
The quality of cardiopulmonary resuscitation (CPR) is a crucial determinant of outcome following cardiac arrest. Interruptions in chest compressions are detrimental. We aimed to compare the effect of mouth-to-mouth ventilation (MMV), mouth-to-pocket mask ventilation (MPV) and bag-valve-mask ventilation (BMV) on the quality of CPR. Surf lifeguards in active service were included in the study. Each surf lifeguard was randomized to perform three sessions of single-rescuer CPR using each of the three ventilation techniques (MMV, MPV and BMV) separated by 5 min of rest. Data were obtained from a resuscitation manikin and video recordings. A total of 60 surf lifeguards were included (67% male, 33% female, mean age 25 years). Interruptions in chest compressions were significantly reduced by MMV (8.9 ± 1.6s) when compared to MPV (10.7 ± 3.0s, P<0.001) and BMV (12.5 ± 3.5s, P<0.001). Significantly more effective ventilations (visible chest rise) were delivered using MMV (91%) when compared to MPV (79%, P<0.001) and BMV (59%, P<0.001). The inspiratory time was longer during MMV (0.7 ± 0.2s) and MPV (0.7 ± 0.2s, P<0.001 for both) compared to BMV (0.5 ± 0.2s). Tidal volumes were significantly lower using BMV (0.4 ± 0.2L) compared to MMV (0.6 ± 0.2L, P<0.001) and MPV (0.6 - 0.3L, P<0.001), whereas no differences were observed when comparing MMV and MPV. Mouth to mouth ventilation reduces interruptions in chest compressions and produces a higher proportion of effective ventilations during lifeguard CPR. This suggests that CPR quality is improved using MMV compared to MPV and BMV.

Comparative study


Background: Trauma activation for prehospital hypotension in blunt trauma is controversial. Some patients subsequently arrive at the trauma center normotensive, but they can still have life-threatening injuries. Admission base deficit (BD) ≤ −6 correlates with injury severity, transfusion requirement, and mortality. Can admission base deficit (BD) be used to discriminate those severely injured patients who arrive normotensive but “crump,” (i.e., become hypotensive again) in the Emergency Department? The purpose is to determine whether admission BD < −6 discriminates patients at risk for future bouts of unexpected hypotension during evaluation. Methods: Retrospective chart review was performed on all blunt trauma admissions at a Level I trauma center from August 2002 through July 2007. Hypotension was defined as a systolic blood pressure ≤90 mm Hg. Patients who were hypotensive in the field but normotensive upon arrival in the emergency department (ED) were included. Age, gender, injury severity score, arterial blood gas analysis, results of focused abdominal sonogram for trauma (FAST), computed tomography, intravenous fluid administration, blood transfusions, and the presence of repeat bouts of hypotension were noted. Patients were stratified by BD ≤ −6 or ≥ −5. Statistical analysis was performed using paired t test, χ2, and logistic regression analysis with significance attributed to p < 0.05. Results: During the 5-year period, 231 blunt trauma patients had hypotension in the field with subsequent normotension on admission to the ED. Of these, 189 patients had admission BD data
recorded. Patients with a BD ≤ −6 were significantly more likely to have repeat hypotension (78% vs. 30%, p < 0.001). Overall mortality was 13% (24 of 189), but patients with repeat hypotension had greater mortality (24% vs. 5%, p < 0.003). Conclusion: Blunt trauma patients with repeat episodes of hypotension have significantly greater mortality. Patients with transient field hypotension and a BD ≤ −6 are more than twice as likely to have repeat hypotension (crump). This study reinforces the need for early arterial blood gases and trauma team involvement in the evaluation of these patients. Patients with BD ≤ −6 should have early invasive monitoring, liberal use of repeat FAST exams, and careful resuscitation before computed tomography scanning. Surgeons should have a low threshold for taking such patients to the operating room.


Aims: The use of cocaine as a recreational drug has increased in recent years. The aims of this study were to analyse the prevalence and inhospital evolution of acute coronary syndrome (ACS) associated with cocaine consumption (ACS-ACC). Methods and results: Prospective analysis of ACS patients admitted to a coronary care unit from January 2001 to December 2008. During the study period, 2752 patients were admitted for ACS, and among these 479 were ≤50 years of age. Fifty-six (11.7%) patients had a medical history of cocaine use with an increase in prevalence from 6.8% in 2001 to 21.7% in 2008 (P = 0.035). Among patients younger than 30 years of age, 25% admitted to being users compared with 5.5% of those aged 45–50 years (P = 0.007). Similarly, the prevalence of positive urine tests for cocaine was four times higher in the younger patients (18.2 vs. 4.1%, P = 0.035). Acute coronary syndrome associated with cocaine consumption patients (n = 24; those who had a positive urine test for cocaine or who admitted to being users upon admission) had larger myocardial infarcts as indicated by troponin I levels (52.9 vs. 23.4 ng/mL, P < 0.001), lower the left ventricular ejection fraction (44.5 vs. 52.2%, P = 0.049), and increased inhospital mortality (8.3 vs. 0.8%, P = 0.030). Conclusions: The association between cocaine use and ACS has increased significantly over the past few years. Young adults with ACS-ACC that require admission to the coronary care unit have greater myocardial damage and more frequent complications.

Guideline 14: ACS


Purposes: We performed this study to assess the impact of pre-hospital time on the patient's outcome. Procedures: Starting from the symptoms onset, "total time to treatment" was divided into less than or equal to 120 minutes and more than 120 minutes ("pre-hospital time" of ≤ or > 30 minutes respectively). Adverse patient outcomes were compared in the two subgroups. Findings: Our patients had a mean age of 63 (±13) years. On-scene time (17.8 ± 9.4 minutes) was the biggest fraction of "pre-hospital time". Comparing the groups with "Total time to treatment" of >120 minutes vs. ±120 minutes ("pre-hospital time" of >30 vs. ≤ 30 minutes), mortalities were 4 vs. 0 and transfers to a tertiary care facility were 3 vs.1. Conclusions: Most of the pre-hospital time in STEMI was spent on the scene and we suggest "total time to treatment" as a core measure instead of "door to balloon time".

Guideline 14: ACS

BACKGROUND: To describe the organization of an ECMO-centre from triage by telephone to the phase of inter-hospital transportation with ECMO of patients affected by H1N1-induced ARDS, describing techniques and equipment used. METHODS: From September 2009 to January 2010, 18 patients with H1N1-induced ARDS were referred to our ECMO-centre from other hospitals. Six patients had contraindications to treatment with ECMO and remained in the local hospital. Twelve patients were transported to our centre and were included in this study. Four patients were transported on ECMO (Group A) and eight on conventional ventilation (Group B). The groups were compared on the basis of adverse events during transport, clinical characteristics and outcome. RESULTS: The PaO2/FiO2 ratio was lower in the patients of Group A (46.8 vs 89.7 [median]) despite the PEEP values being higher (15.0 vs 8.5 [median]). The Murray score was higher in Group A (3.50 vs 2.75 [median]). During the transfer there were no significant complications noted in Group A, whereas two patients in Group B were reported with hypoxia (SpO2< 90%). One patient in Group A died. All the other patients of the two groups have been discharged from hospital. CONCLUSIONS: The creation of an ECMO team, with various experts in the treatment of ARDS, assured a safe transfer of patients with severe hypoxia, over long distances, when in other cases they wouldn't have been be transportable.


Context: The risks associated with new-onset atrial fibrillation (AF) among middle-aged women and populations with a low comorbidity burden are poorly defined. Objectives: To examine the association between incident AF and mortality in initially healthy women and to evaluate the influence of associated cardiovascular comorbidities on risk. Design, Setting, and Participants: Between 1993 and March 16, 2010, 34,722 women participating in the Women's Health Study underwent prospective follow-up. Participants were 95% white, older than 45 years (median, 53 [interquartile range {IQR}, 49-59] years), and free of AF and cardiovascular disease at baseline. Cox proportional hazards models with time-varying covariates were used to determine the risk of events among women with incident AF. Secondary analyses were performed among women with paroxysmal AF. Main Outcome Measures: Primary outcomes included all-cause, cardiovascular, and non-cardiovascular mortality. Secondary outcomes included stroke, congestive heart failure, and myocardial infarction. Results: During a median follow-up of 15.4 (IQR, 14.7-15.8) years, 1011 women developed AF. Incidence rates per 1000 person-years among women with and without AF were 10.8 (95% confidence interval [CI], 8.1-13.5) and 3.1 (95% CI, 2.9-3.2) for all-cause mortality, 4.3 (95% CI, 2.6-6.0) and 0.57 (95% CI, 0.5-0.6) for cardiovascular mortality, and 6.5 (95% CI, 4.4-8.6) and 2.5 (95% CI, 2.4-2.6) for non-cardiovascular mortality, respectively. In multivariable models, hazard ratios (HRs) of new-onset AF for all-cause, cardiovascular, and non-cardiovascular mortality were 2.14 (95% CI, 1.64-2.77), 4.18 (95% CI, 2.69-6.51), and 1.66 (95% CI, 1.19-2.30), respectively. Adjustment for nonfatal cardiovascular events potentially on the causal pathway to death attenuated these risks, but incident AF remained associated with all mortality components (all-cause: HR, 1.70 [95% CI, 1.30-2.22]; cardiovascular: HR, 2.57 [95% CI, 1.63-4.07]; and non-cardiovascular: HR, 1.42 [95% CI, 1.02-1.98]). Among women with paroxysmal AF (n=656), the increase in mortality risk was limited to cardiovascular causes (HR, 2.94; 95% CI, 1.55-5.59). Conclusion: Among a group of healthy women, new-onset AF was independently
associated with all-cause, cardiovascular, and non-cardiovascular mortality, with some of the risk potentially explained by nonfatal cardiovascular events.

Guideline 14: ACS


To investigate whether infants <29 weeks gestation who receive positive pressure ventilation (PPV) immediately after birth with a T-piece have higher oxygen saturation (SpO2) measurements at 5 minutes than infants ventilated with a self inflating bag (SIB). Randomized, controlled trial of T-piece or SIB ventilation in which SpO2 was recorded immediately after birth from the right hand/wrist with a Masimo Radical pulse oximeter, set at 2-second averaging and maximum sensitivity. All resuscitations started with air. Forty-one infants received PPV with a T-piece and 39 infants received PPV with a SIB. At 5 minutes after birth, there was no significant difference between the median (interquartile range) SpO2 in the T-piece and SIB groups (61% [13% to 72%] versus 55% [42% to 67%]; P = .27). More infants in the T-piece group received oxygen during delivery room resuscitation (41 [100%] versus 35 [90%], P = .04). There was no difference in the groups in the use of continuous positive airway pressure, endotracheal intubation, or administration of surfactant in the delivery room. There was no significant difference in SpO2 at 5 minutes after birth in infants <29 weeks gestation given PPV with a T-piece or a SIB as used in this study.

Guideline 13.4: Airway management and mask ventilation of the newly born infant


The objective was to describe a new method of studying correlations between real-time end tidal carbon dioxide (ETCO2) data and resuscitation outcomes. Methods: This was a prospective cohort study of 30 patients who underwent cardiopulmonary resuscitation (CPR) in a university hospital. Sidestream capnograph data were collected during CPR and analyzed by a mathematician blinded to patient outcome. The primary outcome measure was to determine whether a meaningful relationship could be drawn between detailed computerized ETCO2 characteristics and the return of spontaneous circulation (ROSC). Significance testing was performed for proof-of-concept purposes only. Results: Median patient age was 74 years (interquartile range [IQR] = 60–80 years; range = 16–92 years). Events were mostly witnessed (63%), with a median call-to-arrival time of 150 seconds (IQR = 105–255 seconds; range = 60–300 seconds). The incidence of ROSC was 57% (17 of 30), and of hospital discharge 20% (six of 30). Ten minutes after intubation, patients with ROSC had higher peak ETCO2 values (p = 0.035), larger areas under the ETCO2 curve (p = 0.016), and rising ETCO2 slopes versus flat or falling slopes (p = 0.016) when compared to patients without ROSC. Cumulative maxETCO2 > 20 mm Hg at all time points measured between 5 and 10 minutes post-intubation best predicted ROSC (sensitivity = 0.88; specificity = 0.77; p < 0.001). Mathematical modeling targeted toward avoiding misdiagnosis of patients with recovery potential (fixed condition, false-negative rate = 0) demonstrated that cumulative maxETCO2 (at 5–10 minutes) > 25 mm Hg or a slope greater than 0 measured between 0 and 8 minutes correctly predicted patient outcome in 70% of cases within less than 10 minutes of intubation. Conclusions: This preliminary study suggests that computerized ETCO2 carries potential as a tool for early, real-time decision-making during some resuscitations.

