
The aim of this study was to determine whether a normal range of elbow movement can be used as a rule out tool for significant injury after blunt trauma in the paediatric population. Methods: A prospective observational study was set up in an Australian tertiary paediatric emergency department. Patients from 3 to 16 years old were included. Active range of elbow movement (flexion, extension, supination and pronation) was recorded as either normal or abnormal. All participants received standard elbow x-rays. Range of movement (ROM) was compared to the radiologist's final x-ray report. An x-ray was considered abnormal if it showed a fracture, dislocation or isolated elbow effusion. Results: 177 patients were included in the study, of which all received elbow x-rays. 146 had a restricted ROM (82%). 106 x-rays were reported as abnormal (60%). An abnormal ROM had a sensitivity of 93.4% (95% CI 86.9% to 97.3%), specificity 33.8% (95% CI 23.0% to 46.0%) and negative predictive value of 77.4% (95% CI 58.9% to 90.4%) for an abnormal x-ray. There were seven false-negative results in this group. Clinical management was changed in four of these patients due to abnormalities seen on x-ray. Conclusion: In the setting of blunt trauma resulting in elbow injury in children, a normal range of movement does not rule out a significant injury and should not be used as a screening tool.


Aeromedical transfer can reduce transfer times for primary percutaneous coronary intervention (PPCI). Delays in dispatch of the helicopter and landing-reperfusion can reduce the benefits of air travel. The ad hoc nature of these transfers may compound delays. A formal aeromedical transfer service, with rapid dispatch protocols and rapid landing to balloon times could significantly reduce reperfusion times. Methods: A standard operating procedure (SOP) was developed using a field assessment team (doctor, aircrew paramedic) and a cardiologist-led multidisciplinary team meeting the incoming aircraft. The aeromedical SOP for STEMI care was implemented when anticipated land journey >30 min to the nearest PPCI centre. Reperfusion times for actual air travel and estimated virtual land journeys from the same location were compared. Results: Between April and December 2009, 8 patients were managed according to the aeromedical SOP. Median air distance 49 miles and road, 40 miles. All subsequent data shown in median minutes (range). Call-balloon time 109 (97-116). Call-aeromedical activation 13 (9-26). Aeromedical activation-arrive scene 12 (9-16). Time at scene 29 (24-52). Call-depart scene 57 (45-75). Air journey 25 (18-30) and landing-balloon 21 (8-22). Call-arrive at PPCI centre for air 85 (70-95); estimated virtual road call-arrive at PPCI centre 102 (85-104). Conclusions: This SOP delivered sub 120 min call-balloon times in all cases undergoing PPCI from difficult locations where anticipated land journeys were >30 min. With longer anticipated land journeys (or more remote locations) the proportional gains with air transfer will be greater. Subject to a formal SOP and very rapid landing-balloon times, aeromedical transfer can significantly reduce the number of patients suffering long reperfusion delays in acute myocardial infarction.

*Guideline 14: ACS*

Objective: To aggregate data across institutions to identify, characterize, and differentiate potential survivors from non-survivors based on etiology of event. Aim: To evaluate the association of the cardiopulmonary resuscitation (CPR) duration and probability of survival (Ps), stratified by etiology of arrest (for paediatric patients). Background: In-hospital cardiac arrests occur in 2–6% of pediatric patients with poor survival rates resulting in significant expenditures of time and resources. Methods: Retrospective data from six pediatric hospitals on patients suffering from pulseless cardiac arrests receiving CPR for over one minute were analyzed. Data included demographics, reason for code, pre-cardiac arrest diagnosis, devices and treatment, management strategies during cardiac arrest, compression duration, outcome at hospital discharge, and neurologic outcome of survivors at hospital discharge. Results of logistic regression analysis generated predicted probabilities of survival for duration of compression. Patients were stratified by cardiac-induced cardiac arrests (CICA) and respiratory-induced cardiac arrest (RICA). Results: A total of 257 patients were included, and 27% of CICA (cardiac induced cardiac arrest) and 35% of RICA (respiratory-induced cardiac arrest) patients survived to hospital discharge. The probability of survival was initially lower for the CICA patients (Ps at 1 min = 29%) and remained constant (Ps at 60 min = 25%). RICA patients’ Ps was higher initially (Ps at 1 min = 62%) but demonstrated a dramatic drop within the first 60 min of CPR (Ps at 60 min = 0.2%). Conclusions: Probability of survival curves based on duration of CPR was statistically significantly different for CICA (cardiac induced cardiac arrest) patients compared to RICA (respiratory-induced cardiac arrest) patients.

Guideline 12: Paediatric ALS


In-hospital cardiac arrest is a significant public health problem with a low probability of patient survival to hospital discharge. Objective: We evaluated the survival rates for adults with in-hospital cardiac arrest based on whether the arrest was witnessed and/or monitored. Our hypothesis is that patients with either a witnessed or monitored arrest had improved survival to hospital discharge with intact neurologic function. Design, setting, and patients: We studied a cohort study of 74,213 patients who suffered in-hospital cardiac arrest from January 1, 2000 through February 1, 2008 at the 369 hospitals participating in the National Registry of Cardiopulmonary Resuscitation. Interventions: The primary exposure of interest was whether the arrest was witnessed and/or monitored (i.e. electrocardiography, pulse oximetry, apnea, or bradycardia monitoring) at the time of arrest. Events were classified as being both monitored and witnessed, monitored only, witnessed only, or neither witnessed nor monitored. Main outcome measures: Survival to hospital discharge and cerebral performance category at time of discharge. Results: A total of 73% of patients suffering in-hospital cardiac arrest were witnessed and monitored; 10% were monitored but not witnessed; 9% were witnessed but not monitored; and 8% were neither witnessed nor monitored. Compared with those who were unmonitored/unwitnessed, each of the three groups of patients who were monitored and/or witnessed were over twice as likely to survive to hospital discharge with a cerebral performance category of 1 or 2 (monitored/witnessed OR = 2.40, 95% CI: 2.08, 2.76; monitored-only OR = 2.12, 95% CI: 1.81, 2.47; witnessed-only OR = 2.43, 95% CI: 2.10, 2.83). Conclusions: Patients who are witnessed and/or monitored at the time of cardiac arrest demonstrate a significantly higher rate of survival to hospital discharge compared to those patients who are neither monitored nor witnessed. Monitored and/or witnessed cardiac arrest patients were also more likely to be discharged with favorable neurologic outcome. Cardiac monitoring...
confers no additional outcome benefit over direct observation of patients suffering in-hospital cardiac arrest.


Objective: Few data are available on traumatic cardiopulmonary arrest in children. Efforts at resuscitation typically result in heavy utilization of finite resources with little understanding of which characteristics, if any, may be associated with success. The objectives of this study were to describe the outcome of children in traumatic cardiac arrest and to identify patients for whom aggressive resuscitation may or may not be warranted. Methods: Data were analyzed from a previous study of prehospital pediatric airway management in Los Angeles and Orange Counties, California, over a 33-month period. Patients included in this secondary analysis were younger than 13 years and found pulseless and apneic after having an injury. Data sources included prospective, phone interviews with paramedics after transfer of care to the receiving facility, and chart review to determine outcome. Two main outcomes were assessed: survival and neurological function as measured by the Pediatric Cerebral Performance Category. Results: The emergency medical services responded to 118 traumatic arrests during the study period. Of these victims, only 6 (5%) survived. Median Injury Severity Score was 25 with an interquartile range of 16 to 75. The survivors all were neurologically impaired with a median Pediatric Cerebral Performance Category of 5 (interquartile range, 4-5). Conclusions: Children who had trauma resulting in cardiac arrest have universally poor outcomes, and survivors have severe neurological compromise. We are unable to identify a subset of patients for whom aggressive resuscitation is indicated. This is the largest prospective study of pediatric traumatic arrest to date.

Guideline 12: Paediatric ALS


BACKGROUND: Acute chest pain is a frequently occurring symptom in patients with medical emergencies and imposes potentially life-threatening situations outside hospitals. Little is known about the epidemiology of patients with acute chest pain in a primary care setting in Norway, and we aimed to obtain more representative data on such patients using data from emergency medical communication centres (EMCCs). METHODS: Data were collected prospectively during three months in 2007 from three EMCCs, covering 816 000 inhabitants. The EMCCs gathered information on every situation that was triaged as a red response (defined as an "acute" response, with the highest priority), according to the Norwegian Index of Medical Emergencies. Records from ambulances and primary care doctors were subsequently collected. International Classification of Primary Care - 2 symptom codes and The National Committee on Aeronautics (NACA) System scores were assigned retrospectively. Only chest pain patients were included in the study. RESULTS: 5,180 patients were involved in red response situations, of which 21% had chest pain. Estimated rate was 5.4 chest pain cases per 1000 inhabitants per year. NACA-scores indicated that 26% of the patients were in a life-threatening medical situation. Median prehospital response time was 13 minutes; an ambulance reached the patient in less than 10 minutes in 30% of the cases. Seventy-six per cent of the patients with chest pain were admitted to a hospital for further investigation, 14% received final treatment at a casualty clinic, while 10% had no further investigation by a doctor ("left at the scene"). CONCLUSIONS: The majority of patients with acute chest pain were admitted to a hospital for further investigation, but only a quarter of the patients were assessed
prehospital to have a severe illness. This sheds light on the challenges for the EMCCs (emergency medical communication centres) in deciding the appropriate level of response in patients with acute chest pain. Overtriage is to some extent both expected and desirable to intercept all patients in need of immediate help, but it is also well known that overtriage is resource demanding. Further research is needed to elucidate the challenges in the diagnosis and management of chest pain outside hospitals.

*Guideline 14: ACS*

7. Caterino JM and Raubenolt A. *The prehospital simplified motor score is as accurate as the prehospital Glasgow coma scale: analysis of a statewide trauma registry.* EMJ 2011; (Online first): July 27

Objectives: The simplified motor score (SMS) is a three-point measure of traumatic brain injury (TBI) severity, which is easier to calculate than the 15-point Glasgow coma scale (GCS). Using a state trauma registry, the accuracy of the emergency medical services (EMS)-obtained SMS was compared with the GCS for predicting neurological outcomes and mortality. Methods: A retrospective, observational analysis was performed of patients aged 16 years and older in the 2002 Ohio Trauma Registry. Those not initially transported by EMS or with incomplete EMS GCS scores were excluded. Outcomes included inhospital mortality, TBI, neurosurgical intervention, any emergency intubation and emergency department intubation. Discriminatory ability was compared using area under the receiver-operating characteristic curves (AUC). Sensitivity and specificity for each outcome were calculated at a SMS cutoff of one or less (any abnormal SMS) and a GCS cutoff of 13 or less. Results: 52,412 patients were identified. Sensitivity, specificity and AUC were similar between the SMS and GCS for all outcomes. Sensitivity for mortality was 72.2% for SMS and 74.6% for GCS. Sensitivity for TBI was 40.8% for SMS and 45.4% for GCS. Sensitivity for neurosurgical intervention was 52.9% for SMS and 60.0% for GCS. Sensitivity for any intubation was 72.7% for SMS and 75.5% for GCS. Specificity was less than 2% different for all outcomes. Discriminatory ability was similar with the difference in AUC between SMS and GCS no greater than 6% for any outcome. Conclusions: In a state trauma registry including both trauma and non-trauma centres, the EMS-obtained SMS (simplified motor score) performs as well as the 15-point GCS.


