
Objectives: In a national perspective, to describe survival among patients found in ventricular fibrillation or pulseless ventricular tachycardia witnessed by a bystander and with a presumed cardiac aetiology and answer two principal questions: (1) what are the changes over time? and (2) which are the factors of importance? Design: Observational register study. Setting: Sweden. Patients: All patients included in the Swedish Out of Hospital Cardiac Arrest Register between 1 January 1990 and 31 December 2009 who were found in bystander-witnessed ventricular fibrillation with a presumed cardiac aetiology. Interventions: Bystander cardiopulmonary resuscitation (CPR) and defibrillation. Main outcome measures: Survival to 1 month. Results: In all, 7187 patients fulfilled the set criteria. Age, place of out-of-hospital cardiac arrest (OHCA) and gender did not change. Bystander CPR increased from 46% to 73%; 95% CI for OR 1.060 to 1.081 per year. The median delay from collapse to defibrillation increased from 12 min to 14 min (p for trend 0.0004). Early survival increased from 28% to 45% (95% CI 1.044 to 1.065) and survival to 1 month increased from 12% to 23% (95% CI 1.058 to 1.086). Strong predictors of early and late survival were a short interval from collapse to defibrillation, bystander CPR, female gender and OHCA outside the home. Conclusion: In a long-term perspective in Sweden, survival to 1 month after ventricular fibrillation almost doubled. This was associated with a marked increase in bystander CPR. Strong predictors of outcome were a short delay to defibrillation, bystander CPR, female gender and place of collapse.


Mass gathering events in sports arenas create challenges regarding the cardiovascular safety of both athletes and spectators. A comprehensive medical action plan, to ensure properly applied cardiopulmonary resuscitation, and wide availability and use of automated external defibrillators (AEDs), is essential to improving survival from sudden cardiac arrest at sporting events. This paper outlines minimum standards for cardiovascular care to assist in the planning of mass gathering sports events across Europe with the intention of local adaptation at individual sports arenas, to ensure the full implementation of the chain of survival.


We aimed to compare the relative efficacy of tropisetron and metoclopramide in treating nausea/vomiting in undifferentiated ED patients. Methods: We undertook a randomized, double-blinded, clinical trial. Adult patients requiring treatment for nausea/vomiting were randomly assigned to either tropisetron (5 mg) or metoclopramide (10 mg), by IV bolus. The primary end point was incidence of vomiting. Secondary end points were decrease in nausea score from baseline (0–100 VAS), the requirement of ‘rescue’ anti-emetics, ongoing nausea over 48 h and side
effects. Results: Fifty patients were enrolled in each group. The demographic variables, presenting complaints and nausea scores at baseline did not differ (P > 0.05). By 180 min, two (4.0%) and nine (18.0%) patients had vomited in the tropisetron and metoclopramide groups respectively (difference 14.0%, 95% CI 0.1–28.0, P= 0.05). Also, there were two and 20 episodes of vomiting respectively. Vomiting rates were 0.02 and 0.16 episodes/person-hour (difference 0.14 episodes/person-hour, 95% CI 0.07–0.21, P < 0.001) respectively. By 60 min and thereafter, the decrease in nausea score from baseline was greater (although not significantly so) in the tropisetron group. At 180 min, the decreases were 47.9 mm and 37.0 mm respectively (difference 10.9 mm, 95% CI −0.7–22.6). Five (10.0%) and 13 (26.0%) patients required a rescue anti-emetic respectively (difference 13.2%, 95% CI −7.7–34.0, P= 0.25). The tropisetron group had less akathisia. Conclusions: Tropisetron was associated with a significantly lower vomiting rate and shows promise as an alternative anti-emetic in the ED.


The aim of the study was to analyse the incremental usefulness of high blood glucose level for non-ST elevation acute coronary syndrome (ACS) diagnosis in patients admitted to the emergency department (ED) for chest pain and suspected ACS. Methods: A post hoc analysis of a prospective, observational study of 11 months duration was carried out. Initial glucose levels were analysed in 672 consecutive patients admitted to the ED with chest pain and suspected non-ST elevation ACS. A cut-off glucose level (>140mg/dl) for high glucose level diagnosis was defined. Based on hospital diagnostic test results, patients were classified as having non-ST elevation ACS by two independent physicians. The association and performance of high glucose level for ACS diagnosis were studied by univariate and multivariate analysis and receiver operator characteristic (ROC) curves. Results: Out of the 672 eligible patients who were recruited, 181 (26.9%) had a confirmed non-ST elevation ACS. The independent factors associated with a diagnosis of ACS were age, previous coronary artery disease, hyperlipidaemia, smoking status and glucose level >140mg/dl (OR 1.98 95% CI 1.14 to 3.45). In addition to a predictive model that included the usual diagnostic tools for non-ST elevation ACS management, a glucose level >140mg/dl added significant incremental information (p=0.03). However, the addition of blood glucose level >140mg/dl to the conventional diagnostic tool resulted in small increases in the ability to classify ACS, as measured by the c-statistic (0.82, 95% CI 0.79 to 0.85). Conclusion: An initial serum glucose level >140 mg/dl is associated with non-ST elevation ACS in patients admitted to an ED for chest pain but added moderately to conventional tools used for ACS diagnosis.

Guideline 14: ACS


Background- Perishock pauses are pauses in chest compressions before and after defibrillatory shock. We examined the relationship between perishock pauses and survival to hospital discharge. Methods and Results- We included out-of-hospital cardiac arrest patients in the Resuscitation Outcomes Consortium Epistry-Cardiac Arrest who suffered arrest between December 2005 and June 2007, presented with a shockable rhythm (ventricular fibrillation or pulseless ventricular tachycardia), and had cardiopulmonary resuscitation process data for at least 1 shock (n=815). We used multivariable logistic regression to determine the association between survival and perishock pauses. In an analysis adjusted for Utstein predictors of survival, the odds of survival were significantly lower for patients with preshock pause 20 seconds (odds ratio,
0.47; 95% confidence interval, 0.27 to 0.82) and perishock pause ≥40 seconds (odds ratio, 0.54; 95% confidence interval, 0.31 to 0.97) compared with patients with preshock pause <10 seconds and perishock pause <20 seconds. Postshock pause was not independently associated with a significant change in the odds of survival. Log-linear modeling depicted a decrease in survival to hospital discharge of 18% and 14% for every 5-second increase in both preshock and perishock pause interval (up to 40 and 50 seconds, respectively), with no significant association noted with changes in the postshock pause interval. Conclusions- In patients with cardiac arrest presenting in a shockable rhythm, longer perishock and preshock pauses were independently associated with a decrease in survival to hospital discharge. The impact of preshock pause on survival suggests that refinement of automatic defibrillator software and paramedic education to minimize preshock pause delays may have a significant impact on survival.

Guideline 11: Adult ALS

Background: The Fourth National Audit Project of the Royal College of Anaesthetists and Difficult Airway Society (NAP4) was designed to identify and study serious airway complications occurring during anaesthesia, in intensive care unit (ICU) and the emergency department (ED). Methods: Reports of major complications of airway management (death, brain damage, emergency surgical airway, unanticipated ICU admission, prolonged ICU stay) were collected from all National Health Service hospitals over a period of 1 yr. An expert panel reviewed inclusion criteria, outcome, and airway management. Results: A total of 184 events met inclusion criteria: 36 in ICU and 15 in the ED. In ICU, 61% of events led to death or persistent neurological injury, and 31% in the ED. Airway events in ICU and the ED were more likely than those during anaesthesia to occur out-of-hours, be managed by doctors with less anaesthetic experience and lead to permanent harm. Failure to use capnography contributed to 74% of cases of death or persistent neurological injury. Conclusions: At least one in four major airway events in a hospital are likely to occur in ICU or the ED. The outcome of these events is particularly adverse. Analysis of the cases has identified repeated gaps in care that include: poor identification of at-risk patients, poor or incomplete planning, inadequate provision of skilled staff and equipment to manage these events successfully, delayed recognition of events, and failed rescue due to lack of or failure of interpretation of capnography. The project findings suggest avoidable deaths due to airway complications occur in ICU and the ED.

The Emergency Medical Retrieval Service (EMRS) provides an aeromedical retrieval service to remote and rural communities. Most of these facilities are unable to deliver Critical Care Interventions (CCI). CCI are delivered by the EMRS team prior to transfer of the patient to definitive care. This study addresses correlation between total on-scene times (TOST) and level of intervention delivered, and whether there is any variation in TOST between medical and trauma emergencies. Methods: Prospective data were collected on EMRS secondary retrievals over a 5-year period from GP-led facilities. Data were collected on the CCI undertaken by EMRS during TOST prior to transfer of the patient. Interventions undertaken were scored using TISS-76. Correlation was analysed using Spearman's coefficient and differences between groups analysed using Mann Whitney tests. Statistical significance was defined as p<0.01. Results: EMRS retrieved 308 patients suitable for inclusion. Complete data
were available for 97% of patients (n=300). Underlying diagnosis was trauma in 26% (n=72) and medical in 74% (n=228). There was a significant correlation between TOST and TISS-76 for all EMRS patients. Spearman's coefficient of rank correlation was ($\rho_\text{TOST-TISS-76}$)=0.616 with p<0.0001. The median TOST for the medical group was 60 min and for the trauma group 60 min (point estimate for difference 0 min, 95% CI 10 to 10, p=0.951).

Conclusion: This study demonstrates a significant relationship between TOST on-scene by the retrieval team and the level of intervention delivered to patients. The present data do not support the assertion that there is a difference in TOST for medical and trauma patients.

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.

These updated guidelines are for the diagnosis and treatment of stinging insect hypersensitivity. They were developed by the Joint Task Force on Practice Parameters, representing the American Academy of Allergy, Asthma & Immunology (AAAAI); the ACAAI; and the Joint Council of Allergy, Asthma and Immunology.
Guideline 9.2.7: Anaphaxis

Trauma centers use “secondary triage” to determine the necessity of trauma surgeon involvement. A clinical decision rule, which includes penetrating injury, an initial systolic blood pressure less than 100 mm Hg, or an initial pulse rate greater than 100 beats/min, was developed to predict which trauma patients require emergency operative intervention or emergency procedural intervention (cricothyroidotomy or thoracotomy)
in the emergency department. Our goal was to validate this rule in an adult trauma population and to compare it with the American College of Surgeons' major resuscitation criteria. We used Level I trauma center registry data from September 1, 1995, through November 30, 2008. Outcomes were confirmed with blinded abstractors. Sensitivity, specificity, and 95% confidence intervals (CIs) were calculated. Our patient sample included 20,872 individuals. The median Injury Severity Score was 9 (interquartile range 4 to 16), 15.3% of patients had penetrating injuries, 13.5% had a systolic blood pressure less than 100 mm Hg, and 32.5% had a pulse rate greater than 100 beats/min. Emergency operative intervention or procedural intervention was required in 1,099 patients (5.3%; 95% CI 5.0% to 5.6%). The sensitivities and specificities of the rule and the major resuscitation criteria for predicting emergency operative intervention or emergency procedural intervention were 95.6% (95% CI 94.3% to 96.8%) and 56.1% (95% CI 55.4% to 56.8%) and 85.5% (95% CI 83.3% to 87.5%) and 80.9% (95% CI 80.3% to 81.4%), respectively. This new rule was more sensitive for predicting the need for emergency operative intervention or emergency procedural intervention directly compared with the American College of Surgeons' major resuscitation criteria, which may improve the effectiveness and efficiency of trauma triage.