May 2011 Research Updates

Some major trauma patients in metropolitan Perth (area 5000km²) are initially transported to a secondary hospital (non-trauma centre), rather than directly to a tertiary hospital (trauma centre). They are subsequently transferred to a tertiary hospital. We compared outcomes from these different systems of care. Major trauma ( Injury Severity Score, ISS>15) data from the Trauma Registries, 1 July 1997 - 30 June 2006. Two groups were studied: group 1 (metropolitan major trauma transported directly to a tertiary hospital) and group 2 (metropolitan major trauma transported initially to a secondary hospital and then to a tertiary hospital). The primary endpoint was death. Group 1 (n=2005) and group 2 (n=1078) mean age (43.9±24.3 yrs vs. 39.1±24.3 yrs, p<0.0001) both with a median ISS=24 (p=0.084). Group 2 had significantly more head/neck injuries (p<0.0001) and significantly less thoracic, abdominal and pelvis/extremities injuries (p<0.0001). There were also a significantly greater total number of regions injured in group 1 vs. group 2 (p<0.0001). Mean times to definitive care were 59min vs. 4.5h, respectively (p<0.0001). After adjusting for age, ISS, RTS, total regions injured and time, the OR for death in group 2 was 0.99 (95% CI 0.58'1.68). There is an equivalent risk of major trauma death in these two systems of care. In our metropolitan area, we were unable to demonstrate a mortality benefit associated with time.


Chest pain due to suspected myocardial infarction (MI) is responsible for many hospital admissions and consumes substantial health care resources. The Randomized Assessment of Treatment using Panel Assay of Cardiac markers (RATPAC) trial showed that diagnostic assessment using a point-of-care (POC) cardiac biomarker panel consisting of CK-MB, myoglobin, and troponin increased the proportion of patients successfully discharged after emergency department (ED) assessment. In this economic analysis, the authors aimed to determine whether POC biomarker panel assessment reduced health care costs and was likely to be cost-effective. Methods: The RATPAC trial was a multicenter individual patient randomized controlled trial comparing diagnostic assessment using a POC biomarker panel (CK-MB, myoglobin, and troponin, measured at baseline and 90 minutes) to standard care without the POC panel in patients attending six EDs with acute chest pain due to suspected MI (n = 2,243). Individual patient resource use data were collected from all participants up to 3 months after hospital attendance using self-completed questionnaires at 1 and 3 months and case note review. ED staff and POC testing costs were estimated through a micro-costing study of 246 participants. Resource use was valued using national unit costs. Health utility was measured using the EQ-5D self-completed questionnaire, mailed at 1 and 3 months. Quality-adjusted life-years (QALYs) were calculated by the trapezium rule using the EQ-5D tariff values at all follow-up points. Mean costs per patient were compared between the two treatment groups. Cost-effectiveness was estimated in terms of probability of dominance and incremental cost per QALY. Results: Point-of-care panel assessment was associated with higher ED costs, coronary care costs, and cardiac intervention costs, but lower general inpatient costs. Mean costs per patient were £1217.14 (standard deviation [SD] ± 3164.93), or $1,987.14 (SD ±$4,939.25), with POC versus £1005.91 (SD ±£1907.55), or $1,568.64 (SD ±$2,975.78), with standard care (p = 0.056). Mean QALYs were 0.158 (SD ± 0.052) versus 0.161 (SD ± 0.056; p = 0.250). The probability of standard care being dominant (i.e., cheaper and more
effective) was 0.888, while the probability of the POC panel being dominant was 0.004. These probabilities were not markedly altered by sensitivity analysis varying the costs of the POC panel and excluding intensive care costs. **Conclusions:** Point-of-care panel assessment does not reduce costs despite reducing admissions and may even increase costs. It is unlikely to be considered a cost-effective use of health care resources.


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

*Guideline 11.6: Equipment & techniques in ALS*


**Background:** Whether severely injured patients should be transported directly to tertiary trauma centers, bypassing closer non-tertiary facilities, or be transported first to nearby, less-specialized facilities for immediate care and stabilization has been studied with mixed findings. Differences in study locale, case mix, and variation in the structure and level of maturation of the trauma system may explain some of the discrepancy in findings. In addition, risk adjustment strategies used in these studies did not take into account prehospital baseline characteristics as well as time since injury. **Methods:** This was a retrospective cohort study of 1,998 patients treated at a Level I trauma center between January 1, 2006, and December 31, 2007. Propensity-adjusted survival analyses were used to compare short-term mortality outcomes in transferred versus directly transported major trauma patients. **Results:** A total of 1,398 patients were transported directly to the Level I trauma center and 600 patients were transferred from lower level facilities. After adjusting for the propensity to be transported directly, age, injury severity score, severe head injury, emergency medical service or emergency department intubation, comorbid conditions, and time to definitive Level I trauma care, the 2-week mortality risk in transferred patients was almost three-fold that of patients transported directly to a Level I trauma center (hazard ratio, 2.7; 95% confidence interval, 1.31–5.6). **Conclusion:** Transferred
patients in a predominantly rural region are at an increased risk of short-term mortality. This suggests that severely injured patients should be transported directly to tertiary trauma centers. For patients requiring immediate stabilization at non-tertiary facilities, this should be performed promptly without unnecessary delays.


Aims: Return of spontaneous circulation (ROSC) following cardiopulmonary resuscitation from cardiac arrest (CA) depends on numerous variables. The aim of this study was to develop a score to predict the initial resuscitation outcome - the RACA (ROSC after cardiac arrest) score. Methods and results Based on 5471 prospectively registered out-of-hospital CAs patients between 1998 and 2008 within the German Resuscitation Registry, calculation of the RACA score was performed by multivariate logistic regression analysis with ROSC as the outcome variable. The probability of ROSC was defined as \(1/(1 + e^{-X})\), where \(X\) is the weighted sum of independent factors. Additional 2218 patients documented between 2009 and 2010 were used for validation of the RACA score. The following independent variables were found to have a significant positive (+) or negative (-) impact on the probability of ROSC: male gender (-0.2); age >80 years (-0.2); witnessing by lay people (+0.6) and by professionals (+0.5); asystole (-1.1); location at doctor's office (+1.2), medical institution (+0.5), public place (+0.3) and nursing home (-0.3); presumable aetiology of hypoxia (+0.7), intoxication (+0.5) and trauma (-0.6); and time until professionals arrival (-0.04 per minute). In a validation cohort, observed ROSC (43.8%) did not differ from predicted ROSC (43.7%).

Conclusion: The RACA score represents a simple tool and enables comparison between observed and predicted ROSC rates based on readily available variables after CA. Thereby, the RACA score may contribute to preclinical quality assessment and may help analysing the effects of different (post)-resuscitation strategies.


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

Objective. We studied patterns related to patient age and indication for airway interventions delivered by paramedics from 2000 through 2004. Methods. The study population included patients ≥15 years old managed by paramedics. Outcomes were the frequencies of definitive airway, ventilatory techniques, and oxygenation techniques. Independent variables were patient age, gender, race, hospital drive time, do-not-resuscitate status, and two trauma indicators of the American College of Surgeons Committee on Trauma (anatomic injury and mechanism of injury). Subset analysis was performed with the presence or absence of a set of recorded conditions. Results. A total of 827,772 paramedic transports were studied; 233,470 were identified with at least one indication for airway intervention. Patients older than 65 years were, when compared with patients 65 years old or younger, 1) less likely to receive ventilatory interventions with any indication; 2) more likely to receive ventilatory intervention without an indication; and 3) more likely to receive oxygenation interventions whether indications were present or not. We considered age in five-year intervals and noted a consistent biphasic pattern for all interventions, regardless of indications. The odds ratios for interventions for patients in each block compared with those for 15- to 29-year-old patients increased with age until about 70 years of age, then gradually declined. Conclusions. Patterns of age-related variations in airway interventions cannot be explained by the application of protocols. The reason for the peak rate of interventions at age 70 years is unknown. Explanations need to consider the influence on paramedic behavior of a number of factors, including frailty and futility. Additional paramedic training may be needed to change these patterns.

Guideline 11.6: Equipment & techniques in ALS


BACKGROUND: In 2000 the Scandinavian Neurotrauma Committee published guidelines for safe and cost-effective management of minimal, mild and moderate head injured patients. The aims of this study were to investigate to what extent the head injury population is under the influence of alcohol, and to evaluate whether the physicians’ compliance to the guidelines is affected when patients are influenced by alcohol.

METHODS: This study included adult patients (>15 years) referred to a Norwegian University Hospital with minimal, mild and moderate head injuries classified according to the Head Injury Severity Scale (HISS). Information on alcohol consumption was recorded, and in most of these patients blood alcohol concentration (BAC) was measured. Compliance with the abovementioned guidelines was registered. RESULTS: The study includes 860 patients. 35.8% of the patients had consumed alcohol, and 92.1% of these patients had a BAC > 1.00 per thousand. Young age, male gender, trauma occurring during the weekends, mild and moderate head injuries were independent factors significantly associated with being under the influence of alcohol. Guideline compliance was 60.5%, and over-triage was the main violation. The guideline compliance showed no significant correlation to alcohol consumption or to BAC-level. CONCLUSIONS: This study confirms that alcohol consumption is common among patients with head injuries. The physicians’ guideline compliance was not affected by the patients’ alcohol consumption, and alcohol influence could therefore not explain the low guideline compliance.

Prognostication may be difficult in comatose cardiac arrest survivors. Magnetic resonance imaging (MRI) is potentially useful in the prediction of neurological outcome, and it may detect acute ischemia at an early stage. In a pilot setting we determined the prevalence and development of cerebral ischemia using serial MRI examinations and neurological assessment. Ten witnessed out-of-hospital cardiac arrest patients were included. MRI was carried out approximately 2h after admission to the hospital, repeated after 24h of therapeutic hypothermia and 96h after the arrest. The images were assessed for development of acute ischemic lesions. Neuropsychological and cognitive tests as well as a self-reported quality-of-life questionnaire, Short Form-36 (SF-36), were administered minimum 12 months after discharge. None of the patients had acute cerebral ischemia on MRI at admission. Three patients developed ischemic lesions after therapeutic hypothermia. There was a change in the apparent diffusion coefficient, which significantly correlated with the temperature (p<0.001). The neuropsychological tests appeared normal. The patients scored significantly better on SF 36 than the controls as regards both bodily pain (p=0.023) and mental health (p=0.016). MRI performed in an early phase after cardiac arrest has limitations, as MRI performed after 24 and 96h revealed ischemic lesions not detectable on admission. ADC was related to the core temperature, and not to the volume distributed intravenously. Follow-up neurophysiologic tests and self-reported quality of life were good.

Guideline 11.8: Therapeutic hypothermia after cardiac arrest


Background--The balance between benefit (ischemia protection) and risk (bleeding) is a key consideration in choosing the intensity of antiplatelet therapy for patients with acute coronary syndromes. The goals of this analysis were to identify baseline characteristics that independently predict bleeding and to determine how bleeding events impact the subsequent mortality in the Trial to Assess Improvement in Therapeutic Outcomes by Optimizing Platelet Inhibition With Prasugrel-Thrombolysis in Myocardial Infarction 38 (TRITON-TIMI 38).