This addendum summarises clinical trial evidence published since 2007 that is relevant to the recommendations contained in the Heart Foundation’s Guidelines for the management of acute coronary syndromes 2006 (2006 Guidelines) and 2007 addendum to the National Heart Foundation of Australia/Cardiac Society of Australia and New Zealand Guidelines for the management of acute coronary syndromes 2006 (2007 Addendum). These recommendations are directed at the management of patients with spontaneous acute coronary syndromes, rather than those occurring as a result of other conditions (e.g. anaemia or thyrotoxicosis) where management may be directed at the underlying cause. Grades of recommendation and levels of evidence are indicated according to current National Health and Medical Research Council classifications. In addition, consensus recommendations have been made where there is insufficient evidence on which to base a grading. When applying this information, clinicians should consider the context and circumstances of the individual patient and the clinical setting.

*Guideline 14: ACS*

Characteristics and outcomes of out-of-hospital cardiac arrest (OHCA) in young adults are not well described in Australia. Methods A 10-year retrospective case review of all OHCA in young adults (aged 16-39) and not witnessed by EMS, was performed using data from the Victorian Ambulance Cardiac Arrest Registry (VACAR). Results Between 2000 and 2009 there were 30,006 adult cardiac arrests of which 3912 (13%) were in this age group. The median (IQR) age was 30 (25-35) years for both sexes with a 3:1 male to female ratio. Overdose was the most common precipitant (33.5%) followed by presumed cardiac (20%). Bystander CPR occurred in 21.2%, EMS median response time was 7 min and resuscitation was attempted in 36% of OHCAs. The presenting rhythm was asystole in 84.6%, PEA in 8.8% and VF/VT in 6.6%. Survival to hospital discharge, for all cause OHCA where resuscitation was attempted, was similar for young adult and older adults (8.8% vs 8.4%, p = 0.2). However, for presumed cardiac aetiology OHCA, young adults had a greater proportion of survivors (14.8% vs 9.0%, p < 0.001). Cardiac arrest with shockable rhythm (VF/pulseless VT) had a survival rate of 31.2% for young adults compared to 18.5% for older adults (p < 0.001). Conclusion: Survival to hospital discharge rates from OHCA due to a 'presumed cardiac' precipitant in young adults is much better than older adults, however, all cause OHCA survival is similar. Multi agency novel upstream preventive strategies aimed at tackling drug overdose may reduce this aetiology of OHCA and save lives.


Metropolitan and rural Western Australia (WA) major trauma transport times are extremely different. We compared outcomes from these different systems of care. Methods: Major trauma (Injury Severity Score, ISS>15) data from the Royal Flying Doctor Service (RFDS) and Trauma Registries, 1 July 1997-30 June 2006. Two groups were studied: Metro (metropolitan major trauma transported directly to a tertiary hospital), and Rural (rural major trauma transferred by the RFDS to a tertiary hospital in Perth). The primary endpoint was death. We used logistic regression and multiple imputation. Results: 3333 major trauma patients were identified (mean age 40.1±22.6 yrs; Metro=2005, Rural=1328). The rural patients were younger, had a larger proportion of motor vehicle crashes, and higher median ISS (25 vs 24, p<0.001). Mean times to definitive care were 59 min versus 11.6 h, respectively (p<0.0001). After adjusting for age, injury severity and the effect of time with the initial rural deaths, there was a significantly increased risk of death (OR 2.60, 95% CI 1.05-6.53, p=0.039) in the Rural group. For those rural patients who reached Perth, the adjusted OR for death was 1.10 (95% CI 0.66-1.84, p=0.708). Conclusion: There is more than double the risk of major trauma death in rural and remote WA. However, if a major trauma patient survives to be retrieved to Perth by the RFDS, then mortality outcomes are equivalent to the metropolitan area.

In The Netherlands there is no consensus about criteria for cancelling helicopter emergency medical services (HEMS) dispatches. This study assessed the ability of the primary HEMS dispatch criteria to identify major trauma patients. The predictive power of other early prehospital parameters was evaluated to design a safe triage model for HEMS dispatch cancellations. Methods All trauma-related dispatches of HEMS during a period of 6 months were included. Data concerning prehospital information and inhospital treatment were collected. Patients were divided into two groups (major and minor trauma) according to the following criteria: injury severity score 16 or greater, emergency intervention, intensive care unit admission, or inhospital death. Logistic regression analysis was used to design a prediction model for the early identification of major trauma patients. Results: In total, 420 trauma-related dispatches were evaluated, of which 155 concerned major trauma patients. HEMS was more often cancelled for minor trauma patients than for major trauma patients (57.7% vs 20.6%). Overall, HEMS dispatch criteria had a sensitivity of 87.7% and a specificity of 45.3% for identifying major trauma patients. Significant differences were found for vital sign abnormalities, anatomical components and several parameters of the mechanism of injury. A triage model designed for cancelling HEMS correctly identified major trauma patients (sensitivity 99.4%). Conclusion: The accuracy of the current HEMS dispatch criteria is relatively low, resulting in high cancellation rates and low predictability for major trauma. The new HEMS cancellation triage model identified all major trauma patients with an acceptable overtriage and will probably reduce unjustified HEMS dispatches.


The ability to rapidly identify patients with ST-segment elevation myocardial infarction (STEMI) at hospitals without percutaneous coronary intervention (PCI) and transfer them to hospitals with PCI capability is critical to STEMI regionalization efforts. Our objective was to assess the association of prehospital, emergency department (ED), and hospital processes of care implemented as part of a statewide STEMI regionalization program with door-in, door-out times at non-PCI hospitals. Methods and Results: Door-in, door-out times for 436 STEMI patients at 55 non-PCI hospitals were determined before (July 2005 to September 2005) and after (January 2007 to March 2007) a year-long implementation of standardized protocols as part of a statewide regionalization program (Reperfusion of Acute Myocardial Infarction in North Carolina Emergency Departments, RACE). The association of 8 system care processes (encompassing emergency medical services [EMS], ED, and hospital settings) with door-in door-out times was determined using multivariable linear regression. Median door-in, door-out times improved significantly with the intervention (before: 97.0 minutes, interquartile range, 56.0 to 160.0 minutes; after: 58.0 minutes, interquartile range, 35.0 to 90.0 minutes; P<0.0001). Hospital, ED, and EMS care processes were each independently associated with shorter door-in, door-out times (17.7 [95% confidence interval, 27.5 to 7.9]; 10.1 [95% confidence interval, 19.0 to 1.1], and 7.3 [95% confidence interval, 13.0 to 1.5] minutes for each additional hospital, ED, and EMS process, respectively). Combined, adoption of EMS processes was associated with the shortest median treatment times (44 versus 138 minutes for hospitals that adopted all EMS processes versus none). Conclusions: Prehospital, ED, and hospital processes of care were independently associated with shorter door-in, door-out times for STEMI patients requiring transfer. Adoption of several EMS processes was associated with the largest reduction in treatment times. These findings highlight the need for an integrated, system-based approach to improving STEMI care.
Guideline 14: ACS


Objective: To determine the most important indicators of prognosis in patients with return of spontaneous circulation (ROSC) following out-of-hospital cardiopulmonary arrest (OHCA) and to develop a best outcome prediction model. Design and patients: All patients were prospectively recorded based on the Utstein Style in Osaka over a period of 3 years (2005-2007). Criteria for inclusion were a witnessed cardiac arrest, age greater than 17 years, presumed cardiac origin of the arrest, and successful ROSC. Multivariate logistic regression (MLR) analysis was used to develop the best prediction model. The dependent variables were favourable outcome (cerebral-performance category [CPC]: 1-2) and poor outcome (CPC: 3-5) at 1 month after the event. Eight explanatory pre-hospital variables were used concerning patient characteristics and resuscitation. External validation was performed on an independent set of Utstein data in 2007. Results: Subjects comprised 285 patients in VF and 577 patients with pulseless electrical activity (PEA)/asystole. The percentage of favourable outcomes was 31.9% (91/285) in VF and 5.7% (33/577) in PEA/asystole. The most important prognostic indicators of favourable outcome found by MLR were age (p = 0.10), time from collapse to ROSC (TROSC) (p < 0.01), and presence of pre-hospital ROSC (PROSC) (p = 0.15) for VF and age (p = 0.03), TROSC (p < 0.01), and conversion to VF (p = 0.01) for PEA/asystole. For external validation data, areas under the receiver-operating characteristic curve were 0.867 for VF and 0.873 for PEA/asystole. Conclusions: A model based on four selected indicators showed a high predictive value for favourable outcome in OHCA patients with ROSC.


Aim: We sought to examine whether the outcomes of out-of-hospital cardiopulmonary arrest (OHCA) patients differed between weekday and weekend/holiday admissions, or between daytime and nighttime admissions. Methods: From a national registry of OHCA events in Japan between 2005 and 2008, 173,137 cases where the call-to-hospital admission interval was shorter than 120 min and collapse was witnessed by a bystander were included in this study. One-month survival rate and neurologically favourable 1-month survival rate were used as outcome measures. Logistic regression was used to adjust for potential confounding factors. Results: No significant differences in outcome were found between weekday and holiday/weekend admissions in rates of 1-month survival or neurologically favourable 1-month survival (p = 0.78 and p = 0.80, respectively). In contrast, patients admitted in the daytime exhibited significantly better outcomes than those admitted at night, on both outcome measures (p < 0.001 and p < 0.001). After adjusting for possible confounding factors, outcomes were significantly better for daytime admissions, with odds ratios of 1.26 (95% confidence interval (CI) 1.22–1.31; p < 0.001) for 1-month survival, and 1.26 (95% CI 1.20–1.32; p < 0.001) for neurologically favourable 1-month survival. In contrast, no significant differences on either outcome measure were found between weekday and weekend/holiday cases, with odds ratios of 1.00 (95% CI 0.96–1.04; p = 0.96) for 1-month survival and 0.99 (95% CI 0.94–1.04; p = 0.78) for neurologically favourable 1-month survival. Conclusions: Even after adjusting for confounding factors, admission day (weekday vs. weekend/holiday) had no effect on 1-month survival or neurologically favourable 1-month survival. In contrast, daytime admission was associated
with significantly better outcomes than nighttime admissions.


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.