Initial goal directed resuscitation for shock usually includes the administration of intravenous fluids, followed by initiating vasopressors. Despite obvious immediate effects of vasopressors on haemodynamics their effect on patient relevant outcomes remains controversial. This review was originally published in 2004 and was updated in 2011. OBJECTIVES: Our primary objective was to assess whether particular vasopressors reduce overall mortality, morbidity, and health-related quality of life. SEARCH STRATEGY: We searched the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2010, Issue 2), MEDLINE, EMBASE, PASCAL BioMed, CINAHL, BIOSIS, and PsycINFO (from inception to March 2010). The original search was performed in November 2003. We also asked experts in the field and searched meta-registries for ongoing trials. SELECTION CRITERIA: Randomized controlled trials comparing various vasopressor regimens for hypotensive shock. DATA COLLECTION AND ANALYSIS: Two authors abstracted data independently. Disagreement between the authors was discussed and resolved with a third author. We used a random-effects model for combining quantitative data. MAIN RESULTS: We identified 23 randomized controlled trials involving 3212 patients, with 1629 mortality outcomes. Six different vasopressors, alone or in combination, were studied in 11 different comparisons. All 23 studies reported mortality outcomes; length of stay was reported in nine studies. Other morbidity outcomes were reported in a variable and heterogeneous way. No data were available on quality of life or anxiety and depression outcomes. We classified 10 studies as being at low risk of bias for the primary outcome mortality; only four studies fulfilled all trial quality items. In summary, there was no difference in mortality in any of the comparisons between different vasopressors or combinations. More arrhythmias were observed in patients treated with dopamine compared to norepinephrine. Norepinephrine versus dopamine, as the largest comparison in 1400 patients from six trials, yielded almost equivalence (RR 0.95, 95% confidence interval 0.87 to 1.03). Vasopressors used as add-on therapy in comparison to placebo were not effective either. These findings were consistent among the few large studies as well as in studies with different levels of within-study bias risk. AUTHORS' CONCLUSIONS: There is some evidence of no difference in mortality between norepinephrine and dopamine. Dopamine appeared to increase the risk for arrhythmia. There is not sufficient evidence of any difference between any of the six vasopressors examined. Probably the choice of vasopressors in patients with shock does not influence the outcome, rather than any vasoactive effect per se.
There is not sufficient evidence that any one of the investigated vasopressors is clearly superior over others.


OBJECTIVE: Investigators in France have developed a risk score to predict death or poor neurologic outcome after out-of-hospital cardiac arrest. The aim of this study is to externally validate this score in an independent patient population in the United States. DESIGN: Retrospective, observational, cohort study. PATIENTS: Patients being admitted to the intensive care unit after out-of-hospital cardiac arrest. SETTING: Two geographically distinct tertiary care hospitals in the United States. INTERVENTIONS: None. MEASUREMENTS AND MAIN RESULTS: The primary end point was poor outcome, defined as either death or a Cerebral Performance Category score of 3-5. The secondary end point was all-cause mortality. Calibration was assessed by comparing the number of expected outcomes based on the logistic model of the French study with observed outcomes within this study using Hosmer-Lemeshow C test (goodness-of-fit). Discrimination was assessed by calculation of the area under the receiver operating characteristic curve. Of a total of 128 patients, 99 (77%) had a poor outcome, including 91 nonsurvivors (71%). The probability of poor neurologic outcome and mortality increased stepwise with increasing out-of-hospital cardiac arrest score. Graphic display of observed against predicted outcomes and goodness-of-fit test indicated good calibration of the score (p = .4). The score showed good discrimination for poor outcome (area under the receiving operating characteristic curve, 0.85; 95% confidence interval, 0.79-0.92) and for mortality (area under the receiving operating characteristic curve, 0.85; 95% confidence interval, 0.78-0.91). In patients with an out-of-hospital cardiac arrest score >40 points and >60 points, the positive predictive value for poor outcome was 97% and 100%, respectively. CONCLUSIONS: This study found good calibration and high discrimination of the out-of-hospital cardiac arrest score in two geographically distinct patient populations in the United States. Particularly, this score had a high positive predictive value and performed well in identifying high-risk patients for poor outcomes.


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 etiology 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.


Background: High sensitivity troponin T (hsTnT) detects lower levels of troponin T with greater precision than the 4th generation (cTnT) assay. However, the clinical implications of this are uncertain. Objectives: Primary: Describe the proportion of patients who test ‘positive’ with hsTnT but negative with cTnT. Secondary: Determine proportion in each group with an adverse event (representation, AMI or died) within 90 days of the index test. Method: 161 patients samples were tested with cTnT and hsTnT assays. McNemar’s test was used to compare paired samples. Electronic medical records were reviewed, with discharge diagnosis and 90 day outcomes determined blind to hsTnT results. Patients were then classified as ‘TnT negative’ (hsTnT was <0.014 mcg/mL), ‘new positive’ (hsTnT was ≥0.014 mcg/mL and cTnT <0.03 mcg/mL) and ‘TnT positive’ (cTnT was ≥0.03 mcg/mL). Results: Positive results more than doubled with the hsTnT assay (50% vs 22%, P < 0.001). 81 patients were ‘TnT negative’, 44 were ‘new positive’ and 36 ‘cTnT positive’. The discharge diagnosis for ‘new positives’ was AMI in 4 (9%), other cardiac in 13 (30%) and non-cardiac in 27 (61%). At 90 days adverse events occurred in 30%, 54% and 50% of the groups respectively. There were no late cases of AMI or cardiovascular death in ‘new positive’ patients. Conclusion: Many patients with diagnoses other than AMI will have hsTnT above the reference level. Indiscriminate testing with hsTnT might lead to more patients requiring serial troponin testing and/or invasive further tests, which will have process and resource implications for EDs and health services.

Guideline 14: ACS


BACKGROUND: Effectiveness of cooling and adverse events (AEs) involving skin have not been intensively evaluated in cardiac arrest survivors treated with therapeutic hypothermia (TH) when induced and maintained with a servomechanism-regulated surface cooling system. METHODS: Retrospective review of sixty-nine cardiac arrest survivor-events admitted from April 2006-September 2008 who underwent TH using the Medivance Arctic Sun Temperature Management System. A TH database and medical records were reviewed, and nursing interviews conducted. Primary endpoint was time from initiation to target temperature (TT; 32-34 C). Secondary endpoints were cooling rate, percentage of hypothermia maintenance phase at TT, effect of body-mass index (BMI) on rate of cooling, and AEs. RESULTS: Mean time to the target temperature (TT) was 2.78 h; 80% of patients achieved TT within 4 h; all did within 8 h. Patients were at TT for 96.7% of hypothermia maintenance; 17% of patients had >1 hourly temperature measurement outside TT range. Mean cooling rate during induction phase was 1.1 C/h, and was not associated with BMI. Minor skin injury occurred in 14 (20%) patients; 4 (6%) were device-related. Skin injuries were associated with shock (P = 0.04), and decubitus ulcers were associated with left ventricular ejection fraction <45% (P = 0.004). AEs included shivering (94%), hypokalemia (81%), hyperglycemia (57%), pneumonia (23%), bleeding (22%), post-cooling fever (17%), and bacteremia (9%). CONCLUSIONS:
The Arctic Sun Temperature Management System was an effective means of performing therapeutic hypothermia after cardiac arrest. Infrequent skin injuries were associated with vasopressor use and low ejection fraction.

**Guideline 11.8: Therapeutic hypothermia after cardiac arrest**


**Objective:** To describe in-hospital resuscitation outcomes and factors associated with survival at Auckland City Hospital, New Zealand. **Methods:** The Utstein template for in-hospital cardiac arrests was used. A retrospective audit of all cardiac arrests 2004–20 determined patient demographics, resuscitation time intervals, interventions, survival and neurological outcome at 12 months. Factors associated with survival to discharge were explored with logistic regression. **Results:** There were 3470 in-hospital deaths. Resuscitation was attempted in 415 patients (12%), with survival to discharge 27.2%. Survival was higher in first rhythm VT/VF (52.7% vs 13.1%, \( \chi^2 = 75.3, P < 0.001 \)), when the arrest was ‘In-Hours’ (41.4% vs 17%, \( \chi^2 = 30.1, P < 0.001 \)) and with younger age (mean [SD] for survivors 59.4 [7.1] vs 69.1 [14] for non-survivors). These associations were independent predictors of survival after multivariate logistic regression, with OR 6.2 (95% CI 3.6–10.5), 3.1 (95% CI 1.8–5.4) and 1.04 (95% CI 1.02–1.06), respectively (all \( P < 0.001 \)). Other univariate predictors of survival; cardiac arrest team on site, monitored arrest and time to CPR were not significant after multivariate logistic regression. **Conclusions:** Survival from cardiac arrest in our hospital compared well to similar centres and good neurological outcome was higher than reported previously. Reduced survival during the ‘After-Hours’ period is cause for concern, and further research into the factors underlying this is required.


We determine whether aerosolized intranasal or buccal midazolam reduces the distress of pediatric laceration repair compared with oral midazolam. Children aged 0.5 to 7 years and needing nonparenteral sedation for laceration repair were randomized to receive oral, aerosolized intranasal, or aerosolized buccal midazolam. Patient distress was rated by blinded review of videotapes, using the Children's Hospital of Eastern Ontario Pain Score. Secondary outcomes included activity scores, sedation adequacy, sedation onset, satisfaction, and adverse events. For the 169 subjects (median age 3.1 years) evaluated for the primary outcome, we found significantly less distress in the buccal midazolam group compared with the oral route group (\( P = .04; \) difference \(-2; \) 95% confidence interval \(-4 to 0)\) and a corresponding nonsignificant trend for the intranasal route (\( P = .08; \) difference \(-1\); 95% confidence interval \(-3 to 1)\). Secondary outcomes (177 subjects) favored the intranasal group, including a greater proportion of patients with an optimal activity score (74%), a greater proportion of parents wanting this sedation in the future, and faster sedation onset. Intranasal was the route least tolerated at administration. Adverse events were similar between groups. When comparing the administration of midazolam by 3 routes to facilitate pediatric laceration repair, we observed slightly less distress in the aerosolized buccal group. The intranasal route demonstrated a greater proportion of patients with optimal activity scores, greater proportions of parents wanting similar sedation in the future, and faster onset but was also the most poorly tolerated at administration. Aerosolized buccal or intranasal midazolam represents an effective and useful alternative to oral midazolam for sedation for laceration repair.

As hospital crowding has increased, more patients have ended up boarding in the emergency department (ED) awaiting their inpatient beds. To the best of our knowledge, no study has compared the quality of care of boarded and nonboarded patients. Objectives: This study sought to examine whether being a boarded patient and boarding longer were associated with more delays, medication errors, and adverse events among ED patients admitted with chest pain, pneumonia, or cellulitis. Methods: This study was a retrospective cohort design in which data collection was accomplished via medical record review from two urban teaching hospitals. Patients admitted with chest pain, pneumonia, or cellulitis between August 2004 and January 2005 were eligible for inclusion. Our outcomes measures were: 1) delays in administration of home medications, cardiac enzyme tests, partial thromboplastin time (PTT), and antibiotics; 2) medication errors; and 3) adverse events or near misses. Primary independent variables were boarded status, boarding time, and boarded time interval. Multiple logistic regression models controlling for patient, ED, and hospital characteristics were used. Results: A total of 1,431 patient charts were included: 811 with chest pain, 387 with pneumonia, and 233 with cellulitis. Boarding time was associated with an increased odds of home medication delays (adjusted odds ratio [AOR] = 1.07, 95% confidence interval [CI] = 1.05 to 1.10), as were boarded time intervals of 12, 18, and 24 hours. Boarding time also was associated with lower odds of having a late cardiac enzyme test (AOR = 0.93, 95% CI = 0.88 to 0.97). Conclusions: Boarding was associated with home medication delays, but fewer cardiac enzyme test delays. Boarding was not associated with delayed PTT checks, antibiotic administration, medication errors, or adverse events/near misses. These findings likely reflect the inherent resources of the ED and the inpatient units.


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.

