We aimed to describe the epidemiological features and to determine the predictors for survival to discharge of non-traumatic out-of-hospital cardiac arrest (OHCA) in Korea. A nationwide Utstein style OHCA database (2006–2007) was constructed from ambulance records and hospital medical record review. Cases were enrolled when they were non-traumatic OHCA with presumed cardiac aetiology. Using the population census (2005), we calculated age–gender standardized incidence rates (SIR) and mortality (SMR). We modelled a multivariate logistic regression analysis to determine the effect of risk factors on hospital outcomes. The total number of EMS-assessed non-traumatic OHCA patients was 19045. The SIR was 20.9 (2006) and 22.2 (2007) per 100000 and survival-to-discharge rate was 2.3% for EMS-assessed non-traumatic OHCA, and was 3.5% for the resuscitation-attempted group. From a multivariate logistic regression analysis, witnessed arrest, and shorter basic life support (BLS) and EMS intervals turned out to be significant predictors of good outcome in the resuscitation-attempted group. From a nationwide OHCA cohort, the incidence of EMS-assessed non-traumatic OHCA was found to be low. Survival-to-discharge rate in the resuscitation-attempted group was 3.5%, which was significantly associated with witnessed arrest, and shorter BLS and EMS intervals.

This study aimed to determine whether automated external defibrillator (AED) use during resuscitation is associated with lower in-hospital health care costs. For this observational prospective study, we included all treated out-of-hospital cardiac arrests of suspected cardiac cause. Clinical, survival and cost data were collected from July 2005 until March 2008. Cost data were based on hospital transport, duration of admission in hospital wards, diagnostics and interventions. We divided the study population in three groups based on AED use: (1) onsite AED, (2) dispatched AED, (3) no AED. The endpoint was survival to discharge. P<0.05 is indicated by *. Of the 2126 included patients, 136 were treated with an onsite AED, 365 with a dispatched AED and 1625 without AED. Overall (95% confidence interval [CI]) survival rate was 43% (35–51%), 16% (13–20%) and 14% (12–16%), respectively*. Per 100 survivors, the mean duration admitted at intensive care unit [ICU] were 267 (166–374), 495 (344–658), and 537 (450–609) days, respectively*; total duration of hospital admission was 2188 (1800–2594), 3132 (2573–3797), and 2765 (2519–3050) days, respectively*. Mean costs per survivor for hospital stay were €9233 (€7351–€11,280), €14,194 (€11,656–€17,254), and €13,693 (€12,226–€15,166), respectively*; total health care costs were €29,575 (€24,695–€34,183), €34,533 (€29,832–€39,487) and €31,772 (€29,217–€34,385), respectively*.
respectively. For both survivors and non-survivors, total costs per patient were €14,727 (€11,957–€18,324), €7703 (€6141–€9366) and €6580 (€5875–€7238), respectively*. Onsite AED use was associated with higher survival rates. Surviving patients of the onsite AED group had lower total costs, mainly due to the shorter ICU stay.


Mild therapeutic hypothermia improves survival and neurologic recovery in primary comatose survivors of cardiac arrest. Cooling effectiveness, safety and feasibility of nasopharyngeal cooling with the RhinoChill device (BeneChill Inc., San Diego, USA) were determined for induction of therapeutic hypothermia. Eleven emergency departments and intensive care units participated in this multi-centre, single-arm descriptive study. Eighty-four patients after successful resuscitation from cardiac arrest were cooled with nasopharyngeal delivery of an evaporative coolant for 1h. Subsequently, temperature was controlled with systemic cooling at 33°C. Cooling rates, adverse events and neurologic outcome at hospital discharge using cerebral performance categories (CPC; CPC 1=normal to CPC 5=dead) were documented. Temperatures are presented as median and the range from the first to the third quartile. Nasopharyngeal cooling for 1h reduced tympanic temperature by median 2.3 (1.6; 3.0)°C, core temperature by 1.1 (0.7; 1.5)°C. Nasal discoloration occurred during the procedure in 10 (12%) patients, resolved in 9, and was persistent in 1 (1%). Epistaxis was observed in 2 (2%) patients. Peri-orbital gas emphysema occurred in 1 (1%) patient and resolved spontaneously. Thirty-four of 84 patients (40%) patients survived, 26/34 with favorable neurological outcome (CPC of 1–2) at discharge. Nasopharyngeal evaporative cooling used for 1h in primary cardiac arrest survivors is feasible and safe at flow rates of 40–50L/min in a hospital setting.

Guideline 11.9 Therapeutic Hypothermia after Cardiac Arrest


There is no information on the clinical features and outcome of patients receiving multiple Medical Emergency Team (MET) reviews. Accordingly, we studied the characteristics and outcome of patients receiving one MET call and compared them with those receiving multiple MET reviews. Retrospective observational study using prospectively collected data. Tertiary hospital cohort of 1664 patients receiving 2237 MET reviews over a 2-year period. We retrieved information about patient demographics, reasons for MET review, procedures performed by the MET and hospital outcome. We found that 1290 (77.5%) patients received a single MET review and 374 (22.5%) received multiple MET reviews (mean 2.5 reviews, median 2.0). Multiple MET reviews were more likely to be in surgical patients (p<0.001) and to be due to arrhythmias (p=0.016). Multiple MET review patients were more likely to be admitted for
gastrointestinal diseases (p<0.001), had a 50% longer hospital stay (p<0.001) and a 34.6% increase in hospital mortality (p<0.001) compared to single MET review patients. Their odds ratio (OR) for mortality was 2.14 (95% C.I.: 1.62–2.83; p<0.001). After exclusion of patients with not for resuscitation (NFR) orders, the OR for mortality was 2.92 (95% C.I.: 2.10–4.06; p<0.001). The in-hospital mortality of patients subject to multiple MET reviews who were not designated NFR was 34.1%, but only 9.7% of these deaths occurred within 48h of the initial MET review. In our hospital, one fifth of patients receiving MET calls are subject to multiple MET calls. Such patients have identifiable features and have an increased risk of morbidity and mortality. Within any rapid response system, such patients should be recognized as a higher risk group and receive specific additional attention.

Securing the airway in emergency is among the key requirements of appropriate prehospital therapy. The Easytube (Ezt) is a relatively new device, which combines the advantages of both an infra-glottic and supraglottic airway. Our goal was to evaluate the effectiveness and the safety of use of Ezt by emergency physicians in case of difficult airway management in a prehospital setting with minimal training. We performed a prospective multi-centre observational study of patients requiring airway management conducted in prehospital emergency medicine in France by 3 French mobile intensive care units from October 2007 to October 2008. Data were available for 239 patients who needed airway management. Two groups were individualized: the “easy airway management” group (225 patients; 94%) and the “difficult airway management” group (14 patients; 6%). All patients had a successful airway management. The Ezt was used in eight men and six women; mean age was 64 years. It was used for ventilation for a maximum of 150min and the mean time was 65min. It was positioned successfully at first attempt, except for two patients, one needed an adjustment because of an air leak, and in the other patient the Ezt was replaced due to complete obstruction of the Ezt during bronchial suction. The present study shows that emergency physicians in cases of difficult airway management can use the EzT safely and effectively with minimal training. Because of its very high success rate in ventilation, the possibility of blind intubation, the low failure rate after a short training period. It could be introduced in new guidelines to manage difficult airway in prehospital emergency.
Guideline 11.7 Equipment and techniques in adult ALS

Objectives: The sensitivity and specificity of consensus triage criteria for identifying which apparently inebriated patients could be triaged to care in a sobering centre were determined. Sensitivity and specificity for modifications to these criteria were also
investigated. Methods Paramedics prospectively collected data on apparently inebriated persons en route to the emergency department (ED). 99 of these patients' ED charts were retrospectively reviewed to assess who actually required ED care. Results: Of 99 subjects with both paramedic and ED chart data available, most were male (89%), homeless (57%) and found on the street (81%). Five were admitted and 13 others appeared to require ED care. Per consensus criteria, only 40 were eligible for triage to a sobering centre, but among those were five who appeared to require ED care (sensitivity 72%, 95% CI 47% to 90%; specificity 43%, 95% CI 32% to 55%). Paramedic opinion alone was specific (80%) but not very sensitive (39%). Lowering the pulse exclusion threshold from 130 to 83 would increase sensitivity to 100%, but decrease specificity to 22%. A simple post hoc rule excluding those with age >55 or pulse >83 from non-ED care had high sensitivity (94%) and fair specificity (61%). The consensus criteria's sensitivity and specificity varied (65–83% and 44–49%, respectively) depending on which ED services were considered optional (eg, psychiatric consultation, ECG, intravenous fluids, etc.). Conclusion: Most apparently inebriated individuals in this study did not require ED care, but prospective identification of these persons is difficult. A low exclusion cut-off for tachycardia may improve sensitivity.

Section 2: BLS Assessment.


Background--The majority of out-of-hospital cardiac arrests (OHCAs) occur in residential locations, but knowledge about strategic placement of automated external defibrillators in residential areas is lacking. We examined whether residential OHCA areas suitable for placement of automated external defibrillators could be identified on the basis of demographic characteristics and characterized individuals with OHCA in residential locations. Methods and Results--We studied 4828 OHCAs in Copenhagen between 1994 and 2005. The incidence and characteristics of OHCA were examined in every 100x100-m (109.4x109.4-yd) residential area according to its underlying demographic characteristics. By combining 2 demographic characteristics, it was possible to identify 100x100-m (109.4x109.4-yd) areas with at least 1 arrest every 5.6 years (characterized by >300 persons per area and lowest income) to 1 arrest every 4.3 years (characterized by >300 persons per area, lowest income, low education, and highest age). These areas covered 9.0% and 0.8% of all residential OHCAs, respectively. Individuals with OHCA in residential locations differed from public ones in that the patients were older (70.6 versus 60.6 years; P<0.0001), the ambulance response interval was longer (6.0 versus 5.0 minutes; P<0.0001), arrests occurred more often at night (21.2% versus 11.2%; P<0.0001), the patients had ventricular fibrillation less often (12.8% versus 38.1%; P<0.0001), and the patients had a worse 30-day survival rate (3.2% versus 13.9%; P<0.0001). Conclusions--On the basis of simple demographic characteristics of a city center, we could identify residential areas suitable for automated external defibrillator placement. Individuals with OHCA in residential locations were more likely to have characteristics associated with poor outcome compared with public arrests.
Guideline 10.1.3 Public access defibrillation

Introduction: The use of rapid sequence induction and tracheal intubation (RSI) in the pre-hospital environment is controversial. Currently, it is felt that competence to perform RSI should be defined by skills in anaesthesia not by the primary specialty of a practitioner. This aim of the study was to evaluate the tracheal intubation success rate of doctors drawn from different clinical specialties performing RSI in the pre-hospital environment.
Method: Retrospective review of all RSI performed by doctors operating on the Warwickshire and Northamptonshire Air Ambulance over a 5-year period. Tracheal intubation failure rates were calculated and analysed for proportional differences between groups by χ² and, where appropriate, Fisher’s exact test.
Results: 4362 active missions were flown. RSI was performed in 200 cases (4.6%, 3.1/month). Successful intubation occurred in 194 cases, giving a failure rate of 3% (6 cases, 95% CI 0.6 to 5.3%). While no difference in failure rate was observed between emergency department (ED) staff and anaesthetists (2.73% (3/110, 95% CI 0 to 5.7%) vs 0% (0/55, 95% CI 0 to 0%); p=0.55), a significant difference was found when non-ED, non-anaesthetic staff (GP and surgical) were compared to anaesthetists (10.34% (3/29, 95% CI 0 to 21.4%) vs 0%; p=0.04). There was no significant difference associated with seniority of practitioner (p=0.65).
Conclusions: Non-anaesthetic practitioners have a higher tracheal intubation failure rate during pre-hospital RSI. This likely reflects a lack of training opportunities and infrequency of clinical experience. Strategies to improve pre-hospital airway management are required.

Guideline 11.7 Equipment and techniques in adult ALS

Therapeutic hypothermia (32–34°C) is recommended for comatose survivors of cardiac arrest; however, the optimal technique for cooling is unknown. We aimed to compare therapeutic hypothermia using either surface or endovascular techniques in terms of efficacy, complications and outcome. Retrospective cohort study. Thirty-bed teaching hospital intensive care unit (ICU). All patients (n=83) undergoing therapeutic hypothermia following cardiac arrest over a 2.5-year period. The mean age was 61±16 years; 88% of arrests occurred out of hospital, and 64% were ventricular fibrillation/tachycardia. Therapeutic hypothermia was initiated in the ICU using iced Hartmann’s solution, followed by either surface (n=41) or endovascular (n=42) cooling; choice of technique was based upon endovascular device availability. The target temperature was 32–34°C for 12–24h, followed by rewarming at a rate of 0.25°C/h. Endovascular cooling provided a longer time within the target temperature range (p=0.02), less temperature fluctuation (p=0.003), better control during rewarming (0.04), and a lower 48-h temperature load (p=0.008). Endovascular cooling also
produced less cooling-associated complications in terms of both overcooling (p=0.05) and failure to reach the target temperature (p=0.04). After adjustment for known confounders, there were no differences in outcome between the groups in terms of ICU or hospital mortality, ventilator free days and neurological outcome. Endovascular cooling provides better temperature management than surface cooling, as well as a more favorable complication profile. The equivalence in outcome suggested by this small study requires confirmation in a randomized trial.