The aim of this study was to determine whether prehospital endotracheal intubation (ETI) and chest tube placement is unnecessarily time consuming in severely injured patients. Patients and Methods: A retrospective, multicentre study including all adult patients (ISS ≥9; 2002–7) of the Trauma Registry of the German Society of Trauma Surgery who were not secondarily transferred to a trauma centre and received a definitive airway and a chest tube. Creating four groups: AA (n=963) receiving ETI and chest tube on scene, AB (n=1547) ETI performed in the prehospital setting but chest tubing later in the emergency department (ED) and BB (n=640) receiving both procedures in the ED. The BA collective (ETI performed in the ED, but chest tubing on scene) was excluded from the study because of the small sample size (n=41). The trauma resuscitation time (TRT), demographic data, injuries, treatment and outcome of the remaining three collectives were compared. Results: The prehospital TRT
of the AA collective was longer than the AB and BB subgroups (80±37 min vs 77±44 min 65±46 min; p<0.01). Although the AA and AB subgroups were more severely injured (ISS 35±15 vs 38±15 vs 31±12; p<0.01) and showed poorer vital parameters on scene, the overall TRT (accident until end of ED treatment) were equal for all three groups (152±59 min vs 151±62 min vs 148±68 min; p=0.07). The TRISS adjusted mortality was also equal in all three groups. Conclusions: In a physician-based emergency medical service, prehospital ETI and chest tube placement do not prolong the total TRT of severely injured patients.


Mild therapeutic hypothermia has proved beneficial after out-of-hospital cardiac arrest in the adult population, when the initial rhythm is ventricular fibrillation (VF). In this study, data from 110 consecutive patients with out-of-hospital cardiac arrest due to VF (n = 86) or to non-VF rhythm (n = 24), admitted to an intensive cardiac care unit with restoration of spontaneous circulation and who remained unconscious on admission, were analyzed. Patients were cooled using an external cooling system. Of the patients with VF, 66% had favorable outcomes (Glasgow-Pittsburgh Cerebral Performance Category 1 or 2), and 30% died. Of the patients with non-VF, 8% had favorable outcomes (p <0.001 vs VF), and 63% died (p = 0.004 vs VF). In patients with VF, those with poor outcomes were older than those with favorable outcomes (odds ratio [OR] 1.61, 95% confidence interval [CI] 1.03 to 2.7, p = 0.001) and had previous ejection fractions <35% (OR 7.72, 95% CI 1.8 to 33, p = 0.002). Outcomes were also worse when patients presented to the emergency room with seizures (OR 20.96, 95% CI 2.48 to 177.42, p = 0.003) or hemodynamic instability (OR 14.4, 95% CI 3.47 to 60, p <0.0001). In the non-VF group, the 2 patients with good outcomes were younger than those with unfavorable outcomes (39 ± 16 vs 65 ± 12 years, respectively, p = 0.04), with good left ventricular function on presentation (100% vs 4.5%, p = 0.0001) and with short asystole and/or short time from collapse to restoration of spontaneous circulation. In conclusion, mild therapeutic hypothermia in the adult population is more effective in patients with VF compared to those with non-VF. Good prognostic factors for patients with non-VF could be young age, good left ventricular function, and short anoxic time.

Guideline 11.8: Therapeutic hypothermia after cardiac arrest


Cervical spine injuries in children are rare. However, immobilization and imaging for potential cervical spine injury after trauma are common and are associated with adverse effects. Risk factors for cervical spine injury have been developed to safely limit immobilization and radiography in adults, but not in children. The purpose of our study is to identify risk factors associated with cervical spine injury in children after blunt trauma. We conducted a case-control study of children younger than 16 years, presenting after blunt trauma, and who received cervical spine radiographs at 17 hospitals in the Pediatric Emergency Care Applied Research Network (PECARN) between January 2000 and December 2004. Cases were children with cervical spine injury. We created 3 control groups of children free of cervical spine injury: (1) random controls, (2) age and mechanism of injury-matched controls, and (3) for cases receiving out-of-hospital emergency medical services (EMS), age-matched controls
who also received EMS care. We abstracted data from 3 sources: PECARN hospital, referring hospital, and out-of-hospital patient records. We performed multiple logistic regression analyses to identify predictors of cervical spine injury and calculated the model's sensitivity and specificity. We reviewed 540 records of children with cervical spine injury and 1,060, 1,012, and 702 random, mechanism of injury, and EMS controls, respectively. In the analysis using random controls, we identified 8 factors associated with cervical spine injury: altered mental status, focal neurologic findings, neck pain, torticollis, substantial torso injury, conditions predisposing to cervical spine injury, diving, and high-risk motor vehicle crash. Having 1 or more factors was 98% (95% confidence interval 96% to 99%) sensitive and 26% (95% confidence interval 23% to 29%) specific for cervical spine injury. We identified similar risk factors in the other analyses. We identified an 8-variable model for cervical spine injury in children after blunt trauma that warrants prospective refinement and validation.


Background. Although such data are available for young competitive athletes, the prevalence, characteristics, and outcome of sports-related sudden death have not been assessed previously in the general population. Methods and Results: prospective and comprehensive national survey was performed throughout France from 2005 to 2010, involving subjects 10 to 75 years of age. Case detection for sports-related sudden death, including resuscitated cardiac arrest, was undertaken via national ambulance service reporting and Web-based screening of media releases. The overall burden of sports-related sudden death was 4.6 cases per million population per year, with 6% of cases occurring in young competitive athletes. Sensitivity analyses used to address suspected underreporting demonstrated an incidence ranging from 5 to 17 new cases per million population per year. More than 90% of cases occurred in the context of recreational sports. The age of subjects was relatively young (mean ± SD 46±15 years), with a predominance of men (95%). Although most cases were witnessed (93%), bystander cardiopulmonary resuscitation was only commenced in 30.7% of cases. Bystander cardiopulmonary resuscitation (odds ratio 3.73, 95% confidence interval 2.19 to 6.39, P<0.0001) and initial use of cardiac defibrillation (odds ratio 3.71, 95% confidence interval 2.07 to 6.64, P=0.0001) were the strongest independent predictors for survival to hospital discharge (15.7%, 95% confidence interval 13.2% to 18.2%). Conclusions: Sports-related sudden death in the general population is considerably more common than previously suspected. Most cases are witnessed, yet bystander cardiopulmonary resuscitation was only initiated in one third of cases. Given the often predictable setting of sports-related sudden death and that prompt interventions were significantly associated with improved survival, these data have implications for health services planning.


Cardiac arrest center (CAC) criteria are not well defined, nor are their potential impact on current emergency medical services (EMS) transportation practices for post–cardiac arrest (PCA) patients. In addition to the availability of emergent cardiac catheterization (CATH) and therapeutic hypothermia (TH), high-volume centers and those with PCA protocols have been associated with improved outcomes. Objectives. This study aimed 1) to identify the PCA treatment capabilities of receiving hospitals in a 10-county regional EMS system without official CAC designation and 2) to determine the proportion of PCA patients who are transported to hospitals meeting three proposed CAC definitions. We
hypothesized that a majority of patients are already transported to hospitals that meet proposed CAC criteria. Methods. We distributed a survey to 34 receiving hospitals to determine availability and volume of CATH, TH, a PCA protocol, and a 24-hour intensivist. We conducted a retrospective study of adult, nontrauma cardiac arrest patients transported with a pulse from 2006 to 2008 for 16 EMS agencies. The proportions of patients transported to hospitals meeting three CAC criteria were compared: criteria A (availability of CATH and TH), criteria B (criteria A, >200 CATHs per year, and a PCA protocol), and criteria C (criteria B and a 24-hour intensivist). Results: Data were obtained from 31 of 34 hospitals (91.1%), of which 10 (32.3%) met criteria A, seven (22.6%) met criteria B, and six (19.4%) met criteria C. Of 1,193 cardiac arrest patients, 46 (3.9%) were excluded because of transport to a pediatric, closed, or out-of-region hospital. There were 335 patients (81.1%) with return of spontaneous circulation and a pulse present upon arrival at the destination facility transported to hospitals meeting criteria A, 304 patients (73.6%) transported to hospitals meeting criteria B, and 273 patients (66.1%) transported to hospitals meeting criteria C. Conclusions. In a region without official CAC designation, only one-third of hospitals meet basic CAC criteria (CATH and TH), but those facilities receive 81% of PCA patients. Fewer patients (66%) are transported to hospitals meeting more stringent CAC criteria. These data describe the potential impact of developing a CAC policy based on current transportation practices.


Background: Activation of emergency medical services (EMS) is critical for the early triage and treatment of patients experiencing ST-segment-elevation myocardial infarction, yet data regarding EMS use and its association with subsequent clinical care are limited. Methods and Results:- We performed an observational analysis of 37 634 ST-segment-elevation myocardial infarction patients treated at 372 US hospitals participating in the National Cardiovascular Data Registry Acute Coronary Treatment and Intervention Outcomes Network Registry-Get With the Guidelines between January 2007 and September 2009, and examined independent patient factors associated with EMS transportation versus patient self-transportation. We found that EMS transport was used in only 60% of ST-segment-elevation myocardial infarction patients. Older patients, those living farther from the hospital, and those with hemodynamic compromise were more likely to use EMS transport. In contrast, race, income, and education level did not appear to be associated with the mode of transport. Compared with self-transported patients, EMS-transported patients had significantly shorter delays in both symptom-onset-to-arrival time (median, 89 versus 120 minutes; P<0.0001) and door-to-reperfusion time (median door-to-balloon time, 63 versus 76 minutes; P<0.0001; median door-to-needle time, 23 versus 29 minutes; P<0.0001). Conclusions: Emergency medical services transportation to the hospital is underused among contemporary ST-segment-elevation myocardial infarction patients. Nevertheless, use of EMS transportation is associated with substantial reductions in ischemic time and treatment delays. Community education efforts are needed to improve the use of emergency transport as part of system-wide strategies to improve ST-segment-elevation myocardial infarction reperfusion care.

Guideline 14: ACS

During adult cardiac arrest, rescuers frequently provide ventilations at rates exceeding those recommended by the American Heart Association (AHA). Excessive ventilation is associated with worse clinical outcome after adult cardiac arrest. This study is the first to characterize ventilation rate adherence to AHA guidelines during in-hospital pediatric cardiac arrest resuscitation. We prospectively enrolled children and adolescents (≥ 8 years of age) who suffered a cardiac arrest in a pediatric intensive care unit (PICU) or emergency department (ED) of a tertiary-care pediatric hospital. Ventilation rate (breaths per minute [bpm]) was monitored via changes in chest wall impedance (CWI) recorded by defibrillator electrode pads during cardiopulmonary resuscitation (CPR). Twenty-four CPR events were enrolled yielding 588 thirty-second CPR epochs. The proportion of CPR epochs with ventilation rates exceeding AHA guidelines (>10bpm) was 63% (CI95 59, 67%), significantly higher than our a priori hypothesis of 30% (p<0.01). The proportion of CPR epochs with ventilation rates exceeding 20bpm was 20% (CI95 17–23). After controlling for location of arrest and initial event rhythm, resuscitations that occurred on nights/weekends were 3.6 times (CI95: 1.6-7.9, p<0.01) more likely to have a ventilation rate exceeding AHA guidelines. During in-hospital pediatric cardiac arrest, rescuers frequently provide artificial ventilations at rates in excess of AHA guidelines, with twenty percent of CPR time having ventilation rates double that recommended. Excessive ventilation was particularly common during CPR events that occurred on nights/weekends.