Methods and Results--Multivariable Cox regression analyses adjusted for treatment, baseline, and procedural variables were used to determine the predictors for serious (TIMI major or minor) bleeding. To analyze the hazard ratio and time dependency of bleeding on mortality, we used iterative day-to-day landmark analyses after the bleed. From the 13 420 patients with acute coronary syndromes included in this analysis, 534 (4.0%) experienced a serious bleeding event. Variables with the highest strength of association with risk of serious bleeding were female sex, use of a glycoprotein IIb/IIIa inhibitor, duration of intervention, age, assignment to prasugrel, regional characteristics, admission diagnosis of ST-elevation myocardial infarction, femoral access for angiography, creatinine clearance, hypercholesterolemia, and arterial hypertension. Serious bleeding was associated with a significantly increased adjusted hazard ratio of 5.84 (95% confidence interval 4.11 to 8.29) for mortality. However, the hazard ratio did not differ statistically from baseline risk by 40 days after the bleeding event. Conclusions--The major predictors of serious bleeding were a combination of patient and procedural characteristics and antiplatelet therapies. Although serious bleeding was strongly associated with mortality within the first month of the bleeding event, this association was not significant beyond 40 days.
Background: Non-physician advanced life support (ALS) providers often perform tracheal intubation (TI) for cardiac arrest or other life-threatening indications in the prehospital setting, where airway assessment and airway management tools are limited. However, the frequency of difficult TI in obese patients in this setting is unclear. In this study we determined factors associated with tracheal intubation (TI) success, and determined TI difficulty as a function of body mass index (BMI) in a system of ALS providers experienced in TI, to guide future prehospital education efforts. Methods: A retrospective review was performed of all patients ≥15 years of age who underwent prehospital TI by paramedics in the Seattle Medic One system over a 4-year period, and were transported to the regional level 1 trauma center (Harborview Medical Center). Data were abstracted from a prospectively collected prehospital airway management database and from the hospital medical records, including demographic information, number of TI attempts, TI success or failure, and body weight/height (BMI). Descriptive statistics and multivariable logistic regression were calculated, with the primary end point being difficult TI (defined as ≥4 TI attempts or the need to use an alternative airway management technique). Results: Of 80,501 patient contacts in whom 4114 TIs were attempted during the 4-year study period, 823 met study entry criteria (including a calculable BMI). The overall TI success rate in the study population was 98.5% (811 out of 823), with 6.8% (56 out of 823) meeting the predetermined definition for difficult TI. There was no significant association between difficult TI and patient age, gender, use of succinylcholine, or medical diagnosis (trauma vs. non-trauma). In comparison with the lean patient subgroup (BMI <30 kg/m²), patients with class III obesity (BMI >40 kg/m²) had a significant association with difficult TI (odds ratio 3.68; confidence interval [CI] 1.27–10.59), whereas those with class I/II obesity (BMI ≥30 kg/m² and <40 kg/m²) did not (odds ratio 0.98; CI 0.46 –2.07). Conclusions: Among prehospital ALS providers with previously documented and published successful TI performance, increased difficulty with TI was observed in patients with extreme obesity, but not in patients with lesser degrees of obesity. Because extreme obesity is an easily identifiable patient characteristic, didactic and clinical (e.g., operating room) airway management education for such providers should emphasize airway management challenges and strategies associated with obesity, including specific equipment, patient positioning, and practice recommendations that may facilitate both TI and alternative airway management techniques in this population.

Guideline 11.6: Equipment & techniques in adult ALS

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

Guideline 11.6: Equipment & techniques in adult ALS

Context: Only limited information is available on the speed of implementation of new evidence-based and guideline-recommended treatments and its association with survival in real life health care of patients with ST-elevation myocardial infarction (STEMI). Objective: To describe the adoption of new treatments and the related chances of short- and long-term survival in consecutive patients with STEMI in a single country over a 12-year period. Design, Setting, and Participants: The Register of Information and Knowledge about Swedish Heart Intensive Care Admission (RIKS-HIA) records baseline characteristics, treatments, and outcome of consecutive patients with acute coronary syndrome admitted to almost all hospitals in Sweden. This study includes 61 238 patients with a first-time diagnosis of STEMI between 1996 and 2007. Main Outcome Measures: Estimated and crude proportions of patients treated with different medications and invasive procedures and mortality over time. Results Of evidence-based treatments, reperfusion increased from 66% (95%, confidence interval [CI], 52%-79%) to 79% (95% CI, 69%-89%; P < .001), primary percutaneous coronary intervention from 12% (95% CI, 11%-14%) to 61% (95% CI, 45%-77%; P < .001), and revascularization from 10% (96% CI, 6%-14%) to 84% (95% CI, 73%-95%; P < .001). The use of aspirin, clopidogrel, β-blockers, statins, and angiotensin-converting enzyme (ACE) inhibitors all increased: clopidogrel from 0% to 82% (95% CI, 69%-95%; P < .001), statins from 23% (95% CI, 12%-33%) to 83% (95% CI, 75%-91%; P < .001), and ACE inhibitor or angiotensin II receptor blockers from 39% (95% CI, 26%-52%) to 69% (95% CI, 58%-70%; P < .001). The estimated in-hospital, 30-day and 1-year mortality decreased from 12.5% (95% CI, 4.3%-20.6%) to 7.2% (95% CI, 1.7%-12.6%; P < .001); from 15.0% (95% CI, 6.2%-23.7%) to 8.6% (95% CI, 2.7%-14.5%; P < .001); and from 21.0% (95% CI, 11.0%-30.9%) to 13.3% (95% CI, 6.0%-20.4%; P < .001), respectively. After adjustment, there was still a consistent trend with lower standardized mortality over the years. The 12-year survival analyses showed that the decrease of mortality was sustained over time. Conclusion: In a Swedish registry of patients with STEMI, between 1996 and 2007, there was an increase in the prevalence of evidence-based treatments. During this same time, there was a decrease in 30-day and 1-year mortality that was sustained during long-term follow-up.

Guideline 14: ACS

Background--Laboratory and recent clinical data suggest that hyperoxemia after resuscitation from cardiac arrest is harmful; however, it remains unclear if the risk of adverse outcome is a threshold effect at a specific supranormal oxygen tension, or is a dose-dependent association. We aimed to define the relationship between supranormal oxygen tension and outcome in postresuscitation patients. Methods and Results--This was a multicenter cohort study using the Project IMPACT database (intensive care units at 120 US hospitals). Inclusion criteria were age >17 years, nontrauma, cardiopulmonary resuscitation preceding intensive care unit arrival, and postresuscitation arterial blood gas obtained. We excluded patients with hypoxia or severe oxygenation impairment. We defined the exposure by the highest partial pressure of arterial oxygen (PaO2) over the first 24 hours in the ICU. The primary outcome measure was in-hospital mortality. We tested the association between PaO2 (continuous variable) and mortality using multivariable logistic regression adjusted for patient-oriented covariates and potential hospital effects. Of 4459 patients, 54% died. The median postresuscitation PaO2 was 231 (interquartile range 149 to 349) mm Hg. Over ascending ranges of oxygen tension, we found significant linear trends of increasing in-hospital mortality and decreasing survival as functionally independent. On multivariable analysis, a 100 mm Hg increase in PaO2 was associated with a 24% increase in mortality risk (odds ratio 1.24 [95% confidence interval 1.18 to 1.31]). We observed no evidence supporting a single threshold for harm from supranormal oxygen tension. Conclusion--In this large sample of postresuscitation patients, we found a dose-dependent association between supranormal oxygen tension and risk of in-hospital death.

Guideline 11.7: Post-resuscitation therapy in adult ALS


Objectives. This study aimed to determine whether short cardiopulmonary resuscitation (CPR) by emergency medical services before defibrillation (CPR first) has a better outcome than immediate defibrillation followed by CPR (shock first) in patients with ventricular fibrillation/pulseless ventricular tachycardia (VF/pulseless VT) out-of-hospital cardiac arrest. Methods. We analyzed a national database between 2006 and 2008, and included patients aged 18 years or more who had witnessed cardiac arrests and whose first recorded rhythm was VF/pulseless VT. Those study subjects were divided into five groups in accordance with the CPR/defibrillation intervention sequence. Each group was subdivided into call-to-response intervals of <5 minutes and ≥5 minutes. We identified 267 patients in the shock-first group and 6,407 patients in the CPR-first group. One-month survival and neurologically favorable one-month survival rates were used for outcome measures. The association of intervention type on outcomes (one-month survival or neurologically favorable one-month survival) was analyzed using multivariate logistic regression analyses by adjusting potential confounding factors such as survey year, gender, age (years), bystander CPR, intubation, and call-to-response interval (min). Results. The overall one-month survival rate was 26.2% (3,125/11,941) and the neurologically favorable one-month survival rate was 16.6% (1,983/11,934). The CPR-first group had a one-month survival rate of 27.8% (1,780/6,407) and a neurologically favorable one-month survival rate of 17.8% (1,140/6,404), and the shock-first group had survival rates of 24.7% (66/267) and 18.4% (49/267), respectively. There were no significant differences in one-month survival and neurologically favorable one-month survival in these two primary comparison groups (odds ratio [95% confidence
interval], 0.85 [0.64–1.13] and 1.04 [0.76–1.42], respectively). Logistic regression analysis showed that neither CPR first nor shock first was associated with the rate of one-month survival or neurologically favorable one-month survival, after adjusting for potential confounders. Conclusions. In our study, CPR prior to attempted defibrillation did not present a better outcome compared with shock first as measured by either one-month survival or neurologically favorable one-month survival, after adjusting for potential confounders. Further studies are required to determine whether CPR first has an advantage over shock first.

Conclusions. In our study, CPR prior to attempted defibrillation did not present a better outcome compared with shock first as measured by either one-month survival or neurologically favorable one-month survival, after adjusting for potential confounders. Further studies are required to determine whether CPR first has an advantage over shock first.

Guideline 11.4: Electrical therapy for adult ALS


Objectives: Hypopneic hypoventilation, a decrease in tidal volume without a change in respiratory rate, is not easily detected by standard monitoring practices during sedation but can be detected by capnography. Our goal was to determine the frequency of hypopneic hypoventilation and its association with hypoxia in children undergoing sedation with ketamine. Methods: Children who received intravenous ketamine with or without midazolam for sedation in a pediatric emergency department were prospectively enrolled. Heart rate, respiratory rate, pulse oximetry, and end-tidal carbon dioxide (ETCO₂) levels were recorded every 30 seconds. Results: Fifty-eight subjects were included in this study. Fifty percent of subjects had recorded ETCO₂ values less than 30 mm Hg without a rise in respiratory rate. Twenty-eight percent of subjects experienced a decrease in pulse oximetry less than 95%. Patients who experienced a persistent decrease in ETCO₂ at least 30 seconds in length were much more likely to have a persistent decrease in pulse oximetry than those with normal or transient decreases in ETCO₂ (relative risk, 6.6; 95% confidence interval, 1.4–30.5). Decreases in ETCO₂ occurred on an average of 3.7 minutes before decreases in pulse oximetry. Conclusions: Hypopneic hypoventilation as detected by capnography is common in children undergoing sedation with ketamine with or without midazolam. Hypoxia is frequently preceded by low ETCO₂ levels. Further studies are needed to determine if the addition of routine monitoring with capnography can reduce the frequency of hypoxia in children undergoing sedation.


Background: Factors that affect prognosis in successfully resuscitated out-of-hospital cardiopulmonary arrest (OHCA) patients in the intensive care unit (ICU) who survived the initial 24 h period of post-resuscitation have not been established. This study was conducted to evaluate the clinical prognostic factors associated with 90-day survival in patients who were successfully resuscitated from OHCA. Methods: This study was conducted at a tertiary large university hospital. Clinical data were obtained from the medical records of 224 adult non-traumatic patients who were successfully resuscitated from OHCA and who survived the initial 24 h post-resuscitation phase. Univariate and multivariate analyses were performed to identify independent predictors associated with 90-day survival. Results: Significant adverse prognosticators included liver cirrhosis (HR 4.36, 95% CI 1.76 to 10.79), prolonged cardiopulmonary resuscitation (CPR) duration >20 min (HR 1.95, 95% CI 1.27 to 3.00) and underlying malignancy (HR 1.64, 95% CI 1.06 to 2.54). Favourable prognostic factors included the best Glasgow Coma Scale within 24–48 h after return of spontaneous circulation >5 (HR 0.16, 95% CI 0.04 to 0.68), mean arterial pressure on ICU admission >100 mmHg (HR 0.81, 95% CI 0.43 to 0.94) and the presenting rhythm of pulseless electrical
activity (HR 0.44, 95% CI 0.1 to 0.63). A high burden of comorbidities (by Charlson score >5) was associated with significantly poorer 90-day survival (HR 1.60, 95% CI 1.03 to 2.49). Conclusions: Underlying comorbidities have a significant influence on survival. CPR duration, post-resuscitative blood pressure and early neurological recovery may serve as practical clinical predictors of short-term survival.