Guideline 11.9 Therapeutic hypothermia after cardiac arrest


To determine the feasibility of transporting post-cardiac arrest patients to tertiary-care facilities, the rate of re-arrest, and the rate of critical events during critical care transport team (CCTT) care. Retrospective chart review of cardiac arrest patients transported via CCTT between 1/1/2001 and 5/31/2009. Demographic information, re-arrest, and critical events during transport were abstracted. We defined critical events as hypotension (systolic blood pressure<90mmHg), hypoxia (oxygen saturation<90%), or both hypotension and hypoxia at any time during CCTT care. Comparisons were performed using Chi-squared test and a Cox proportional hazards model was employed to determine predictors of events. Of the 248 patients studied, the majority was male (61%), presented in ventricular fibrillation or ventricular tachycardia (VF/VT, 50%), and comatose (80%). Re-arrest was uncommon (N=15; 6%). Critical events affected 58 patients (23%) during transport. Median transport time was 63min (IQR 51, 81) in both those who experienced a critical event and those who did not. Vasopressor use was associated with any decompensation during CCTT (Hazard Ratio 1.81; 95%CI 1.29, 2.54). Three patients (20%) suffering re-arrest survived to hospital discharge. Survival (Chi square 11.77; p<0.01) and good neurologic outcome (Chi square 5.93; p=0.01) were higher in patients who did not suffer any event during transport. Transport of resuscitated cardiac arrest patients to a tertiary-care facility via CCTT is feasible, and the duration of transport is not associated with re-arrest during transport. Repeat cardiac arrest occurs infrequently, while critical events are more common. Outcomes are worse in those experiencing an event.


The present study was designed to assess the value of the presenting symptom of “typical” anginal pain, “atypical/nonanginal” pain, or the lack of chest pain in predicting the presence of inducible myocardial ischemia using cardiac stress testing in emergency department patients being evaluated for possible acute coronary syndrome. We performed a retrospective observational study of
adult patients who were evaluated for acute coronary syndrome in an emergency department chest pain unit. The presenting symptoms were obtained from a structured questionnaire administered before stress testing. Patient chest pain was categorized according to the presence of substernal chest pain or discomfort that was provoked by exertion or emotional stress and was relieved by rest and/or nitroglycerin. Chest pain was classified as “typical” angina if all 3 descriptors were present and “atypical” or “non-anginal” if <3 descriptors were present. All patients underwent serial biomarker and cardiac stress testing before discharge. A total of 2,525 patients met the eligibility criteria. Inducible ischemia on stress testing was found in 33 (14%, 95% confidence interval 10% to 19%) of the 231 patients who had typical anginal pain, 238 (11%, 95% confidence interval 10% to 13%) of the 2,140 patients presenting with atypical/non-anginal chest pain, and 25 (16%, 95% confidence interval 11% to 22%) of the 153 patients who had no complaint of chest pain on presentation. Compared to patients with atypical or no chest pain, patients with typical chest pain were not significantly more likely to have inducible ischemia on stress testing (likelihood ratio +1.25, 95% confidence interval 0.89 to 1.78). In conclusion, in our study, the patients who presented with “typical” angina were no more likely to have inducible myocardial ischemia on stress testing than patients with other presenting symptoms.

Guideline 8.2 Heart attack


Out of hospital cardiac arrest (OHCA) is common and lethal. It has been suggested that OHCA witnessed by EMS providers is a predictor of survival because advanced help is immediately available. We examined EMS witnessed OHCA from the Resuscitation Outcomes Consortium (ROC) to determine the effect of EMS witnessed vs. bystander witnessed and unwitnessed OHCA. Data were analyzed from a prospective, population-based cohort study in 10 U.S. and Canadian ROC sites. Individuals with non-traumatic OHCA treated 04/01/06–03/31/07 by EMS providers with defibrillation or chest compressions were included. Cases were grouped into EMS-witnessed, bystander witnessed, and unwitnessed and further stratified for bystander CPR. Multiple logistic regressions evaluated the odds ratio (OR) for survival to discharge relative to the EMS-witnessed group after adjusting for age, sex, public/private location of collapse, ROC site, and initial ECG rhythm. Of 9991 OHCA, 1022 (10.2%) of EMS-witnessed, 3369 (33.7%) bystander witnessed, and 5600 (56.1%) unwitnessed. The most common initial rhythm in the EMS-witnessed group was PEA which was higher than in the bystander- and unwitnessed groups (p<0.001). The adjusted OR (95% CI) of survival compared to the EMS-witnessed group was 0.41, (0.36, 0.46) in bystander witnessed with bystander CPR, 0.37 (0.33, 0.43) in bystander witnessed without bystander CPR, 0.17 (0.14, 0.20) in unwitnessed with bystander CPR and 0.21 (0.18, 0.24) in unwitnessed cases without bystander CPR. Immediate application of prehospital care for OHCA may improve survival. Efforts should be made to educate patients to access
9-1-1 for prodromal symptoms.


Background: Sudden loss of consciousness (LOC) and chest pain are common manifestations of out-of-hospital cardiac arrest (OHCA). History of acute pain may be helpful in estimating aetiology and prognosis of OHCA victims. The objective of this study was to evaluate the relationship between acute pain at various locations preceding collapse and outcome. Methods Clinical data of 250 witnessed, non-traumatic OHCA victims were reviewed, and the incidence of pain based on anatomical distribution was documented. The focus was on identifying the difference between those collapsing with LOC alone and those collapsing with chest pain (CP). Clinical variables predictive of survival were identified using a logistic regression model. Results Among the 250 victims, 55.2% collapsed with LOC alone. The incidence of acute pain was: 28.0% for CP, 3.2% for headache, 2.8% for abdominal pain and 2.4% for back pain. The overall 6-month survival rate was 7.2%. The LOC group had a significantly higher return of spontaneous circulation (ROSC) rate compared with the CP group (48.6% vs 31.4%, p<0.05). The rate was elevated in the LOC group; however, only when the initial rhythm was non-shockable. There was no significant intergroup difference in the survival rate. Initial shockable rhythm positively and history of cardiovascular diseases negatively predicted survival. None of the victims in the headache, abdominal pain or back pain groups survived. Conclusion: The LOC group's seemingly higher ROSC rate may be due to its aetiological heterogeneity. Complaint of a headache, abdominal pain or back pain in OHCA victims carries a poor prognosis.

Section 2: Assessment


Background-- Although chest compression-only cardiopulmonary resuscitation (CPR) is effective for adult out-of-hospital cardiac arrest (OHCA) of cardiac origin, it remains uncertain whether bystander-initiated rescue breathing has an incremental benefit for OHCA of noncardiac origin. Methods and Results-- A nationwide, prospective, population-based, observational study covering the whole population of Japan and involving consecutive OHCA patients with emergency responder resuscitation attempts was conducted from January 2005 through December 2007. The primary outcome was neurologically intact 1-month survival. Multiple logistic regression analysis was used to assess the contribution of bystander-initiated CPR to better neurological outcomes. Among a total of 43 246 bystander-witnessed OHCA of noncardiac origin, 8878 (20.5%) received chest compression-only CPR, and 7474 (17.3%) received conventional CPR with rescue breathing. The conventional CPR group (1.8%) had a higher rate of better neurological outcome than both the no CPR group (1.4%; odds ratio, 1.58; 95% confidence interval, 1.28 to 1.96) and the
compression-only CPR group (1.5%; odds ratio, 1.32; 95% confidence interval, 1.03 to 1.69). However, the compression-only CPR group did not produce better neurological outcome than the no CPR group (odds ratio, 1.19; 95% confidence interval, 0.96 to 1.47). The number of OHCAs needed to treat with conventional CPR versus compression-only CPR to save a life with favorable neurological outcome after OHCA was 290. Conclusions-- This nationwide observational study indicates that rescue breathing has an incremental benefit for OHCAs of noncardiac origin, but the impact on the overall survival after OHCA was small.

**Guideline 7 Cardiopulmonary resuscitation**


Patients with ST-elevation myocardial infarction (STEMI) surviving pre-hospital resuscitation represent a selected subgroup of patients with a very high adverse event rate. Only few data on the outcome of primary percutaneous coronary intervention (primary PCI) and thrombolysis in such patients are available. We analysed the Maximal Individual Therapy of Acute Myocardial Infarction (MITRA) Plus registry. 1529 survivors of pre-hospital resuscitation with STEMI were included. 593 (38.8%) of those patients did not receive early reperfusion therapy, 793 (51.9%) patients received thrombolysis and 143 (9.4%) patients received primary PCI. Hospital mortality in patients receiving primary PCI or thrombolysis was adjusted for confounding factors with a propensity score analysis. Primary PCI as well as thrombolysis in survivors of pre-hospital resuscitation with STEMI were associated with a significant reduction of hospital mortality (OR: 0.29, 95% CI 0.17–0.50; and 0.74, 95% CI 0.54–0.99, respectively), while primary PCI was superior compared to thrombolysis (OR 0.50, 95% CI 0.30–0.84). Reperfusion therapy improves mortality of patients with STEMI surviving pre-hospital resuscitation, while primary PCI seems to be more effective than thrombolysis.

**Guideline 11.8 Post-resuscitation therapy in adult ALS**


BACKGROUND: Direct laryngoscopy of a patient lying on the ground is difficult because the intubator's head is far above the head of the patient, making alignment of the intubator's visual axis with the patient's tracheal axis difficult. The Airway Scope is a laryngoscope designed to facilitate tracheal intubation without requiring alignment of the oral, pharyngeal, and tracheal axes. We thus tested the hypothesis that intubation with the Airway Scope is faster than with the Macintosh laryngoscope in subjects lying on the ground. METHODS: Adult surgical patients were enrolled. After anesthesia induction, direct laryngoscopy was performed and airway characteristics noted. Patients were randomly assigned to tracheal intubation by either the Airway Scope (n = 50) or the
Macintosh laryngoscope (n = 50). The intubator performed tracheal intubation from a table positioned at the same height as that of the operating table, thus simulating intubating on the ground. An unblinded observer recorded overall intubation success rate, time required for intubation, the number of attempts required for successful intubation, and airway complications related to intubation. Of these, the primary end point was time required for intubation. RESULTS: Overall intubation success rates were 98% with the Airway Scope and 100% with the Macintosh laryngoscope. Intubation was 17 s faster with the Airway Scope (mean, 18 (SD, 4) seconds) versus the Macintosh laryngoscope (35 (16) seconds). The number of intubation attempts was similar with each device. The incidences of airway complications were similar, with no hypoxia (Spo2 <95%) occurring in either group. CONCLUSIONS: Both the Airway Scope and the Macintosh laryngoscope offer high success rates in adequately prepared paralyzed patients lying supine at ground level in the hands of a skilled practitioner. However, the Airway Scope facilitated faster tracheal intubation.

Guideline 11.7 Equipment and techniques in adult ALS


While the use of therapeutic hypothermia (TH) has improved outcomes after resuscitation from cardiac arrest, prognostication of survival and neurologic function remains difficult during the post-arrest time period. Bispectral index (BIS) monitoring, a non-invasive measurement of simplified electroencephalographic data, is increasingly being considered for post-arrest neurologic assessment and outcomes prediction, although data supporting the technique are limited. We hypothesized that BIS values within 24h after resuscitation would correlate with neurologic outcomes at discharge. We prospectively collected BIS data in consecutive patients initially resuscitated from cardiac arrest and treated with TH in one academic medical center. We assessed BIS values in context of cerebral performance category (CPC) assessment on the day of discharge. Data were collected in 62 post-arrest patients, of whom 26/62 (42%) survived to hospital discharge. Mean BIS values at 24h post-resuscitation were significantly different in the survivors with CPC 1 - 2 ('good' outcome) vs those with CPC 3 - 5 ('poor' outcome) or death during hospitalization (49±13 vs 30±20; p<0.001). Receiver operator characteristic analysis suggested that 24h BIS was most predictive of CPC 1 - 2 outcome compared to the other timepoints; a BIS cutpoint of 45 exhibited a sensitivity of 63% and a specificity of 86%, with a positive likelihood ratio of 4.67. Sixteen patients exhibited a BIS of zero during at least one timepoint; all of these patients died during hospitalization. BIS monitoring values at 24h post-resuscitation are correlated with neurologic outcomes in patients undergoing TH treatment. In 16/62 patients, a BIS of zero at any timepoint was observed, which was uniformly correlated with poor outcome after resuscitation from cardiac arrest; however, a non-zero BIS is insufficient as a sole predictor of good neurologic survival.

Guideline 11.9 Therapeutic hypothermia after cardiac arrest

Current guidelines recommend intraosseous (IO) vascular access in adults if peripheral venous access is unavailable. Most available data derive from children, animal models, cadaver studies or the prehospital setting. Therefore we compared two different IO access devices in adults under resuscitation in the hospital setting. This prospective, randomized clinical study compared two different IO access devices in adults (≥18 years of age) under trauma or medical resuscitation admitted to our emergency department with impossible peripheral venous access. Each adult was randomized to either spring-loaded BIG Bone Injection Gun or battery-powered EZ-IO. Outcome measures included success rates on first attempt, procedure times and complications. Forty consecutive adults under resuscitation were enrolled. Twenty patients received the BIG, another twenty patients the EZ-IO. Overall success rate on first attempt was 85% and mean procedure time 2.0min±0.9. Comparing the two devices, success rate on first attempt was 80% for the BIG versus 90% for the EZ-IO and mean procedure time was 2.2min±1.0 for the BIG versus 1.8min±0.9 for the EZ-IO. The differences between both IO devices were not statistically significant. No other relevant complications like infection, extravasation or bleeding were observed. IO vascular access was a reliable and safe method to gain rapid vascular access for in-hospital adult emergency patients under resuscitation. Further studies are necessary regarding comparative effectiveness of different IO devices.