Guideline 12: Paediatric ALS

22. Mitra B, Tullio F, Cameron PA and Fitzgerald M. Trauma patients with the "triad of death". EMJ 2011; Online first (July 23)

Introduction: Injured patients presenting with hypothermia, acidosis and coagulopathy have been identified at high risk of death. This study aimed to describe the presentation, management and outcome of major trauma patients presenting with the ‘triad of death’ and identify ways to improve survival. Methods: A retrospective, explicit chart review was undertaken on patients presenting to a level I adult major trauma centre with the ‘triad of death’. These patients presented directly from the scene, were coagulopathic (international normalised ratio (INR) >1.5), hypothermic (temperature <35C) and acidic (pH <7.2) on arrival. Results: There were 90 patients over an 8-year period, with an overall mortality of 47.8%. No significant differences were observed among demographics and injury severity scores between survivors and non-survivors. Extremes of systolic blood pressure and heart rate, a high activated partial thromboplastin time activated partial thromboplastin time, low fibrinogen counts, pH, bicarbonate, base excess and haemoglobin were present among survivors. There were no survivors in our cohort with an initial INR greater than 3.2. Survivors received significantly lower volumes of packed red blood cells. Conclusions: There has been little change in mortality over time in this subgroup of major trauma patients. While the presence of the triad alone does not determine futility, there were no survivors over 8 years with extreme coagulopathy with concurrent hypothermia and acidosis.


Background: Therapeutic hypothermia (TH) improves survival and confers neuroprotection in out-of-hospital cardiac arrest (OHCA), but TH is underutilized, and regional systems of care for OHCA that include TH are needed. Methods and Results: The Cool It protocol has established TH as the standard of care for OHCA across a regional network of hospitals transferring patients to a central TH-capable hospital. Between February
2006 and August 2009, 140 OHCA patients who remained unresponsive after return of spontaneous circulation were cooled and rewarmed with the use of an automated, noninvasive cooling device. Three quarters of the patients (n=107) were transferred to the TH-capable hospital from referring network hospitals. Positive neurological outcome was defined as Cerebral Performance Category 1 or 2 at discharge. Patients with non-ventricular fibrillation arrest or cardiogenic shock were included, and patients with concurrent ST-segment elevation myocardial infarction (n=68) received cardiac intervention and cooling simultaneously. Overall survival to hospital discharge was 56%, and 92% of survivors were discharged with a positive neurological outcome. Survival was similar in transferred and non-transferred patients. Non-ventricular fibrillation arrest and presence of cardiogenic shock were associated strongly with mortality, but survivors with these event characteristics had high rates of positive neurological recovery (100% and 89%, respectively). A 20% increase in the risk of death (95% confidence interval, 4% to 39%) was observed for every hour of delay to initiation of cooling. Conclusions: A comprehensive therapeutic hypothermia protocol can be integrated into a regional ST-segment elevation myocardial infarction network and achieves broad dispersion of this essential therapy for OHCA.

**Guideline 14: ACS**


Objectives: To evaluate the role of ambulance response times in improving survival for out-of-hospital cardiac arrest (OHCA). Methods: OHCA was identified by sampling consecutive life-threatening category A emergency ambulance calls on an annual basis for the 5 years 1996/7 - 2000/1 from four ambulance services in England. From these, all calls where an ambulance arrived at the scene and treated or transported a patient were included in the study. These cohorts of patients were followed up to discharge from hospital. Results: Overall, 30 (2.6%) of the 1161 patients with cardiac arrest survived to hospital discharge. If the patient arrested while the paramedics were on scene, survival to hospital discharge was 14%. The most important predictive factors for survival were response time, initial presenting heart rhythm in ventricular fibrillation and whether the arrest was witnessed. The estimated effect of a 1 min reduction in response time was to improve the odds of survival by 24% (95% CI 4% to 48%). The costs of reducing response times across the board by 1 min at the time of this study were estimated at around £54 million. Conclusions: The arrival of a crew prior to OHCA means that the chance of surviving the arrest increases sevenfold. Overall it is possible that rapid response to patients in immediate risk of arrest may be at least as beneficial as rapid response to those who have arrested. Concentrating resources on reducing response times across the board to improve survival for those patients already in arrest is unlikely to be a cost-effective option to the UK National Health Service.


Background: The cardiopulmonary resuscitation (CPR) registry has been documented for medical records and investigational purposes. Although the accuracy of the CPR registry is generally adequate, it is difficult to precisely describe CPR in emergency situations. Objectives: To evaluate the accuracy of the CPR registry in an emergency department (ED) and to determine whether closed-circuit television (CCTV) is useful for recording CPR events. Methods: To assess the accuracy of the CPR registry, CCTV clips of the room in which CPR was performed in the ED
and the corresponding CPR registry were consecutively collected and reviewed. The contents of the registry, specifically the time interval between patient arrival and CPR procedures, were compared with those determined by the CCTV clips. Accuracy was defined as the frequency of accurately registered time intervals differing by < 30 s. Results: In a university-based ED between May and November 2009, 46 CPRs were performed and 150 CPR time intervals were documented in the CPR registry. The level of CPR registry accuracy was 54% (81/150). Conclusions: The accuracy of the CPR registry was improved by the use of CCTV. These results indicate that more detailed CPR investigations could be performed with the addition of CCTV-based information to the CPR registry.


Patient's age belongs to the independent prognostic factors of patients after out-of-hospital cardiac arrest (OHCA). This study aimed to evaluate the influence of age on 5-year survival in professionally cardio-pulmonary resuscitated patients with "primary cardiac" etiology OHCA. In this analysis of prospective multi-centric study, from April 1, 2002 until August 31, 2004, a total of 560 patients were included (aged 16-97 years) from the East Bohemian region, for whom a professional cardio-pulmonary resuscitation for OHCA was attempted. In the age subgroup <70 years there were 307 patients and in the age subgroup ≥70 years there were 253 patients. Of the subgroup <70 years, 29 patients (10%) survived to year 5 (58% from the 50 patients surviving to day 30), and in the subgroup ≥70 years, we had 4 patients surviving to year 5 (2%) (29% from the 14 patients surviving to day 30), respectively (Fisher's exact test; comparison in the all resuscitated patients: p<0.001, in the population surviving to day 30: p=0.071). In conclusion, there was a trend towards a worse outcome in 5-year survival following OHCA in the patients aged ≥70 years. Nevertheless, these data support that prognosis OHCA of elders is not associated with universal dismal outcome.

Comparative study


Objectives: To determine the sensitivity and specificity of the San Francisco Syncope Rule (SFSR) electrocardiogram (ECG) criteria for determining cardiac outcomes and to define the specific ECG findings that are the most important in patients with syncope. Methods: A consecutive cohort of emergency department (ED) patients with syncope or near syncope was considered. The treating emergency physicians assessed 50 predictor variables, including an ECG and rhythm assessment. For the ECG assessment, the physicians were asked to categorize the ECG as normal or abnormal based on any changes that were old or new. They also did a separate rhythm assessment and could use any of the ECGs or available monitoring strips, including prehospital strips, when making this assessment. All patients were followed up to determine a broad composite study outcome. The final ECG criterion for the SFSR was any non-sinus rhythm or new ECG changes. In this specific study, the initial assessments in the database were used to determine only cardiac-related outcomes (arrhythmia, myocardial infarction, structural, sudden death) based on set criteria, and the authors determined the sensitivity and specificity of the ECG criteria for cardiac outcomes only. All ECGs classified as “abnormal” by the study criteria were compared to the official cardiology reading to determine specific findings on the ECG.
Univariate and multivariate analysis were used to determine important specific ECG and rhythm findings. Results: A total of 684 consecutive patients were considered, with 218 having positive ECG criteria and 42 (6%) having important cardiac outcomes. ECG criteria predicted 36 of 42 patients with cardiac outcomes, with a sensitivity of 86% (95% confidence interval [CI] = 71% to 94%), a specificity of 70% (95% CI = 66% to 74%), and a negative predictive value of 99% (95% CI = 97% to 99%). Regarding specific ECG findings, any non-sinus rhythm from any source and any left bundle conduction problem (i.e., any left bundle branch block, left anterior fascicular block, left posterior fascicular block, or QRS widening) were 2.5 and 3.5 times more likely associated with significant cardiac outcomes. Conclusions: The ECG criteria from the SFSR are relatively simple, and if used correctly can help predict which patients are at risk of cardiac outcomes. Furthermore, any left bundle branch block conduction problems or any non-sinus rhythms found during the ED stay should be especially concerning for physicians caring for patients presenting with syncope.


Objective: We conducted a blinded, prospective, randomized control trial to determine which oxygen-titration strategy was most effective at achieving and maintaining oxygen saturations of 85% to 92% during delivery-room resuscitation. Methods: Infants born at 32 weeks' gestation or less were resuscitated either with a static concentration of 100% oxygen (high-oxygen group) or using an oxygen-titration strategy starting from a concentration of 100% (moderate-oxygen group), or 21% oxygen (low-oxygen group). In the moderate- and low-oxygen groups, the oxygen concentration was adjusted by 20% every 15 seconds to reach a target oxygen saturation range of 85% to 92%. Treatment failure was defined as a heart rate slower than 100 beats per minute for longer than 30 seconds. Results: The moderate-oxygen group spent a greater proportion of time in the target oxygen saturation range (mean: 0.21 [95% confidence interval: 0.16, 0.26]) than the high-oxygen group (mean: 0.11 [95% confidence interval: 0.09, 0.14]). Infants in the low-oxygen group were 8 times more likely to meet the criteria for treatment failure than those in the high-oxygen group (24% vs 3%; P = .022). The 3 groups did not differ significantly in the time to reach the target oxygen saturation range. Conclusions: Titrating from an initial oxygen concentration of 100% was more effective than giving a static concentration of 100% oxygen in maintaining preterm infants in a target oxygen saturation range. Initiating resuscitation with 21% oxygen resulted in a high treatment-failure rate.

Guideline 13: Neonatal ALS


Current guidelines for the diagnosis of acute myocardial infarction (AMI), among other criteria, also require a rise and/or fall in cardiac troponin (cTn) levels. It is unknown whether absolute or relative changes in cTn have higher diagnostic accuracy and should therefore be preferred. Methods and Results: In a prospective, observational, multicenter study, we analyzed the diagnostic accuracy of absolute (ΔE) and relative (Δ%E) changes in cTn in 836 patients presenting to the emergency department with symptoms suggestive of AMI. Blood samples for the determination of high-sensitive cTn T and cTn I ultra were collected at presentation and after 1 and 2 hours in a blinded fashion. The final diagnosis was adjudicated by 2 independent cardiologists. The area under the receiver operating characteristic curve for diagnosing AMI was
significantly higher for 2-hour absolute (Δ) versus 2-hour relative (Δ%) cTn changes (area under the receiver operating characteristic curve [95% confidence interval], high-sensitivity cTn T: 0.95 [0.92 to 0.98] versus 0.76 [0.70 to 0.83], P<0.001; cTn I ultra: 0.95 [0.91 to 0.99] versus 0.72 [0.66 to 0.79], P<0.001). The receiver operating characteristic curve-derived cutoff value for 2-hour absolute (Δ) change was 0.007 μg/L for high-sensitivity cTn T and 0.020 μg/L for cTn I ultra (both cutoff levels are half of the 99th percentile of the respective cTn assay). Absolute changes were superior to relative changes in patients with both low and elevated baseline cTn levels. Conclusions: Absolute changes of cTn levels have a significantly higher diagnostic accuracy for AMI than relative changes, and seem therefore to be the preferred criteria to distinguish AMI from other causes of cTn elevations.