Objective: To measure the growth in emergency ambulance use across metropolitan Melbourne since 1995, to measure the impact of population growth and ageing on these services, and to forecast demand for these services in 2015. Design and setting: A population-based retrospective analysis of Ambulance Victoria’s metropolitan emergency ambulance transportation data for the period from financial year 1994–95 to 2007–08, and modelling of demand in the financial year 2014–15. Main outcome measures: Numbers and rates of emergency ambulance transportations. Results: The crude annual rate of emergency transportations across all age groups increased from 32 per 1000 people in 1994–95 to 58 per 1000 people in 2007–08. The rate of transportation for all ages increased by 75% (95% CI, 62%–89%) over the 14-year study period, representing an average annual growth rate of 4.8% (95% CI, 4.3%–5.3%) beyond that explained by demographic changes. Patients aged ≥ 85 years were eight times (incident rate ratio, 7.9 [95% CI, 7.6–8.3]) as likely to be transported than those aged 45–69 years over this period. Forecast models suggest that the number of transportations will increase by 46%–69% between 2007–08 and 2014–15, disproportionately driven by increasing usage by patients aged ≥ 85 years. Conclusions: These findings confirm a dramatic rise in emergency transportations over the study period, beyond that expected from demographic changes. Rates increased across all age groups, but more so in older patients. In the future, such acceleration is likely to have major effects on ambulance services and acute hospital capacity. This calls for further investigation of underlying causes and alternative models of care.


SAVES, the name used to describe a register of survivors of out-of-hospital cardiac arrest (OHCA), was established in rural Northwest Ireland in 1992. From 1992 to 2008, 80 survivors were identified (population 239 000 (2006)). Most incidents were witnessed (69/70) and all were in shockable rhythm at the time of first rhythm analysis (66/66). Of 66 patients who could be traced, 46 were alive in December 2008. Average survival rates appeared to increase over the lifetime of the database. SAVES has also contributed to the development of a national OHCA register.


Background: We aimed at comparing the performance of the C-MAC, Airtraq, and Macintosh laryngoscopes when performing tracheal intubation in patients undergoing neck immobilization using manual inline axial cervical spine stabilization. Methods: Ninety consenting patients presenting for surgery requiring tracheal intubation were randomly assigned to undergo intubation using a C-MAC (n=30), Airtraq (n=29), or Macintosh (n=31) laryngoscope. All patients were intubated by one anaesthetist experienced in the use of each laryngoscope.
Results: The Airtraq laryngoscope performed best in these patients, reducing the Intubation Difficulty Scale score, improving the Cormack and Lehane glottic view, and reducing the need for optimization manoeuvres, compared with both the Macintosh and the C-MAC. The C-MAC and Macintosh laryngoscopes performed similarly. There were no differences in success rates or haemodynamic profiles post-intubation between any of the devices tested. Conclusions: The Airtraq laryngoscope performed better than the C-MAC and Macintosh laryngoscopes in patients undergoing cervical immobilization.


Annually, almost 6 million U.S. citizens are evaluated for acute chest pain syndromes (ACPSs), and billions of dollars in resources are utilized. A large part of the resource utilization results from precautionary hospitalizations that occur because care providers are unable to exclude the presence of coronary artery disease (CAD) as the underlying cause of ACPSs. The purpose of this study was to examine whether the addition of coronary computerized tomography angiography (CCTA) to the concurrent standard care (SC) during an index emergency department (ED) visit could lower resource utilization when evaluating for the presence of CAD. Methods: Sixty participants were assigned randomly to SC or SC + CCTA groups. Participants were interviewed at the index ED visit and at 90 days. Data collected included demographics, perceptions of the value of accessing health care, and clinical outcomes. Resource utilization included services received from both the primary in-network and the primary out-of-network providers. The prospectively defined primary endpoint was the total amount of resources utilized over a 90-day follow-up period when adding CCTA to the SC risk stratification in ACPSs. Results: The mean (± standard deviation [SD]) for total resources utilized at 90 days for in-network plus out-of-network services was less for the participants in the SC + CCTA group ($10,134; SD ±$14,239) versus the SC-only group ($16,579; SD ±$19,148; p = 0.144), as was the median for the SC + CCTA ($4,288) versus SC only ($12,148; p = 0.652; median difference = −$1,291; 95% confidence interval [CI] = −$12,219 to $1,100; p = 0.652). Among the 60 total study patients, only 19 had an established diagnosis of CAD at 90 days. However, 18 (95%) of these diagnosed participants were in the SC + CCTA group. In addition, there were fewer hospital readmissions in the SC + CCTA group (6 of 30 [20%] vs. 16 of 30 [53%]; difference in proportions = −33%; 95% CI = −56% to −10%; p = 0.007). Conclusions: Adding CCTA to the current ED risk stratification of ACPSs resulted in no difference in the quantity of resources utilized, but an increased diagnosis of CAD, and significantly less recidivism and rehospitalization over a 90-day follow-up period.

Guideline 14.1: Presentation with ACS


The goal of the 2009 American Heart Association (AHA) Cardiac Arrest Survival Summit was to develop consensus recommendations for implementation strategies to optimize the care of patients with out-of-hospital sudden cardiac arrest (OHCA). For the purposes of this conference, implementation was broadly defined as the translation of best practices into common practice. The scope was the entire system of care, including recognition and response by lay-people, emergency medical services (EMS) dispatch, EMS care, and hospital-
based care. The conference planning committee included representatives from multiple disciplines involved in all stages of cardiac arrest care. Conference participants included stakeholders from the lay public, EMS systems, relevant clinical specialties, health insurance providers, and federal regulatory and funding agencies.


To test the hypothesis that a normal capillary refill time (CRT) ≤ 2 seconds is associated with superior vena cava oxygen saturation (ScvO2) ≥ 70% in critically ill children. Two-year, prospective study in a tertiary-level pediatric intensive care unit. Whenever ScvO2 measurements were obtained, central (forehead/sternum) and peripheral (finger/toe) CRTs were concomitantly assessed. Central and peripheral CRTs ≤ 2 seconds were both associated with ScvO2 ≥ 70% (P < .01). Sensitivity/specificity analyses revealed that central CRT ≤ 2 seconds demonstrated a sensitivity of 84.4%, specificity of 71.4%, positive predictive value of 93.1%, and negative predictive value of 50.0% in predicting ScvO2 ≥ 70%. Peripheral CRT ≤ 2 seconds had a sensitivity of 71.9%, specificity of 85.7%, positive predictive value of 95.8%, and negative predictive value of 40.0% in predicting ScvO2 ≥ 70%. A normal CRT ≤ 2 seconds can be predictive of ScvO2 ≥ 70%. Our study corroborates the recommendations of the Pediatric Advanced Life Support curricula targeting a normal CRT ≤ 2 seconds as a therapeutic endpoint for goal-directed shock resuscitation. This clinical target remains particularly relevant in community hospitals when the ability to obtain central venous catheter access may be limited and ScvO2 data unavailable.

32. Reyes JA, Somers GR, Taylor GP, Chiasson DA. Increased incidence of CPR-related rib fractures in infants - is it related to changes in CPR technique? Resuscitation 2011; 82 (5): 545-8

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


Background. Endotracheal intubation (ETI) is considered to be the “gold standard” of prehospital airway management of trauma patients. However, ETI requires substantial technical skills and ongoing experience. Because failed prehospital ETI is common and associated with a higher mortality, reliable airway devices are needed to be used by rescuers who are less experienced in ETI. Objective. To prospectively evaluate the feasibility of the use of laryngeal tubes by paramedics and emergency physicians for out-of-hospital airway management in trauma patients. Methods. During a 40-month period, data for all cases of prehospital use of the laryngeal tube suction disposable (LTS-D)
within a large metropolitan area were recorded by a standardized questionnaire. We determined indications for laryngeal tube use, placement success, number of placement attempts, placement time, and personal level of experience. All patients admitted to our institution also underwent in-hospital follow-up. Results. Fifty-six of 57 prehospital intubations attempts with the LTS-D were successfully performed by paramedics (n = 19) or emergency physicians (n = 37) within one (n = 50) or two (n = 6) placement attempts. The device was used as initial airway (n = 27) or rescue device after failed ETI (n = 30). The placement time was ≤45 seconds (n = 42), 46–90 seconds (n = 13), and >90 seconds (n = 1). The majority of users (n = 44) were relative novices with no more than 10 previous laryngeal tube placements on actual patients. Of 33 patients eligible for follow-up, one underwent urgent LTS-D removal and subsequent ETI upon hospital admission, six underwent ETI after primary survey, and 26 underwent both primary and secondary survey or even damage-control surgery with the LTS-D. Conclusion. The LTS-D represents a promising alternative to ETI in the hands of both paramedics and emergency physicians. It can be used as an initial tool to secure the airway until ETI is prepared, as a definitive airway by rescuers less experienced in ETI, or as a rescue device when ETI has failed.

Guideline 11.6: Equipment & techniques in adult ALS


Despite the fact that non-steroidal anti-inflammatory drugs (NSAIDs) are contraindicated among patients with established cardiovascular disease, many receive NSAID treatment for a short period of time. However, little is known about the association between NSAID treatment duration and risk of cardiovascular disease. We therefore studied the duration of NSAID treatment and cardiovascular risk in a nationwide cohort of patients with prior myocardial infarction (MI). Methods and Results—Patients >30 years of age who were admitted with first-time MI during 1997 to 2006 and their subsequent NSAID use were identified by individual-level linkage of nationwide registries of hospitalization and drug dispensing from pharmacies in Denmark. Risk of death and recurrent MI according to duration of NSAID treatment was analyzed by multivariable time-stratified Cox proportional-hazard models and by incidence rates per 1000 person-years. Of the 83 677 patients included, 42.3% received NSAIDs during follow-up. There were 35 257 deaths/recurrent MIs. Overall, NSAID treatment was significantly associated with an increased risk of death/recurrent MI (hazard ratio, 1.45; 95% confidence interval, 1.29 to 1.62) at the beginning of the treatment, and the risk persisted throughout the treatment course (hazard ratio, 1.55; 95% confidence interval, 1.46 to 1.64 after 90 days). Analyses of individual NSAIDs showed that the traditional NSAID diclofenac was associated with the highest risk (hazard ratio, 3.26; 95% confidence interval, 2.57 to 3.86 for death/MI at day 1 to 7 of treatment). Conclusions: Even short-term treatment with most NSAIDs was associated with increased risk of death and recurrent MI in patients with prior MI. Neither short- nor long-term treatment with NSAIDs is advised in this population, and any NSAID use should be limited from a cardiovascular safety point of view.

To evaluate the prevalence and cause of severe hypokalaemia in patients administered for cardiopulmonary resuscitation (CPR) for non-traumatic cardiac arrest. We conducted a retrospective database review in the setting of a University hospital on 281 consecutive adult patients admitted to emergency admission, cardiac catheterization laboratory or intensive care units for resuscitation from non-traumatic cardiac arrest. The first available potassium value was evaluated. The mean potassium level was 3.9 ± 0.9 mmol/l and thus within the reference range of 3.5 - 5.0 mmol/l, but the overall prevalence of hypokalaemia was high (31.0%). Moderate rather than severe hypokalaemia was typically observed, with 95% of patients exhibiting potassium levels above 2.7 mmol/l. Among those six patients with extreme hypokalaemia defined as a potassium levels below the 2.5 percentile, two adult females were identified to suffer from previously untreated body scheme disorder with furosemide abuse (potassium 1.1 and 1.4 mmol/l). Another patient (potassium 2.1 mmol/l) suffered from poorly controlled bulimia nervosa and acute diarrhoea due to GI infection and one (potassium 2.4 mmol/l) from untreated bulimic anorexia. In contrast to moderately reduced potassium, which is a frequent finding in adult patients at the time of admission for non-traumatic cardiac arrest, severe hypokalaemia is uncommon. The high prevalence of patients with body dysmorphophobic eating disorders in this group underscores accidental self-induced hypokalaemia may evolve as an important differential diagnosis in cardiac arrest in young female patients.

