a negative, quadratic relationship, increased with breast size, increased with having blond hair, and decreased with body size. These findings, which are discussed from an evolutionary perspective, make several contributions to the literature on female physical attractiveness. First, they replicate some previous findings regarding the determinants of female physical attractiveness using a larger, more diverse, and more ecologically valid set of stimuli than has been studied before. Second, they provide needed evidence that some of those determinants of female beauty affect interpersonal behaviors as well as attractiveness ratings. Finally, they indicate that some determinants of female physical attractiveness do not have the same effects on overt interpersonal behavior (such as tipping) that they have on attractiveness ratings. This latter contribution highlights the need for more ecologically valid tests of evolutionary theories about the determinants and consequences of female beauty.