Guideline 14: ACS


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 by rescuers who are less experienced in ETI. Objective. To prospectively evaluate the feasibility of the use of laryngeal tubes (LTS-D) 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 and techniques in adult ALS


Aim: An emergency department providing critical care will have an effect on outcome and intensive-care-units’ resources by avoiding unnecessary or futile intensive-care admissions and thereby save hospital expenses. The study focussed on this result. Methods: The study employed a retrospective analysis of prospectively collected data of out-of-hospital cardiac arrest patients with return of spontaneous circulation,
Comatose on arrival. Outcomes and length of stay of patients who either stayed at the 'emergency department only' or were 'transferred in addition to an intensive care unit' were compared. Linear regression with log length of stay as outcome and 'emergency department only' as predictor with covariates was used for modelling. Results: From 1991 to 2008, out of 1236 patients (age 57 +/- 15 years, female 31%), the 'emergency department only' group (n = 349 (28%)) survived to discharge in 81 (23%) cases, with a median length-of-stay in critical care of 1.7 (interquartile range 0.8; 3.1) days. The patients 'transferred in addition to an intensive care unit' (n = 887 (72%)), with a survival rate of 55% (n = 486, p < 0.001) stayed 10 (5; 18) days (p < 0.001). The length-of-stay in hospital was significantly shorter if patients were treated in the 'emergency department only' independent of other cardiac-arrest-related factors (regression coefficient -1.42, confidence interval -1.60 to -1.24).

Conclusions: An emergency department with critical care prevents admissions to intensive care units in 28% of patients with out-of-hospital cardiac arrest. It saves intensive-care-unit resources and shortens length of stay for comatose out-of-hospital cardiac-arrest survivors, regardless of their outcome.


Background: The cooling efficacy of intravenous administration of cold crystalloids can be enhanced by optimisation of the procedure. This study assessed the temperature stability of different application regimens of cold normal saline (NS) in simulated prehospital conditions. Methods: Twelve different application regimens of 4C cold NS (volumes of 250, 500 and 1000 ml applied at infusion rates of 1000, 2000, 4000 and 6000 ml/h) were investigated for infusion temperature changes during administration to an artificial detention reservoir in simulated prehospital conditions. Results: An increase in infusion temperature was observed in all regimens, with an average of 8.1 ± 3.3 C (p<0.001). This was most intense during application of the residual 20% of the initial volume. The lowest rewarming was exhibited in regimens with 250 and 500 ml bags applied at an infusion rate of 6000 ml/h and 250 ml applied at 4000 ml/h. More intense, but clinically acceptable, rewarming presented in regimens with 500 and 1000 ml bags administered at 6000 ml/h, 1000 ml at 6000 ml/h and 250 ml applied at 2000 ml/h. Other regimens were burdened by excessive rewarming. Conclusion: Rewarming of cold NS during application in prehospital conditions is a typical occurrence. Considering that the use of 250 ml bags means the infusion must be exchanged too frequently during cooling, the use of 500 or 1000 ml NS bags applied at an infusion rate of 4000 ml/h and termination of the infusion when 80% of the infusion volume has been administered is regarded as optimal.

Guideline 11.8: Therapeutic hypothermia after cardiac arrest


Mild hypothermia treatment (32–34 °C) in survivors after cardiac arrest (CA) is clearly recommended by the current guidelines. The effects of cooling procedure towards QT interval have not been evaluated so far outside of case series. In a prospective study 34 consecutive survivors after cardiac arrest were continuously monitored with Holter ECG over the first 48 h. Patients and methods: A total of 34 patients were analysed and received mild therapeutic hypothermia treatment (MTH) according to the current guidelines and irrespective of the initial rhythm. At
admission to hospital and in the field in case of OHCA, a 12-lead ECG was performed in all patients. Results: During cooling the incidence of ventricular tachycardia was low (8.8%) and in none of the patients Torsade de pointes occurred. The QTc interval was within normal range at first patient contact with EMS in the field (440.00 ms; IQR 424.25–476.75; n = 17) but during hypothermia treatment the QTc interval was significantly prolonged at 33 °C after 24 h of cooling (564.47 ms; IQR 512.41–590.00; p = 0.0001; n = 34) and decreased after end of hypothermia to baseline levels (476.74 ms; 448.71–494.97; p = 0.15). Conclusion: The QTc interval was found to be significantly prolonged during MTH treatment, and some severe prolongations >670 ms were observed, without a higher incidence of life-threatening arrhythmias, especially no Torsade des pointes were detected. However, routine and frequent ECG recording with respect to the QTc interval should become part of any hypothermia standard operation protocol and should be recommended by official guidelines.

Guideline 11.8: Therapeutic hypothermia after cardiac arrest


Regionalization of emergency care for patients with serious infections has the potential to improve outcomes, but is not feasible without accurate identification of patients in the prehospital environment. Objective. To determine the incremental predictive value of provider judgment in addition to prehospital physiologic variables for identifying patients who have serious infections. Methods. We conducted a prospective study at a single teaching tertiary-care emergency department (ED) where a convenience sample of emergency medical services (EMS) providers and ED clinicians completed a questionnaire about the same patients. Prehospital providers provided limited demographics and work history about themselves. They also reported the presence of abnormal prehospital physiology for each patient (heart rate >90 beats/min, systolic blood pressure <100 mmHg, respiratory rate >20 breaths/min, pulse oximetry <95%, history of fever, altered mental status) and their judgment about whether the patient had an infection. At the end of formal evaluation in the ED, the physician was asked to complete a survey describing the same patient factors in addition to patient disposition. The primary outcome of serious infection was defined as the presence of both 1) ED report of acute infection and 2) patient admission. We included prehospital factors associated with serious infection in the prediction models. Operating characteristics for various cutoffs and the area under the curve (AUC) were calculated and reported with 95% confidence intervals (95% CIs). Results. Serious infection occurred in 32 (16%) of 199 patients transported by EMS, 50% of whom were septic, and 16% of whom were admitted to the intensive care unit. Prehospital systolic blood pressure <100 mmHg, EMS-elicited history or suspicion of fever, and prehospital judgment of infection were associated with primary outcome. Presence of any one of these resulted in a sensitivity of 0.59 (95% CI 0.40–0.76) and a specificity of 0.81 (95% CI 0.74–0.86). The AUC for the model was 0.71. Conclusions. Including prehospital provider impression to objective physiologic factors identified three more patients with infection at the cost of over-triaging five. Future research should determine the effect of training or diagnostic aids for improving the sensitivity of prehospital identification of patients with serious infection.

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.


Reducing health and economic burdens from diagnostic delay of psychogenic non-epileptic seizures (PNES) requires prompt referral for video electroencephalography (VEEG) monitoring, the diagnostic gold standard. Practitioners make VEEG referrals when semiology suggests PNES, although few semiological signs are supported by well-designed studies, and most VEEG studies neglect to concurrently measure how accurately seizure witnesses can ascertain semiology. In this study, we estimate the value of eyewitness-reported and video-documented semiology for predicting psychogenic non-epileptic seizures (PNES), and we measure accuracy of eyewitness reports.

Methods: We prospectively interviewed eyewitnesses of seizures in patients referred for VEEG monitoring, to inquire about 48 putative PNES and ES signs. Multiple, EEG-blinded, epileptologists independently evaluated seizure videos and documented the presence/absence of signs. We used generalized estimating equations to identify reliable video-documented PNES and ES signs, and we compared eyewitness reports with video findings to assess how accurately signs are reported. We used logistic regression to determine whether eyewitness reports could predict VEEG-ascertained seizure type. Results: We analyzed 120 seizures (36 PNES, 84 ES) from 35 consecutive subjects. Of 45 video-documented signs, only 3 psychogenic non-epileptic seizures signs (“preserved awareness,” “eye flutter,” and “bystanders can intensify or alleviate”) and 3 epileptic seizure signs (“abrupt onset,” “eye-opening/widening,” and postictal “confusion/sleep”) were significant and reliable indicators of seizure type. Eyewitness reports of these 6 signs were inaccurate and not statistically different from guessing. Consequentially, eyewitness reports of signs did not predict VEEG-ascertained diagnosis. We validated our findings in a second, prospective cohort of 36 consecutive subjects. Interpretation: We identified 6 semiological signs that reliably distinguish psychogenic non-epileptic seizures and epileptic seizures, and found that eyewitness reports of these signs are unreliable. We offer suggestions to improve the accuracy of eyewitness reports.
Guideline 9.2.4: Seizures


Body mass index (BMI) may influence the quality of cardiopulmonary resuscitation and may influence prognosis after cardiac arrest. To review the direct effect of obesity on outcome after cardiac arrest, the following cohort study was conducted. Methods: This study based on a cardiac arrest registry comprising all adult patients with cardiac arrest of non-traumatic origin and restoration of spontaneous circulation (ROSC) admitted to the department of emergency medicine of a tertiary-care facility. Data were collected between January 1992 and December 2007 according to the Utstein criteria. We assessed the association between BMI according to the WHO classification (underweight, BMI<18.5; normal weight, 18.5-24.9; overweight, 25.0-29.9; obese=>30), six-month survival and neurological recovery. Results: Analysis was carried out on a total of 1915 adult patients (32% female). Patients had a median age of 59 years (interquartile range [IQR] 49-70) and a median BMI of 26.0 (IQR 23.9-29.1). Survival to six months was 50%. There was no significant difference in survival between the BMI groups (underweight 46%, normal weight 47%, overweight 52%, obese 51%). In a multivariate analysis neurological outcome was better in overweight patients as compared to subjects with normal BMI (odds ratio 1.35; 95% confidence interval 1.02-1.79). Conclusion: Body mass index may have no direct influence on six-month survival after cardiac arrest, but patients with moderately elevated BMI may have a better neurological prognosis.


Background: This prospective, randomized, controlled trial compares the performance of the pediatric i-gel (Intersurgical Ltd., Wokingham, United Kingdom) with the Ambu AuraOnce laryngeal mask (Ambu A/S, Ballerup, Denmark) in anesthetized and ventilated children. Methods: With ethics committee approval and written informed consent, the authors included 208 children, aged 0-17 yrs, scheduled for elective day-surgery under general anesthesia. The primary outcome variable was oropharyngeal leak pressure. Other outcome variables were first-attempt and overall success, time to sufficient ventilation, and adverse events., Results: Demographic data did not differ between groups. The leak pressure of the i-gel was significantly higher than the leak pressure of the Ambu (mean +/- SD: 22 +/- 5 cm H2O vs. 19 +/- 3, P < 0.01). First-attempt success was 91% for the i-gel and 93% for the Ambu (P = 0.50). Overall success was 93% for the i-gel versus 98% for the Ambu (P = 0.10). Successfully inserted i-gels needed to be secured by taping in place to ensure the seal in 44% (0% with the Ambu, P < 0.01). Insertion was faster with the Ambu (24 +/- 8 s vs. 27 +/- 11, P = 0.02). There were no major side effects with either device. Conclusions: The leak pressure of the i-gel was statistically but not clinically significantly higher than the leak pressure of the Ambu. Time to insertion was longer with the i-gel. Both airway devices are suitable for positive pressure ventilation with high success rates in infants and children. Because the i-gel is prone to sliding out, it must be taped in place to avoid loss of the airway.