AIMS: The aims of this study were to double check old (Resuscitation Predictor Scoring [RPS], Advanced Cardiac Life Support, and Early Prediction Score [EPS]) and form new (Serbian Quality of Life immediately [SR-QOLi], Serbian Quality of Life short-term [SR-QOLs], and Serbian Quality of Life long-term [SR-QOLl]) scores for survival prediction in out-of-hospital cardiopulmonary resuscitation (OH CPR) in Serbia. METHODS: A prospective, 2-year, multi-centre study was designed. By the means of the Utstein style, OH CPR performed and its outcome were followed. In every patient, immediate (i) (Return of Spontaneous Circulation [ROSC] >20 min), short-term (s) (to hospital discharge), and long-term [l] (1 year upon) survival after the OH CPR, under the application of RPS, ASCLS, and EPS models, was evaluated. We assessed the association between survival rate and individual predictors of OH CPR using RPS, ASCLS, and EPS: cardiopulmonary resuscitation (CPR) started (>4 or <4 minutes after out-of-hospital cardiac arrest), swallowing activity (present or not), the primary arrest mode (cardiac or respiratory), and initial pupillary photoreaction (present or absent). By the successive-logistic and linear-regression analysis method, the additional model of the type SR-QOL (SR-QOLi, SR-QOLs, and SR-QOLl) was created. RESULTS: We found that bystander CPR, witnessed arrest, shockable rhythms, CPR within 4 minutes, pupillary photoreaction, and primary cardiac arrest mode were associated with improved survival. Cumulative survival upon OH CPR was 12.7% for immediate, 11.3% before patient’s discharge, and 10% after 12 months. Applied on our sample, standard scores displayed satisfactory (RPS) and good (Advanced Cardiac Life Support and EPS) degree of survival prediction in OH CPR. In receiver operator characteristic (ROC) analysis, SR-QOLi (ROC = 0.833) and SR-QOLs (ROC = 0.882) were defined as a good models and SR-QOLl (ROC = 0.913) was defined as an excellent model for prediction of outpatient CPR outcomes. CONCLUSION: In the course of the research, SR-QOL models were created for prediction of the immediate (SR-QOLi), short-term (SR-QOLs), and long-term (SR-QOLl) survival after the OH CPR, better predictions in our environment.

Background: Almost every patient who comes to an emergency department (ED) with the chief complaint of ankle or foot pain will receive a radiograph, but less than 15% will have a finding positive for ankle or midfoot fracture. In an effort to reduce the number of radiographs performed, clinicians have attempted to derive a set of maximally sensitive clinical prediction rules. Dayan et al (Acad Emerg Med. 2004;11(7):736-745) in 2004 derived a set of such rules for children. These rules have not yet been evaluated in the adult population. 

Objective: The objective of this study is to apply the existing clinical prediction rules used to identify children with fractures after twisting injuries of the ankle to a population that includes adults. Methods: This was a prospective observational study using convenience sampling. Patients older than 2 years presenting to the ED or associated urgent care center with the chief complaint of an ankle or foot injury were considered eligible for enrollment into the study. After informed consent was obtained, 11 physical examination variables were assessed. Radiographs were obtained and reported, and the radiograph results were noted on the patient's data sheet. Based on the radiograph results, sensitivity and specificity of each of the physical examination variables were analyzed. Results: Sixty-eight patients were eligible, and 29 patients were enrolled after exclusion criteria were applied (median age, 34 years). Three patients were diagnosed with a malleolar zone fracture, and 2 patients were diagnosed with a midfoot zone fracture. Five indicators were found to be 100% sensitive for ankle fracture, and 2 indicators were 100% sensitive for midfoot fracture. 

Conclusions: The same indicators found to be predictive of high risk for fracture in a population of pediatric patients were found to be predictive in a population including adults.


Background: The circadian clock influences a number of cardiovascular (patho)physiological processes including the incidence of acute myocardial infarction. A circadian variation in infarct size has recently been shown in rodents, but there is no clinical evidence of this finding. 

Objective: To determine the impact of time-of-day onset of ST segment elevation myocardial infarction (STEMI) on infarct size. 

Methods: A retrospective single-centre analysis of 811 patients with STEMI admitted between 2003 and 2009 was performed. Infarct size was estimated by peak enzyme release. The relationship between peak enzyme concentrations and time-of-day were characterised using multivariate regression splines. Time of STEMI onset was divided into four 6-hour periods in phase with circadian rhythms. 

Results: Model comparisons based on likelihood ratio tests showed a circadian variation in infarct size across time-of-day as evaluated by peak creatine kinase (CK) and troponin-I (TnI) concentrations (p=0.015 and p=0.012, respectively). CK and TnI curves described similar patterns across time, with a global maximum in the 6:00–noon period and a local minimum in the noon–18:00 period. Infarct size was largest in patients with STEMI onset in the dark-to-light transition period (6:00–noon), with an increase in peak CK and TnI concentrations of 18.3% (p=0.031) and 24.6% (p=0.033), respectively, compared with onset of STEMI in the 18:00–midnight period. Patients with anterior wall STEMI also had significantly larger infarcts than those with STEMI in other locations. 

Conclusions: Significant circadian oscillations in infarct size were found in patients according to time-of-day of STEMI onset. The infarct size was found to be significantly larger with STEMI onset in the dark-to-light transition period (6:00–noon). If confirmed, these results may have a significant impact on the interpretation of clinical trials of cardioprotective strategies in STEMI.

Background. Some studies have shown improved outcomes with helicopter emergency medical services (HEMS) transport, while others have not. Safety concerns and cost have prompted reevaluation of the widespread use of HEMS. Objective. To determine whether the mode of transport of trauma patients affects mortality. Methods. Data for 56,744 injured adults aged ≥18 years transported to 62 U.S. trauma centers by helicopter or ground ambulance were obtained from the National Sample Program of the 2007 National Trauma Data Bank. In-hospital mortality was calculated for different demographic and injury severity groups. Adjusted odds ratios (AOR) were produced by utilizing a logistic regression model measuring the association of mortality and type of transport, controlling for age, gender, and injury severity (Injury Severity Score [ISS] and Revised Trauma Score [RTS]). Results. The odds of death were 39% lower in those transported by HEMS compared with those transported by ground ambulance (AOR = 0.61, 95% confidence interval [CI] = 0.54–0.69). Among those aged ≥55 years, the odds of death were not significantly different (AOR = 0.92, 95% CI = 0.74–1.13). Among all transports, male patients had a higher odds of death (AOR = 1.23, 95% CI = 1.10–1.38) than female patients. The odds of death increased with each year of age (AOR = 1.040, 95% CI = 1.037–1.043) and each unit of ISS (AOR = 1.080, 95% CI = 1.075–1.084), and decreased with each unit of RTS (AOR = 0.46, 95% CI = 0.45–0.48). Conclusion. The use of HEMS for the transport of adult trauma patients was associated with reduced mortality for patients aged 18–54 years. In this study, HEMS did not improve mortality in adults aged ≥55 years. Identification of additional variables in the selection of those patients who will benefit from HEMS transport is expected to enhance this reduction in mortality.


Introduction. The availability of ambulances to respond to emergency calls is related to their ability to return to service from the hospital. Extended hospital turnaround times decrease the number of available unit hours ambulances are deployed, which in turn can increase coverage costs or sacrifice coverage. Objective. To determine whether ambulance turnaround times were associated with patient acuity, destination hospital, and time of day. Methods. This retrospective analysis of ambulance hospital turnaround times utilized 12 months of data from a single, countywide, metropolitan emergency medical services (EMS) service. Turnaround time was defined as the interval between the time of ambulance arrival at the hospital and the time the ambulance became available to respond to another call. Independent variables included patient acuity (low [BLS nonemergency transport], medium [ALS care and nonemergency transport], and high [ALS care and emergency transport]), destination hospital (seven regional hospitals), and time of day (one-hour intervals). Data analysis consisted of descriptive statistics, t-tests, and linear regression. Results. Of the 61,094 patient transports, the mean turnaround time was 35.6 minutes (standard deviation [SD] = 16.5). Turnaround time was significantly associated with patient acuity (p < 0.001). High-acuity calls had a mean turnaround time of 52.5 minutes (SD = 21.5), whereas moderate-acuity and low-acuity calls had mean turnaround times of 42.0 minutes (SD = 16.4) and 32.5 minutes (SD = 14.4), respectively. A statistically significant relationship between destination hospital and turnaround time was found, with the differences in means ranging from 30 seconds to 8 minutes. Similarly, time of day was associated with turnaround time, with the longest turnaround times occurring between 0600 and 1500 hours. Conclusion. This study demonstrated that patient acuity, destination hospital, and time of day were associated with variation in ambulance turnaround times. Research describing other system characteristics such as current emergency department census and patient handoff procedures may further demonstrate areas for improvement in HTAT. Results from this analysis may be used to inspire EMS administrators and EMS medical directors to start tracking these times to create a predictive model of EMS staffing needs.

To update a comprehensive systematic review of the use of therapeutic hypothermia after cardiac arrest that was undertaken initially as part of the 2010 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science. The specific question addressed was: "in post-cardiac arrest patients with a return of spontaneous circulation, does the induction of mild hypothermia improve morbidity or mortality when compared with usual care?" Pubmed was searched using ('heart arrest' or 'cardiopulmonary resuscitation') AND 'hypothermia, induced' using 'Clinical Queries' search strategy; EmBASE was searched using (heart arrest) OR (cardiopulmonary resuscitation) AND hypothermia; The Cochrane database of systematic reviews; ECC EndNote Library for 'hypothermia' in abstract OR title. Excluded were animal studies, reviews and editorials, surveys of implementation, analytical models, reports of single cases, pre-arrest or during arrest cooling and group where the intervention was not hypothermia alone. 77 studies met the criteria for further review. Of these, four were meta-analyses (LOE 1); seven were randomised controlled trials (LOE 1), although six of these were from the same set of patients; nine were non-randomised, concurrent controls (LOE 2); 15 were trials with retrospective controls (LOE 3); 40 had no controls (LOE 4); and one was extrapolated from a non-cardiac arrest group (LOE 5). There is evidence supporting the use of mild therapeutic hypothermia to improve neurological outcome in patients who remain comatose following the return of spontaneous circulation after a cardiac arrest; however, much of the evidence is from low-level, observational studies. Of seven randomised controlled trials, six use data from the same patients.

*Guideline 11.8: Therapeutic hypothermia after cardiac arrest*


Introduction. Naloxone is widely used in the treatment and reversal of opioid overdose. Most emergency medical services (EMS) systems administer naloxone by standing order, and titrate only to reverse respiratory depression without fully reversing sedation. Some EMS systems routinely administer sufficient naloxone to fully reverse the effects of opioid overdose. Frequently patients refuse further medical evaluation or intervention, including transport. Objectives. The purpose of this study was to evaluate the safety of this practice and determine whether increased mortality is associated with full reversal of opioids. As a component of a comprehensive quality assurance initiative, we assessed mortality during the 48 hours after patients received naloxone to reverse opioid overdose followed by patient-initiated refusal of transportation. Methods. The setting was a large urban fire-based EMS system. Investigators provided the Bexar County Medical Examiner's Office (MEO) with a list of patients who were treated by the San Antonio Fire Department with naloxone, and not transported. Inclusion criteria were administration of naloxone and patient-initiated refusal. Patient dispositions also included aid only, referral to the MEO, or referral to law enforcement. The list was then compared with the MEO database. A chart review was completed on all patients treated and subsequently presented to the MEO within two days. A secondary time period of 30 days was also assessed. Results. The list identified 592 patients treated with naloxone and not transported to the emergency department. Five-hundred fifty-two patients received naloxone and refused transport or were not transported. The remaining 40 patients all presented to EMS in cardiac arrest, naloxone was administered during the course of resuscitation, and subsequent efforts were terminated in the field. None of the
patients receiving naloxone with a subsequent patient-initiated refusal were examined at the MEO within the two-day end point. The 30-day assessment revealed that nine individuals were treated with naloxone and subsequently died, but the shortest time interval between date of service and date of death was four days. Conclusion. The primary outcome was that no patients who were treated with naloxone for opioid overdose and then refused care were examined by the Medical Examiner’s Office (died) within a 48-hour time frame.