Objectives: Infectious complications are frequently reported in critically ill patients, especially after cardiac arrest. Recent and widespread use of therapeutic hypothermia has raised concerns about increased septic complications, but no specific reappraisal has been performed. We investigated the infectious complications in cardiac arrest survivors and assessed their impact on morbidity and long-term outcome. Design: Retrospective review of a prospectively acquired intensive care unit database. Setting: A 24-bed medical intensive care unit in a French university hospital. Patients: Between March 2004 and March 2008, consecutive patients admitted for management of resuscitated out-of-hospital cardiac arrest were considered. Patients dying within 24 hrs were excluded. All patients’ files were reviewed to assess the development of infection. Interventions: None. Measurements and Main Results: Of the 537 patients admitted after cardiac arrest, 421 were included and 281 patients (67%) presented 373 infectious complications. Pneumonia was the most frequent (318 episodes), followed by bloodstream infections (35 episodes) and catheter-related infections (11 episodes). When grouped together, Gram-negative bacteria were the most frequently isolated infectious germs (64%), but the main pathogen detected was Staphylococcus aureus (57 occurrences). Both application itself (83 vs. 73%; p = .02) and duration (1244 vs. 1176 mins; p = .05) of therapeutic hypothermia were significantly more frequent in infected patients. Infection was associated with increased mechanical ventilation duration (6 [2-9] vs. 3 [2-5.5] days; p < .001) and intensive care unit length of stay (7 [4-10] vs. 3 [2-7] days; p < .001). Nonetheless, there was no impact on intensive care unit mortality (174 [62%] vs. 92 [66%] patients; p = .45) or on favorable neurologic outcome (cerebral performance category 1-2, 102 [36%] vs. 47 [34%] patients; p = .58). Conclusions: Infectious complications are frequent after cardiac arrest and may be even more frequent after therapeutic hypothermia. Despite increase in care costs, long-term and clinically relevant outcomes do not seem to be impaired. This should not discourage the use of therapeutic hypothermia in cardiac arrest survivors.

Guideline 11.8: Therapeutic hypothermia after cardiac arrest


Background: The decision-making processes used for out-of-hospital trauma triage and hospital selection in regionalized trauma systems remain poorly understood. The objective of this study was to assess the process of field triage decision making in an established trauma system. Methods: We used a mixed methods approach, including emergency medical services (EMS) records to quantify triage decisions and reasons for hospital selection in a population-based, injury cohort (2006-2008), plus a focused ethnography to understand EMS cognitive reasoning in making triage decisions. The study included 10 EMS agencies providing service to a four-county regional trauma system with three trauma centers and 13 nontrauma hospitals. For qualitative analyses, we conducted field observation and interviews with 35 EMS field providers and a round table discussion with 40 EMS management personnel to generate an empirical model of out-of-hospital decision making in trauma triage. Results: A total of 64,190 injured patients were evaluated by EMS, of whom 56,444 (88.0%) were transported to acute care hospitals and 9,637 (17.1% of transports) were field trauma activations. For nontrauma activations, patient/family preference and proximity accounted for 78% of destination decisions. EMS provider judgment was cited in 36% of field trauma activations and was the sole criterion in 23% of trauma patients. The empirical model demonstrated that trauma triage is driven primarily by EMS provider “gut feeling” (judgment) and relies heavily on provider experience, mechanism of injury, and early visual cues at the scene. Conclusions: Provider cognitive reasoning for field trauma triage is more heuristic than algorithmic and driven primarily by provider judgment, rather than specific triage criteria.

Background and Purpose: Individuals with stroke-like symptoms are recommended to receive rapid diagnostic evaluation. Emergency medical services (EMS) transport, compared with private modes, and hospital notification before arrival may reduce delays in evaluation. This study estimated associations between hospital arrival modes (EMS or private and with or without EMS prenotification) and times for completion and interpretation of initial brain imaging in patients with presumed stroke. Methods: Among patients with suspected stroke identified and enrolled by the North Carolina Stroke Care Collaborative registry in 2008 to 2009, we analyzed data on arrival modes, meeting recommended targets for brain imaging completion and interpretation times (<25 minutes and <45 minutes since hospital arrival, respectively) and patient- and hospital-level characteristics. We used modified Poisson regression to estimate adjusted risk ratios and 95% CIs. Results: Of 13,894 eligible patients, 21% had their brain imaging completed and 23% had their brain imaging interpreted by a physician within target times. Arrival by EMS (versus private transport) was associated with both brain imaging completed within 25 minutes of arrival (EMS with prenotification: risk ratio, 3.0; 95% CI, 2.1 to 4.1; EMS without prenotification: risk ratio, 1.9; 95% CI, 1.6 to 2.3) and brain imaging interpreted within 45 minutes (EMS with prenotification: risk ratio, 2.7; 95% CI, 2.3 to 3.3; EMS without prenotification: risk ratio, 1.7; 95% CI, 1.4 to 2.1). Conclusions: Patients with presumed stroke arriving to the hospital by EMS were more likely to receive brain imaging and have it interpreted by a physician in a timely manner than those arriving by private transport. Moreover, EMS arrivals with hospital prenotification experienced the most rapid evaluation.


Aim of the document: Palpitations are among the most common symptoms that prompt patients to consult general practitioners, cardiologists, or emergency healthcare services. Very often, however, the diagnostic and therapeutic management of this symptom proves to be poorly efficacious and somewhat frustrating for both the patient and the physician. Indeed, in many cases a definitive, or at least probable, diagnosis of the cause of palpitations is not reached and no specific therapy is initiated. This means that many patients continue to suffer recurrences of their symptoms, which impair their quality of life and mental balance, lead to the potential risk of adverse clinical events, and induce continual recourse to healthcare facilities. These difficulties stem from the fact that palpitations are generally a transitory symptom. Indeed, at the moment of clinical evaluation, the patient is often asymptomatic and the diagnostic evaluation focuses on the search for pathological conditions that may be responsible for the symptom. This gives rise to some uncertainty in establishing a cause–effect relationship between any anomalies that may be detected and the palpitations themselves. Moreover, as palpitations may be caused by a wide range of different physiological and pathological conditions, clinicians tend to apply a number of instrumental investigations, laboratory tests, and specialist examinations, which are both time-consuming and costly. Comparable, for example, to syncope, such an approach is warranted in selected patients, whereas other patients with palpitations may not require such careful follow-up. The initial clinical assessment should, therefore, include an educated estimation of the likelihood of a relevant underlying arrhythmia in a patient with palpitations (‘gatekeeper’ function). The current management of patients with palpitations is guided chiefly by the clinical experience of the physician. Indeed, the literature lacks specific policy documents or recommendations regarding the most appropriate diagnostic work-up to be adopted in individual patients. The aim of this article is to propose expert advice for diagnostic evaluation in order to guide optimal management of patients with palpitations.

Objectives: Previous reports on emergency medical services (EMS) transportation of pediatric patients have demonstrated a high rate of overutilization. However, there is also a concern that pediatric patients may underutilize EMS for emergencies that might benefit from EMS. This article compares EMS utilization rate between adult and pediatric patients for high-acuity patients and for the most common reasons for transport.

Methods: This study was a secondary analysis of the National Hospital Ambulatory Medical Care Survey to compare hospital arrival by EMS to walk-in arrivals. Primary variables were age category, mode of arrival, immediacy to be seen (triage category), reason for visit, and disposition.

Results: There were 253,898 records, weighted to represent 914.4 million emergency department visits, included. Emergency medical services mode of arrival was significantly higher for adult patients at 19.1% as compared with pediatric patients at 6.5% (odds ratio, 3.38). For the subgroup of patients requiring critical care interventions, adult patient arrival by EMS was 87.3% as compared with pediatric patients at 66.3% (odds ratio, 3.50). When considering the top 20 most common medical complaints in which pediatric patients used EMS transport, adult patients utilized EMS more frequently in 85% (17/20) of those complaints.

Conclusions: As compared with adults, pediatric patients are less likely to utilize EMS for transport to the hospital for both routine and emergent complaints. The definition of inappropriate utilization of EMS for pediatric transport, which has largely focused on inappropriate overutilization, should also incorporate the potential of underutilization for critical patients.


Snake venom toxins first transit the lymphatic system before entering the bloodstream. Ointment containing a nitric oxide donor, which impedes the intrinsic lymphatic pump, prolonged lymph transit time in rats and humans and also increased rat survival time after injection of venom. This pharmacological approach should give snakebite victims more time to obtain medical care and antivenom treatment. This paper reports on one animal and one human study, both examining the effect of GTN ointment on the slowing of lymphatic transmission of simulated snake venom (in human volunteers) and snake venom (in rats).


Aim: To evaluate the use of prehospital non-invasive ventilation (NIV) in patients with acute exacerbation of chronic obstructive pulmonary disease. Methods: 36 adult patients were treated by prehospital NIV or standard oxygen therapy. Results: Prehospital NIV was described as feasible by the paramedics. Prehospital improvement of respiratory rate and dyspnoea was significantly better and the length of intensive care was significantly lower in NIV patients. Conclusion Prehospital NIV can be managed by a trained emergency team with high but sustainable workload. Dyspnoea and length of intensive care may be significantly reduced.


Context: Ambulance diversion, a practice in which emergency departments (EDs) are temporarily closed to ambulance traffic, might be
problematic for patients experiencing time-sensitive conditions, such as acute myocardial infarction (AMI). However, there is little empirical evidence to show whether diversion is associated with worse patient outcomes. **Objective** To analyze whether temporary ED closure on the day a patient experiences AMI, as measured by ambulance diversion hours of the nearest ED, is associated with increased mortality rates among patients with AMI. **Design, Study, and Participants:** A case-crossover design of 13,860 Medicare patients with AMI from 508 zip codes within 4 California counties (Los Angeles, San Francisco, San Mateo, and Santa Clara) whose admission date was between 2000 and 2005. Data included 100% Medicare claims data that covered admissions between 2000 and 2005, linked with date of death until 2006, and daily ambulance diversion logs from the same 4 counties. Among the hospital universe, 149 EDs were identified as the nearest ED to these patients. **Main Outcome Measures:** The percentage of patients with AMI who died within 7 days, 30 days, 90 days, 9 months, and 1 year from admission (when their nearest ED was not on diversion and when that same ED was exposed to <6, 6 to <12, and >12 hours of diversion out of 24 hours on the day of admission). **Results:** Between 2000 and 2006, the mean (SD) daily diversion duration was 7.9 (6.1) hours. Based on analysis of 11,625 patients admitted to the ED between 2000 and 2005, and whose nearest ED had at least 3 diversion exposure levels (3541, 3357, 2667, and 2060 patients for no exposure, exposure to <6, 6 to <12, and >12 hours of diversion, respectively), there were no statistically significant differences in mortality rates between no diversion and exposure to less than 12 hours of diversion. Exposure to 12 or more hours of diversion was associated with higher 30-day mortality vs no diversion status (unadjusted mortality rate, 392 patients [19%] vs 545 patients [15%]; regression adjusted difference, 2.89 percentage points; 95% confidence interval [CI], 0.60-5.88); higher 90-day mortality (537 patients [26%] vs 762 patients [22%]; 2.89 percentage points; 95% CI, 0.13-5.64); higher 9-month mortality (680 patients [33%] vs 980 patients [28%]; 2.93 percentage points; 95% CI, 0.15-5.71); and higher 1-year mortality (731 patients [35%] vs 1034 patients [29%]; 3.04 percentage points; 95% CI, 0.33-5.75). **Conclusion:** Among Medicare patients with AMI in 4 populous California counties, exposure to at least 12 hours of diversion by the nearest ED was associated with increased 30-day, 90-day, 9-month, and 1-year mortality.