Guideline 11.6 Medications in Adult Cardiac Arrest


Using Poiseuille's law and standardized gauge sizes, an 18-gauge (g) intravenous catheter (IV) should be 2.5 times faster than a 20-g IV, but this is not borne out by observation, in vitro testing, and manufacturer's data. Our objective was to determine if the infusion rate of a single 18-g IV was equivalent to the infusion rate of two 20-g IVs. This was a prospective study in healthy adult volunteers. Subjects simultaneously received 500 mL of normal saline via an 18-g IV in one arm and 500 mL of normal saline via two 20-g IVs in the other arm. We measured the rates of fluid administration. Paired Student's t test was used for comparison of the 2 arms of the study. We estimated that 18 trials were needed in sample size analysis. Eighteen trials were completed. The mean infusion rate for a single 18-g 500-mL IV administration was 35.6 mL/min (95% confidence interval [CI], 30.3-40.8), with manufacturer's rating being 105 mL/min. The mean infusion rate for two 20-g IVs was 41.3 mL/min (95% CI, 36.1-46.4), with manufacturer's rating being 120 mL/min. The rate of infusion via two 20-g IVs were statistically significantly faster than the single 18-g IV, with a mean difference in flow rate of 5.7 mL/min (95% CI, 1.3-10; P = .026). In healthy volunteers, administration of intravenous fluids through two 20-g IVs is faster than a single 18-g IV, although both approaches are markedly slower than the manufacturer's estimates.

Background: There are many complications involved in the immobilization of unconscious patients with potential cervical spine injuries. In February 2005, the Intensive Care Society (ICS), United Kingdom, produced consensus guidelines to evaluate spinal injuries in unconscious victims of blunt multiple injuries to address this important clinical problem. Methods: A postal questionnaire was sent to lead consultants of intensive care units in England enquiring about the management of the cervical spine in unconscious trauma patients. Data were collated, and the responses to open questions were grouped into themes. Responses were compared with published ICS guidelines. Results: The response rate was 46% (91 of 199). Forty-four of 89 units had formal policies. Twenty-two of 44 of these units had adopted national guidelines. Common methods of immobilization were "collar & head blocks" (59 of 83) and collar only (18 of 83). Thirty of the 70 were immobilized in a semirigid collar. Common X-ray combinations were combined lateral/anteroposterior/Odontoid views (18 of 64) and lateral and anteroposterior views (21 of 64). Fifty of 71 would perform computed tomography scans if images were unsatisfactory. Senior radiologist involvement in reporting was mentioned by 65 of 78. Immobilization was discontinued in the presence of normal X-ray studies and computed tomography scans by 44 of 83. Conclusion: A unit policy ensures that current recommendations are followed. Despite the ICS guidelines being published 4 years ago, over half of the individual intensive care units have no policy in place. A lack of adequate guidance for junior doctors can lead to steps in the process of clearance being omitted and potential injuries being missed. We recommend that the national organization do more to facilitate a wider dissemination of these guidelines.


Objectives: To gather data on the ages and weights of children aged between 1 and 16 years in order to assess the validity of the current weight estimation formula ‘Weight(kg)=2(age+4)’ and the newly derived formula ‘Weight=3(age)+7’. Design Retrospective study using data collected from paediatric attendances at an emergency department (ED). Setting A large paediatric ED in a major UK city. Patients 93 827 children aged 1–16 years attending the ED between June 2003 and September 2008. Main outcome measures Percentage weight difference between the child’s actual weight and the expected weight, the latter determined by ‘Weight(kg)=2(age+4)’ and by ‘Weight(kg)=3(age)+7’, in order to compare these two formulae. Results The weights of seriously ill children were recorded in only 20.5% of cases, necessitating a weight estimate in the remainder. The formula ‘Weight=2(age+4)’
underestimated children’s weights by a mean of 33.4% (95% CI 33.2% to 33.6%) over the age range 1–16 years whereas the formula ‘Weight=3(age)+7’ provided a mean underestimate of 6.9% (95% CI 6.8% to 7.1%). The formula ‘Weight=3(age)+7’ remains applicable from 1 to 13 years inclusive. Conclusions: Weight estimation is of paramount importance in paediatric resuscitation. This study shows that the current estimation formula provides a significant underestimate of children’s weights. When used to calculate drug and fluid dosages, this may lead to the under-resuscitation of a critically ill child. The formula ‘Weight=3(age)+7’ can be used over a larger age range (from 1 year to puberty) and allows a safe and more accurate estimate of the weight of children today.

Guideline 12.4 Medication and fluids in paediatric advanced life support


BACKGROUND: Knowledge of the epidemiology of postresuscitation care is insufficient. We describe the epidemiology of postresuscitation care in a community from a 26-year perspective, focusing on incidence, patient characteristics, survival, and estimated cerebral function in relation to intensified postresuscitation care and initial arrhythmia. METHODS: The study included patients with out-of-hospital cardiac arrest (OHCA) who were brought alive to a hospital ward in Goteborg, Sweden, between 1980 and 2006. Two periods (1980-2002 and 2003-2006) were compared. RESULTS: In all, 1603 patients were included. For age, sex, and history, no significant differences between the 2 periods were seen. There was a significant multiple increase in bystander cardiopulmonary resuscitation, the use of coronary angiography, coronary revascularization, and therapeutic hypothermia. The number of patients found in ventricular fibrillation (VF) decreased (P = .011). For all patients, 1-year survival did not change significantly (27% vs 32%; P = .14). Among patients found in VF, an increase in 1-year survival was found (37% vs 57%; P < .0001), whereas no significant change was seen in nonshockable rhythm (10% vs 7%; P = .38). Survivors to discharge displaying low cerebral function (ie, cerebral performance categories score >or=3) decreased from 28% to 6% (P = .0006) among all patients. CONCLUSION: After the introduction of a more intensified postresuscitation care, there was no overall improvement in survival but signs of an improved cerebral function among survivors. There was a marked increase in survival among patients found in a shockable rhythm but not among those found in a nonshockable rhythm.

Guideline 11.8 Post-resuscitation therapy in adult ALS

patients. Emergency Medicine Journal 2010: Online first

Objective: To describe the effects of implementing a percutaneous coronary intervention (PPCI) service and compare the distribution of reperfusion therapies 12months pre and post introduction of PPCI. Design Observational study with data collected 12months pre and post-availability of Primary PCI as routine treatment. Setting Lothian region in South-East Scotland. Patients: 625 Patients who received reperfusion treatment between December 2005 and November 2007. Results PHT was given to 96/328 patients (29%) prior to availability of PPCI as routine treatment. Following routine availability, PPCI was delivered to 248/297 patients who received reperfusion treatment (84%). Median diagnosis-to-PCI balloon inflation time and hospital door-to-balloo
time were 84 and 54min, respectively. Patients received PPCI balloon inflation within 90min of diagnosis in 60% of cases. PPCI-related delay was 74min compared with prehospital thrombolysis (PHT). PHT (152min) and PPCI (166min) had shorter symptom onset-to-assessment of reperfusion times than in-hospital thrombolysis (IHT) (226min). Conclusions: More than two-thirds of the total-ischaemic-time in (ST-segment elevation myocardial infarction) STEMI occurs before the patient reaches hospital, with less than one-third being accounted for by door-to-needle (IHT) or door-to-balloo (PPCI) time. The magnitude of difference in the time between symptom onset-and-assessment of reperfusion treatment efficacy is short and should be considered, particularly in patients treated with thrombolysis in hospitals without cath-lab facilities. Optimal reperfusion treatment including a combination of PHT, IHT and PPCI, as recommended in international guidelines, is feasible in the UK although the balance between the use of different treatments will differ between urban and rural areas.


Purpose--The aim of this guideline is to present current and comprehensive recommendations for the diagnosis and treatment of acute spontaneous intracerebral hemorrhage. Methods--A formal literature search of MEDLINE was performed. Data were synthesized with the use of evidence tables. Writing committee members met by teleconference to discuss data-derived recommendations. The American Heart Association Stroke Council's Levels of Evidence grading algorithm was used to grade each recommendation. Prerelease review of the draft guideline was performed by 6 expert peer reviewers and by the members of the Stroke Council Scientific Statements Oversight Committee and Stroke Council Leadership Committee. It is intended that this guideline be fully updated in 3 years' time. Results--Evidence-based guidelines are presented for the care of patients presenting with intracerebral hemorrhage. The focus was subdivided into diagnosis, hemostasis, blood pressure management, inpatient and nursing management, preventing medical comorbidities, surgical treatment, outcome prediction, rehabilitation, prevention of recurrence, and future considerations. Conclusions--Intracerebral hemorrhage is a serious medical condition for which outcome can be impacted
by early, aggressive care. The guidelines offer a framework for goal-directed treatment of the patient with intracerebral hemorrhage.

Guideline 8.24 Stroke

25. Muakkassa FF, Marley RA, Workman MC and Salvator AE, Hospital Outcomes and Disposition of Trauma Patients Who Are Intubated Because of Combative Behavior. The Journal of Trauma 2010: 68(6);1305-9

Background: The purpose of this study was to determine whether trauma patients, who are intubated because of combative behavior, and not because of medical necessity, have more complications resulting in longer lengths of stay. Methods: Data were retrospectively collected from 2001 through 2004 on trauma patients who were intubated because of combative behavior before hospital admission (group 1, N = 34). Cases were matched 1:2 by age, sex, injury severity score (ISS), and injury to controls each who were not intubated (group 2, N = 68). Additionally, there were 187 patients identified who were intubated because of medical necessity before hospital admission; these represented unmatched intubated controls and were divided based on ISS <15 (group 3, N = 58) and ISS >15 (group 4, N = 129). Results: There were no significant differences between groups 1, 2, and 3 with regard to age, sex, or ISS. There was no significant difference between the groups 1 and 2 in frequency of head injuries as demonstrated by positive computed tomography (50 vs. 37%, p = 0.28); however, there was a significant difference in frequency of neurologic deficit at discharge (33 vs. 6%, p = 0.006). There was a significant difference in the frequency of head injuries between groups 1 and 3 (50 vs. 22%, p = 0.006); however, there was no significant difference in neurologic deficit at discharge (33 vs. 22%, p = 0.24). There was a significant difference in hospital length of stay between groups 1 and 2 (7.4 +/- 5.9 vs. 4.3 +/- 4.5 days, p = 0.0009). The incidence of pneumonia was significantly greater in group 1 than in group 2 (29 vs. 0%, p < 0.0001). The amount of lorazepam in average mg per day was also significantly greater in group 1 versus group 2 (4.4 +/- 11.5 vs. 0.4 +/- 1.6, p < 0.0001). There was also a difference in the discharge status, with significantly fewer group 1 cases being discharged home compared with group 2 (56 vs. 91%, p < 0.0001). There was no significant difference between groups 1 and 3 with regard to length of stay, ventilator days, pneumonia, or discharge status. There was a significant difference between groups 1 and 3 in the amount of lorazepam per day (4.4 +/- 11.5 vs. 0.4 +/- 1.6, p = 0.002). Conclusion: The results from this study indicate that trauma patients, who are intubated because of combative behavior, and not because of medical necessity, have longer lengths of stay, increased incidence of pneumonia, and poorer discharge status when compared with matched controls. The outcomes of this group are similar to that of patients who are intubated because of medical necessity.

Guideline 11.7 Equipment and techniques in adult ALS

cohort study. BMJ 341: 3498
Objective: To determine the effect of time and day of birth on the risk of neonatal death at term. Design: Population based retrospective cohort study. Setting: Data from the linked Scottish morbidity records, Stillbirth and Infant Death Survey, and birth certificate database of live births in Scotland, 1985-2004. Subjects: Liveborn term singletons with cephalic presentation. Perinatal deaths from congenital anomalies excluded. Final sample comprised 1 039 560 live births. Main outcome measure All neonatal deaths (in the first four weeks of life) unrelated to congenital abnormality, plus a subgroup of deaths ascribed to intrapartum anoxia. Results: The risk of neonatal death was 4.2 per 10 000 during the normal working week (Monday to Friday, 0900-1700) and 5.6 per 10 000 at all other times (out of hours) (unadjusted odds ratio 1.3, 95% confidence interval 1.1 to 1.6). Adjustment for maternal characteristics had no material effect. The higher rate of death out of hours was because of an increased risk of death ascribed to intrapartum anoxia (adjusted odds ratio 1.7, 1.2 to 2.3). Though exclusion of elective caesarean deliveries attenuated the association between death ascribed to anoxia and delivery out of hours, a significant association persisted (adjusted odds ratio 1.5, 1.1 to 2.0). The attributable fraction of neonatal deaths ascribed to intrapartum anoxia associated with delivery out of hours was 26% (95% confidence interval 5% to 42%). Conclusions: Delivering an infant outside the normal working week was associated with an increased risk of neonatal death at term ascribed to intrapartum anoxia.

Guideline 13.1 Introduction to resuscitation of the newborn infant

The role of rescue breathing in cardiopulmonary resuscitation (CPR) performed by a layperson is uncertain. We hypothesized that the dispatcher instructions to bystanders to provide chest compression alone would result in improved survival as compared with instructions to provide chest compression plus rescue breathing. Methods: We conducted a multicenter, randomized trial of dispatcher instructions to bystanders for performing CPR. The patients were persons 18 years of age or older with out-of-hospital cardiac arrest for whom dispatchers initiated CPR instruction to bystanders. Patients were randomly assigned to receive chest compression alone or chest compression plus rescue breathing. The primary outcome was survival to hospital discharge. Secondary outcomes included a favorable neurologic outcome at discharge. Results: Of the 1941 patients who met the inclusion criteria, 981 were randomly assigned to receive chest compression alone and 960 to receive chest compression plus rescue breathing. We observed no significant difference between the two groups in the proportion of patients who survived to hospital discharge (12.5% with chest compression alone and 11.0% with chest compression plus rescue breathing, P=0.31) or in the proportion who survived with a favorable neurologic outcome in the two sites that assessed this secondary outcome (14.4% and 11.5%, respectively; P=0.13). Pre-specified subgroup analyses showed a trend toward a higher proportion of patients surviving to hospital discharge with chest
compression alone as compared with chest compression plus rescue breathing for patients with a cardiac cause of arrest (15.5% vs. 12.3%, P=0.09) and for those with shockable rhythms (31.9% vs. 25.7%, P=0.09). Conclusions: Dispatcher instruction consisting of chest compression alone did not increase the survival rate overall, although there was a trend toward better outcomes in key clinical subgroups. The results support a strategy for CPR performed by laypersons that emphasizes chest compression and minimizes the role of rescue breathing.