Guideline 12: Paediatric ALS

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.


Aim: To report the long-term changes in the incidence of out-of-hospital ventricular fibrillation (VF), and also to report concurrent changes in the possible explanatory factors for the change. Methods: This was a retrospective observational study. All bystander-witnessed out-of-hospital cardiac arrests (with a known initial rhythm) in Helsinki, Finland during 1.1.1994-31.12.2007 were included in the study. High (years 1994-1996) and low (2002-2004) incidence periods for VF were defined and compared. Results: There were 3131 bystander-witnessed out-of-hospital cardiac arrests of which 3118 (99.6%) had a known initial rhythm. During 2000-2007 the annual incidence of bystander witnessed ventricular fibrillation (VF) was 11.6 (95% CI 9.7-13.5) per 100,000 inhabitants. In 1994-1996 VF was 1.8 times more likely than in 2002-2004, after adjustment for several patient related factors and EMS related factors. Arrests with cardiac aetiology became less common, as 54.8% arrests had a cardiac cause in 1994-1996 compared to 45.2% in 2002-2004 (p < 0.001). Of cardiac arrests with cardiac aetiology, 60.6% presented with VF in 1994-1996 compared to 45.7% in 2002-2004 (p < 0.001). There were major changes in the possible explanatory factors during the study period. Conclusion: The decline in the incidence of out-of-hospital VF seems to have ended, and the annual incidence of VF has stabilised to 11.6 (95% CI 9.7-13.5) per 100,000 inhabitants. During the period of lower incidence of VF, cardiac aetiology caused fewer arrests, and these
arrests did not present with VF as often as previously.


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 and 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 MEO (Medical Examiner's Office) within a 48-hour time frame.


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
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 non-haemorrhagic 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.

Reviews


Background: Restraint is sometimes necessary to successfully perform procedures on pediatric patients in the emergency department. A papoose may be intimidating and uncomfortable, and a wrapped sheet may not keep the child's arms from wiggling free. Discussion: We present an adaptation of the wrapped sheet (burrito) technique, using a pillowcase to better immobilize the child's arms. The arms are inserted in the pillowcase behind the child's back, and then the child is placed supine over a horizontally placed sheet and turned to each side so the sheet is tucked behind the back. The child is thereby easily and comfortably restrained. Conclusions: We believe this technique more successfully
restrains the child than the wrapped sheet alone, and is easier to execute than other wrapped sheet techniques aimed at improving arm immobilization.

Review

44. Caldicott DGE. BET 2: Which intraosseous device is best in the prehospital setting?. EMJ 2011; 28 (8): 717-8

A short cut review was carried out to establish which intraosseous device is best for use in the prehospital environment. A total of 2100 papers were found using the reported search, of which 2 represented the best evidence to answer the clinical question. The author, date and country of publication, patient group studied, study type, relevant outcomes, results, and study weaknesses of these best papers are tabulated. The clinical bottom line is that traditional manual intraosseous infusion devices have better success rates and faster insertion times compared with semi-automatic intraosseous infusion devices in the prehospital setting.

Review: Guideline 11.6: Equipment and techniques in adult ALS

45. Clamp JA and Moran CG. Haemorrhage control in pelvic trauma. Trauma 2011; Online first (August 1)

A pelvic fracture usually indicates high-energy transfer from a significant mechanism and a high likelihood of associated injuries. Mortality from pelvic trauma is usually due to massive haemorrhage mandating expedient resuscitation of the patient and immediate control of exsanguinating haemorrhage. Damage control resuscitation incorporates permissive hypotensive resuscitation and early replacement of clotting factors with early aggressive surgical control of bleeding. A commercially available pelvic binder provides circumferential compression and rapidly closes the pelvis, leading to fracture splintage and reduction in pelvic volume, both of which reduce haemorrhage. It is critical to distinguish ongoing bleeding due to a pelvic ring injury from intra-peritoneal haemorrhage. The identification of intra-peritoneal bleeding in a haemodynamically unstable patient mandates laparotomy. On-going haemorrhage from the pelvis requires diagnostic pelvic angiography, followed by selective embolisation if a source of bleeding is identified. If angiography is not available pelvic packing can be life-saving.

Review


In addition to the impact of long-term stressors such as sedentary lifestyle and long-term exposure to high levels of air pollution, many studies have shown that there is an increased risk of acute cardiovascular events immediately after behavioral, psychosocial, and environmental triggers. After the landmark study documenting the increased rates of myocardial infarction (MI) related to the 1981 earthquake in Athens and the description of the circadian variation in the incidence of MI by Muller et al, various studies documented the frequency of potential triggers in the period immediately preceding MI onset. Although the observational studies examining physical, psychological, and chemical triggers of acute cardiovascular events are not without limitations, studies continue to show that short-term exposures appear to play a role in the occurrence of cardiovascular events. These triggers have been discussed in previous reviews, with a general consensus that different preventive strategies may be appropriate for particular triggers. The purpose of this review is to bring together the evidence of the association between several triggers
and cardiovascular outcomes and to discuss the common underlying pathophysiology of these triggers.

Review


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.

Review


Definitive management of the exsanguinating patient continues to challenge providers in multiple specialties. Significant haemorrhage may be encountered in a variety of patient care circumstances. Over the past two decades, the vast majority of data and evidence regarding transfusion in the exsanguinating patient has been based upon the trauma literature, and a large amount of recent research has investigated this subject area. In addition to the care of trauma patients, the data that have emerged can also be extrapolated to the treatment of nontrauma patients undergoing transfusion for major hemorrhage. The concept of massive transfusion is an evolving paradigm, and numerous investigations have challenged old principles while creating new controversies. The current review will examine the latest developments in the management of patients with profound hemorrhage. The challenges of dealing with the 'lethal triad' will be discussed, as will the various aspects of damage control and hemostatic resuscitation. The latest literature and controversy regarding massive transfusions and massive transfusion protocols will be elucidated with inclusion of data from recent military experiences. Finally, adjuncts including the most recent advances in hemorrhage control, identification of early predictors for massive transfusion, and utilization of pharmacologic and complementary factor agent therapy will be discussed.

Review

The 2010 International Liaison Committee on Resuscitation guidelines for newborn resuscitation represents important progress. The criteria for assessment are simplified based on heart rate and respiration only and there is no timing of stages after the first 60 sec. Instead of giving supplemental oxygen, the guidelines state that ‘it is best to start with air’. However, the optimal oxygen concentration later in the process and for premature babies is not yet clear. A description of an adequate heart rate response is not given, and the cut-off of 100 bpm may be arbitrary. There are still no clear recommendations regarding ventilation, inspiratory time, or the use of positive end expiratory pressure or continuous positive airway pressure. The guidelines do not mention which paCO₂ level might be optimal. As colour pink assessment and routine suctioning of airways are not recommended anymore, there is an urgent need to obtain international consensus and create a new and revised Apgar score without these two variables. Conclusion: In spite of improved guidelines for newborn resuscitation, there are still a number of unanswered questions and a need for more delivery room studies.

Review: Guideline 13: Neonatal resuscitation

50. Tipton MJ and Golden FSC. A proposed decision-making guide for the search, rescue and resuscitation of submersion (head under) victims based on expert opinion. Resuscitation 2011; 82 (7): 819-24

There is some confusion, and consequent variation in policy, between the agencies responsible for the search, rescue and resuscitation of submersion victims regarding the likelihood of survival following a period of submersion. The aim of this work was to recommend a decision-making guide for such victims. This guidance was arrived at by a review of the relevant literature and specific case studies, and a "consensus" meeting on the topic. The factors found to be important for determining the possibility of prolonged survival underwater were: water temperature; salinity of water; duration of submersion; and age of the victim. Of these, only water temperature and duration are sufficiently clear to form the basis of guidance in this area. It is concluded that if water temperature is warmer than 6 C, survival/resuscitation is extremely unlikely if submerged longer than 30min. If water temperature is 6C or below, survival/resuscitation is extremely unlikely if submerged longer than 90min. Review

Animal, manikin & cadaver models

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This study assesses intubation times and potential trauma with two new portable video laryngoscopes, the GlideScope Ranger (GSR) and the Venner A.P. Advance (APA), in a simulated difficult prehospital airway. The GSR has a hockey stick shape and is inserted by a different (midline) technique compared with direct laryngoscopy and requires the use of a stylet. The APA has a handle similar to a direct laryngoscope, but with an angulated difficult airway blade. The APA is designed to have an intuitive insertion technique somewhat similar to that of direct laryngoscopy (lateral tongue displacement) and has a guiding mechanism that foregoes the need for a stylet. Methods: Thirty qualified paramedics received a short demonstration of each device and were asked to intubate a modified Grade III difficult laryngoscopy mannequin in a random order (closed envelope technique). Optimal view and tracheal intubation times were recorded, and potential trauma assessed by the number of additional discrete forward advances and by visual analog scale (VAS). Direct laryngoscopy was used as a comparator. The Wilcoxon rank sum test was used for intubation times, optimal view times, percentage of glottis opening (POGO) seen, and objective trauma assessment. Student’s paired t-test was used for subjective trauma assessment and a Bonferroni correction was used for the primary outcome measures. Results: Participants declared a median of 60 (range 20 to 300) previous intubations. Time to achieve optimal view between APA and GSR was not different (20 seconds vs. 19 seconds; p = 0.19), but tracheal intubation was significantly faster with the APA (25 seconds vs. 46 seconds; p < 0.0001). Intubation success was ultimately 97% in both groups. Participants judged subjective trauma to be less for the APA than GSR on a VAS (1.6 cm vs. 3.3 cm; p < 0.001). More than three additional forward advances were required in 43% of GSR and 0% of APA intubations. Conclusions: Following a brief demonstration to paramedics naïve to video laryngoscopy, the APA demonstrated earlier intubation, fewer additional discrete forward advances of the tube, and less participant-judged subjective trauma when compared to the GSR in this simulation model.