Background. While prior studies describe the clinical presentation of patients requiring paramedic out-of-hospital endotracheal intubation (ETI), limited data characterize the underlying medical conditions or comorbidities. Objective. To characterize the medical conditions and comorbidities of patients receiving successful paramedic out-of-hospital ETI. Methods. We used Pennsylvania statewide emergency medical services (EMS) clinical data, including all successful ETIs performed during 2003–2005. Using multiple imputation triple-match algorithms, we probabilistically linked EMS ETI to statewide death and hospital admission data. Each hospitalization record contained one primary and up to eight secondary diagnoses, classified according to the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). We determined the proportion of patients in each major ICD-9-CM diagnostic group and subgroup. We calculated the Charlson Comorbidity Index score for each patient. Using binomial proportions with confidence intervals (CIs), we analyzed the data and combined imputed results using Rubin's method. Results. Across the imputed sets, we linked 25,733 (77.7% linkage) successful ETIs to death or hospital records; 56.3% patients died before and 43.7% survived to hospital admission. Of the 14,478 patients who died before hospital admission, most (92.7%; 95% CI: 92.5–93.3%) had presented to EMS in cardiac arrest. Of the 11,255 hospitalized patients, the leading primary diagnoses were circulatory diseases (32.0%; 95% CI: 30.2–33.7%), respiratory diseases (22.8%; 95% CI: 21.9–23.7%), and injury or poisoning (25.2%; 95% CI: 22.7–27.8%). Prominent primary diagnosis subgroups included asphyxia and respiratory failure (15.2%), traumatic brain injury and skull fractures (11.3%), acute myocardial infarction and ischemic heart disease (10.9%), poisonings and drug and alcohol disorders (6.7%), dysrhythmias (6.7%), hemorrhagic and nonhemorrhagic stroke (5.9%), acute heart failure and cardiomyopathies (5.6%), pneumonia and aspiration (4.9%), and sepsis, septicemia, and septic shock (3.2%). Most of the admitted ETI patients had a secondary circulatory (70.8%), respiratory (61.4%), or endocrine, nutritional, or metabolic (51.4%) secondary diagnosis. The mean Charlson Index score was 1.6 (95% CI: 1.5–1.7). Conclusions. The majority of successful paramedic ETIs occur on patients with cardiac arrest and circulatory and respiratory conditions. Injuries, poisonings, and other conditions compromise smaller but important portions of the paramedic ETI pool. Patients undergoing ETI have multiple comorbidities. These findings may guide the systemic planning of paramedic airway management care and education.

Guideline 11.6: Equipment & techniques in adult ALS


Introduction: Prehospital transmission of the electrocardiogram (ECG) in ST-elevation myocardial infarction patients has been shown to reduce door to treatment time and improve outcome. Acquisition of the ECG tracing is a paramedic skill, thus limiting the benefit of early ECG transmission to primarily urban areas. The purpose of this investigation was to determine whether prehospital ECGs could be
transmitted by non-paramedic personnel. Methods: A prospective case series of consecutive patients with a chief complaint of chest pain was conducted. An ECG was transmitted on all eligible patients. Proper lead placement was verified, and the diagnostic quality of the ECG was assessed on emergency department arrival. Time on scene was recorded and compared with historical controls. Results: Ninety patients were enrolled in the study. An ECG was transmitted successfully in 89 (98.9%) of 90 patients. Accurate lead placement was noted in 89 (98.9%) of 90, and the ECG was of "diagnostic quality" in 85 (95.5%) of 89 patients. There was no increase in scene time during the study period. Conclusion: Prehospital transmission of diagnostic-quality ECG can be reliably performed by non-paramedic providers.

BACKGROUND: Little is known about the effects of geographic variation on outcomes of out-of-hospital cardiac arrest (OHCA). The present study investigated the relationship between population density, time between emergency call and ambulance arrival, and survival of OHCA, using the All-Japan Utstein-style registry database, coupled with geographic information system (GIS) data. METHODS: We examined data from 101,287 bystander-witnessed OHCA patients who received emergency medical services (EMS) through 4,729 ambulatory centers in Japan between 2005 and 2007. Latitudes and longitudes of each center were determined with address-match geocoding, and linked with the Population Census data using GIS. The endpoints were 1-month survival and neurologically favorable 1-month survival defined as Glasgow-Pittsburgh cerebral performance categories 1 or 2. RESULTS: Overall 1-month survival was 7.8%. Neurologically favorable 1-month survival was 3.6%. In very low-density (<250/km2) and very high-density (>=10,000/km2) areas, the mean call-response intervals were 9.3 and 6.2 minutes, 1-month survival rates were 5.4% and 9.1%, and neurologically favorable 1-month survival rates were 2.7% and 4.3%, respectively. After adjustment for age, sex, cause of arrest, first aid by bystander and the proportion of neighborhood elderly people >=65 yrs, patients in very high-density areas had a significantly higher survival rate (odds ratio (OR), 1.64; 95% confidence interval (CI), 1.44 - 1.87; p < 0.001) and neurologically favorable 1-month survival rate (OR, 1.47; 95%CI, 1.22 - 1.77; p < 0.001) compared with those in very low-density areas. CONCLUSION: Living in a low-density area was associated with an independent risk of delay in ambulance response, and a low survival rate in cases of OHCA. Distribution of EMS centers according to population size may lead to inequality in health outcomes between urban and rural areas.

Background--Sudden death (SD) is a frequent catastrophic complication in patients after myocardial infarction. Circumstances of SD may affect strategies for prevention. Methods and Results--We reviewed source documentation for 1067 patients who died suddenly in the Valsartan in Acute Myocardial Infarction Trial (VALIANT) trial. We determined the circumstances of these events and assessed long-term mortality in patients who were resuscitated. Location of the SD event was available in 978 of 1067 patients, with 226 events occurring within the first 40 days. Although SD was more likely to occur at home (645 of 978, 66%) than in hospital (204 of 978, 21%), the proportion of in-hospital events was higher early on (99 of 226, 44%). Home events were less likely to be witnessed regardless of time frame. Preceding activity was known for 42% of patients with home arrest; of these, 52% were determined to be asleep at time of event, and these deaths were more likely to be unwitnessed. A majority of patients for whom initial ECG rhythm was reported had ventricular
tachycardia/ventricular fibrillation (189 of 283, 67%). Of the 155 patients successfully resuscitated, 24% subsequently received an implantable cardioverter-defibrillator. Nineteen percent of those who received an implantable cardioverter-defibrillator subsequently died compared with 49% of patients who did not receive an implantable cardioverter-defibrillator (hazard ratio, 0.36; 95% confidence interval, 0.14 to 0.93; P=0.04). Conclusions--A high proportion of sudden death (SD) events after high-risk myocardial infarction occurred at home, but in-hospital events were more common early on. Patients who were asleep were more likely to have un witnessed arrests. Alternative strategies for the prevention of SD in patients who are not candidates for implantable cardioverter-defibrillator will need to take into account the circumstances of SD events.

Reviews

Emergency departments (EDs) in many developed countries are experiencing increasing pressure due to rising numbers of patient presentations and emergency admissions. Reported increases range up to 7% annually. Together with limited inpatient bed capacity, this contributes to prolonged lengths of stay in the ED; disrupting timely access to urgent care, posing a threat to patient safety. The aim of this review is to summarise the findings of studies that have investigated the extent of and the reasons for increasing emergency presentations. To do this, a systematic review and synthesis of published and unpublished reports describing trends and underlying drivers associated with the increase in ED presentations in developed countries was conducted. Most published studies provided evidence of increasing ED attendances within developed countries. A series of inter-related factors have been proposed to explain the increase in emergency demand. These include changes in demography and in the organisation and delivery of healthcare services, as well as improved health awareness and community expectations arising from health promotion campaigns. The factors associated with increasing ED presentations are complex and inter-related and include rising community expectations regarding access to emergency care in acute hospitals. A systematic investigation of the demographic, socioeconomic and health-related factors highlighted by this review is recommended. This would facilitate untangling the dynamics of the increase in emergency demand.

The use of electronic control devices has expanded worldwide during the last few years, the most widely used model being the Taser. However, the scientific knowledge about electronic control devices remains limited. We reviewed the medical literature to examine the potential implications of electronic devices in terms of morbidity and mortality, and to identify and evaluate all the existing experimental human studies. A single exposure of an electronic control device on healthy individuals can be assumed to be generally safe, according to 23 prospective human experimental studies and numerous volunteer exposures. In case series, however, electronic control devices could have deleterious effects when used in the field, in particular if persons receive multiple exposures, are intoxicated, show signs of "excited
delirium," or present with medical comorbidities. As the use of electronic control devices continues to increase, the controversy about its safety, notably in potentially high-risk individuals, is still a matter of debate. The complications of electronic control device exposure are numerous but often recognizable, usually resulting from barbed dart injuries or from falls. Persons exposed to electronic control devices should therefore be fully examined, and traumatic lesions must be ruled out.

Animal, Manikin & Cadaver models


Background. Various alternative airway devices have been developed in the last several years. Among these is the Supraglottic Airway Laryngopharyngeal Tube (SALT), which was designed to function as a basic mechanical airway and as an endotracheal tube (ET) introducer for blind endotracheal intubation (ETI). Objective. To determine the rate of successful placement of the SALT and the success rate of subsequent blind ET insertion by a cohort of emergency medical services (EMS) providers of varying levels of EMS certification. Methods. This study was a two-phase, two-group non-blinded, prospective time trial using a convenience cohort of prehospital providers to determine the success rate for SALT placement (i.e., the basic life support [BLS] phase) and ET placement using the SALT (i.e., the advanced life support [ALS] phase) in an unembalmed human cadaver model. The part 1 cohort (group 1) comprised predominantly basic and intermediate emergency medical technician (EMT)-level providers, whereas the part 2 cohort (group 2) comprised exclusively paramedic-level providers. Results. In group 1, 51 (98%) of the subjects were able to successfully place the SALT and ventilate the cadaver (BLS phase), with 48 (92.3%) subjects successfully placing it on the first attempt. In group 2, 21 (96%) of the subjects were able to successfully place the SALT, with 19 (86%) placing the SALT on the first attempt. Successful blind placement of an ET through the SALT (ALS phase) by group 1 was 48.1% (95% confidence interval [CI]: 34–62), with 37% (95% CI: 24–51) placing the ET on the first attempt. In group 2, 20 subjects (91% [95% CI: 71–99]) were able to successfully place an ET through the SALT, with 13 (59% [95% CI: 36–79]) doing so on the first attempt. Conclusions. Emergency medical services providers of varying levels can successfully and rapidly place the SALT and ventilate a cadaver specimen. The success rate for blind placement of an ET through the SALT was suboptimal. Guideline 11.6: Equipment & techniques in adult ALS


Study objective: Early antidotal therapy may be lifesaving in hazardous materials victims. Intravenous line placement is difficult while wearing personal protective equipment (PPE). We assessed the ability of protected, experienced first responders and limited-experience first receivers to place intraosseous (IO) lines for antidote administration. Methods: Six first responders donned 4 (A, B, C, and D) and 12 first receivers donned 2 (C and D) United States Environmental Protection Agency PPE levels in random order and then placed IO lines in 1 of 4 anatomical sites in 12 anesthetized Spanish goats. Observers timed interventions until bolus injection of isotonic sodium chloride.
solution. First responders placed IO lines successfully in 100% of cases. The median (interquartile range) times to completion (in seconds) were as follows: level A, 43.5 (23.0); B, 45.0 (29.0); C, 40.0 (15.0); D, 30.0 (17.0). First receivers placed IO lines successfully in 91% of cases. The median (interquartile range) times to completion (in seconds) were as follows: level C, 42.0 (19.5); D, 37.0 (11.0). There were no significant differences in time to completion among PPE levels (overall or pairwise) or between operator groups. Two (4%) of 48 line placements resulted in recognized extravasation due to penetration of the opposite cortex. Infusions were completed successfully. Conclusion: Hazardous materials first responders and receivers can effectively place IO lines in a goat while wearing PPE. Intraosseous lines may facilitate earlier administration of antidotes in hazardous materials victims.