28. Shields BJ, Pollack-Nelson C and Smith GA. *Pediatric Submersion Events in Portable Above-Ground Pools in the United States, 2001–2009*. Pediatrics 2011; Online first (20 June): Objective: The goal of this study was to describe the epidemiology of pediatric submersion events occurring in portable pools in the United States. **Methods:** A retrospective analysis of fatal and nonfatal submersion events involving children younger than 12 years in portable pools was conducted using injury and fatality data compiled by the US Consumer Product Safety Commission from 2001 through 2009. **Results:** There were 209 fatal and 35 nonfatal submersion cases reported to the commission from 2001 through 2009. The majority (94%) involved children younger than 5 years, 56% involved boys, 73% occurred in the child's own yard, and 81% occurred during the summer months. The number of submersion events increased rapidly from 2001 to 2005 and then leveled off from 2005 to 2009. **Conclusions:** The use of portable pools in residential settings poses a significant risk of submersion-related morbidity and mortality to children, especially in the <5-year-old age group. No single strategy will prevent all submersion deaths and injuries; therefore, layers of protection are recommended. Industry is advised to engage in development of protective devices that are effective and affordable for portable pools, including isolation fencing, pool alarms, and safety covers. A strong and pervasive consumer education campaign is needed to make consumers aware of the dangers of portable pools, because these small, inexpensive, consumer-installed pools may not generate the same sense of risk as an in-ground pool.

29. Simpson PM and Bendall JC. *Prehospital non-invasive ventilation for acute cardiogenic pulmonary oedema: an evidence-based*
Background: Non-invasive ventilation (NIV) is increasingly being implemented by many ambulance jurisdictions as a standard of care in the out-of-hospital management of acute cardiogenic pulmonary oedema (ACPO). This implementation appears to be based on the body of evidence from the emergency department (ED) setting, with the assumption that earlier administration by paramedics would give benefits with regard to inhospital mortality and the rate of endotracheal intubation beyond those seen when initiated in the ED. This paper sought to identify and review the current level of evidence supporting NIV in the prehospital setting.

Methods: Electronic searches of Medline, EMBASE, CINAHL, Cochrane Database of Systematic Reviews and Cochrane Database of Controlled Trials were conducted and reference lists of relevant articles were hand searched. Results: The search identified 12 primary studies documenting the use of NIV, either continuous positive airway pressure or bi-level non-invasive ventilation, for ACPO in the out-of-hospital setting. Only three studies were randomised controlled trials, with none addressing inhospital mortality as a primary outcome measure. The majority of articles were non-comparative descriptive studies.

Conclusion: Early prehospital NIV appears to be a safe and feasible therapy that results in faster improvement in physiological status and may decrease the need for intubation when compared with delayed administration in the ED. There is weak evidence that it may decrease mortality. The cost versus benefit equation of system-wide prehospital implementation of NIV is unclear and, based on the current evidence, should be considered with caution.

Morphine and fentanyl are both frequently used in prehospital trauma patients, but due to limited formulary size, we sought to study whether both drugs should be included. The purpose of this study was to evaluate the effectiveness and safety of fentanyl as compared to morphine for patients requiring analgesic medications for a traumatic injury during transport via a physician-staffed air medical service. Trauma patients were grouped by even and odd days (even - morphine 4 mg, odd - fentanyl 50 μg). Patients were excluded based on age (< 18 or > 64 years), hypotension, inability to communicate a pain score (intubated), or known allergy to the study drugs. During the flight, medical crew assessed numeric pain score, vital signs, and incidence of pruritus or nausea. There were 103 patients enrolled in the morphine arm and 97 patients in the fentanyl arm. The mean pain score at the beginning of enrollment was 8.0 ± 2.0 in the morphine arm and 8.0 ± 1.8 in the fentanyl arm. The mean final pain score was 5.8 ± 2.7 in the morphine arm and 5.5 ± 2.4 in the fentanyl arm (n.s. by either t-test or non-parametric testing). There was no significant difference in analgesia between fentanyl and morphine. There were no significant differences in the incidence of pruritus or vomiting between the two groups. Average transport time was 37 ± 8 min in the morphine group, and 43 ± 11 min in the fentanyl group. Average number of morphine doses was 3 ± 1.2. For fentanyl, average number of doses was 3 ± 1.3. In our study, there was not a significant difference in analgesic effectiveness between morphine and fentanyl. There was no significant difference in the incidence of adverse effects between the two drugs. Our study suggests that either drug can be used safely with equivalent effectiveness.

31. Stub D, Smith K, Bray JE, Bernard S, Duffy SJ and Kaye DM. Hospital characteristics are associated with patient outcomes following out-of-hospital cardiac arrest. Heart 2011; Online first (June 23)
Post-resuscitation care may influence outcome following transport to hospital after resuscitation from out-of-hospital cardiac arrest (OHCA). This
study aimed to determine whether receiving hospital characteristics such as 24-h cardiac catheterisation services, total bed number or OHCA patient volume influence the rate of survival. Setting: Data were analysed from the Victorian Ambulance Cardiac Arrest Registry of patients from January 2003 to March 2010 who were transported to hospital with return of spontaneous circulation (ROSC) after OHCA. Results: Ambulance paramedics attended 9971 patients with OHCA of suspected cardiac cause during the study period. Of these, 2902 (29%) achieved ROSC and were transported to one of 70 hospitals. 1816 (63%) were treated at hospitals with 24-h cardiac interventional services. After adjusting for differences in baseline characteristics, hospital factors significantly associated with survival were treatment at hospitals with 24-h cardiac interventional services (OR 1.40; 95% CI 1.12 to 1.74, p=0.003) and patient reception between 08:00 and 17:00 hours (OR 1.34; 95% CI 1.10 to 1.64, p=0.004). OHCA patient volume and total hospital bed number were not independently associated with outcome. Conclusion: Hospital characteristics are associated with improved survival in patients with OHCA. This finding has implications for the establishment of regionalised systems of care for patients who have been resuscitated from OHCA.


BACKGROUND: Accidental hypothermia increases mortality and morbidity in trauma patients. Various methods for insulating and wrapping hypothermic patients are used worldwide. The aim of this study was to compare the thermal insulating effects and comfort of bubble wrap, ambulance blankets / quilts, and Hibler's method, a low-cost method combining a plastic outer layer with an insulating layer. METHODS: Eight volunteers were dressed in moistened clothing, exposed to a cold and windy environment then wrapped using one of the three different insulation methods in random order on three different days. They were rested quietly on their back for 60 minutes in a cold climatic chamber. Skin temperature, rectal temperature, oxygen consumption were measured, and metabolic heat production was calculated. A questionnaire was used for a subjective evaluation of comfort, thermal sensation, and shivering. RESULTS: Skin temperature was significantly higher 15 minutes after wrapping using Hibler's method compared with wrapping with ambulance blankets / quilts or bubble wrap. There were no differences in core temperature between the three insulating methods. The subjects reported more shivering, they felt colder, were more uncomfortable, and had an increased heat production when using bubble wrap compared with the other two methods. Hibler's method was the volunteers preferred method for preventing hypothermia. Bubble wrap was the least effective insulating method, and seemed to require significantly higher heat production to compensate for increased heat loss. CONCLUSIONS: This study demonstrated that a combination of vapour tight layer and an additional dry insulating layer (Hibler's method) is the most efficient wrapping method to prevent heat loss, as shown by increased skin temperatures, lower metabolic rate and better thermal comfort. This should then be the method of choice when wrapping a wet patient at risk of developing hypothermia in prehospital environments.

33. Wang TY, Nallamothu BK, Krumholz HM, Li S, et al. Association of Door-In to Door-Out Time With Reperfusion Delays and
Outcomes Among Patients Transferred for Primary Percutaneous Coronary Intervention. JAMA 2011; 305 (24): 2540-7

Patients with ST-elevation myocardial infarction (STEMI) requiring interhospital transfer for primary percutaneous coronary intervention (PCI) often have prolonged overall door-to-balloon (DTB) times from first hospital presentation to second hospital PCI. Door-in to door-out (DIDO) time, defined as the duration of time from arrival to discharge at the first or STEMI referral hospital, is a new clinical performance measure, and a DIDO time of 30 minutes or less is recommended to expedite reperfusion care. Objective: To characterize time to reperfusion and patient outcomes associated with a DIDO time of 30 minutes or less. Design, Setting, and Patients: Retrospective cohort of 14 821 patients with STEMI transferred to 298 STEMI receiving centers for primary PCI in the ACTION Registry–Get With the Guidelines between January 2007 and March 2010. Main Outcome Measures Factors associated with a DIDO time greater than 30 minutes, overall DTB times, and risk-adjusted in-hospital mortality. Results: Median DIDO time was 68 minutes (interquartile range, 43-120 minutes), and only 1627 patients (11%) had DIDO times of 30 minutes or less. Significant factors associated with a DIDO time greater than 30 minutes included older age, female sex, off-hours presentation, and non-emergency medical services transport to the first hospital. Patients with a DIDO time of 30 minutes or less were significantly more likely to have an overall DTB time of 90 minutes or less compared with patients with DIDO times greater than 30 minutes (60% [95% confidence interval (CI), 57%-62%] vs 13% [95% CI, 12%-13%]; P < .001). Among patients with DIDO times greater than 30 minutes, only 0.6% (95% CI, 0.5%-0.8%) had an absolute contraindication to fibrinolysis. Observed in-hospital mortality was significantly higher among patients with DIDO times greater than 30 minutes vs patients with DIDO times of 30 minutes or less (5.9% [95% CI, 5.5%-6.3%] vs 2.7% [95% CI, 1.9%-3.5%]; P < .001; adjusted odds ratio for in-hospital mortality, 1.56 [95% CI, 1.15-2.12]). Conclusion: A DIDO time of 30 minutes or less was observed in only a small proportion of patients transferred for primary PCI but was associated with shorter reperfusion delays and lower in-hospital mortality.

Guideline 14.3: ACS Reperfusion strategy


Objective: To quantify the lagged effects of mean temperature on deaths from cardiovascular diseases in Brisbane, Australia. Design: Polynomial distributed lag models were used to assess the percentage increase in mortality up to 30 days associated with an increase (or decrease) of 1°C above (or below) the threshold temperature. Setting Brisbane, Australia. Patients: 22,805 cardiovascular deaths registered between 1996 and 2004. Main outcome measures: Deaths from cardiovascular diseases. Results The results show a longer lagged effect in cold days and a shorter lagged effect in hot days. For the hot effect, a statistically significant association was observed only for lag 0–1 days. The percentage increase in mortality was found to be 3.7% (95% CI 0.4% to 7.1%) for people aged ≥65 years and 3.5% (95% CI 0.4% to 6.7%) for all ages associated with an increase of 1°C above the threshold temperature of 24°C. For the cold effect, a significant effect of temperature was found for 10–15 lag days. The percentage estimates for older people and all ages were 3.1% (95% CI 0.7% to 5.7%) and 2.8% (95% CI 0.5% to 5.1%), respectively, with a decrease of 1°C below the threshold temperature of 24°C. Conclusions: The lagged effects lasted longer for cold temperatures but were apparently shorter for hot temperatures. There was no substantial difference in the lag effect of temperature on mortality between all ages and those aged ≥65 years in Brisbane, Australia.

**PURPOSE OF REVIEW:** Summary estimates indicate that bystander cardiopulmonary resuscitation (CPR) can improve the chances of out-of-hospital cardiac arrest survival two-fold to three-fold. And yet, only a minority of arrest victims receive bystander CPR. This summary will review the challenges and approaches to achieve early and effective bystander CPR. **RECENT FINDINGS:** Given the host of barriers, a successful strategy to improve bystander CPR must enable more timely and comprehensive arrest identification, encourage and empower bystanders to act, and help assure effective CPR. Arrest identification can be simplified so that bystanders should start CPR when a person is unconscious and not breathing normally. Evidence from observational studies and interventional trials supports the effectiveness of chest compression-only CPR for bystanders. As a consequence, the emphasis of bystander CPR training has been modified to feature and assure chest compressions. Bystanders should initiate CPR with compressions and consider the addition of rescue breathing based on their CPR training and skills as well as special circumstances of the victim. Bystander CPR training has evolved to incorporate this emphasis. Although general community-level CPR training remains a cornerstone strategy, training directed to those most likely to witness an arrest also has a useful role. In particular, 'just-in-time' dispatcher-assisted CPR instruction can increase bystander CPR and improve the likelihood of survival. **SUMMARY:** Recent developments in bystander CPR have simplified arrest recognition and improved CPR training, while retaining CPR effectiveness. The goal of these developments is to increase and improve bystander CPR and in turn improve resuscitation.