Manikin study: Guideline 11.6: Equipment and techniques in adult ALS


In animal models of cardiac arrest, the benefit afforded by hypothermia is closely linked to the rapidity of the decrease in body temperature after resuscitation. Because total liquid ventilation (TLV) with temperature-controlled perfluorocarbons induces a very rapid and generalized cooling, we aimed to determine whether this could limit the post-cardiac arrest syndrome in a rabbit model. We especially focused on neurological, cardiac, pulmonary, liver and kidney dysfunctions. Methods and Results: Anesthetized rabbits were submitted to either 5 or 10 minutes of untreated ventricular fibrillation. After cardiopulmonary resuscitation and resumption of a spontaneous circulation, the animals underwent either normothermic life support (control) or therapeutic hypothermia induced by TLV. The latter procedure decreased esophageal and tympanic temperatures to 32C to 33C within only 10 minutes. After rewarming, the animals submitted to TLV exhibited an attenuated neurological dysfunction and decreased mortality 7 days later compared with control. The neuroprotective effect of TLV was confirmed by a significant reduction in brain histological damages. We also observed limitation of myocardial necrosis, along with a decrease in troponin I release and a reduced myocardial caspase 3 activity, with TLV. The beneficial effects of TLV were directly related to the rapidity of hypothermia induction because neither conventional cooling (cold saline infusion plus external cooling) nor normothermic TLV elicited a similar protection. Conclusions:
Ultrafast cooling instituted by TLV exerts potent neurological and cardiac protection in an experimental model of cardiac arrhythmia in rabbits. This could be a relevant approach to provide a global and protective hypothermia against the post-cardiac arrest syndrome.

Animal study, Guideline 11.8: Therapeutic hypothermia after cardiac arrest


Correctly performed basic life support (BLS) and early defibrillation are the most effective measures to treat sudden cardiac arrest. Audiovisual feedback improves BLS. Automated external defibrillators (AED) with feedback technology may play an important role in improving CPR quality. The aim of this simulation study was to investigate if an AED with audiovisual feedback improves CPR parameters during standard BLS performed by trained laypersons. Methods: With ethics committee approval and informed consent, 68 teams (2 flight attendants each) performed 12 min of standard CPR with the AED's audiovisual feedback mechanism enabled or disabled. We recorded CPR quality parameters during resuscitation on a manikin in this open, prospective, randomized controlled trial. Between the feedback and control group we measured differences in compression depth and rate as main outcome parameters and effective compressions, correct hand position, and incomplete decompression as secondary outcome parameters. An effective compression was defined as a compression with correct depth, hand position, and decompression. Results: The feedback-group delivered compression rates closest to the recommended guidelines (101 +/- 9 vs. 109 +/- 15/min, p = 0.009), more effective compressions (20 +/- 18 vs. 5 +/- 6%, p < 0.001), more compressions with correct hand position (96 +/- 13 vs. 88 +/- 16%, p < 0.001), and less leaning (21 +/- 31 vs. 77 +/- 33%, p < 0.001). However, only the control-group adhered to the recommended compression depth (44 +/- 7 mm vs. 39 +/- 1%, p = 0.003). Conclusion: Use of an AED's audiovisual feedback system improved some CPR-quality parameters, thus confirming findings of earlier studies with the notable exception of decreased compression depth, which is a key parameter that might be linked to reduced cardiac output.

Manikin study


The goal of this randomized, open, controlled crossover manikin study was to compare the performance of "Animax", a manually operated hand-powered mechanical resuscitation device (MRD) to standard single rescuer basic life support (BLS). Methods: Following training, 80 medical students performed either standard BLS or used an MRD for 12 min in random order. We compared the quality of chest compressions (effective compressions, compression depth and rate, absolute hands-off time, hand position, decompression), and of ventilation including the number of gastric inflations. An effective compression was defined as a compression performed with correct depth, hand position, and decompression. Results: The use of the MRD resulted in a significantly higher number of effective compressions compared to standard BLS (67 +/- 34 vs. 41 +/- 34%, p < 0.001). In comparison with standard BLS, the use of the MRD resulted in less absolute hands-off time (264 +/- 7 vs. 79 +/- 40 s, p < 0.001) and in a higher minute-volume (1.86 +/- 0.7 vs. 1.62 +/- 0.7 l, p = 0.020). However, ventilation volumes were below the 2005 ERC guidelines for both methods. Gastric inflations occurred only in 0 +/- 0.1% with the MRD compared to 3 +/- 7% during standard BLS (p < 0.001). Conclusion: Single rescuer cardio-pulmonary resuscitation with the manually operated MRD was superior to standard BLS regarding chest compressions in this
simulation study. The MRD delivered a higher minute-volume but did not achieve the recommended minimal volume. Further clinical studies are needed to test the MRD's safety and efficacy in patients.

**Manikin study**


Background: Pressure immobilization bandages have been shown to delay onset of systemic toxicity after Eastern coral snake (Micrurus fulvius) envenomation to the distal extremity. Objectives: To assess the efficacy of a novel compression device in delaying onset of systemic toxicity after truncal envenomations with Eastern coral snake (Micrurus fulvius) venom in a porcine model. Methods: With University approval, nine juvenile pigs (11 kg to 22 kg) were sedated, anesthetized, and intubated but not paralyzed to ensure continuous spontaneous respirations in a university animal laboratory. Each animal was injected subcutaneously with 10 mg of M. fulvius venom in a pre-selected area of the trunk. After 1 min, six animals had the application of a novel, localizing circumferential compression (LoCC) device applied to the bite site (treatment group) and three animals had no treatment (control group). The device was composed of a rigid polymer clay form molded into a hollow fusiform shape with an internal dimension of 8 x 5 x 3 cm and an elastic belt wrapped around the animal securing the device in place. Vital signs were recorded at 30-min intervals. End points included a respiratory rate below 3 breaths/min, oxygen saturation < 80%, or survival to 8 h. Survival to 8 h was analyzed using Fisher's exact test, with p < 0.05 indicating significance. Survival analysis was performed using the Mantel-Cox test to assess time to death with outcomes represented in a Kaplan-Meier Cumulative survival plot. Results: Five of the six pigs in the treatment group survived 8 h (293-480 min). None of the control pigs survived to 8 h (Fisher's exact p = 0.04), with mean time of respiratory failure 322 min (272-382 min). Survival analysis showed a significant delay in time to event in the treatment group compared to the control group (p = 0.04). Conclusions: The LoCC device used in this study delayed the onset of systemic toxicity and significantly increased survival time after artificial truncal envenomation by Eastern coral snake venom.

**Animal study: Guideline 9.4.8: Pressure immobilisation technique**

56. Jeung KW, Ryu HH, Song KH, Lee BK, Lee HY, Heo T and Min YI. *Variable effects of high-dose adrenaline relative to standard-dose adrenaline on resuscitation outcomes according to cardiac arrest duration*. Resuscitation 2011; 82 (7): 932-6

Aim of the study: Adjustment of adrenaline (epinephrine) dosage according to cardiac arrest (CA) duration, rather than administering the same dose, may theoretically improve resuscitation outcomes. We evaluated variable effects of high-dose adrenaline (HDA) relative to standard-dose adrenaline (SDA) on resuscitation outcomes according to CA duration. Methods: Twenty-eight male domestic pigs were randomised to the following 4 groups according to the dosage of adrenaline (SDA 0.02 mg/kg vs. HDA 0.2 mg/kg) and duration of CA before beginning cardiopulmonary resuscitation (CPR): 6 min SDA, 6 min HDA, 13 min SDA, or 13 min HDA. After the predetermined duration of untreated ventricular fibrillation, CPR was provided. Results: All animals in the 6 min SDA, 6 min HDA, and 13 min HDA groups were successfully resuscitated, while only 4 of 7 pigs in the 13 min SDA group were successfully resuscitated (p = 0.043). HDA groups showed higher right atrial pressure, more frequent ventricular ectopic beats, higher blood glucose, higher troponin-I, and more severe metabolic acidosis than SDA groups.
Animals of 13 min groups showed more severe metabolic acidosis and higher troponin-I than animals of 6 min groups. All successfully resuscitated animals, except two animals in the 13 min HDA group, survived for 7 days (p = 0.121). Neurologic deficit score was not affected by the dose of adrenaline. Conclusion: HDA showed benefit in achieving restoration of spontaneous circulation in 13 min CA, when compared with 6 min CA. However, this benefit did not translate into improved long-term survival or neurologic outcome.

Animal study: Guideline 11.5: Medications in adult ALS


An increase in oxygen tension is an important factor in decreasing pulmonary vascular resistance (PVR) at birth. Birth asphyxia results in acidosis and increased PVR. We determined the effect of resuscitation with 21% vs. 100% O2 on pulmonary hemodynamics, pulmonary arterial (PA) reactivity, and oxidant stress in a lamb model of in utero asphyxia. Term fetal lambs were acutely asphyxiated by intrauterine umbilical cord occlusion for 10 min resulting in acidosis (pH-6.96±0.05 and pCO2-103±5mmHg), bradycardia, systemic hypotension and increased PVR. Lambs were treated with 30 min of resuscitation with 21% or 100% O2 (n=6 each). PaO2 was significantly elevated with 100% O2 resuscitation compared to 21% O2 (430±38 vs. 64±8mmHg), but changes in pH and paCO2 were similar. 100% O2 induced greater increase in pulmonary blood flow and decrease in PVR at 1 min of life, but subsequent values were similar to 21% O2 group between 2 and 30 min of life. Oxygen uptake from the lung and systemic oxygen extraction were similar between the two groups. Pulmonary arteries showed increased staining for superoxide anions and increased contractility to norepinephrine following resuscitation with 100% O2. The increased PA contractility induced by 100% O2 was reversed by scavenging superoxide anions with superoxide dismutase and catalase. We conclude that resuscitation of asphyxiated lambs with 100% O2 increases PaO2, but does not improve lung oxygen uptake, decrease PVR at 30 min, or increase systemic oxygen extraction ratios. Furthermore, 100% O2 also induces oxidative stress and increases PA contractility. These findings support the new neonatal resuscitation guidelines recommending 21% O2 for initial resuscitation of asphyxiated neonates.

Animal study: Guideline 13: Neonatal resuscitation


Hyperglycemia is common in the early period following resuscitation from cardiac arrest and has been shown to be a predictor of neurologic outcome in retrospective studies. Objective. To evaluate neurologic outcome and early post-arrest hyperglycemia in a swine cardiac arrest model. Methods. Electrically induced ventricular fibrillation cardiac arrest was induced in 22 anesthetized and instrumented swine. After 7 minutes, cardiopulmonary resuscitation (CPR) and Advanced Cardiac Life Support were initiated. Twenty-one animals were resuscitated and
plasma glucose concentration was measured at intervals for 60 minutes after resuscitation. The animals were observed for 72 hours and the neurologic score was determined at 24-hour intervals. Results. Ten animals had a peak plasma glucose value ≥226 mg/dL during the initial 60 minutes after resuscitation. The neurologic scores at 72 hours in these animals (mean score = 0, mean overall cerebral performance category = 1) were the same as those in the animals with a peak plasma glucose value <226 mg/dL. The end-tidal carbon dioxide (CO2) values measured during CPR, times to restoration of spontaneous circulation, and epinephrine doses were not significantly different between the animals with a peak glucose concentration ≥226 mg/dL and those with lower values. The sample size afforded a power of 95% to detect a 50-point difference from the lowest score (0 points) of the porcine neurologic outcome scale. Conclusion. In this standard porcine model of witnessed out-of-hospital cardiac arrest, early postresuscitation stress hyperglycemia did not appear to affect neurologic outcome. During the prehospital phase of treatment and transport, treatment of hyperglycemia by emergency medical services providers may not be warranted.