Guideline 7: Cardiopulmonary resuscitation

Aim: To compare the flow rates of readily available intravenous infusion devices and to compare the effect of the addition of pressure or a needle-free intravenous connector device. Methods: Several intravenous devices with different characteristics had their flow rates determined under a standard set of conditions. The flow rates were then measured with the addition of a pressure bag to the system and then with a needle-free intravenous connector device. The flow rates and change in flow rates were then analysed. Results: The results showed a general agreement with Poiseuille's law. The needle-free connector slowed the rate of flow by up to 41.4% with the greatest effect on short, wide-bore devices. The addition of pressure had a greater effect on longer devices. Conclusions: Short, wide cannulae should be used when rapid fluid resuscitation is required. Needle-free devices should not be used when rapid fluid resuscitation is needed.

Guideline 11.6 Medications in adult cardiac arrest

Background: The incidence and outcomes of out-of-hospital cardiac arrest vary widely across cities. It is unknown whether similar differences exist at the neighborhood level. Objective: To determine the extent to which neighborhoods have persistently high rates of cardiac arrest but low rates of bystander cardiopulmonary resuscitation (CPR). Design: Multilevel Poisson regression of 1108 cardiac arrests from 161 census tracts as captured by the Cardiac Arrest Registry to Enhance Survival (CARES). Setting: Fulton County, Georgia, between 1 October 2005 to 30 November 2008. Measurements: Incidence of cardiac arrest, by census tract and year and by rates of bystander CPR. Results: Adjusted rates of cardiac arrest varied across neighborhoods (interquartile range [IQR], 0.57 to 0.73 per 1000 persons; mean, 0.64 per 1000 persons [SD, 0.11]) but were stable from year to year (intra-class correlation, 0.36 [95% CI, 0.26 to 0.50]; P < 0.001). Adjusted bystander CPR rates also varied by census tract (IQR, 19% to 29%; mean, 25% [SD, 10%]). Limitation: Analysis was based on data from a single county. Conclusion: Surveillance data can identify neighborhoods with a
persistently high incidence of cardiac arrest and low rates of bystander CPR. These neighborhoods are promising targets for community-based interventions.


Background: Single, isolated hypotensive blood pressure (BP) measurements frequently are ignored or considered "erroneous." Although their clinical significance remains unknown, we hypothesized that single, isolated hypotensive BP readings during trauma resuscitations signify the presence of severe injuries that often warrant immediate intervention. Methods: A prospective observational study was performed on all trauma patients admitted from June 2008 to January 2009. Patients with a single systolic blood pressure (SBP) reading <110 mm Hg during their trauma resuscitation were evaluated, and demographics, hemodynamics, resuscitation (fluids, blood products, and duration), injuries, and operative or endovascular management were analyzed. Single and multiple variable logistic regression analyses were performed. Cutpoint analysis of the entire range of lowest single SBP measurements determined which SBP value best predicted the need for immediate therapeutic intervention. Results: Patients (n = 145) were predominantly male (77.2%) but age (mean, 35.1 +/- 15.3 years) and injury mechanisms varied (penetrating, 46.2%; blunt, 53.8%). Cutpoint analysis determined that a single SBP reading <105 mm Hg best predicted the need for immediate therapeutic intervention. Although 38.1% patients with isolated SBP <105 mm Hg measurements underwent immediate therapeutic operative or endovascular procedures, only 10.4% (p < 0.001) with isolated SBP >=105 mm Hg required these procedures. Patients were 12.4 times (confidence interval: 2.6-59.2; p = 0.002) more likely to undergo immediate therapeutic intervention than those with a single SBP >=105 mm Hg. Conclusions: Single, isolated hypotensive BP measurements during trauma resuscitations should not be ignored or dismissed. Instead, our results suggest that a single SBP reading <105 mm Hg is associated with severe injuries that often require immediate operative or endovascular treatment and surgical intensive care unit admission.

31. Simpson PM, Goodger MS and Bendall JC, Delayed versus immediate defibrillation for out-of-hospital cardiac arrest due to ventricular fibrillation: A systematic review and meta-analysis of randomised controlled trials. Resuscitation 2010: 81(8);925-31

Human studies over the last decade have indicated that delaying initial defibrillation to allow a short period of cardiopulmonary resuscitation (CPR) may promote a more responsive myocardial state that is more likely to respond to defibrillation and result in increased rates of restoration of spontaneous circulation (ROSC) and/or survival. Out-of-hospital studies have produced conflicting results regarding the benefits of CPR prior to defibrillation in relation to survival to hospital discharge. The aim of this study was to conduct a systematic review and meta-analysis of randomised controlled trials comparing the effect of delayed defibrillation preceded by CPR with immediate defibrillation on survival to hospital discharge. A systematic literature search of key electronic
databases including Medline, EMBASE, and the Cochrane Library was conducted independently by two reviewers. Randomised controlled trials meeting the eligibility criteria were critically appraised according to the Cochrane Group recommended methodology. Meta-analyses were conducted for the outcomes of survival to hospital discharge overall and according to response time of emergency medical services. Three randomised controlled trials were identified which addressed the question of interest. All included studies were methodologically appropriate to include in a meta-analysis. Pooled results from the three studies demonstrated no benefit from providing CPR prior to defibrillation compared to immediate defibrillation for survival to hospital discharge (OR 0.94 95% CI 0.46–1.94). Meta-analysis of results according to ambulance response time (≤5min or >5min) also showed no difference in survival rates. Delaying initial defibrillation to allow a short period of CPR in out-of-hospital cardiac arrest due to VF demonstrated no benefit over immediate defibrillation for survival to hospital discharge irrespective of response time. There is no evidence that CPR before defibrillation is harmful. Based on the existing evidence, EMS jurisdictions are justified continuing with current practice using either defibrillation strategy.

*Guideline 11.1.1 Cardiopulmonary resuscitation for ALS providers Guideline 11.5 Electrical therapy for adult ALS*


Background: Acute chest pain is a frequent reason to attend an emergency room, and various instruments for calculating the probability of an acute coronary syndrome exist. Objective: To assess the safety and efficiency of all available instruments investigated in sample validation studies. Methods: A systematic review was conducted. Studies were identified describing the development of instruments and all subsequent validations in electronic databases and reference lists of included studies. Inclusion was screened for, full papers checked and data extracted on salient clinical features, performance characteristics and quality in duplicate. Results Of 20 derivation studies, 10 were at least validated once in 14 validations including 26 488 patients. One study by Selker and colleagues was validated in six new patient series and studies by Goldman et al and the Kennedy et al were both validated in three new patient series. All other studies were validated less than three times. In four out of six validations of the Selker et al study, the sensitivity of the prediction rule was 98% or higher. The corresponding values for specificity ranged from 4% to 34%. All remaining prediction rules showed sensitivity values below 95% in all validations. Conclusions: No instrument assisting clinicians in the diagnostic investigation of patients with suspected acute coronary syndrome consistently fulfils the safety requirements of clinicians.

*Guideline 11.11 Managing acute dysrhythmias Guideline 8.2 Heart attack*

33. Svensson L, Bohm K, Castrèn M, Pettersson H, Engerström L, Herlitz J, et al., Compression-Only CPR or Standard CPR in Out-of-
Hospital Cardiac Arrest. New England Journal of Medicine 2010: 363(5);434-42
Background: Emergency medical dispatchers give instructions on how to perform cardiopulmonary resuscitation (CPR) over the telephone to callers requesting help for a patient with suspected cardiac arrest, before the arrival of emergency medical services (EMS) personnel. A previous study indicated that instructions to perform CPR consisting of only chest compression result in a treatment efficacy that is similar or even superior to that associated with instructions given to perform standard CPR, which consists of both compression and ventilation. That study, however, was not powered to assess a possible difference in survival. The aim of this prospective, randomized study was to evaluate the possible superiority of compression-only CPR over standard CPR with respect to survival. Methods: Patients with suspected, witnessed, out-of-hospital cardiac arrest were randomly assigned to undergo either compression-only CPR or standard CPR. The primary end point was 30-day survival. Results: Data for the primary analysis were collected from February 2005 through January 2009 for a total of 1276 patients. Of these, 620 patients had been assigned to receive compression-only CPR and 656 patients had been assigned to receive standard CPR. The rate of 30-day survival was similar in the two groups: 8.7% (54 of 620 patients) in the group receiving compression-only CPR and 7.0% (46 of 656 patients) in the group receiving standard CPR (absolute difference for compression-only vs. standard CPR, 1.7 percentage points; 95% confidence interval, −1.2 to 4.6; P=0.29). Conclusions: This prospective, randomized study showed no significant difference with respect to survival at 30 days between instructions given by an emergency medical dispatcher, before the arrival of EMS personnel, for compression-only CPR and instructions for standard CPR in patients with suspected, witnessed, out-of-hospital cardiac arrest.

Guideline 7 Cardiopulmonary resuscitation

34. Te Pas AB, Lopriore E, Dito I, Morley CJ and Walther FJ, Humidified and Heated Air During Stabilization at Birth Improves Temperature in Preterm Infants. Pediatrics 2010: 125(6);e1427-32
Neonatal resuscitation guidelines recommend techniques to minimize heat loss in the delivery room. The use of humidified and heated gas is standard of care for preterm infants who need respiratory support in the NICU, but international resuscitation guidelines do not stipulate use of this therapy during stabilization at birth. We aimed to investigate the effect of humidified and heated gas on admission temperature in preterm infants who require respiratory support at birth. METHODS: Two cohorts of very preterm infants born at [≤32 weeks' gestational age in the Leiden University Medical Center were compared prospectively before (the "cold" cohort) and after (the "heated" cohort) introduction of the use of heated and humidified gas during respiratory support at birth (continuous positive airway pressure or intubation). The primary outcome was the infant's rectal temperature at admission in the NICU. RESULTS There was a difference in the mean (SD) rectal temperature between the cold and heated cohorts (35.9 [0.6] vs 36.4 [0.6], respectively; P < .0001). Normothermia (36.5(degrees)C-37.5(degrees)C) occurred less often in the cold cohort than in the heated cohort (12% vs 43%; P < .0001). There was no difference in occurrence of mild hypothermia (36.0(degrees)C-
36.4°C) between groups (33% vs 35%; not significant). Moderate hypothermia (<36.0°C) occurred more often in the cold cohort (53% vs 19%; P < .001). CONCLUSIONS: The use of heated and humidified air during respiratory support in very preterm infants just after birth reduced the postnatal decrease in temperature. Heating and humidifying the gas during stabilization merits additional investigation.

*Guideline 13.5 Tracheal intubation and ventilation of the newly born infant*

**35. The Consortium on Safe Labor, Respiratory Morbidity in Late Preterm Births. JAMA 2010: 304(4):419-25**

Context: Late preterm births (340/7-366/7 weeks) account for an increasing proportion of prematurity-associated short-term morbidities, particularly respiratory, that require specialized care and prolonged neonatal hospital stays. Objective To assess short-term respiratory morbidity in late preterm births compared with term births in a contemporary cohort of deliveries in the United States. Design, Setting, and Participants: Retrospective collection of electronic data from 12 institutions (19 hospitals) across the United States on 233 844 deliveries between 2002 and 2008. Charts were abstracted for all neonates with respiratory compromise admitted to a neonatal intensive care unit (NICU), and late preterm births were compared with term births in regard to resuscitation, respiratory support, and respiratory diagnoses. A multivariate logistic regression analysis compared infants at each gestational week, controlling for factors that influence respiratory outcomes. Main Outcome Measures Respiratory distress syndrome, transient tachypnea of the newborn, pneumonia, respiratory failure, and standard and oscillatory ventilator support. Results Of 19 334 late preterm births, 7055 (36.5%) were admitted to a NICU and 2032 had respiratory compromise. Of 165 993 term infants, 11 980 (7.2%) were admitted to a NICU, 1874 with respiratory morbidity. The incidence of respiratory distress syndrome was 10.5% (390/3700) for infants born at 34 weeks' gestation vs 0.3% (140/41 764) at 38 weeks. Similarly, incidence of transient tachypnea of the newborn was 6.4%(n = 236) for those born at 34 weeks vs 0.4% (n = 155) at 38 weeks, pneumonia was 1.5% (n = 55) vs 0.1% (n = 62), and respiratory failure was 1.6% (n = 61) vs 0.2% (n = 63). Standard and oscillatory ventilator support had similar patterns. Odds of respiratory distress syndrome decreased with each advancing week of gestation until 38 weeks compared with 39 to 40 weeks (adjusted odds ratio [OR] at 34 weeks, 40.1; 95% confidence interval [CI], 32.0-50.3 and at 38 weeks, 1.1; 95% CI, 0.9-1.4). At 37 weeks, odds of respiratory distress syndrome were greater than at 39 to 40 weeks (adjusted OR, 3.1; 95% CI, 2.5-3.7), but the odds at 38 weeks did not differ from 39 to 40 weeks. Similar patterns were noted for transient tachypnea of the newborn (adjusted OR at 34 weeks, 14.7; 95% CI, 11.7-18.4 and at 38 weeks, 1.0; 95% CI, 0.8-1.2), pneumonia (adjusted OR at 34 weeks, 7.6; 95% CI, 5.2-11.2 and at 38 weeks, 0.9; 95% CI, 0.6-1.2), and respiratory failure (adjusted OR at 34 weeks, 10.5; 95% CI, 6.9-16.1 and at 38 weeks, 1.4; 95% CI, 1.0-1.9). Conclusion: In a contemporary cohort, late preterm birth, compared with term delivery, was associated with increased risk of respiratory distress syndrome and other respiratory morbidity.
The increasing survival rates after out-of-hospital cardiac arrests (OHCA) are due mainly to improvements in the first 3 steps of the chain of survival. The aim of this study was to describe the temporal trends of OHCA incidence and outcomes with shock-resistant ventricular fibrillation (VF) requiring advanced life support procedures. All our subjects were persons aged 18 years or more, who had suffered OHCA of presumed cardiac etiology, were witnessed by bystanders, treated by emergency medical service (EMS), and had VF as initial rhythm. Our study was conducted in Osaka Prefecture, Japan from May 1, 1998 through December 31, 2006. Data were collected by EMS personnel using an Utstein-style database. We evaluated the temporal trends of incidence and outcomes of shock-resistant VF. During the study period, there were 8782 witnessed OHCA cases of presumed cardiac etiology. Among them, 1733 had VF as an initial rhythm, 392 of whom were shock-resistant. While the age-adjusted annual incidence of witnessed VF increased from 2.0 to 3.3 per 100,000 inhabitants, that of shock-resistant VF underwent little change during the study period. The proportion of shock-resistant VF among witnessed VF decreased from 37.0% to 19.0%. Neurologically intact 1-month survival rates after shock-resistant VF remained low at 5.6% even in 2006. The actual incidence of shock-resistant VF has remained unchanged, and their outcomes continue to be dismal. Further efforts are required to reduce the mortality rates of such shock-resistant VF to achieve improved survival after OHCA.