Despite substantial efforts to make cardiopulmonary resuscitation (CPR) algorithms known to healthcare workers, the outcome of CPR has remained poor during the past decades. Resuscitation teams often deviate from algorithms of CPR. Emerging evidence suggests that in addition to technical skills of individual rescuers, human factors such as teamwork and leadership affect adherence to algorithms and hence the outcome of CPR. This review describes the state of the science linking team interactions to the performance of CPR. Because logistical barriers make controlled measurement of team interaction in the earliest moments of real-life resuscitations challenging, our review focuses mainly on high-fidelity human simulator studies. This technique allows in-depth investigation of complex human interactions using precise and reproducible methods. It also removes variability in the clinical parameters of resuscitation, thus letting researchers study human factors and team interactions without confounding by clinical variability from resuscitation to resuscitation. Research has shown that a prolonged process of team building and poor leadership behavior are associated with significant shortcomings in CPR. Teamwork and leadership training have been shown to improve subsequent team performance during resuscitation and have recently been included in guidelines for advanced life support courses. We propose that further studies on the effects of team interactions on performance of complex medical emergency interventions such as resuscitation are needed. Future efforts to better understand the influence of team factors (e.g., team member status, team hierarchy, handling of human errors), individual factors (e.g., sex differences, perceived stress), and external factors (e.g., equipment, algorithms, institutional characteristics) on team performance in resuscitation situations are critical to improve CPR performance and medical outcomes of patients.

PURPOSE OF REVIEW: Reversal of tissue hypoxia, particularly in the heart and brain, is a fundamental goal of cardiopulmonary resuscitation. However, a growing body of evidence suggests that hyperoxia, especially after return of spontaneous circulation (ROSC), may worsen outcomes. The purpose of this review is to describe the current evidence supporting the concept of controlled oxygenation during and after cardiac arrest.

RECENT FINDINGS: Animal studies over the last two decades have built a compelling case that arterial hyperoxemia during the first hour after ROSC causes increased oxidative damage, increased neuronal death, and worse neurologic function. However, human data are limited. The only prospective randomized clinical trial comparing different inspired oxygen concentrations in post-cardiac arrest patients was underpowered to detect a difference in survival or neurologic outcome. More recently a retrospective analysis of data from a multicenter registry found that initial arterial hyperoxemia (paO2 >= 300 mmHg) was associated with increased mortality and worse functional outcome in patients admitted to the ICU after cardiac arrest. The existing evidence, though limited, has contributed to new guidelines for oxygen therapy in patients resuscitated from cardiac arrest. SUMMARY: The benefit of supplemental oxygen during cardiopulmonary resuscitation remains uncertain. However, in patients who achieve ROSC after cardiac arrest, available evidence supports adjusting inspired oxygen content to avoid arterial hyperoxemia while providing adequate arterial oxyhemoglobin saturation. This strategy is likely to be most effective when initiated as soon as possible after ROSC and appears to be most important during the first hour. Definitive clinical trials are needed to determine the ultimate impact on outcome.


PURPOSE OF REVIEW: Therapeutic hypothermia and aggressive management of postresuscitation disease considerably improved outcome after adult cardiac arrest over the past decade. However, therapeutic hypothermia alters prognostic accuracy. Parameters for outcome prediction, validated by the American Academy of Neurology before the introduction of therapeutic hypothermia, need further update. RECENT FINDINGS: Therapeutic hypothermia delays the recovery of motor responses and may render clinical evaluation unreliable. Additional modalities are required to predict prognosis after cardiac arrest and therapeutic hypothermia. Electroencephalography (EEG) can be performed during therapeutic hypothermia or shortly thereafter; continuous/reactive EEG background strongly predicts good recovery from cardiac arrest. On the contrary, unreactive/spontaneous burst-suppression EEG pattern, together with absent N20 on somatosensory evoked potentials (SSEP), is almost 100% predictive of irreversible coma. Therapeutic hypothermia alters the predictive value of serum markers of brain injury [neuron-specific enolase (NSE), S-100B]. Good recovery can occur despite NSE levels >33 g/l, thus this cut-off value should not be used to guide therapy. Diffusion MRI may help predicting long-term neurological sequelae of hypoxic-ischemic encephalopathy. SUMMARY: Awakening from postanoxic coma is increasingly observed, despite early absence of motor signs and frank elevation of serum markers of brain injury. A new multimodal approach to prognostication is therefore required, which may particularly improve early prediction of favorable clinical evolution after cardiac arrest.

*Guideline 11.8: Therapeutic hypothermia after cardiac arrest*


PURPOSE OF REVIEW: This review discusses recent data relating to delivering high-quality cardiopulmonary resuscitation (CPR) to patients with in-hospital cardiac arrest. RECENT FINDINGS: Delivering high-quality CPR requires interventions at a national, local, team and individual
rescuer level. These include measuring patient outcomes, patient safety incident reporting, education, an increased emphasis on human factors, briefing and debriefing of resuscitation teams, and the use of sensing devices that provide real-time prompts or feedback to rescuers during CPR. Data from national registries, patient safety incident reports and mock codes can be used to identify areas for improving practice. Education of staff is essential in both technical and nontechnical resuscitation skills (human factors). Resuscitation team performance can be improved by ensuring teams brief and plan beforehand and also debrief using feedback data collected during resuscitation events. The use of feedback and prompt devices helps improve adherence to guidelines for chest compression quality but data are lacking in terms of showing improved patient outcomes. SUMMARY: Delivering high-quality CPR in-hospital requires a multifaceted approach. Collecting data during arrests and feeding back in real time and post-event during debriefings can be used to improve delivery of high-quality CPR. There are few studies that show improvement in actual patient outcomes (e.g., survival to hospital discharge) with improvements in delivery of high-quality CPR. Recognizing the importance of both technical and nontechnical skills (human factors) to deliver high-quality CPR is essential.


PURPOSE OF REVIEW: Therapeutic hypothermia is widely recommended after cardiac arrest. In this review, we present publications reflecting the current discussion and opinions related to use of therapeutic hypothermia in comatose adult cardiac arrest survivors. RECENT FINDINGS: The clinical outcome benefit of therapeutic hypothermia found in recent effectiveness studies is similar to that found in previous randomized trials. No single cooling method has been shown to be superior in terms of clinical outcomes. Therapeutic hypothermia is easy to perform and lacks severe side effects or complications associated with mortality. Prehospital and intra-arrest cooling are being explored as a way to further improve outcome, although no clear relationship between timing of cooling and outcome has been documented. SUMMARY: Although only proven beneficial for patients with ventricular fibrillation, the majority of centres today use therapeutic hypothermia also for comatose survivors with other initial rhythms. Some controversies still exist; the optimal target temperature, timing and duration of cooling have not yet been defined, and some researchers still think that the concept of therapeutic hypothermia is not satisfactorily proven scientifically. A new randomized study comparing temperature management to 36°C with 33°C is therefore underway.

Guideline 11.8: Therapeutic hypothermia after cardiac arrest

Animal, manikin & cadaver models


Background: International neonatal resuscitation guidelines recommend assessing chest excursion when the heart rate is not improving. However, the accuracy in assessing ‘adequate’ chest excursion lacks objectivity. Aim: It was the aim of this study to test the accuracy in the assessment of ‘adequate’ chest excursion by measuring intra- and inter-observer variability of participants during simulated neonatal resuscitation. Methods: Thirty-seven staff members (8 neonatologists, 8 registrars, 21 nurses) of the Neonatal Intensive Care Unit, Leiden University Medical Center, Leiden, The Netherlands, ventilated 2 different intubated, leak-free manikins at 2 attempts, each with a different
compliance. Blinded to the manometer, participants could change the peak inflation pressure until chest movement was adequate according to their perception. Inflating pressures were recorded. Results: According to the participants, a median (interquartile range) pressure of 18 cm H(2)O (16-22) at the first and 18 cm H(2)O (16-25) at the second attempt were needed to reach adequate chest excursion in the Laerdal manikin. The HAL manikin needed 26 cm H(2)O (19-31) and 24 cm H(2)O (22-33), respectively. The inter-observer coefficient of variance was 30% with the Laerdal manikin at both attempts, and 35 and 40% with the HAL manikin, respectively. The intra-observer coefficient of variance was 15% (8-23) with the Laerdal and 13% (9-20) with the HAL manikin. In both manikins and attempts, no significant differences in pressures and variances of pressures between the 3 groups were found. Conclusion: 'Adequate' chest excursion is a subjective parameter for guidance of appropriate ventilation during neonatal resuscitation.

**Guideline 13: Neonatal resuscitation**


Objective: Post-cardiac-arrest therapeutic hypothermia improves outcomes in comatose cardiac arrest survivors. This study tests the hypothesis that the efficacy of post-cardiac-arrest therapeutic hypothermia is dependent on the onset and duration of therapy. Design: Prospective randomized laboratory investigation. Setting: University research laboratory. Subjects: A total of 268 male Long Evans rats. Interventions: Post-cardiac-arrest therapeutic hypothermia. Measurements and Main Results: Adult male Long Evans rats that achieved return of spontaneous circulation after a 10-min asphyxial cardiac arrest were block randomized to normothermia (37C +/- 1C) or therapeutic hypothermia (33C +/- 1C) initiated 0, 1, 4, or 8 hrs after return of spontaneous circulation and maintained for 24 or 48 hrs. Therapeutic hypothermia initiated 0, 1, 4, and 8 hrs after return of spontaneous circulation resulted in 7-day survival rates of 45%, 36%, 36%, and 14%, respectively, compared to 17% for normothermic controls and survival with good neurologic function rates of 24%, 24%, 19%, and 0%, respectively, compared to 2% for normothermic controls (p < .05 vs. normothermia). These outcomes were not different when therapeutic hypothermia was maintained for 24 vs. 48 hrs. In contrast, hippocampal CA1 pyramidal neuron counts were 53% +/- 27%, 53% +/- 19%, 51% +/- 24%, and 65% +/- 16% of normal, respectively, when therapeutic hypothermia was initiated 0, 1, 4, or 8 hrs after return of spontaneous circulation compared to 9% in normothermic controls (p < .01 vs. normothermia). Furthermore, surviving neuron counts were greater when therapeutic hypothermia was maintained for 48 hrs compared to 24 hrs (68% +/- 15% vs. 42% +/- 22%, p < .0001). Conclusions: In this study, post-cardiac-arrest therapeutic hypothermia resulted in comparable improvement of survival and survival with good neurologic function when initiated within 4 hrs after return of spontaneous circulation. However, histologic assessment of neuronal survival revealed a potentially broader therapeutic window and greater neuroprotection when therapeutic hypothermia was maintained for 48 vs. 24 hrs.

**Guideline 11.8: Therapeutic hypothermia after cardiac arrest**


Unrecognized dislodgement of an endotracheal tube (ETT) during the transport of an intubated patient can have life-threatening consequences. Standard methods to monitor these patients, such as pulse oximetry and physical examination, are both subject to inaccuracies with patient movement and ambient noise. Capnography provides a continuous and objective measure of ventilation that can alert a provider immediately to
The objective of this study was to determine through simulation if capnography decreases time to correction of dislodged ETTs during the transport of intubated patients, in comparison to standard monitoring. Methods: Paramedics and paramedic students were randomized as to whether or not they had capnography available to them in addition to standard monitoring during a simulated scenario. In the scenario, subjects monitored an intubated baby who subsequently experienced a dislodgement of the ETT during interfacility transport. Time to correction of the ETT dislodgement was the primary outcome. The secondary outcome was correction of dislodgement prior to decline in pulse oximetry. Results: Fifty-three subjects were enrolled in the study, with complete data on 50 subjects. Median time to correction of ETT dislodgement was 2.02 minutes (95% confidence interval [CI] = 1.22 to 4.12 minutes) for the capnography group versus 4.00 minutes (95% CI = 3.35 to 5.50 minutes) in the standard monitoring group (p = 0.05). Forty-eight percent of subjects using capnography corrected the ETT dislodgement prior to decline in pulse oximetry compared with 12% of controls (p = 0.01). There were no differences in time to correction of dislodgement based on years of experience, perceived comfort, reported adequacy of teaching, or past use of capnography. Conclusions: The addition of capnography to standard monitoring significantly improves recognition of ETT dislodgement and reduces the time to correction of dislodged ETTS by prehospital providers in a simulated pediatric transport setting.