Background: After spine board immobilization of the trauma victim and transport to the hospital, the patient is removed from the spine board as soon as practical. Current Advanced Trauma Life Support's recommendations are to log roll the patient 90 degrees, remove the spine board, inspect and palpate the back, and then log roll back to supine position. There are several publications showing unacceptable motion in an unstable spine when log rolling. Methods: Cervical spine motion was evaluated during spine board removal. A C5 to C6 instability was surgically created in cadavers. A three-dimensional electromagnetic tracking system was used to assess motion between C5 and C6. The log roll was compared with a lift-and-slide technique. Throughout the log roll procedure, manual inline cervical stabilization was provided by a trained individual in a series of trials. In other trials, the lift-and-slide technique was used. In the final stage, the amount of motion generated was assessed when the spine board removal techniques were completed by experienced and novice persons in maintaining inline stabilization of the head and neck. Results: Motion between C5 and C6 was reduced during the lift-and-slide technique in five of six parameters. The reduction was statistically significant in four parameters. When performing the log roll, motion was not reduced with increased head holder experience. Conclusions: Spine boards can be removed using a lift-and-slide maneuver with less motion and potentially less risk to the patient's long-term neurologic function than expected using the log roll.


Clinical observations suggest that the assumption of a linear relationship between chest compression pressure and cardiac output may be oversimplified. More complex behaviour may occur when the transmural pressure is large, changing the compliances and resistances in the intra-thoracic vasculature. A fundamental understanding of these compression-induced phenomena is required for improving CPR. An extensively used, lumped element computer model (model I) of the circulation was upgraded and refined to include the intrathoracic vasculature (model II). After validation, model II was extended by adding variable compliances and resistances (model III) to the vascular structures. Successively, ranges of compression pressures, frequencies, duty cycles and compression pulse shapes were applied while controlling all other parameters. Cardiac output was then compared. The nonlinearities in compliance and resistance become important, limiting factors in cardiac output, starting in our experimental series at 70 mmHg peak compression pressure, and increasing with higher pressures. This effect is reproducible for sinusoidal and trapezoidal compression forms, resulting in lower cardiac output in all experiments at high compression pressures. Duty cycle and wait time are key parameters for cardiac output. Our data strongly indicate that vascular
compliance, especially the ability of vessels to collapse (and potentially the cardiac chambers), can be a central factor in the limited output generated by chest compressions. Just pushing "harder" or "faster" is not always better, as an 'optimal' force and frequency may exist. Overly forceful compression can limit blood flow by restricting filling or depleting volume in the cardiac chambers and central great vessels.

53. Larabee TM, Campbell JA, Severyn FA, Little CM. Intravenous infusion of ice-cold saline is less efficacious than intravenous infusion for induction of mild therapeutic hypothermia in a swine model of cardiac arrest. Resuscitation 2011; 82 (5): 603-6

Intravenous (IV) infusion of ice-cold saline is an effective method to initiate induction of mild therapeutic hypothermia (MTH) following resuscitation from out-of-hospital cardiac arrest (OOHCA). Intravenous (IO) infusion of cold saline may be an alternative method to induce MTH. The goal of this study was to determine if intravenous infusion of cold saline is a comparable alternative to IV infusion for inducing MTH in a laboratory swine model of cardiac arrest. Ten mixed breed swine were resuscitated from cardiac arrest and randomized post-resuscitation to infusion with ice-cold saline using either IO (n=5) or IV (n=5) access. The study endpoints were either a goal esophageal temperature of 34°C or the elapse of a 30min time period, simulating a long prehospital transport. Four of five pigs in the IV infusion group achieved goal temperature within 30min compared to 0/5 in the IO infusion group (p=0.048). The mean esophageal temperature change was significantly higher in the IV group when compared to the IO group (p<0.001). Post-arrest hemodynamic parameters were similar between the two groups. IV infusion of ice-cold saline is an efficacious method to achieve MTH in this swine model of cardiac arrest. Furthermore, IO infusion of cold saline is not sufficient to induce MTH in the time routinely available in the prehospital setting following OOHCA.

Guideline 11.8: Therapeutic hypothermia after cardiac arrest


Objectives: Tracheal mucosal perfusion is compromised at an endotracheal tube (ETT) cuff pressure of 30 cm H_2O, and blood flow is obstructed at a pressure of 50 cm H_2O. Methods: We measured the change in pressure of air-filled cuffs of 6.0 and 7.5 ETTs and a size 4 laryngeal mask airway (LMA) from sea level to 2400 m. The ETTs and LMA cuff measurements were done with the devices uncontained, and an additional 6.0 ETT was placed in a 10-mL syringe barrel to mimic placement in a trachea. This restricted cuff expansion simulating what would occur when it is placed within the trachea. The pressure of fluid-filled 6.0 ETT cuffs was also measured. Results: Intracuff pressure increases linearly with increasing altitude, in all air-filled ETT and LMAs. Water-filled cuffs demonstrated no significant change in pressure with changes in altitude. The rate of ETT cuff pressure increase was greater for the ETT restricted within the syringe barrel compared with the unrestricted ETT cuff. The rate of LMA cuff pressure increase was greater than the rate of increase for all the ETTs (restricted and unrestricted). Conclusions: This model indicates that ETT cuffs inflated before air transport are likely to exceed critical pressure levels rapidly during flight. In addition, there will be loss of ETT cuff pressure, with loss of a good seal, during descent if a cuff is initially inflated at peak altitudes. Therefore, we suggest ETT cuff pressures should be monitored and adjusted continuously during ascent and descent.

Guideline 11.6: Equipment & techniques in adult ALS

This study investigated the systemic and microvascular hemodynamic changes related to increased nitric oxide (NO) availability following significant hemorrhage, made available by administration of NO releasing nanoparticles (NO-nps). Hemodynamic responses to hemorrhagic shock were studied in the hamster window chamber. Acute hemorrhage was induced by arterial controlled bleeding of 50% of blood volume, and the resulting hemodynamic parameters were followed over 90 min. Exogenous NO was administered in the form of NO-nps (5mg/kg suspended in 50ml saline) 10 min following induced hemorrhage. Control groups received equal dose of NO free nanoparticles (Control-nps) and Vehicle solution. Animals treated with NO-nps partially maintained systemic and microvascular function during hypovolemic shock compared to animals treated with Control-nps or the Vehicle (50ml saline). The continuous NO released by the NO-nps reverted arteriolar vasoconstriction, partially recovered both functional capillary density and microvascular blood flows. Additionally, NO supplementation post hemorrhage prevented cardiac decompensation, and thereby maintained and stabilized the heart rate. Paradoxically, the peripheral vasodilation induced by the NO-nps did not decrease blood pressure, and combined with NO's effects on vascular resistance, NO-nps promoted intravascular pressure redistribution and blood flow, avoiding tissue ischemia. Therefore, by increasing NO availability with NO-nps during hypovolemic shock, it is possible that cardiac stability and microvascular perfusion can be preserved, ultimately increasing survivability and local tissue viability, and reducing hemorrhagic shock sequelae. The relevance, stability, and efficacy of exogenous NO therapy in the form of NO-nps will potentially facilitate the intended use in battlefield and trauma situations.


Objective. To determine whether prehospital providers can successfully place a pediatric King laryngeal tube (LT-D) and ventilate a Laerdal SimBaby pediatric simulator during a respiratory arrest simulation. Methods. We studied the ability of 45 paramedics and flight nurses to place the pediatric King LT-D in a SimBaby manikin. For the purposes of this study, paramedics and flight nurses were considered equivalent, because in this air medical system they have the same scope of practice in regard to airway skills. Because the participants had previous training and field experience with the adult King LT-D, we limited pediatric King LT-D training to our standard adult training plus selecting the correct size and inflation volumes for the device. Outcomes included rate of successful pediatric King LT-D placement, number of attempts to correctly place the tube, and time to first adequate ventilation. The subjects were evaluated on airway management using an 11-point skill test. A score of 8 or greater (≥73%) was considered passing. The subjects indicated their perceptions and preferences for the pediatric King LT-D using a five-point Likert scale. Data were analyzed using descriptive statistics. Results. Crewmembers successfully placed the pediatric King LT-D 95.5% (43/45) of the time. The median number of attempts was one. Four subjects required a second attempt; two of these subjects failed at placement. Mean time to placement was 34 seconds (95% confidence interval [CI]: 26.4–67.3 sec). Ninety percent of the participants (40/45) successfully completed the skill test, with a mean score of 78.2% (95% CI: 73.6–82.7). The subjects strongly agreed that their previous training on the adult King LT-D and using it in the field had adequately prepared them to use the pediatric King LT-D. The subjects agreed that the pediatric King LT-D was easier to place than a pediatric endotracheal tube; they strongly agreed that they would use the pediatric King LT-D as an alternative airway. The participants disagreed that they would prefer the pediatric King LT-D as a primary means of securing pediatric airways. Conclusions. The pediatric
King LT-D was quickly and reliably placed. Providers perceived the pediatric King LT-D to be easier to use than pediatric endotracheal intubation in this setting.

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

Guideline 11.6: Equipment & techniques in adult ALS

Background: Videolaryngoscopy has been developed mainly to assist difficult airway intubation. However, there is a lack of studies demonstrating the real efficacy of its use in children. In this study, we tested the hypothesis that GlideScope (Verathon Inc, Bothell, Wash) videolaryngoscope improves tracheal intubation when used by pediatric residents in an advanced patient simulation model. Methods: Pediatric residents who passed a pediatric advanced life support course were eligible for the study. An advanced infant simulator was used, and 4 scenarios were proposed: normal airway (NA), tongue edema (TE), tongue edema and oropharyngeal edema, and cervical collar. No participant had prior experience with any videolaryngoscope. After a brief instruction in GlideScope technique, each participant performed the 4 scenarios using both the standard Miller and GlideScope laryngoscopes, in a random sequence. Results: Sixteen residents were included. The number of failed intubations was higher with GlideScope in NA and TE scenarios (3 vs 0, in both cases). Mean (SD) time to successful intubation was significantly longer with GlideScope in the NA scenario (GlideScope, 38 [SD, 13] vs Miller, 26
The number of maneuvers was significantly higher with GlideScope in the tongue edema and oropharyngeal edema scenario (2.3 [SD, 1.5] vs 1.5 [SD, 1]; P = 0.04). Upper jaw injury index was significantly lower with GlideScope in NA (2.0 [SD, 1] vs 2.6 [SD, 0.8]; P = 0.008) and cervical collar (2.1 [SD, 1.0] vs 2.8 [SD, 0.5]; P = 0.011) scenarios. Participants considered GlideScope technique more difficult than standard Miller in NA (5 [SD, 2.0] vs 3 [SD, 1.3]; P = 0.04) and TE (5.9 [SD, 2.5] vs 3.9 [SD, 1.7]; P = 0.02) scenarios. Conclusions: In simulated scenarios of infant NA and difficult airway, when used by pediatric residents, GlideScope did not improve intubation performance when compared with the standard laryngoscope. Nevertheless, GlideScope may be safer for upper jaw injury and could have advantages in the management of complicated airway. Further studies are needed to assess if specific training will improve GlideScope intubation performance and whether the “in simulator” results translate into clinical practice.