NON-SYSTEMATIC REVIEWS / OPINION

Airway management in obese adults can be challenging, and much of the literature on this subject focuses on elective surgical cases, rather than acutely ill patients. In this article, we review the emergency department evaluation of the airway in obesity, discussing anatomy, physiology, and pharmacology. In addition, we describe techniques and devices used to improve intubating conditions in the obese patient. After our review of the relevant literature, we conclude that research in this particular area of acute care remains in its infancy.

Guideline 11.7 Equipment and techniques in adult ALS

Purpose of review: The primary purpose of this article is to highlight the latest airway research in multitrauma. Recent findings: Management of the airway in multitrauma patients is a critical resuscitation task. Prehospital airway management is difficult with a high risk of failure, complications, or both. In-hospital performed conventional oral intubation with manual in-line stabilization, cricoid pressure, and a backup plan for a surgical airway is still the most efficient and effective approach for early airway control in multitrauma patients. Selective utilization of airway maintenance, instead of ultimate airway control in the field, has been suggested as a primary prehospital strategy. Properties of video-laryngoscopes complement standard laryngoscopes. When compared with a Macintosh laryngoscope, the Airtraq and Airwayscope diminish cervical spine motion during elective oro-tracheal intubation. Penetrating neck injuries are the most frequent indication for awake intubation, whereas patients with maxillofacial injuries have the highest rate of initial surgical airway. Summary: Risks and benefits of ultimate prehospital airway control is a controversial topic. Utilization of videolaryngoscopes in multitrauma remains open for research. Standardization of training requirements, equipment, and development of prehospital and in-hospital airway algorithms are needed to improve outcomes. Rational utilization of available airway devices, development of new devices, or both may help to promote this goal.

Guideline 11.7 Equipment and Techniques in Adult ALS

39. Elder G, Activated charcoal: To give or not to give? International Emergency Nursing 2010: 18(3);154-7
There has been much debate about the use of activated charcoal in patients who have taken overdoses and then present to Emergency Departments. There are clinical trials, research and position statements that have examined the effectiveness of activated charcoal in a number of overdoses of different medications, but there is still a debate surrounding the evidence based practice of administering activated charcoal in patients who have taken a drug overdose due to lack of evidence. This article will examine on the two main guidelines on activated charcoal, one produced by the National Institute for Clinical Excellence and the second produced by American Academy of Clinical Toxicology. It will discuss the methods of administration on activated charcoal, contraindications and the difficulties or challenges in adhering to these guidelines in the clinical setting.
Guideline 8.12 Emergency management of a victim who has been poisoned

Purpose of review: Trauma patients requiring massive transfusion represent a population at high risk for potentially preventable death. This review describes recent advances in the early recognition and treatment of the coagulopathy of trauma, as well as ongoing work to define optimal resuscitation strategies. Recent findings: Damage control resuscitation involves the rapid correction
of hypothermia and acidosis, direct treatment of coagulopathy, and early transfusion in trauma patients. Recent evidence demonstrates improved mortality and lower overall blood product usage with higher ratios of plasma and platelets to red blood cells transfused. Adjuncts to damage control resuscitation such as factor VIIa may also be beneficial. Thrombelastography and advances in point-of-care testing may provide timely measurements to help guide massive transfusion in patients based on their individual needs. Summary: As optimal resuscitation strategies continue to evolve, recent efforts have focused on early and aggressive treatment of coagulopathy, with higher ratios of plasma and platelets to red blood cells transfused. Early evidence suggests that such strategies have a beneficial outcome in regards to trauma-related mortality. (C) 2010 Lippincott Williams & Wilkins, Inc.

Guideline 11.8 Post-resuscitation Therapy in Adult Advance Life Support

The 'chain of survival' has been a useful tool for improving the understanding of, and the quality of the response to, cardiac arrest for many years. In the 2005 European Resuscitation Council Guidelines the importance of recognising critical illness and preventing cardiac arrest was highlighted by their inclusion as the first link in a new four-ring 'chain of survival'. However, recognising critical illness and preventing cardiac arrest are complex tasks, each requiring the presence of several essential steps to ensure clinical success. This article proposes the adoption of an additional chain for in-hospital settings - a 'chain of prevention' - to assist hospitals in structuring their care processes to prevent and detect patient deterioration and cardiac arrest. The five rings of the chain represent 'staff education', 'monitoring', 'recognition', the 'call for help' and the 'response'. It is believed that a 'chain of prevention' has the potential to be understood well by hospital clinical staff of all grades, disciplines and specialties, patients, and their families and friends. The chain provides a structure for research to identify the importance of each of the various components of rapid response systems.

Time to first defibrillation is widely accepted to correlate closely with survival and recovery of neurological function after cardiac arrest due to ventricular fibrillation or ventricular tachycardia. Focused training of a cadre of nurses to defibrillate on their own initiative may significantly decrease time to first defibrillation in cases of in-hospital cardiac arrest outside of critical care units. Such a program may be the best single strategy to improve in-hospital survival, simply and at reasonable cost.

Reducing the heart’s temperature by 2-5°C is a potent cardio-protective treatment in animal models of coronary artery occlusion. The anti-infarct benefit depends upon the target temperature and the time at which cooling is instituted. Protection primarily results from cooling during the ischemic period, while cooling during reperfusion or beyond offers little protection. In animal studies protection is proportional to both the depth and duration of cooling. An optimal cooling protocol must appreciably shorten the normothermic ischemic time to effectively salvage myocardium. Patients presenting with acute myocardial infarction could be candidates for mild hypothermia since the current door to balloon time is typically 90min. But they would have to be cooled quickly shortly after their arrival. Several strategies have been proposed for ultra-fast cooling, but most like liquid ventilation and pericardial perfusion are too invasive. More feasible strategies might include cutaneous cooling, peritoneal lavage with cold solutions, and endovascular cooling with intravenous thermodes. This last option has been investigated clinically, but the results have been disappointing possibly because the devices lacked capacity to cool the patient quickly or cooling was not implemented soon enough. The mechanism of hypothermia’s protection has been assumed to be energy conservation. However, while deep hypothermia clearly preserves ATP, mild hypothermia has only a modest effect on ATP depletion during ischemia. Some evidence suggests that intracellular signaling pathways might be responsible for the protection. It is unknown how cooling could trigger these pathways, but, if true, then it might be possible to duplicate cooling’s protection pharmacologically.

*Guideline 11.9 Therapeutic hypothermia after cardiac arrest*

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


In patients with cardiopulmonary arrest, brain cooling may improve neurological outcome, especially if applied prior to or during early reperfusion. Thus it is important to develop feasible cooling methods for pre-hospital use. This study examines cerebral and compartmental thermokinetic properties of nasopharyngeal cooling during various blood flow states. Ten swine (40±4kg) were anesthetized, intubated and monitored. Temperature was determined in the frontal lobe of the brain, in the aorta, and in the rectum. After the preparatory phase the cooling device (RhinoChill™ system), which produces evaporative cooling in the nasopharyngeal area, was activated for 60min. The thermokinetic response was evaluated during stable anaesthesia (NF, n=3); during untreated cardiopulmonary arrest (ZF, n=3); during CPR (LF, n=4). Effective brain cooling was achieved in all groups with a median cerebral temperature decrease of −4.7°C for NF, −4.3°C for ZF and −3.4°C for LF after 60min. The initial brain cooling rate however was fastest in NF, followed by LF, and was slowest in ZF; the median brain temperature decrease from baseline after 15min
of cooling was −2.48°C for NF, −0.12°C for ZF, and −0.93°C for LF, respectively. A median aortic temperature change of −2.76°C for NF, −0.97°C for LF and +1.1°C for ZF after 60 min indicated preferential brain cooling in all groups. While nasopharyngeal cooling in swine is effective at producing preferential cerebral hypothermia in various blood flow states, initial brain cooling is most efficient with normal circulation.

Guideline 11.9 Therapeutic hypothermia after cardiac arrest


Using our porcine model of deep dermal partial thickness burn injury, various durations (10 min, 20 min, 30 min or 1 h) and delays (immediate, 10 min, 1 h, 3 h) of 15 °C running water first aid were applied to burns and compared to untreated controls. The subdermal temperatures were monitored during the treatment and wounds observed weekly for 6 weeks, for re-epithelialisation, wound surface area and cosmetic appearance. At 6 weeks after the burn, tissue biopsies were taken of the scar for histological analysis. Results showed that immediate application of cold running water for 20 min duration is associated with an improvement in re-epithelialisation over the first 2 weeks post-burn and decreased scar tissue at 6 weeks. First aid application of cold water for as little as 10 min duration or up to 1 h delay still provides benefit.

Guideline 8.5 Burns


BACKGROUND: Esophageal detector devices (EDDs) impose negative pressure on the trachea or esophagus to verify endotracheal tube (ETT) position. In cardiac arrest, the smooth muscle of the lower esophageal sphincter relaxes in a time-dependent and irreversible manner. If relaxation also occurs in the muscular posterior tracheal wall, it could predispose tracheal invagination or collapse with negative pressure, potentially yielding false-negative (tracheal ETT, EDD indicates esophagus) results. We compared 3 different EDDs in their ability to correctly discriminate tracheal and esophageal intubation. METHODS: ETTs were placed into the trachea and esophagus of 5 domestic swine, and bronchoscopy was used to visualize the trachea while 3 EDDs were tested. Tracheal wall activity was observed before and after induced cardiac arrest. Tracheal ETTs were aspirated with increasing negative force and pressures at initial wall movement and >50% tracheal lumen obliteration were recorded. Measurements were repeated at 4, 8, and 12 minutes postarrest and pressures at tracheal wall collapse pre- and postarrest were determined. EDDs were also tested on esophageal ETTs prearrest and at 6 and 10 minutes postarrest. RESULTS: In a closed system, each EDD generated more than −100 cm
H2O pressure. Average prearrest pressure at tracheal collapse was −112 cm H2O. Average postarrest collapse pressures were −68, −66, and −54 cm H2O at 4, 8, and 12 minutes postarrest. One EDD consistently gave equivocal results; the remaining 2 gave accurate results in all subjects. Most observed movement was insufficient to cause device failure although tracheal wall movement was noted in all postarrest EDD trials. Esophageal intubation was correctly determined at all times pre- and postarrest. CONCLUSION: These findings describe a mechanism for false-negative results from decreased posterior tracheal wall tone during cardiac arrest. Further studies are required to elucidate factors contributing to its occurrence and impact on EDD use.

Guideline 11.7 Equipment and techniques in adult ALS


The rationale for a compression to ventilation ratio of 3:1 in neonates with primary hypoxic, hypercapnic cardiac arrest is to emphasize the importance of ventilation; however, there are no published studies testing this approach against alternative methods. An extended series of cardiac compressions offers the theoretical advantage of improving coronary perfusion pressures and hence, we aimed to explore the impact of compression cycles of two different durations. Newborn swine (n=32, age 12–36h, weight 2.0–2.7kg) were progressively asphyxiated until asystole occurred. Animals were randomized to receive compressions: ventilations 3:1 (n=16) or 9:3 (n=16). Return of spontaneous circulation (ROSC) was defined as a heart rate ≥100beatsmin⁻¹. All animals except one in the 9:3 group achieved ROSC. One animal in the 3:1 group suffered bradycardia at baseline, and was excluded, leaving us with 15 animals in each group surviving to completion of protocol. Time to ROSC (median and interquartile range) was 150s (115–180) vs. 148s (116–195) for 3:1 and 9:3, respectively (P=0.74). There were no differences in diastolic blood pressure during compression cycles or in markers of hypoxia and inflammation. The temporal changes in mean arterial blood pressure, heart rate, arterial blood gas parameters, and systemic and regional oxygen saturation were comparable between groups. Neonatal pigs with asphyxia-induced cardiac arrest did not respond to a compression: ventilation ratio of 9:3 better than to 3:1. Future research should address if alternative compression: ventilation ratios offer advantages over the current gold standard of 3:1.