Guideline 11.6: Equipment and techniques in adult ALS


Limited fluid resuscitation has been proven to have a good effect on uncontrolled hemorrhagic shock. Arginine vasopressin (AVP) and norepinephrine (NE) were used to treat vasodilatory or septic shock, and were used to reduce the fluid requirement for uncontrolled hemorrhagic shock. Based on their pressor and hemodynamic stabilization effects, it is speculated that AVP and NE may be a good treatment for uncontrolled hemorrhagic shock at early stage after hemostasis. Experiments were conducted in two parts. Each part had control, lactated Ringer's solution (LR), whole blood, NE, arginine vasopressin (AVP), NE+AVP, and AVP+NE+whole blood. Rats (n = 8–10/group), respectively, received LR, whole blood, NE (1 μg/kg) and AVP (0.1 U/kg) infusion alone, or in combination after 60 min hypotensive resuscitation (50 mmHg). The volume in each group was two times the volume of shed blood. Whole blood improved all observed parameters, particularly the tissue blood flow and mitochondrial function of liver and kidney, and the 12-h survival (50%). NE only increased the hemodynamics. 0.1 U/kg of AVP had a similar effect with whole blood on hemodynamics, tissue blood flow, mitochondrial function, and the 12-h survival. AVP+NE significantly improved all observed variables (P < 0.05 or 0.01), the 12-h survival was 70%. Whole blood further potentiated the beneficial effect of AVP+NE, and 12-h animal survival rate in this group was 80%. AVP+NE is a good treatment for uncontrolled hemorrhagic shock at the early stage after hemostasis if blood is unavailable. Whole blood transfusion can potentiate this beneficial effect of AVP+NE.


Background: Prolonged compression of limb muscles and subsequent decompression are important in the development of crush syndrome (CS). We applied a simple rubber tourniquet to rat hind limbs to create a CS model. Methods: Anesthetized rats were subjected to bilateral hind limb compression for 5 hours followed by decompression and reperfusion for 0 hour, 1 hour, 3 hours, and 24 hours under monitoring of arterial blood pressure and electrocardiography. Blood and tissue samples were collected for histology, biochemical analysis, and tissue myeloperoxidase...
activity assessment. Results: The survival rates of the CS-model groups remained at 100% until 3 hours, however, dropped to 25% at 24 hours after reperfusion mainly because of hyperkalemia and consequent hypotension observed at 1 hour and deteriorated at 3 hours after reperfusion. Rhabdomyolysis evaluated by circulating and histologic markers of injury was found as early as 1 hour and more marked at 3 hours after reperfusion, possibly causing subsequent multiple organ dysfunction frequently encountered in CS. Conclusion: The findings from this study demonstrate the feasibility of a novel small animal model of extremity crush injury. By using this model, the impact of incremental periods of reperfusion on mortality and remote organ dysfunctions can be characterized. Future studies are necessary to better define a threshold for this injury pattern and the impact of other factors underlying this syndrome.


The aim of the present study was to evaluate the performance of three indirect laryngoscopes, Truview EVO2 laryngoscope, Clarus Levitan fiberoptic stylet and AirwayScope AWS, in comparison with direct Macintosh laryngoscope (ML) when performed in normal and difficult airway scenarios. Methods: This prospective comparative study recruited 30 emergency physicians familiar with direct laryngoscopic intubation. Intubations were performed on manikin and were repeated twice for both scenarios. The primary end points were intubation time and rate of failed intubation. Glottis visualization was graded on Cormack and Lehane score and VAS. Results: In normal airway scenario: AWS had shortest intubation time (6.0 s) followed by ML (8.7 s); VAS score of ML and AWS was lower (easier to use) than the other two devices; Cormack and Lehane score was similar for all devices. In difficult airway scenario: AWS had shortest intubation time (5.9 s); VAS score of AWS was lower than the other three devices; TVL, FOS, AWS had better Cormack and Lehane score than ML. Intubation time, rate of failed intubation, and Cormack and Lehane score were similar between attempts in both scenarios. Learning effect was significant in FOS in both scenarios and in TVL in normal airway scenario. Conclusions: AWS performed best in normal and difficult airways. ML performed better than TVL and FOS in normal airways. Performances of ML, TVL and FOS were similar in difficult airways. Skills with AWS could be mastered rapidly. TVL and FOS required more practice to gain expertise.

Guideline 11.6: Equipment and techniques in adult ALS


STUDY OBJECTIVE: High-quality chest compressions (CCs) are an important component of successful resuscitation. Suboptimal in-hospital CC are commonly reported. Skill degradation and fatigue have been implicated. We assessed the effect of a handheld feedback device on the measured and perceived quality of CC and rescuer physiologic response. METHODS: This is a non-blinded randomized controlled study of nurses at an academic medical center. Participants performed CC on a mannequin either with or without a feedback device. Compression rate (CR) and compression depth (CD), heart rate, and oxygen saturation were documented. Perceived quality of CC, fatigue, and ease of use of the device were obtained. RESULTS: Twelve nurses were in the feedback group (FG) and 13 were controls. Mean CD was significantly higher in the
FG (1.99 +/- 0.37 in vs 1.52 +/- 0.36 in; P = .005) and mean CR significantly lower in the FG (127 +/- 13.8 per min vs 101 +/- 9.7 per min; P <= .0001). Using a CD of more than 1.5 in and a CR of 90 to 100 as a composite measure of high-quality CC, the FG performed significantly better (81.4% +/- 22.0% vs 10.4% +/- 21.9%; P < .0001). Perceived CD, CR, and fatigue did not differ between groups; however, participants overestimated depth and underestimated rate. The FG rated the design as user-friendly (85% + 26%) helpful in maintaining correct CR (83% + 26%). CONCLUSION: A handheld accelerometer-based audiovisual cardiopulmonary resuscitation (CPR) feedback device significantly improved the quality of CCs provided by experienced hospital nurses in a simulated setting, with no perceived or measured difference in fatigue between the 2 groups. The CPR feedback provides an effective means to monitor and improve CPR performance.


There is a discrepancy between resuscitation teaching and witnessed clinical practice. Furthermore, deleterious outcomes are associated with hyperventilation. We therefore conducted a manikin-based study of a simulated cardiac arrest to evaluate the ability of three ventilating devices to provide guideline-consistent ventilation. Mean (SD) minute ventilation was reduced with the paediatric self-inflating bag (7.0 (3.2) l.min⁻¹) compared with the Mapleson C system (9.8 (3.5) l.min⁻¹) and adult self-inflating bag (9.7 (4.2) l.min⁻¹; p = 0.003). Tidal volume was also lower with the paediatric self-inflating bag (391 (52) ml) compared with the others (582 (87) ml and 625 (103) ml, respectively; p < 0.001), as was peak airway pressure (14.5 (5.2) cmH2O vs 20.7 (9.0) cmH2O and 30.3 (11.4) cmH2O, respectively; p < 0.001). Participants hyperventilated patients' lungs in simulated cardiac arrest with all three devices. The paediatric self-inflating bag delivered the most guideline-consistent ventilation. Its use in adult cardiopulmonary resuscitation may ensure delivery of more guideline-consistent ventilation in patients with tracheal intubation.


Objective: To assess the effectiveness of sodium nitroprusside (SNP)-"enhanced" cardiopulmonary resuscitation (SNPeCPR) on 24-hr survival rates compared to standard CPR in animals after cardiac arrest. SNPeCPR consists of large intravenous SNP bolus doses during CPR enhanced by active compression-decompression CPR, an inspiratory impedance threshold device (ITD), and abdominal binding (AB). The combination of active compression-decompression CPR+ITD+AB without SNP will be called "enhanced" or eCPR. Design: Randomized, blinded, animal study. Setting: Preclinical animal laboratory. Subjects: Twenty-four female farm pigs (30 +/- 1 kg). Interventions: Isoflurane anesthetized and intubated pigs were randomized after 8 mins of untreated ventricular fibrillation to receive either standard CPR (n = 8), SNPeCPR (n = 8), or eCPR (n = 8) for 25 mins followed by defibrillation. Measurements and Main Results: The primary end point was carotid blood flow during CPR and 24-hr survival with good neurologic function defined as an overall performance category score of <=2 (1 = normal, 5 = brain dead or dead). Secondary end points included hemodynamics and end-tidal CO2. SNPeCPR significantly improved carotid blood flow and 24-hr survival rates with good neurologic function compared to standard CPR or eCPR (six of eight vs. zero of eight vs. one of eight, p < .05).
The improved survival rates were associated with higher coronary perfusion pressure and ETCO2 during CPR. Conclusion: In pigs, SNPeCPR significantly improved hemodynamics, resuscitation rates, and 24-hr survival rates with good neurologic function after cardiac arrest when compared with standard CPR or eCPR alone.

**Guideline 11.5: Medications in adult ALS**

**Case Studies, Letters & Editorials**


We describe our experience with extracorporeal cardiopulmonary resuscitation (CPR) using extracorporeal membrane oxygenation (ECMO) in children with refractory cardiac arrest, and determine predictors for mortality. ECMO support was instituted on 42 children, median age 0.7 years (1 day-17.8 years), median weight 7.05 (range 2.7-80) kg who suffered refractory cardiac arrest (1992-2008). Patients were post-cardiotomy (n=27), or had uncorrected congenital heart diseases (n=3), cardiomyopathy (n=3), myocarditis (n=2), respiratory failure (n=3), or had trauma (n=4). Cannulation site was the chest in all except for three neonates who were cannulated through the neck vessels and two children who had femoral cannulation. ECMO was successfully discontinued in 17 patients. Primary cause of mortality was neurological injury. Pre-ECMO CPR duration for survivors against those who died was a mean of 35 +/- 1.3 min vs. a mean of 46 +/- 4.2 min. Age, weight, sex, anatomic diagnosis, etiology (surgical vs. medical) were not significant predictors of poor outcome. Prolonged CPR and high-dose inotropes are significant predictors of mortality. Rescue ECMO support in children with refractory cardiac arrest can achieve acceptable survival and neurological outcomes.

*Case series*


Despite major efforts to improve outcomes from sudden death, average survival rate from cardiac arrest remains dismal and presents a large variation, with a spread between 2% and 50%. Among the interventions directed to improve outcome of cardiac arrest, the first is the capability to perform high-quality cardiopulmonary resuscitation (CPR). Accordingly, chest compression potentially reestablishes some cardiac output and organ blood flows, accounting for tissue oxygen delivery and reducing thereby the ischemic injuries to the heart and brain. Over the past decades, a variety of alternatives to conventional CPR have been developed in an effort to enhance perfusion during resuscitation and to improve survival; however, none has consistently been shown to be superior to conventional CPR in routine use. Poor outcomes have also raised the question of the optimal pharmacologic approach to augment circulation during CPR. Again, there is no clinical demonstration of survival benefits from administration of a specific vasopressor or combination of vasopressors during CPR, at either standard or higher doses. In this issue of Critical Care Medicine, Dr. Yannopoulos and colleagues (citation in this Research Update Report - SRD) have introduced a new and
quite provocative drug intervention to be used during CPR that includes the administration of a potent vasodilator, namely, sodium nitroprusside (SNP). Indeed, this elegant investigation clearly demonstrated that repeated administration of SNP, combined with mechanically enhanced venous return, improved aortic and coronary perfusion pressures and allowed for greater carotid blood flow during CPR, without need for epinephrine. This approach also prevented the development of progressive metabolic acidosis during prolonged CPR, while promoting return of spontaneous circulation and survival. Despite the apparently “nonsense” proposal for an hypotensive drug during cardiac arrest, a valid rationale stands beyond this approach. SNP, by reducing the systemic resistance, would consequently decrease the preload, which in the specific setting was maintained by mechanical interventions, as well as the afterload. The latter effect would allow for increases in cardiac output generated by chest compression and ultimately would provide the possibility to improve tissue perfusion. This is an innovative CPR approach that is finally directed to really improving organ perfusion rather than achieving only potential benefits expressed by increases in coronary perfusion pressure.