Case Studies, Letters & Editorials


Background: Prehospital cardiac arrest associated with trauma almost always results in death. A case of survival after prehospital thoracotomy was published in 1994 and several others have followed. This article describes the result of prehospital thoracotomy in a physician-led system for patients with stab wounds to the chest who suffered cardiac arrest on scene. Methods: A 15-year retrospective prehospital trauma database review identified victims of stab wounds to the chest who suffered cardiac arrest on scene and had thoracotomy performed according to local standard operating procedures. Results: Overall, 71 patients met inclusion criteria. Thirteen patients (18%) survived to hospital discharge. Neurologic outcome was good in 11 patients and poor in 2. Presenting cardiac rhythm was asystole in four patients, pulseless electrical activity in five, and unrecorded in the remaining four. All survivors had cardiac tamponade. The medical team was present at the time of cardiac arrest for six survivors (good neurologic outcome): arrived in the first 5 minutes after arrest in three patients (all good neurologic outcome), arrived 5 minutes to 10 minutes after arrest in two patients (one poor neurologic outcome), and in one patient (poor neurologic outcome) the period was unknown. Of the survivors, seven thoracotomies were performed by emergency physicians and six by anesthesiologists. Conclusions: Prehospital thoracotomy is a well-established procedure in this physician-led prehospital service. Results from this and other similar systems suggest that when performed for the subgroup of patients described, significant numbers of survivors with good neurologic outcome can be expected.

Case series


Extra corporeal life support (ECLS) with a mobile system is an option in the treatment of cardiac arrest often of unknown reason. After commencing ECLS the search for a provoking origin may include advanced radiologic examinations before deciding further treatment.
Fifty-eight patients with circulatory arrest were treated with ECLS. In 15 cases the patient went through CT scans of the cerebrum, thorax and abdomen, pulmonary angiography, and or invasive cardiologic examinations. Two patients were transported in ambulance and helicopter on ECLS before the examinations. The underlying diagnosis in the 15 patients were: lung embolism (n=6), accidental hypothermia (n=2), myocardial infarction (n=2), WPW syndrome (n=1), sepsis (n=1), disseminated intravascular coagulation (n=2), high voltage accident (n=1). Only in the last mentioned patient the CT scan was indicative of major brain damage, and further treatment was stopped. Five of the 15 examined patients survived. The diagnoses in the survivors were lung embolism (n=2), myocardial infarction (n=1), WPW syndrome (n=1), and accidental hypothermia (n=1). The results of the radiologic examinations had great influence on all treatments.

It is possible to make radiological examinations i.e., CT scans, pulmonary and coronary angiography in patients suffering heart arrest of unknown origin with the use of ECLS in order to improve patient treatment in this very high-risk population.

Case series


Sudden cardiac death is rare in children and adolescents but accounts for 19% to 30% of sudden deaths until 21 years of age. Fatal ventricular arrhythmias are usual common pathways in such tragic events, and underlying etiologies include cardiac ion channelopathies in majority of cases. We present a case of aborted sudden cardiac death in field, resuscitated successfully, and a clinical event in the pediatric emergency department that led to the diagnosis of the underlying rare condition.

Case study


"Bougies," otherwise known as endotracheal tube introducers, remain preferred devices for the emergency physician when faced with a difficult airway. Bougies have high success rates for the prehospital provider and the first-time emergency department (ED) user, with few reported complications. Inexpensive, disposable models provide simple yet valuable tools in the challenging patient with an anterior airway or limited neck mobility. Objectives: Use of the bougie is similar to standard endotracheal intubation. Correct placement is determined by feeling "clicks" as the device passes over the tracheal rings and a "hold up" when entering the distal airways. Case Reports: Three recent cases from our ED are briefly reported, in which the bougie was invaluable in the management of the difficult airway. All patients had limited visualization of the glottis but were intubated successfully. Conclusion: This article discusses three example cases, and then reviews the history of the bougie, placement technique, and current evidence for use.

Case studies

Education & ethics in resuscitation
63. Bhanji F, Gottesman R, de Grave W, Steinert Y and Winer L. Paediatric resuscitation training: Do medical students believe it should be a mandatory component of the curriculum? Resuscitation 2011; 82 (5): 584-7

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

64. Adelborg K, Thim T, Secher N, Grove EL, Lofgren B. Benefits and shortcomings of mandatory first aid and basic life support courses for learner drivers. Resuscitation 2011; 82 (5): 614-17

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


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

Purpose: The object of this study was to assess, in cost-effective measures, 3 different models for pediatric first-aid training among caregivers and teachers. Methods: Quasi-experimental design was used. A stratified random sampling method was used to obtain 1282 teachers working at nurseries and kindergartens in Shanghai that consists of 18 districts and 1 county. One thousand two hundred eighty-two teachers were allocated randomly to the 3 models of training: 441 to interactive training model (group A), 441 to lecture-based training model (group B), and 400 to video instruction training model (group C). The first-aid knowledge in the 3 models was evaluated before and after the training. Results: There was a statistical significance in the results of post-assessment among the 3 training models. In group A, 329 (87.3%) trainees passed the course; in group B, 294 (81.7%) passed; and in group C, 262 (79.4%) passed. The total cost of group A was ¥2361 per edition, the total cost of group B was ¥1955 per edition, and the total cost of group C was ¥1064 per edition (P < 0.001). The cost per passed student was ¥151 in group A, ¥74 in group B, and ¥41 in group C (P < 0.001). Conclusions: Although interactive training model may slightly increase the rate of trainees who passed the course, the cost-effectiveness of video instruction training model is clearly superior.

Guideline 10.1: BLS training

67. Moran K and Stanley T. Toddler parents training, understanding, and perceptions of CPR. Resuscitation 2011; 82 (5): 572-6
Little is known about parent CPR skills and their perceptions of its use, especially in the context of drowning incidents among young children where parents are often the first responder. The primary objective of the study was to examine parental understanding of child and adult CPR, extent of CPR training, and parental confidence to perform CPR. Survey research using a self-complete questionnaire was used to gather data from parents (n=1716) whose 2 - 4-year-old toddlers were either attending early childhood centres (n=781) or enrolled in swim schools (n=935). Differences in parental CPR training, knowledge, levels of confidence in ability to perform CPR, and perceptions were measured by frequency, with regression tests used to discern differences by institution, gender, ethnicity, length of residency, and recency of CPR training. Almost two-thirds (64%) of parents reported that they had received formal CPR training in the past, yet few correctly reported the current ratios for either adult CPR (19%) or child CPR (12%). Most parents correctly agreed that, in child CPR, you
must always give initial breaths before starting compressions (74%), but the majority incorrectly believed you should seek help before starting CPR (61%) and continue CPR for 5min before stopping (59%). Most parents (56%) felt anxious about their ability to perform CPR on an adult, and even more (62%) felt anxious about their ability to perform child CPR. Our findings highlight the need for education interventions to address the substantial gaps in knowledge of CPR for all parents of young children.

*Guideline 10.1: BLS training*


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

*Guideline 10.1: BLS training*


It has been hypothesized that high rates of cardiopulmonary resuscitation (CPR) training in a community will lead to improved survival for out-of-hospital cardiac arrest. However, factors to consider when designing a far-reaching community CPR training program are not well defined. We explored factors associated with receiving CPR training in the survey community and characteristics contributing to willingness to perform CPR in an emergency. A telephone survey was administered to 1001 randomly selected residents in September 2008 assessing CPR training history, demographics, and willingness to perform CPR. Characteristics of survey respondents were compared to examine factors that may be associated with reports of being trained compared to reports of never being trained. A stratified analysis compared characteristics of respondents who reported a high level of willingness to perform CPR in those trained compared to those never trained. The survey response rate was 39%. Seventy-nine percent of survey respondents reported ever attending a CPR training class. A majority of people (53%) attended their most recent class more than five years ago. People who had never been trained in CPR were older, were more likely to be men and were less likely to have at least a 2-year college degree than those who had ever been
trained. Among those who had been trained, younger age, male gender, time of last training and number of times trained were all significantly associated with willingness to perform CPR and none of these factors were associated with willingness in those who had not been trained. Retraining rates, methods for reaching underserved populations and measures that will improve the likelihood that bystanders will perform CPR in an emergency should be considered when designing a community CPR education program.

Guideline 10.1: BLS training


This study aimed to evaluate the association of cardiopulmonary resuscitation (CPR) training with bystander resuscitation performance and patient outcomes after out-of-hospital cardiac arrest (OHCA). This was a prospective, population-based cohort study of all persons aged 18 years or older with OHCA of presumed intrinsic origin and their rescuers from January through December 2008 in Takatsuki, Osaka prefecture, Japan. Data on resuscitation of OHCA patients were obtained by emergency medical service (EMS) personnel in charge based on the Utstein style. Rescuers’ characteristics including experience of CPR training were obtained by EMS personnel interview on the scene. The primary outcome was the attempt of bystander CPR. Data were collected for 120 cases out of 170 OHCA of intrinsic origin. Among the available cases, 60 (50.0%) had previous CPR training (trained rescuer group). The proportion of bystander CPR was significantly higher in the trained rescuer group than in the untrained rescuer group (75.0% and 43.3%; p=0.001). Bystanders who had previous experience of CPR training were 3.40 times (95% confidence interval 1.3’ 8.85) more likely to perform CPR compared with those without previous CPR training. The number of patients with neurologically favorable one-month survival was too small to evaluate statistical difference between the groups (2 [3.3%] in the trained rescuer group versus 1 [1.7%] in the untrained rescuer group; p=0.500). People who had experienced CPR training had a greater tendency to perform bystander CPR than people without experience of CPR training. Further studies are needed to prove the effectiveness of CPR training on survival.

Guideline 10.1: BLS training


Simulation-based inter-professional team training is important to ensure high-quality, safe patient care, but several barriers exist, including diverging learning needs and schedules as well as limited available resources. Methods. The authors developed an in situ, simulation-based inter-professional team training program around pediatric emergencies for physicians, nurses, respiratory therapists, and pharmacists at their institution and performed an analysis of the program, impact on self-efficacy in resuscitation skills among pediatric residents and nurses. Results. The results showed that with a design based in best principles of team training and simulation education, inter-professional team training is feasible and sustainable. The program had a beneficial effect on self-efficacy in resuscitation skills among both residents and nurses at the authors’ institution and received widespread acceptance. Conclusions. A collaborative approach to design and implementation of inter-professional team training can lead to a sustainable program that serves both patient safety and training requirements set forth by professional organizations.
This study examined whether biases concerning age and/or disability status influenced resuscitation decisions. Medical students were randomly chosen to read 1 of 4 vignettes, organized in a 2 (age: infant vs school-age) × 2 (disability: preexisting vs no preexisting) between-subjects design. The vignettes described a pediatric patient experiencing an acute episode who required resuscitation. Following resuscitation, patients with existing disability would continue to have disability, whereas those without would develop disability. Participants indicated whether they would resuscitate, given a 10% chance of success. There was a significant main effect of disability: Medical students displayed a preference for resuscitating previously disabled children compared with previously healthy children when prognosis was held constant, F(1, 121) = 4.89, p = .03. This differential treatment of the two groups cannot easily be morally justified and poses a quandary for educators.

Another important study

73. Lee L, Frederick S and Ariely D. Try It, You’ll Like It: The Influence of Expectation, Consumption, and Revelation on Preferences for Beer. Psychological Science 2006; 17 (12): 1054-8
Patrons of a pub evaluated regular beer and ‘MIT brew’ (regular beer plus a few drops of balsamic vinegar) in one of three conditions. One group tasted the samples blind (the secret ingredient was never disclosed). A second group was informed of the contents before tasting. A third group learned of the secret ingredient immediately after tasting, but prior to indicating their preference. Not surprisingly, preference for the MIT brew was higher in the blind condition than in either of the two disclosure conditions. However, the timing of the information mattered substantially. Disclosure of the secret ingredient significantly reduced preference only when the disclosure preceded tasting, suggesting that disclosure affected preferences by influencing the experience itself, rather than by acting as an independent negative input or by modifying retrospective interpretation of the experience.