ARC Guideline 13.6 Chest compressions during resuscitation of the newborn infant


A percutaneous left ventricular assist device can maintain blood flow to vital organs during ventricular fibrillation and may improve outcomes in ischaemic cardiac arrest. We compared haemodynamic and clinical effects of a percutaneous left ventricular assist
device with a larger device deployed via endovascular prosthesis and with open-chest cardiac massage during ischaemic cardiac arrest. Eighteen swine were randomised into three groups. After thoracotomy, coronary ischaemia and ventricular fibrillation was induced. Cardiac output was measured with transit-time flowmetry. Tissue perfusion was measured with microspheres. Defibrillation was performed after 20min. Cardiac output with cardiac massage was 1129mLmin⁻¹ vs. 1169mLmin⁻¹ with the percutaneous- and 570mLmin⁻¹ with the surgical device (P<0.05 surgical vs. others). End-tidal CO₂ was 3.3kPa with cardiac massage vs. 3.2kPa with the percutaneous- and 2.3kPa with the surgical device (P<0.05 surgical vs. others). Subepicardial perfusion was 0.33mLmin⁻¹g⁻¹ with cardiac massage vs. 0.62mLmin⁻¹g⁻¹ with both devices (P<0.05 devices vs. massage), cerebral perfusion was comparable between groups (all reported values after 3min cardiac arrest, all P<0.05 vs. baseline, all P=NS for 3min vs. 15min). Return of spontaneous circulation was achieved in 5/6 subjects with cardiac massage vs. 6/6 with the percutaneous- and 4/6 with the surgical device (P=NS). The percutaneous device improved myocardial perfusion, maintained cerebral perfusion and systemic circulation with similar rates of successful defibrillation vs. cardiac massage. Increased delivery was not obtained with the surgical device during cardiac arrest.

To compare the efficacy of nifekalant and amiodarone in the treatment of cardiac arrest in a porcine model. After 4min of untreated ventricular fibrillation, animals were randomly treated with nifekalant (2mgkg⁻¹), amiodarone (5mgkg⁻¹) or saline placebo (n=12 pigs per group). Precordial compression and ventilation were initiated after drug administration and defibrillation was attempted 2min later. Hemodynamics were continuously measured for 6h after successful resuscitation. Compared with saline, nifekalant and amiodarone equally decreased the number of electric shocks, defibrillation energy, epinephrine dose, and duration of cardiopulmonary resuscitation required for successful resuscitation (P<0.01). The incidence of restoration of spontaneous circulation (ROSC) and the 24-h survival rate were higher in both antiarrhythmic drug groups (P<0.05) vs. the saline group. Furthermore, post-resuscitation myocardial dysfunction at 4–6h after successful resuscitation was improved in animals given antiarrhythmic drugs as compared with the saline group (P<0.05). There were no differences between nifekalant and amiodarone for any of these parameters. The effect of nifekalant was similar to that of amiodarone for improving defibrillation efficacy and for the treatment of cardiac arrest. Administration of either nifekalant or amiodarone before defibrillation increased the ROSC and 24-h survival rates and improved post-resuscitation cardiac function in this porcine model.

Guideline 11.6 Medications in cardiac arrest

50. Genzwuerker HV, Gernoth C, Hinkelbein J, Schmidbauer W and Kerner T, Influence of an impedance threshold valve on
ventilation with supraglottic airway devices during cardiopulmonary resuscitation in a manikin. Resuscitation 2010: 81(8);1010-3

This study investigates if an impedance threshold valve (ITV) might improve survival after cardiac arrest by increasing vital organ blood flow. The combination of ITV and supraglottic airway devices (SADs) has not been previously studied. This simulation study in a manikin aimed at analysing differences in ventilation with different SADs without and with an ITV. In a resuscitation manikin, cardiopulmonary resuscitation (CPR) was performed with interrupted (30:2) and continuous chest compressions using facemask, tracheal tube and 10 SADs (six different laryngeal masks, LT-D, LTS-D, Combitube® and Easy Tube®). Ventilation was performed with and without an ITV. A total of 550 CPR cycles of 3-min duration were performed with chest compressions and ventilation standardised by use of a mechanical thumper device and an emergency ventilator. Sufficient ventilation was possible with all devices tested. For ventilation during continuous chest compressions, there were significantly reduced tidal volumes for all airway devices with ITV use. By contrast, during interrupted chest compressions, no differences in tidal volumes with the ITV occurred in the majority of devices. The maximum reduction of tidal volume for any device was 7.8% of the volume reached without the ITV. Based on the findings of this manikin trial, the use of an ITV for ventilation during CPR is possible in combination with supraglottic airway devices. Merging these two strategies warrants further clinical evaluation to judge the relevance of tidal volume reduction found in this trial.

Guideline 11.7 Equipment and techniques in adult ALS


BACKGROUND: Hands-only cardiopulmonary resuscitation (HO-CPR) is recommended as an alternative to standard CPR (STD-CPR). Studies have shown a degradation of adequate compressions with HO-CPR after 2min when performed by young, healthy medical students. Elderly rescuers' ability to maintain an adequate compression rate and depth until emergency medical services (EMS) arrives is unknown. OBJECTIVES: The specific aim of this study was to compare elderly rescuers' ability to maintain adequate compression rate and depth during HO-CPR and STD-CPR in a manikin model. METHODS: In this prospective, randomized crossover study, 17 elderly volunteers performed both HO-CPR and STD-CPR, separated by at least 2 days, on a manikin model for 9min each. The primary endpoint was the number of adequate chest compressions (> 38mm) delivered per minute. Secondary endpoints were total compressions, compression rate, and the number of breaks taken for rest. RESULTS: There was no difference in the number of adequate compressions between groups in the first minute; however, the STD-CPR group delivered significantly more adequate chest compressions in minutes 2-9 (p<0.05). The total number of compressions delivered was significantly greater in the HO-CPR than STD-CPR group when considering the entire resuscitation period. A significantly greater number of rescuers took breaks for rest during HO-CPR than STD-CPR. CONCLUSIONS: Although HO-CPR resulted in a greater number of overall compressions than STD-CPR,
STD-CPR resulted in a greater number of adequate compressions in all but the first minute of resuscitation.

**Guideline 6: Compressions**


This study compared the Airway scope (AWS) to the Macintosh laryngoscope (ML) during chest compressions on a fresh cadaver. This was a prospective crossover study. The participants who had experiences with AWS were excluded. The participants intubated with randomly assigned AWS or ML on a fresh cadaver during chest compressions. Primary outcome were as follows: time to intubation, ease of intubation (rated by using the visual analog scale [VAS]), and intubation success rate. Twenty-five were enrolled. Median time of intubation was similar between the AWS and ML (AWS, 18.5 seconds vs ML, 18.3 seconds; P = .112). The median VAS of AWS and ML were 3.0 and 2.0, respectively (P = .023). There was no failure of intubation. However, participants replied that the AWS was more difficult to use than the ML. Considering the lack of experience with the AWS, AWS could be an alternative intubation device during chest compressions after practices with AWS.

**Guideline 11.7 Equipment and techniques in adult ALS**


If tracheal intubation can be performed during uninterrupted chest compressions, this will sustain circulation during the procedure of intubation and may lead to successful resuscitation. We compared three types of laryngoscope on a manikin as to whether they enabled tracheal intubation while the manikin’s chest was rhythmically compressed. A total of 35 persons who had little or no experience in intubation served as examinees. The laryngoscopes employed were a conventional Macintosh laryngoscope (MAC), a new video laryngoscope, Pentax-AWS (AWS) and an optic laryngoscope Airtraq (ATQ). During chest compression on the manikin by an assistant, the examinee attempted to perform intubation. The success rate and the time for successful intubation were measured. During rhythmic chest compressions, nine examinees failed in tracheal intubation with the MAC, seven failed with the ATQ, and no one failed with the AWS. The success rates with the AWS were significantly higher than those with the MAC (P<0.01) or ATQ (P<0.05). The time needed for intubation was significantly shorter with the Pentax-AWS than with the others. These results suggest that the use of the Pentax-AWS enables tracheal intubation while the patient’s chest is rhythmically compressed, and would more often lead to successful intubation, which in turn may lead to more successful resuscitation.

**Guideline 11.7 Equipment and techniques in adult ALS**

Physicians could encounter difficult intubation during cardiopulmonary resuscitation (CPR) in trauma patients due to the patient’s movement from continuous chest compression and to cervical stabilisation. Therefore, first, we evaluated the impact of chest compression with or without cervical stabilisation on intubation with a Macintosh laryngoscope. Next, we compared difficulty in intubation among the Macintosh laryngoscope, AirWay Scope (AWS), and gum elastic bougie (GEB) with the Macintosh laryngoscope in three simulated CPR scenarios in a randomised, controlled, cross-over study design. Twenty-three anaesthetists intubated the trachea of a manikin (ALS Skill Master, Laerdal Medical Japan, Tokyo, Japan) using the Macintosh laryngoscope, AWS, and GEB in the control scenario, chest compression scenario, and chest compression with cervical stabilisation scenario. Difficulty in intubation was rated on a 5-point scale and the intubation time was measured. Continuous chest compression increased difficulty in intubation with the Macintosh laryngoscope, compared with the control scenario. Concurrent application of cervical stabilisation further increased the difficulty, compared with application of chest compression alone. Of the three devices compared, the AWS facilitated the easiest intubation, and the GEB facilitated the second-easiest intubation in all scenarios, though the intubation time was slightly longer with the GEB than with other devices. CPR employing continuous chest compression with or without cervical stabilisation caused difficult intubation with the Macintosh laryngoscope. The AWS and GEB facilitated the easiest and second-easiest intubation, respectively, even during CPR employing continuous chest compression with or without cervical stabilisation in a manikin.

Guideline 11.7 Equipment and techniques in adult ALS


Heart rate is a primary clinical indicator directing newborn resuscitation. The time taken to assess the heart rate by auscultation in relation to accuracy during newborn resuscitation is not known. To assess both the accuracy and time taken to assess heart rate by stethoscope in simulated resuscitation scenarios. The VitalSim© manikin (Laerdal Medical, Stavanger, Norway) was used in this randomised, single blind study. Four heart rate settings (0, 40, 80, 120 beats per minute (bpm)) were randomly assigned. Participants assessed them by auscultation in three different scenarios. The first scenario was to assess the actual heart rate at birth. In the second scenario, heart rate was assessed during ventilation and assigned to standard ranges (<60, 60–100, >100bpm). In the third scenario, heart rate was assessed after three cycles of compressions and ventilation and assigned to standard ranges. In total 61 midwives, nurses and doctors performed 183 assessments. Mean time to estimate heart rate for scenarios 1, 2 and 3 was: 17.0, 9.8 and 7.8s respectively. Heart rate assessments were inaccurate in 31% (scenario 1), 28% (scenarios 2) and 26% (scenario 3).
was a trend for assessors who were accurate to be quicker and this achieved significance in scenario 2 (p<0.02). Inaccurate assessment would have made a difference to management in 28% of all cases. Mean time to estimate heart rate for the scenarios varied between 7.8 and 17.0s. Twenty-eight percent of all heart rate assessments would have prompted incorrect management during resuscitation or stabilization. Of incorrect assessments, 73% were overestimations. Further research is required to develop a rapid and accurate method for determining heart rate during newborn resuscitation.

Guideline 13.3 Assessment of the newborn infant


To evaluate the efficacy of straddling external chest compression performed on moving stretchers. The study was a prospective, randomized, cross-over study on a manikin performed at a university hospital. Twenty subjects were selected from the 40 graduates using random numbers to participate in the study. Participants were randomized to either performing standard or straddling external chest compression followed by the other technique 7 days later. The compression variables and time to first compression were recorded. Twenty subjects (12 males and 8 females) took part in the study. There were no differences between the standard and straddling external chest compression for the compression rate, effective compression percentage and compression depth. There was no difference between the standard external chest compression and straddling external chest compression for incorrect hand position and incomplete release compression. Time to first compression during straddling external chest compression (10.31±1.65s) was greater than that during standard external chest compression (2.74±0.40s) (P<0.001). The quality of straddling external chest compression performed on a moving stretcher was as effective as standard external chest compression performed on the floor. By performing straddling external chest compression, time for transporting victims to the emergency department to get advanced life support may be shortened.

Guideline 7 Cardiopulmonary resuscitation

CASE SERIES / CASE STUDIES/ LETTERS/EDITORIALS


A 22-year-old male was involved in a single vehicle collision in a remote area. Paramedics found the patient to have a GCS of 3, massive facial deformities, blood gurgling from the mouth, and an oxygen saturation of 30%. The crew elected to perform Rapid
Sequence Airway (RSA)1 while simultaneously preparing for a surgical airway. After etomidate and rocuronium a #4LMA-SupremeTM (LMAS) with 14 Fr gastric tube was placed on the first attempt and the stomach decompressed. Oxygen saturation increased steadily to 90%......

*Guideline 11.7 Equipment and Techniques in Adult ALS*

**58. Eisenberg MS and Psaty BM, Cardiopulmonary Resuscitation: Celebration and Challenges. JAMA 2010: 304(1);87-8**

This year marks the 50th anniversary of cardiopulmonary resuscitation (CPR). In the July 9, 1960, issue of JAMA, Kouwenhoven et al reported the results of chest compressions performed on 20 hospitalized patients who had developed sudden, unexpected cardiac arrest. Using their newly discovered technique of closed chest compression, they successfully resuscitated 14 of the 20 patients. The authors write in their article: "Anyone, anywhere, can now initiate cardiac resuscitative procedures. All that is needed is two hands."

Two months later at the annual meeting of the Maryland Medical Society, Kouwenhoven and Jude demonstrated the technique of chest compression and Peter Safar, MD, shared his data supporting the benefit of mouth-to-mouth ventilation. The 2 techniques were combined at that meeting, and modern CPR was born. Now 50 years later, there is still much to celebrate. Cardiopulmonary resuscitation, usually in combination...