Editorial to accompany Yannopoulos et al (2011)

55. Gray HH and Henderson RA. The GRACE score’s performance in predicting in-hospital and 1-year outcome. Heart 2011; (Online first ): 27 June
Acute coronary syndromes (ACS) (unstable angina, non-ST elevation (NSTEMI) and ST-elevation myocardial infarction (STEMI)) are associated with a significant risk of adverse events, including recurrent myocardial ischaemia and infarction, bleeding complications and mortality. In the most recent report of the Myocardial Ischaemia National Audit Project 30-day mortality was still 8.2% for STEMI and 7.1% for NSTEMI, despite a progressive decline over many years. Patient outcomes may be improved by pharmacological intervention and early coronary revascularisation, but analyses from randomised trials suggest that these benefits are restricted to patients with higher levels of cardiovascular risk. Hence an assessment of individual patient risk may be important in selecting management strategies and is recommended as part of the initial assessment of patients presenting with ACS. Single markers of risk, such as blood levels of cardiac troponin, are not sufficiently accurate predictors of outcome to be clinically useful. Various risk models that incorporate multiple determinants of risk have therefore been derived from randomised clinical trials or from registry data and are more accurate than clinical assessment alone. Risk models derived from randomised trials, such as the TIMI score, have the advantage of being developed from robust scientific data, but are based on selected patient cohorts and their validity in the wider population of patients with ACS is uncertain. By contrast, models derived from registries, such as GRACE (Global Registry of Acute Coronary Events), are based on analyses of observational data from large unselected populations, often enrolled across many different countries. The GRACE score is a numerical summation of scores attributed to a number of clinical factors …

Editorial
Guideline 14: ACS

Background: The use of drugs during resuscitation of extremely preterm infants remains contentious, and while there may be short term gain, long term survival is thought to be poor. We set out to determine the survival and developmental outcome of infants who had received Epinephrine during delivery room resuscitation or at any time during their stay on the neonatal intensive care unit. Method: We conducted a retrospective case note audit on infants who were equal or less than 26 weeks gestation who received Epinephrine during resuscitation. The
study period was from 1 January 2004 to 31 December 2008. Infants were excluded if they were outborn or had significant congenital anomalies. Results: During the 5 year period 361 infants ≤26 weeks were admitted to the regional neonatal unit, of which 156 were inborn. 25 of these infants received epinephrine during resuscitation and were therefore included in our analysis. Mean gestational age was 25 weeks and mean birth weight was 667 g. Mortality in patients who received epinephrine during resuscitation was 80% as 20 infants eventually died. Of the five infants who survived to 1 year, one had significant neurodevelopmental delay (visual impairment and delayed speech), one had hearing impairment, two infants had no delay noted at age 1 year and one patient was lost to follow-up. Conclusion: Survival in extremely preterm infants who require epinephrine during resuscitation is poor. The role of epinephrine in cardiopulmonary resuscitation of these infants may not be appropriate and therefore requires careful consideration.

Case series - poster
Guideline 13: Neonatal resuscitation

The International Liaison Committee on Resuscitation (ILCOR) encompasses a large number of national resuscitation councils and other key stakeholders. These include the Australian and New Zealand Committee on Resuscitation (ANZCOR), as well as the European Resuscitation Council (ERC) and the American Heart Association (AHA). In developing their 2010 guidelines, ILCOR set out to identify and review international science and knowledge relevant to CPR and emergency cardiovascular care and, where consensus existed, to offer treatment recommendations. The first ILCOR conference was originally hosted by the AHA in 1999, and led to the publication of the International Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. The evaluation of the science was planned to occur in 5 year cycles, thus ILCOR updated the guideline in 2005, and most recently in 2010. The current process of evidence evaluation started with the formation of six task forces: BLS, ALS, acute coronary syndromes, paediatric life support, neonatal life support, and education, implementation and teams. These task forces identified topics requiring evaluation of the evidence, and standardized evidence evaluation worksheets were created that detailed the search strategy, evidence evaluation and the level of evidence, and development of treatment recommendations. A total of 313 experts from over 30 countries evaluated 277 resuscitation questions, each using a standard PICO (Population, Intervention, Comparison, Outcome) format. These worksheets were presented and discussed at regular web conferences and other meetings, and were also posted online (http://www.ilcor.org) for public comment. For example, the Australasian College for Emergency Medicine (ACEM) was invited to comment through e-bulletins issued by the College. The agreed 2010 guidelines were published simultaneously in Resuscitation and Circulation in October 2010, and the final worksheets are available on the ILCOR website (http://www.ilcor.org). The Australian Resuscitation Council (ARC) and the New Zealand Resuscitation Council (NZRC) worked collaboratively through the ANZCOR partnership to co-publish, for the first time, joint resuscitation guidelines in December 2010.3 Previously, clinical staff working or transferring between New Zealand and Australia would need to follow separate guidelines. Also, as many Australian and New Zealand professional health-care training bodies, such as the medical colleges, have an Australasian organizational structure, they had to teach and examine on different guidelines. This will no longer be necessary.
A brief summary of some of the most important updates to the Australasian guidelines for 2010 follows. This is not intended as a review of the evidence underpinning the changes, as this can be found in the published International Consensus on CPR Science with Treatment Recommendation (CoSTR) documents. It aims to highlight the areas of change that will most affect BLS and ALS trainers and providers in
Australasia.
Editorial
All Guidelines!

Drug therapy continues to be recommended as part of cardiac arrest management. There has been increasing transparency about the lack of evidence to support such drug therapy, and the gaps identified in our knowledge have stimulated ongoing research. This review aims to highlight recently published articles that relate to the use of drugs during cardiopulmonary resuscitation (CPR). Recent findings: Definitive studies have now been performed in human cardiac arrests, randomly comparing drugs with neutral controls. These publications have confirmed the short-term benefits of the standard drugs used in advanced life support (including epinephrine) when compared with no drugs. There are still many gaps in our knowledge, but a number of new approaches offer promise, including the use of intravenous lipid emulsions (in cardiac arrests due to local anesthetic toxicity), erythropoietin and even stem cells. Summary: The use of some drugs (e.g. epinephrine) can be recommended in cardiac arrest, but only on the basis of short-term benefits. These short-term benefits need to be converted into long-term outcomes by optimizing management in the postarrest period. Potential drug strategies need to be evaluated in settings in which the drug is administered in a timely fashion, good CPR is provided, and postresuscitation care has been optimized.

Editorial
Guideline 11.5: Medications in adult ALS

In patients with severe cardiopulmonary failure extracorporeal assist devices are used to support patients during resuscitation, for transportation, until organ recovery, and as bridge to further therapeutic modalities. We report on our first experience with the new Cardiohelp system for interhospital transfer of cardiopulmonary compromised patients. The Cardiohelp system was used for transportation and in-house treatment in six male patients with a mean age of 41+/-17 years. Five patients suffered respiratory failure; one patient with acute myocardial infarction was in profound cardiogenic shock. Accordingly, the Cardiohelp system was implanted as a veno-venous extracorporeal membrane oxygenation (ECMO) in five patients and as a veno-arterial system in one patient. The pre-ECMO ventilation time was 0.5-4 days. The patients were transported to our institution by car (n=1) or helicopter (n=5) over a distance of 80-5850 km. The subsequent in-house ECMO support was continued with the Cardiohelp and lasted for 5-13 days. Post-ECMO ventilation was one to 25 days. A 100% survival was achieved. The portable Cardiohelp system allows location-independent stabilization of cardiopulmonary compromised patients with consecutive interhospital transfer and in-house treatment. The integrated sensors, which register arterial and venous line pressure, blood temperature, hemoglobin as well as SvO2, greatly alleviate its management and considerably increase safety.

Case series

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

**Case study**


The Australian Resuscitation Council (ARC) and New Zealand Resuscitation Council (NZRC) have for the first time developed guidelines for the management of acute coronary syndromes (ACS) in the prehospital and emergency setting. These guidelines result from the International Liaison Committee on Resuscitation (ILCOR) process and the development of the International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations (COSTR) document for 2010. The current COSTR process devoted a dedicated Task Force to address 25 acute topics related to the initial management of ACS drawing on expert reviewers from Africa, Asia, Australia, Europe, North America and South America. The 2010 COSTR has produced an expanded review of the available evidence in the area of the out-of-hospital and emergency care of ACS. A complete systematic review of the literature is contained in the COSTR document (http://circ.ahajournals.org/cgi/content/full/122/16_suppl_2/S422). The diagnosis and management of patients with ACS in the prehospital and emergency setting has been an area of increased research activity over the last 10 years. It is an area that has been, until recent years, overlooked in ACS guidelines that have tended to focus on immediate and definitive therapeutic interventions once a clear diagnosis has been established. Guidelines for the Management of Acute Coronary Syndromes 2006 and 2007 Addendum published by the Cardiac Society of Australia and New Zealand and the National Heart Foundation of Australia provide comprehensive guidelines for the diagnosis, treatment and long-term management of ACS. The new ARC guidelines focus on managing ACS in the prehospital and emergency setting and have been developed to complement these Cardiac Society of Australia and New Zealand and National Heart Foundation of Australia guidelines (http://www.resus.org.au/policy/guidelines/index.asp). The ARC and NZRC guidelines on ACS encompass three broad areas: the initial presentation with ACS; the initial medical therapy of ACS and recommendations on reperfusion strategies for AMI. An overview of the new information is summarized below.

**Editorial**

**Guideline 14: ACS**


Objective: To describe a patient with transient reversal of findings of brain death after cardiopulmonary arrest and attempted therapeutic hypothermia. Design: Case report. Setting: Intensive care unit of an academic tertiary care hospital. Patient: A 55-yr-old man presented with cardiac arrest preceded by respiratory arrest. Cardiopulmonary resuscitation was performed, spontaneous perfusion restored, and therapeutic
hypothermia was attempted for neural protection. After rewarming to 36.5°C, neurologic examination showed no eye opening or response to pain, spontaneous myoclonic movements, sluggishly reactive pupils, absent corneal reflexes, and intact gag and spontaneous respirations. Over 24 hrs, remaining cranial nerve function was lost. The neurologic examination was consistent with brain death. Apnea test and repeat clinical examination after duration of 6 hrs confirmed brain death. Death was pronounced and the family consented to organ donation. Twenty-four hrs after brain death pronouncement, on arrival to the operating room for organ procurement, the patient was found to have regained corneal reflexes, cough reflex, and spontaneous respirations. The care team faced the challenge of offering an adequate explanation to the patient's family and other healthcare professionals involved. Interventions: Induced hypothermia and brain death determination. Measurements and Main Results: This represents the first published report in an adult patient of reversal of a diagnosis of brain death made in full adherence to American Academy of Neurology guidelines. Although the reversal was transient and did not impact the patient's prognosis, it impacted his eligibility for organ donation and cast doubt about the ability to determine irreversibility of brain death findings in patients treated with hypothermia after cardiac arrest. Conclusions: We strongly recommend caution in the determination of brain death after cardiac arrest when induced hypothermia is used. Confirmatory testing should be considered and a minimum observation period after rewarming before brain death testing ensues should be established.