*Editorial*

**59. García-Sánchez N, Rodríguez-Blanco S, Oulego-erroz I, Busto-Cuíñas MM and Rodríguez-Núñez A, Are paediatric residents able to deliver basic CPR procedures? Ventilation and chest compression rate. Resuscitation 2010: 81(8);1053-4**

Quality of cardiopulmonary resuscitation (CPR) is an important determinant of outcome. However, several studies have shown that the quality of CPR is suboptimal, even when performed by experienced health staff. The most common errors are hyperventilation and inadequate chest compressions. Paediatric residents should be trained to perform CPR manoeuvres effectively and they should maintain such skills by means of retraining programs and real patient resuscitations. Our objective was to assess if paediatric residents are able to ventilate with bag and mask and to deliver chest compressions according to current guidelines. Subjects were 21 voluntary paediatric residents (5 male, 16 female), who had passed a paediatric advanced cardiopulmonary resuscitation course and had observed at least one real resuscitation event.......

*Letter*

**Guideline 9.1.1 Cardiopulmonary resuscitation training**

**60. Jan D and Nithin N, Hospital doctors’ knowledge of adrenaline (epinephrine) administration in anaphylaxis in adults is deficient. Resuscitation 2010: 81(8);1057-8**
Recently a critical incident occurred in a NHS trust in the North of England. A junior doctor was instructed by his consultant to administer 1mg of adrenaline/epinephrine intravenously, to an alert and not haemodynamically compromised 45-year-old patient with anaphylaxis (due to receiving an intravenous antibiotic). The patient suffered from transient coronary vasospasm with a subsequent troponin rise, attributed to the intravenous adrenaline. Detrimental effects of incorrect or inappropriate adrenaline administration have been described previously. Approximately half of the fatal anaphylactic reactions recorded in the UK each year are iatrogenic and the median time to cardio-respiratory arrest for iatrogenic reactions is 5min. This underlines the importance of the knowledge of the correct route and dosage of administration of adrenaline/epinephrine, for all hospital doctors of all grades...

Letter

Guideline 8.2.3 Anaphylaxis

61. Jones N, Lammas C and Gwinnutt C, Poor recall of “4Hs and 4Ts” by medical staff. Resuscitation 2010: in press

While running in-hospital “mock” cardiac arrests for staff training, we noticed that medical members of the cardiac arrest team were frequently slow to recall the “four Hs” and four Ts, potential causes or aggravating factors of a cardiac arrest for which specific treatment must be considered. We therefore undertook a survey of the knowledge of this aspect of resuscitation amongst the doctors who participate as members of the hospital cardiac arrest team. Thirty-seven doctors (9 foundation year [FY]1, 22 FY2 and 6 specialist registrars[SpR]) were asked to recall the “four Hs” and “four Ts”. The time taken to complete the list was recorded along with details when they last completed an RC(UK)ALS course.....

Letter

Guideline 9.1.1 Cardiopulmonary resuscitation training


Cardiac arrest is the “cessation of cardiac mechanical activity, as confirmed by the absence of signs of circulation.” If deaths due to out-of-hospital cardiac arrest (OOHCA) are separated from deaths due to other cardiovascular causes, OOHCA is the third-leading cause of death in the United States. Moreover, there are considerable opportunities to improve outcomes after OOHCA, because there is a more than 5-fold regional variation in survival after OOHCA. Approximately 25% of cardiac arrest patients treated by emergency medical services providers have a first recorded rhythm of ventricular fibrillation, which is usually responsive to defibrillation. Moreover, early provision of cardiopulmonary resuscitation to maintain blood flow or defibrillation to restore mechanical activity is a critical component of effective treatment of OOHCA...

Editorial
This article reports a case of a paediatric pre-hospital tension viscerothorax, and it subsequent management. It also discusses the difficulty in diagnosing this condition in the pre-hospital arena.

64. Spencer C and Butler J, Survival after cardiac arrest and severe lactic acidosis (pH 6.61) due to haemorrhage. Emergency Medicine Journal 2010: In press
This paper describes a 21-year-old man who presented to the emergency department with a knife wound to his buttock. He had a witnessed cardiac arrest in hospital as a result of further haemorrhage. His post-resuscitation arterial blood gas revealed a severe lactic acidosis (pH 6.61, lactate 22.0mmol/l). Despite poor expectations he went on to make a full neurological recovery. To the authors' knowledge, he had the fourth-lowest pH for a cardiac arrest survivor with normal neurology. Severe lactic acidosis occurs post cardiac arrest due to imbalance between cellular oxygen supply and demand. Severe lactic acidosis is associated with hypoxic brain injury but has a low specificity in its prediction. The case illustrates that, especially in younger adults, severe lactic acidosis may be a poor predictor of outcome if it reflects a period of relative hypoperfusion preceding cardiac arrest.

I read with interest the article by Yannopoulos et al in the January issue of Critical Care Medicine. I believe it is an example of gross over-extrapolation from animal studies to the real world of human prehospital resuscitation. The article purports to show the dangers of emergency medical services systems adopting an approach of continuous chest compressions with no assisted ventilation in cases of cardiac arrest. The investigators found significantly better neurologic recovery in pigs receiving chest compressions and positive pressure ventilations when compared with the group with no assisted ventilation. They explain the disagreement with this result with previous porcine studies in terms of “confounders” present in those studies. These are specifically identified as the absence of anesthetic suppression of gasping and interruptions of compressions to deliver rescue breaths.....
Letter

We read with interest the article by Lyon et al that questions the role of endotracheal intubation in a prehospital setting for patients with out-of-hospital cardiac arrest (OHCA). We fully agree that intubation can be challenging and is associated with complications.
The optimal method of managing the airway during cardiac arrest has not yet been determined. The purpose of ventilation during cardiopulmonary resuscitation (CPR) is to maintain adequate oxygenation and sufficient elimination of carbon dioxide. During the first minutes of OHCA, ventilation is probably not as important as chest compressions and defibrillation. Interruptions in chest compressions, for example to insert an endotracheal tube, should be imperatively limited in the first minutes of OHCA management. Therefore, we would like to emphasise the role of an additional factor: timing of intubation. Using our local data of 693 non EMS-witnessed patients with cardiac arrest, we have demonstrated that survival to hospital discharge was 33.3% (40/120) in the group of patients intubated after return of spontaneous circulation (ROSC) versus 12% (69/573) in the group of patients intubated before ROSC (p<0.0001). Timing of intubation seems to have a paramount role and......

Letter

Fifty years have passed since Kouwenhoven, Jude, and Knickerbocker proposed external chest compression to provide circulation of blood to the brain and heart after cardiac arrest. Shortly thereafter, mouth-to-mouth rescue breathing was adopted as an essential addition to this lifesaving procedure. Since that time, there has been very little fundamental change in the method or manner of cardiopulmonary resuscitation (CPR). Decades of observational studies have shown that survival is improved if CPR is performed by bystanders rather than being provided only when emergency medical services (EMS) staff arrives. The use of automated external defibrillators by bystanders and the use of in-hospital hypothermia in comatose patients have also been found to improve outcomes in patients with cardiac arrest. Only relatively recently, however, have the fundamentals of the initial resuscitation been investigated....

Editorial

EDUCATION / ETHICS

Mouth-to-mouth ventilation is a skill taught in cardiopulmonary resuscitation (CPR) training for laypersons. However, its effectiveness is questioned. Our aim was to determine the effectiveness of mouth-to-mouth ventilation training using a self-instruction CPR training video for laypersons. Video-self-instruction CPR training was conducted with CPR Anytime (American Heart Association [AHA] & Laerdal Corporation) for laypersons who had not received CPR training during the recent 5 years. Immediately before, immediately after, and 8 weeks after the CPR training, an AHA basic life support instructor carried out a skill performance
test using a standardized checklist. Also, 8 weeks after the training, a skill test concerning chest compression and mouth-to-mouth ventilation was conducted using a trained reporter. Cardiopulmonary resuscitation training of 84 laypersons was conducted. The mean performance score (from 0 to 2) for mouth-to-mouth ventilation was 0.24 right before the training, 1.58 right after the training, and 0.95 eight weeks after the training. The mean performance scores for chest compression were 0.13, 1.79, and 1.40, right before, right after, and 8 weeks after the CPR training, respectively. The rates of successful mouth-to-mouth ventilation and compression were 11.9%, and 39.1%, respectively. The effectiveness and short-term retention rate of mouth-to-mouth ventilation after video self-instruction CPR training in laypersons was significantly lower than for chest compressions.

**Guideline 9.1.1 Cardiopulmonary resuscitation training**


Self-directed BLS-training, using a personal training manikin with video has been shown to be as effective as instructor-led training. This has not previously been investigated for AED-training. This prospective, randomized study with a non-inferiority design compared traditional instructor-led training with three DVD-based AED-training methods (2.5min DVD without practice; 4.5min DVD with manikin practice; 9min DVD with manikin practice and scenario training). After DVD BLS-training, 396 participants were assigned to one of the four AED-training methods by randomization stratified for age. Participants were tested immediately after the training (post-test) and 2 months later (retention test) using modified Cardiff criteria. The primary endpoint was the percentage of providers scoring 70% or higher on testing. The secondary endpoints were the mean scores and differences per item per age group. Comparison non-inferiority could not be accepted for the post-test or retention-test. Relative risk (RR) and 95% confidence interval (CI) of passing for DVD without practice, with manikin practice and with manikin practice and scenario training compared to instructor-led training were 0.36 (0.25–0.53), 0.35 (0.24–0.51), 0.55 (0.38–0.79), respectively for the post-test, and 0.82 (0.68–0.97), 0.82 (0.68–0.97), and 0.84 (0.70–1.00), respectively for the retention-test. The performance of participants in all DVD-based training groups was significantly higher on the retention-test than on the post-test. Those receiving scenario training scored higher on the post-test compared to the other DVD-training groups (p<0.001). **DVD-based AED-training without scenario is not recommended. Scenario training is a useful addition, but instructor-facilitated training remains the best method.**

**Guideline 9.1.1 Cardiopulmonary resuscitation training**

70. Hulatt L, Laryngeal mask airway training on the Advanced Life Support (ALS) Course—Is it enough? Resuscitation 2010: 81(8);1045

The ALS course teaches insertion of the laryngeal mask airway (LMA) using a manikin. The manual states, “to become proficient in
the insertion of an LMA requires practice on patients”. However, there is no organised process to allow this to occur. I undertook a survey to assess candidates’ interest in gaining further experience of LMA insertion on anaesthetised patients. The survey also questioned candidates on their confidence at airway management. The written survey was completed by 748 candidates from 41 UK ALS courses (return rate 75.0%). I excluded data from 54 anaesthetists from further analysis. Overall, candidates felt that the ALS course provided adequate airway training (640 (92%)). However, ALS candidates are significantly less confident at managing the airway with an LMA than with a bag-valve-mask (BVM)...  

**Guideline 9.1.1 Cardiopulmonary resuscitation training**

The purpose of the study was to compare performance based measures of CPR skills (compressions, ventilations with bag-valve-mask (BVM), and single rescuer CPR) from two types of CPR courses: a computer-based course (HeartCode™ BLS) with voice advisory manikin (VAM) feedback and instructor-led (IL) training with traditional manikins. 604 nursing students from 10 schools of nursing throughout the United States were randomized by school to course type. After successful course completion, students performed 3min each of compressions; ventilations with BVM; and single rescuer CPR on a Laerdal Resusci Anne® SkillReporter™ manikin. The primary outcome measures were: (1) compression rate, (2) percentage of compressions performed with adequate depth, (3) percentage of compressions performed with correct hand placement, (4) number of ventilations/min, and (5) percentage of ventilations with adequate volume. There were no differences in compression rates between the two courses. However, students with HeartCode BLS with VAM training performed more compressions with adequate depth and correct hand placement and had more ventilations with adequate volume than students who had IL courses particularly when learning on hard molded manikins. During single rescuer CPR, students who had HeartCode BLS with VAM training had more compressions with adequate depth and ventilations with adequate volume than students with IL training. **Students who trained using HeartCode BLS and practiced with VAMs performed more compressions with adequate depth and ventilations with adequate volume than students who had IL courses. Results of this study provide evidence to support use of HeartCode BLS with VAM for training nursing students in CPR.**

**Guideline 9.1.1 Cardiopulmonary resuscitation training**

Significant differences in basic life support skills including cardiopulmonary resuscitation and defibrillation (CPR-D) were detected when nurses working in one Finnish and one Swedish hospital were tested using an Objective Structured Clinical Examination
The purpose of this study was to use OSCE test in assessing guideline based CPR-D skills of newly qualified nurses. The CPR-D skills of newly qualified registered nurses studying in Halmstad University (n = 30), Sweden, Helsinki Metropolia University of Applied Sciences (n = 30), and Finland were assessed using an OSCE which was built up with a case of cardiac arrest with ventricular fibrillation as the initial rhythm. The Angoff average, 32.47, was calculated as cutoff point to pass the test. Forty-seven percent of the students in the Swedish group (mean score 32.47/49, range 26-39, SD 3.76) and 13% of the students in the Finnish group (mean score 23.80/49, range 13-35, SD 4.32) passed the OSCE (P<0.0001), the cutoff point being 32.47. Performance grade for the Swedish group was 2.9/5.0 and for the Finnish group 2.1/5.0 (P<0.0001). Good nontechnical skills correlated with high grading of the clinical skills. In conclusion, CPR-D skills of the newly qualified nurses in both the institutes were clearly under par and were not adequate according to the resuscitation guidelines. Current style of teaching is unlikely to result in students being able to perform adequate CPR-D. Standardized testing would help in controlling the quality of learning.

Guideline 9.1.1 Cardiopulmonary resuscitation training


This prospective study compared pre- and post-class performance in basic life support (BLS) on a recording manikin in a convenience sample of 34 health care workers undertaking a two-hour class provided by a hospital resuscitation department teaching the 2005 Resuscitation Council (UK) guidelines. On completion of training there were significant improvements in the proportion of subjects correctly performing a safe approach (14/34 vs. 25/33, 95%CI +11 to +55%, p=0.004), checking for response (17/34 vs. 24/32, 95%CI +1 to +46%, p=0.029), shouting for help (18/34 vs. 28/32, 95%CI +13 to +54%, p=0.002), opening the airway (6/34 vs. 26/32, 95%CI +42 to +79%, p<0.001), checking for breathing (9/34 vs. 27/32, 95%CI +35 to +74%, p<0.001), calling a cardiac arrest team (1/34 vs. 24/32, 95%CI +53 to +85%, p<0.001), and providing the correct compression to breath ratio (11/34 vs. 20/34, +3 to +48%, p=0.033). The median number of correct chest compressions increased from 3 to 41 (p<0.001) with improvements in adequate depth (median depth 36 vs. 40mm, p=0.006), although the compression rate was too fast before training and increased afterwards (median 123 vs. 147, p<0.001). Ventilation performance could not be measured accurately as the manikin was calibrated incorrectly by the manufacturers.

Guideline 9.1.1 Cardiopulmonary resuscitation training

74. Myint PK, Rivas CA and Bowker LK, In-hospital cardiopulmonary resuscitation: Trainees' worst and most memorable experiences. QJM 2010: 129

Background: To examine the personal experiences of higher specialist trainees in Geriatric Medicine (GM) with regard to
cardiopulmonary resuscitation (CPR) and do not attempt resuscitation (DNAR) decision making. Setting: UK. Participants: Two hundred and thirty-five higher trainee members of the British Geriatrics Society (BGS) at the Specialist Registrar (SpR) level. Design: Postal questionnaire survey. Methods: We distributed a questionnaire examining the various issues around DNAR decision making among the trainee members of the BGS in November 2003. In one of the questions, we asked the participants, Briefly describe your worst or most memorable experience of DNAR'. Responses to this question were analysed by thematic schema and are presented. Results: Overall the response rate was 62% (251/408) after second mailing and 235 of these were at SpR grade. One hundred and ninety-eight participants provided an answer to the above question, providing diverse and often detailed accounts, most of which were negative experiences and which appeared to have had a powerful influence on their ongoing clinical practice. The emerging themes demonstrated areas of conflict between trainees and other doctors as well as patients and relatives. Conclusions: SpR grade geriatricians are exposed to extreme and varied experiences of DNAR decision making in the UK. Efforts to improve support and training in this area should embrace the complexity of the subject.

Guideline 9.1.1 Cardiopulmonary resuscitation training


Video-based self-instruction (VSI) with a 24-min DVD and a personal resuscitation manikin solves some of the barriers associated with traditional basic life support (BLS) courses. No accurate assessment of the actual improvement in skills after attending a VSI course has been determined, and in this study we assess the skill improvement in laypersons undergoing VSI. The BLS skills of 68 untrained laypersons (high school students, their teachers and persons excluded from mainstream society) were assessed using the Laerdal ResusciAnne and PC Skill Reporting System 2.0 in a 3min test. A total score (12–48 points) was calculated and 12 different variables were recorded. The participants attended a 24-min VSI course (MiniAnne, Laerdal) and took home the DVD and manikin for optional subsequent self-training. We repeated the test 3½–4 months later. There was a significant increase in the total score (p<0.0001) from 26.5 to 34 points. The participants performed significantly better in checking responsiveness, opening the airway, checking for respiration and using the correct compression/ventilation ratio (all p-values<0.001). The compression depth improved from 38mm to 49.5mm and the total number of compressions increased from 67 to 141. The ventilation volume and the total number of ventilations increased, and total “hands-off” time decreased from 120.5s to 85s. Untrained laypersons attending a 24min DVD-based BLS course have a significantly improved BLS performance after 3½–4 months compared to pre-test skill performance. Especially the total number of compressions improved and the hands-off time decreased.

Guideline 9.1.1. Cardiopulmonary resuscitation training
76. Orde S, Celenza A and Pinder M, A randomised trial comparing a 4-stage to 2-stage teaching technique for laryngeal mask insertion. Resuscitation 2010: Article in press
To compare the ‘4-stage’ teaching technique (demonstration, deconstruction, formulation, performance) with the traditional ‘2-stage’ teaching technique (deconstruction, performance) in laryngeal mask airway (LMA) insertion. Using a prospective randomised study design, participants were taught LMA insertion on a manikin by either the ‘2-stage’ or ‘4-stage’ teaching method. Subjects were eligible if they had never inserted a LMA. Skill acquisition was assessed immediately following training, and skill retention assessed a number of weeks later. The primary outcome was LMA insertion on a manikin, with successful ventilation within 30s. Other outcomes included overall time to LMA insertion, and number of errors. Assessors were blinded to the teaching method used for each subject. A total of 120 participants were randomised between the two teaching groups (60 subjects in each group). Mean time to LMA insertion at acquisition was 39.7s for 2-stage and 34.7s for 4-stage (p>0.05), and proportion completing within 30s was 41.67% for 2-stage and 48.33% for the 4-stage teaching group (p>0.05). With skill retention assessment, mean time to LMA insertion was 44.3s for 2-stage and 42.5s for the 4-stage teaching group (p>0.05). Proportion completing task within 30s was 34.0% for 2-stage and 41.67% for 4-stage group (p>0.05). Overall, there was no significant difference found in skill acquisition or in skill retention between the 2 or 4-stage teaching method. The 2-stage teaching technique is not statistically different to the 4-stage teaching method in efficacy of LMA insertion skill acquisition or retention.

**Guideline 9.1.1 Cardiopulmonary resuscitation training**

Objectives: To evaluate mask technique during simulated neonatal resuscitation and test the effectiveness of training in optimal mask handling. Study design: Seventy participants (consultants, registrars and nurses) from neonatal units were asked to administer positive pressure ventilation at a flow of 8 l/min and a frequency of 40-60/min to a modified leak free, term newborn manikin (lung compliance 0.5 ml/cm H(2)O) using a Neopuff T-piece device. Recordings were made (1) before training, (2) after training in mask handling and (3) 3 weeks later. Leak was calculated. Obstruction (tidal volume <60% of optimal tidal volume) and severe obstruction (<30% of optimal tidal volume) were calculated when leak was minimal. Results: For the 70 participants, median (IQR) leak was 71% (32-95%) before training, 10% (5-37%) directly after training and 15% (4-33%) 3 weeks later (p<0.001). When leak was minimal, gas flow obstruction was observed before, directly after training and 3 weeks later in 46%, 42% and 37% of inflations, respectively. Severe obstruction did not occur. Conclusions: Mask ventilation during simulated neonatal resuscitation was often hampered by large leaks at the face mask. Moderate airway obstruction occurred frequently when effort was taken to minimise leak. Training in mask ventilation reduced mask leak but should also focus on preventing airway obstruction.
Guideline 9.1.1 Cardiopulmonary resuscitation training


Do not attempt resuscitation (DNAR) orders have been shown to be subject to misinterpretation in the 1980s and 1990s. We investigated whether this was still the case, and examined what perceptions doctors and nurses had of what care patients with DNAR orders receive. Using an anonymous written questionnaire, we directly approached 50 doctors and 40 nurses from a range of medical specialties and grades in our teaching hospital. All 50 physicians and 35/40 nurses took part. Using McNemar's test, there were highly significant differences (p<0.0001) in what doctors believed 'should' take place and what they perceived 'in practice' occurred on patients with DNAR orders in all areas questioned (e.g., frequency of nursing observations and contacting medical staff in the event of a patient's deterioration). Using Fisher's exact test, there were significant differences between what nursing staff thought occurred and what doctors thought should occur, for example, frequency of nursing observations (p<0.001), contacting the medical team (p=0.01) and giving fluids (p<0.005). Despite widespread use of DNAR orders, they are still misunderstood. This article highlights the frequency with which DNAR orders are interpreted to mean that other care should be withheld. In addition, it shows that although some doctors know that this should not be the case, they believe that DNAR orders affect the care that their patients receive. We propose that options for more detailed care plans should be embedded within the resuscitation decision and documentation to improve communication and understanding.

Guideline 11.10 Legal and ethical issues related to resuscitation


The “Lazarus phenomenon” or “spontaneous return of circulation” is characterized as a delayed return of spontaneous circulation, occurring after the termination of resuscitation following cardiac arrest. An 84-year-old man with a history of coronary artery bypass grafting, stroke, mild dementia, and surgery for an abdominal aortic aneurysm collapsed in cardiac arrest. The event was witnessed by the patient’s wife. The response time of the physician-manned mobile emergency care unit was 4min. Bystander cardiopulmonary resuscitation (CPR) was not provided. Advanced life support was initiated, including intubation and ventilation with 100% oxygen, and ventricular fibrillation (VF) recognized. Defibrillation was attempted four times. Epinephrine and atropine was administered intravenously. Capnography was not used. Beside a short interlude with pulseless electrical activity between the second and third defibrillation attempt, VF persisted and treatment was withdrawn after 15min. The patient had been without spontaneous circulation for more than 20min. Five minutes after cessation of treatment spontaneous, normal breathing
Apart from the obvious emotional ramifications for family and bystanders, even experienced EMS personnel and physicians are likely to be affected by the Lazarus phenomenon. A feeling of incompetence, questioning of one’s professional abilities, fear of disrepute amongst peers and medico-legal considerations are all aspects of encountering Lazarus.

We sought to better understand SCA survivors’ beliefs about complex issues that arise in the immediate post-arrest period and explore advance care planning. Specifically, we wished to explore four themes: (1) patient and family perception of medical providers’ prognostication in the immediate post-arrest phase; (2) patient definitions of death; (3) use of advance directives (ADs); and (4) perceptions of health and organ donation. We conducted a qualitative study of adult arrest survivors using semi-structured telephone interviews. Participants were recruited from a nonprofit national organization for SCA. Nine of 11 subjects contacted completed the survey. In the immediate post-arrest phase, subjects believed that medical professionals made errors in giving poor prognosis early in the course of resuscitation. While some subjects felt they had experienced “death,” some subjects felt the term “death” was an inappropriate term to describe their experience. The majority of the subjects did not have an AD prior to their SCA and no subjects reported having a conversation about ADs with their medical team. While the majority of subjects classified their health as “very good” or “excellent,” few subjects were registered organ donors, citing comorbidities and skepticism about future resuscitative efforts as rationale. Our study elucidated the attitudes and experiences of SCA survivors. Variability in prognostication timing and inconsistency in describing SCA can complicate discussions between the medical team and families. AD and organ donation discussions may help to provide sensitive care concordant with a patient’s wishes.

Guideline 11.10 Legal and Ethical Issues related to Resuscitation

Background: The appropriateness of family witnessing resuscitation (FWR) is an ethical dilemma with most emergency care providers being opponents. We hypothesized that patients and their families prefer to witness resuscitation of their loved ones.
Methods: One hundred and fifty patients treated for potential life-threatening conditions in our emergency department were presented with a survey on FWR in the reconvalessence phase. They were asked to give their opinion supposing their situation had worsened, requiring a resuscitation effort. Their closest relatives were asked to complete a related questionnaire. Results: Mean age
was 67 years (patient group) and 55 years (relatives group). Fifty-eight percent of the patients were males with only 33% males in the relatives group. Seventy-two percent of the patients preferred the presence of a relative during resuscitation, although 35% estimate that this could be quite a traumatic experience. Forty-one percent had a history of serious medical problems. In the relatives group, 75% expressed their wish to stay with their loved ones and 49% did not fear that this would be too traumatic. There was a good match in patient and family attitude towards FWR (P<0.001). Relatives of a patient with a serious medical history were significantly more in favour of FWR (P<0.01). Conclusion: Our study showed that patients and relatives preferred family presence in emergency department during resuscitation, even when the fear of traumatic effects is considered. It will be a great challenge training emergency care providers for this situation. Staff shortages might compromise the essential support of family members in such situations.

**Guideline 11.10 Legal and ethical issues relating to resuscitation**

82. Fritz Z and Fuld J, Ethical issues surrounding do not attempt resuscitation orders: decisions, discussions and deleterious effects. Journal of Medical Ethics 2010: Online first

Since their introduction as ‘no code’ in the 1980s and their later formalization to ‘do not resuscitate’ orders, such directions to withhold potentially life-extending treatments have been accompanied by multiple ethical issues. The arguments for when and why to instigate such orders are explored, including a consideration of the concept of futility, allocation of healthcare resources, and reaching a balance between quality of life and quality of death. The merits and perils of discussing such decisions with patients and/or their relatives are reviewed and the unintended implications of ‘do not attempt resuscitation’ orders are examined. Finally, the paper explores some alternative methods to approaching the resuscitation decision, and calls for empirical evaluation of such methods that may reduce the ethical dilemmas physicians currently face.

**Guideline 11.10 Legal and ethical issues related to resuscitation**

AND, ONE FOR THOSE THINKING OF EMIGRATING....

83. Christie B, Drinking to excess in Scotland can cost as little as 63p a day. BMJ 2010: 341;c3976

Men in Scotland can spend as little as £4.40 a week to buy enough alcohol to drink in excess of recommended limits, new research has discovered. For women, the cost is even less at £3

NHS Health Scotland has also found that people in Scotland buy 24% more alcohol per year than those in England and Wales—equivalent to an extra two glasses of wine or two pints of beer a week, per person.