Case study

Guideline 11.8: Therapeutic hypothermia after cardiac arrest

Education & ethics in resuscitation


Objective: This pilot study examines the prevalence of cardiac risk factors in a cohort of agricultural workers, assesses their knowledge of local emergency health services and investigates their decision-making abilities with regard to when and how they would seek help when experiencing chest pain. Methods: Farm men and women were recruited from 20 rural Victorian sites and underwent health assessments for total cholesterol, blood glucose, weight, height and blood pressure. Participants completed a survey to determine their knowledge of chest pain treatment, local emergency services and likely response to chest pain. Results: Cardiac risk factors within this cohort of 186 adult farming men and women were common, with 61% of men (58/95, 95% confidence interval [CI] 51–70) and 74% of women (68/91, 95% CI 65–83) either overweight or obese. When asked to name their nearest ED, 10% of participants (19/184, 95% CI 7–16) nominated health services or towns where no ED exists.
Furthermore, 67% of respondents (123/185, 95% CI 59–73) believed it was safe to travel to hospital by car while potentially having a myocardial infarction. Conclusions: This cohort of agricultural workers were at considerable risk of experiencing acute coronary events, but many would make decisions about when and how to seek medical help for chest pain that are at odds with published community guidelines. These results highlight the need for education to improve knowledge of local emergency services and address behavioural barriers to accessing care.

64. Boet S, Borges B, Naik V, Siu L, et al. Complex procedural skills are retained for a minimum of 1 yr after a single high-fidelity simulation training session. Br J Anaesth 2011; (Online first): June 9

Background: Simulation has been shown to be effective in teaching complex emergency procedural skills. However, the retention of these skills for a period of up to 1 yr has not been studied. We aimed to investigate the 6 month and 1 yr retention of the complex procedural skill of cricothyroidotomy in attending anaesthetists using a high-fidelity-simulated cannot intubate, cannot ventilate (CICV) scenario.

Methods: Thirty-eight attending anaesthetists participated individually in a high-fidelity-simulated CICV scenario (pretest) that required a cricothyroidotomy for definitive airway management. Immediately after a debriefing and structured teaching session on cricothyroidotomy insertion, subjects managed a second identical CICV scenario (post-test). Each anaesthetist was randomized to either a ‘6 month retention’ or a ‘12 month retention’ group. No further teaching occurred. At their respective retention times, each anaesthetist managed a third identical CICV scenario (retention post-test).

Results: Subjects from both groups improved on their cricothyroidotomy skill performances from pretest to immediate post-test and from pretest to retention post-test, irrespective of the retention interval; CL mean (sd) 8.00 (2.39) vs 8.88 (1.53), P=0.49; GRS 28.00 (7.80) vs 31.25 (5.31), P=0.25; PT 102.83 (63.81) s vs 106.88 (36.68) s, P=0.73. Conclusions: After a single simulation training session, improvements in cricothyroidotomy skills are retained for at least 1 yr. These findings suggest that high-fidelity simulation training, along with practice and feedback, can be used to maintain complex procedural skills for at least 1 yr.


Introduction: Competence in neonatal resuscitation is often assumed on the basis NLS provider status or previous experience. For trainees commencing a neonatal post this assumption may be unreliable. Methods: Junior (ST1-3) and senior (ST4+) trainees with the Leicester Neonatal Service either (re)certified as NLS providers or received a standardised resuscitation assessment. Assessments used: ST1-3 assessment focusing on basic life support skills and airway positioning. ST4+ assessment: meconium aspiration, focusing on advanced life support, including intubation of a mannequin. These were performed on delivery suite using standard equipment by two experienced NLS instructors and prospectively recorded on a standardised criterion-referenced proforma. Failure at the first assessment resulted in repeat assessment.

Resuscitation records from 2003 to 2010 were independently reviewed by two assessors. Reasons for failure were classified as algorithm, technical or both. Results: 262 assessments were performed. 98/160 (61%) of junior trainees and 57/102 (56%) of senior trainees passed their first assessment. The pass rate remained constant over the period studied. 43/62 (69%) juniors and 40/45 (89%) seniors were reassessed with a 79% and 85% pass rate respectively. Junior first fails were 23% algorithm, 34% technical, 43% both while senior were 20%, 27% and 53%.

Conclusions: A significant portion of trainees previously trained in neonatal resuscitation failed a standardised assessment. Assessment itself is a powerful extrinsic motivating factor as demonstrated by a high reassessment pass rate. Units should consider re-evaluating trainees’ competency at the start of a neonatal post.
Guideline 13: Neonatal resuscitation


Every year, patients leave the Emergency Department against medical advice (AMA) and before an adequate evaluation can be performed. It is well known that many of these patients are at risk of subsequent complications. The goal of this article is to explain the potential legal protections that may be created from a proper AMA discharge. In this article, the authors review the steps that need to be taken when performing an AMA discharge, including an assessment of capacity, proper documentation, and adequate disclosure. The authors then review the potential legal protections that can result from a properly documented and performed discharge. Among these protections are: proof that the provider’s duty to the patient ended with discharge and that the patient assumed the risk of a subsequent complication. The authors conclude that a properly executed discharge can provide significant legal protection from liability risks.


Objective: To investigate the effectiveness of brief bedside cardiopulmonary resuscitation (CPR) training to improve the skill retention of hospital-based pediatric providers. We hypothesized that a low-dose, high-frequency training program (booster training) would improve CPR skill retention. Patients and Methods: CPR recording/feedback defibrillators were used to evaluate CPR quality during simulated arrest. Basic life support–certified, hospital-based providers were randomly assigned to 1 of 4 study arms: (1) instructor-only training; (2) automated defibrillator feedback only; (3) instructor training combined with automated feedback; and (4) control (no structured training). Each session (time: 0, 1, 3, and 6 months after training) consisted of a pre-training evaluation (60 seconds), booster training (120 seconds), and a post-training evaluation (60 seconds). Excellent CPR was defined as chest compression (CC) depth ≥ one-third anterior-posterior chest depth, rate ≥ 90 and ≤120 CC per minute, ≤20% of CCs with incomplete release (>2500 g), and no flow fraction ≤ 0.30. Measurements and Main Results: Eighty-nine providers were randomly assigned; 74 (83%) completed all sessions. Retention of CPR skills was 2.3 times (95% confidence interval [CI]: 1.1–4.5; P = .02) more likely after 2 trainings and 2.9 times (95% CI: 1.4–6.2; P = .005) more likely after 3 trainings. The automated defibrillator feedback only group had lower retention rates compared with the instructor-only training group (odds ratio: 0.41 [95% CI: 0.17–0.97]; P = .043). Conclusions: Brief bedside booster CPR training improves CPR skill retention. Our data reveal that instructor-led training improves retention compared with automated feedback training alone. Future studies should investigate whether bedside training improves CPR quality during actual pediatric arrests.

More for the ‘blokes’ to think about....

Man ‘flu – it really exists....

BACKGROUND: Rhinoviruses (RV) are key triggers in acute asthma exacerbations. Previous studies suggest that men suffer from infectious diseases more frequently and with greater severity than women. Additionally, the immune response to most infections and vaccinations decreases with age. Most immune function studies do not account for such differences, therefore the aim of this study was to determine if the immune response to rhinovirus varies with sex or age. METHODS: Blood mononuclear cells were isolated from 63 healthy individuals and grouped by sex and age (< 50 years old and >52 years old). Cells were cultured with rhinovirus 16 at a multiplicity of infection of 1. The chemokine IP-10 was measured at 24 h as an index of innate immunity while IFNgamma and IL-13 were measured at 5 days as an index of adaptive immunity. RESULTS: Rhinovirus induced IFNgamma and IL-13 was significantly higher in < 50 year old women than in age matched men (p < 0.02 and p < 0.05) and > 52 year old women (p < 0.02 and p > 0.005). There was no sex or age based difference in rhinovirus induced IP-10 expression. Both IFNgamma and IL-13 were negatively correlated with age in women but not in men. CONCLUSIONS: This study suggests that pre-menopausal women have a stronger adaptive immune response to rhinovirus infection than men and older people, though the mechanisms responsible for these differences remain to be determined. Our findings highlight the importance of gender and age balance in clinical studies and in the development of new treatments and vaccines.

Television viewing........

Grontved A and Hu FB. Television Viewing and Risk of Type 2 Diabetes, Cardiovascular Disease, and All-Cause Mortality. JAMA: The Journal of the American Medical Association 2011; 305 (23): 2448-55

Context Prolonged television (TV) viewing is the most prevalent and pervasive sedentary behavior in industrialized countries and has been associated with morbidity and mortality. However, a systematic and quantitative assessment of published studies is not available. Objective: To perform a meta-analysis of all prospective cohort studies to determine the association between TV viewing and risk of type 2 diabetes, fatal or nonfatal cardiovascular disease, and all-cause mortality. Data Sources and Study Selection: Relevant studies were identified by searches of the MEDLINE database from 1970 to March 2011 and the EMBASE database from 1974 to March 2011 without restrictions and by reviewing reference lists from retrieved articles. Cohort studies that reported relative risk estimates with 95% confidence intervals (CIs) for the associations of interest were included. Data Extraction: Data were extracted independently by each author and summary estimates of association were obtained using a random-effects model. Data Synthesis: Of the 8 studies included, 4 reported results on type 2 diabetes (175938 individuals; 6428 incident cases during 1.1 million person-years of follow-up), 4 reported on fatal or nonfatal cardiovascular disease (34253 individuals; 1052 incident cases), and 3 reported on all-cause mortality (26509 individuals; 1879 deaths during 203353 person-years of follow-up). The pooled relative risks per 2 hours of TV viewing per day were 1.20 (95% CI, 1.14-1.27) for type 2 diabetes, 1.15 (95% CI, 1.06-1.23) for fatal or nonfatal cardiovascular disease, and 1.13 (95% CI, 1.07-1.18) for all-cause mortality. While the associations between time spent viewing TV and risk of type 2 diabetes and cardiovascular disease were linear, the risk of all-cause mortality appeared to increase with TV viewing duration of greater than 3 hours per day. The estimated absolute risk differences per every 2 hours of TV viewing per day were 176 cases of type 2 diabetes per
100000 individuals per year, 38 cases of fatal cardiovascular disease per 100000 individuals per year, and 104 deaths for all-cause mortality per 100000 individuals per year. Conclusion: Prolonged TV viewing was associated with increased risk of type 2 diabetes, cardiovascular disease, and all-cause mortality.

And lastly, the family dog was just refining his colorectal cancer detection skills for all those years……


Objective: Early detection and early treatment are of vital importance to the successful treatment of various cancers. The development of a novel screening method that is as economical and non-invasive as the faecal occult blood test (FOBT) for early detection of colorectal cancer (CRC) is needed. A study was undertaken using canine scent detection to determine whether odour material can become an effective tool in CRC screening.

Design: Exhaled breath and watery stool samples were obtained from patients with CRC and from healthy controls prior to colonoscopy. Each test group consisted of one sample from a patient with CRC and four control samples from volunteers without cancer. These five samples were randomly and separately placed into five boxes. A Labrador retriever specially trained in scent detection of cancer and a handler cooperated in the tests. The dog first smelled a standard breath sample from a patient with CRC, then smelled each sample station and sat down in front of the station in which a cancer scent was detected.

Results: 33 and 37 groups of breath and watery stool samples, respectively, were tested. Among patients with CRC and controls, the sensitivity of canine scent detection of breath samples compared with conventional diagnosis by colonoscopy was 0.91 and the specificity was 0.99. The sensitivity of canine scent detection of stool samples was 0.97 and the specificity was 0.99. The accuracy of canine scent detection was high even for early cancer. Canine scent detection was not confounded by current smoking, benign colorectal disease or inflammatory disease. Conclusions: This study shows that a specific cancer scent does indeed exist and that cancer-specific chemical compounds may be circulating throughout the body. These odour materials may become effective tools in CRC screening. In the future, studies designed to identify cancer-specific volatile organic compounds will be important for the development of new methods for early detection of CRC.

Last bit