Animal study. Guideline 11.7: Post-resuscitation therapy


Chest compressions performed correctly have the potential to increase survival post cardiac arrest. The 2005 European Resuscitation Council (ERC) guidelines altered and simplified instructions for hand position placement to increase the number of chest compressions performed. This randomised controlled trial compares chest compression efficacy (hand position and number of effective chest compressions) after training using the 2005 guidelines or the 2005 guidelines with a hand position modification based on 2000 ERC guidelines. Methods: First year healthcare students at the University of Birmingham, United Kingdom, were randomly allocated to either '2005' or 'intervention' group immediately after passing a Basic Life Support (BLS) assessment to ERC standards. The 2005 group performed 2 min of BLS on a SkillReporter(TM) manikin (Laerdal Medical, Stavanger, Norway). The intervention group received training on hand placement using landmark techniques from the 2000 ERC guidelines; emphasising rapid hand positioning. This group also performed 2 min of BLS on a SkillReporter(TM) manikin. Results: 82 students were assessed; 41 in the 2005 group and 41 in the intervention group. Average compression rate was 102 in the 2005 group and 104 in the intervention group (p = 0.29). Average number of incorrect hand placements was 24 in the 2005 group and 9 in the intervention group (p = 0.03). Conclusions: The use of landmark measurement techniques in hand placement for external chest compressions does not have a detrimental effect on the number of chest compressions performed during BLS and increases correct hand positioning.

Manikin study: Guideline 6: Compressions.


Introduction: When using a T-piece device, resuscitators may try to improve airway pressures by increasing gas flow instead of correcting facemask position. Aim: To measure the effects of changing gas flow during positive pressure ventilation (PPV) on peak inspiratory pressure (PIP), positive end expiratory pressure (PEEP), expiratory tidal volume (VTe) and mask leak. Methods: Using a Neopuff T-piece device, 20 neonatal staff members delivered PPV to a modified, leak-free manikin. Resuscitation parameters were recorded. Study A: PPV for 4 min at PIP...
30 cm H2O and PEEP 5 cm H2O. Each minute gas flow was increased (5, 8, 10, and 15 L/min). PIP and PEEP settings were unchanged. Study B: same pressure settings; PPV for 1 min with 5, 8, 10, and 15 L/min in a random order, at a rate of approximately 60/min. The pressures were adjusted to maintain the same PIP and PEEP after each flow change. Results: Study A: As gas flow increased (5, 8, 10 and 15 L/min) the median PEEP increased from 4.7 to 26.4 cm H2O (p < 0.002). Median VT decreased from 10.0 to 0.8 mL (p < 0.001). PIP increased slightly from 30 cm H2O to 36 cm H2O at 15 L/min (p < 0.005). Mask leak increased from 14% to 98% (p < 0.001) because mask pressure increased. Study B: when PIP and PEEP were maintained there were no significant differences in VT (p = 0.42) or mask leak (p = 0.51) with changing gas flow.

Conclusion: During PPV increasing gas flow dramatically increased PEEP and mask leak and in consequence reduced VT. Gas flow should rarely be changed during T-piece resuscitation.


Coagulopathy is often present after resuscitation from cardiac arrest but plays an undefined role in the post cardiac arrest syndrome. The aim of this study was to characterize coagulation changes during cardiac arrest and post-resuscitation care in order to direct further focused study. Methods: Ventricular fibrillation (VF) was induced electrically in immature male swine, followed by normothermic American Heart Association Advanced Cardiac Life Support and a uniform post-resuscitation goal-directed resuscitation protocol. PT, aPTT, fibrinogen, Thrombelastography (TEG), platelet contractile force (PCF), clot elastic modulus (CEM), and collagen-induced platelet aggregation were compared at baseline, at 8 min of VF, during the 3rd round of chest compressions (CPR), and at 15, 90, 180, and 360 min after return of circulation using repeated measures ANOVA. Results: 8/18 (44%) animals were resuscitated after 10.9 +/- 0.9 min of VF and 7.6 +/- 3.4 min of CPR. TEG revealed a significant impairment in clot strength (MA) and clot formation kinetics (K, alpha angle) arising during CPR, followed by a brief prolongation of clot onset times (R) after return of circulation. Both PCF and CEM fell significantly during CPR (PCF by 50%, CEM by 47% of baseline) and platelet aggregation was significantly decreased during CPR. Coagulation changes were partially recovered by 3 h of post-resuscitation care. Conclusion: Whole blood coagulation was rapidly impaired during CPR after electrically induced VF in this swine model by impaired platelet aggregation/contractile function and clotting kinetics. Further platelet-specific study is indicated. Animal study. Guideline 11.7: Post-resuscitation therapy


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.

Cadaver study.

Case Studies, Letters & Editorials

We present the case of a prehospital perimortem hysterotomy and caesarean delivery of the foetus at 38 weeks of gestation. Effective, in-hospital standards of advanced life support were provided by a physician-paramedic team in the prehospital arena to achieve resuscitation of the newborn after maternal cardiac arrest. This case serves as a reminder of the unique challenges of maternal resuscitation and that all physicians involved in the provision of prehospital emergency medical care should be aware of, and be prepared to carry out this procedure.

Case study

A 41-year-old motocross rider sustained blunt trauma to the chest following a collision with another rider. He was initially hypoxic and was given oxygen with a non-rebreather mask. He complained of chest pain. A prehospital extended focused assessment with sonography in trauma (eFAST) scan was negative for pneumothorax, but demonstrated a hypokinetic left ventricle. An electrocardiogram (ECG) in the emergency department confirmed anterior myocardial infarction, found to be due to a traumatic left anterior descending coronary artery dissection. This case highlights a rare but life-threatening cause of hypoxia in blunt chest trauma.

Case study

**Background:** In this preliminary prospective observational study at four physician-led air rescue centres, the efficacy of the C-MAC (Karl Storz, Tuttingen, Germany), a new portable videolaryngoscope, was evaluated during prehospital emergency endotracheal intubations. Methods: 80 consecutive patients requiring prehospital emergency intubation, treated by a physician introduced in the use of the C-MAC were enrolled in this study. Results: Indication for prehospital intubation was trauma in 45 cases (including maxillo-facial trauma in 10 cases), cardiopulmonary resuscitation in 14 cases, and unconsciousness of neurological aetiology and cardiogenic dyspnoea in 21 cases. Forty-nine patients were intubated with a C-MAC blade size 3, and 31 with a C-MAC blade size 4. Median time to successful intubation was 20 (min,max: 5'300) seconds; 63 patients were intubated on the first attempt, 13 on the second and four after more than two attempts. A Cormack-Lehane class 1 view of the glottis was seen in 46 patients, class 2a view in 21, class 2b in eight, class 3 in three and class 4 in two. Six patients could not be intubated with the videolaryngoscopic view, but were successfully intubated at the same attempt using the C-MAC with the direct laryngoscopic view.

**Conclusion:** The C-MAC videolaryngoscope was suitable for prehospital emergency endotracheal intubations with complicated airway conditions, such as maxillo-facial trauma. The option to perform direct laryngoscopy and videolaryngoscopy with the same device appears to be exceptionally important in the prehospital setting.

**Case series**

66. Fitzpatrick D, Brady JA and Maguire D. *Prehospital improvisation of standard oxygen therapy equipment to facilitate delivery of a bronchodilator in a supine patient.* Emerg Med J 2011; Online first (8 July)

A police request was made to the ambulance service to attend an adult victim of an alleged assault. On arrival the patient was found to be alert (AVPU: alert, responds to verbal stimuli, responds to pain, unresponsive), in a seated position, and complaining of head, neck and back pain. The airway was clear; a mild diffuse polyphonic wheeze was noted bilaterally throughout both lungs. Respiratory rate was 16 bpm and heart rate was 126 bpm. Oxygen therapy was commenced via a duo mask (fractional inspired oxygen (FiO₂) 0.53) as oxygen saturation was recorded initially at 94% on air. The mechanism of injury caused concern regarding possible c-spine injury as the patient's head had been struck forcefully against the wall. The patient denied any loss of consciousness. Bony tenderness was elicited during c-spine examination and a c-spine collar was applied with full spinal precautions. The patient was immobilised using …

67. Hughes G. *Transforming NHS ambulance services.* EMJ 2011; Online first (July 5)

In June the UK National Audit Office published a 48-page document called ‘Transforming NHS Ambulance Services’. It is forthright and clear in what it has to say and, depending on your perspective, it offers either a threat or an opportunity for ambulance services to respond. Some highlights of the report (and don't they sound familiar...);

< In England in 2009-10 the cost of ambulance services was £1.9 billion, of which around £1.5 billion was for urgent and emergency services.  
< 7.9 million emergency ‘999’ calls were received, leading to 6.4 million ambulance incidents and 4.7 million emergency or urgent journeys.  
< The number of emergency or urgent calls has increased by 4% a year since 2007-8.
The services are pivotal to the performance of the entire urgent and emergency care system.
Performance over the last decade has been driven by response time targets and not outcomes.
The services must achieve a minimum of 4% efficiency savings in its budget (around £75 million per year).
Advanced practitioners are used in different ways by different services and often in ways that do not make full use of their skills.
The services now handles the increased telephone calls by providing advice (hear and treat), treating patients at the scene (see and treat) and moving patients to a wider range of destinations; the percentage of calls treated in these ways varies considerably between services.
Overtime costs nearly £80 million per year; high sickness rates contribute to poor resource usage; reliance on over-time and sickness rates for staff varies by 60% between services.
There is scope for standardisation and efficiency as evidenced by variations between services in costs per call, the way resources are deployed to meet demand, the take-up of different approaches to call responses and reliance on overtime.
Over one-fifth of patient handovers at A & E departments take longer than the 15 min recommended. If ambulances are queuing outside hospitals, they are not available to respond to other calls. There is scope to reduce the time taken by ambulance crews from patient handover at the hospital to being available for their next job.
The services provide a life-saving service to some patients, is highly regarded by the public and rightly remains committed to providing a rapid response to urgent and emergency calls at a time of steadily growing call volumes; but, until April 2011, the DH's emphasis on response time as a measure of performance rather than on a more rounded view of clinical outcomes meant that the incentive structure did not encourage resource optimisation.
Commissioners must ensure that work to develop local directories of services continues at pace and that alternative destinations to A&E departments are available.
The new measures and performance regime must be carefully thought through to deliver the right balance to preserve rapidity of response, but only as one element of a more rounded response model.

Editorial

68. Rottenberg EM. Are lower survival rates among men who have had an out-of-hospital cardiac arrest in the home primarily due to female-witnessed arrest and poorer bystander cardiopulmonary resuscitation quality? Heart 2011; Online first (August 6)
Adielsson and colleagues conducted a study of out-of-hospital cardiac arrest (OHCA) to identify the strong predictors of survival among witnessed arrests with shockable arrhythmias of presumed cardiac aetiology. They concluded that female gender, OHCA outside the home, bystander cardiopulmonary resuscitation (CPR) and a shorter delay from collapse to defibrillation were all strongly associated with increased early and late survival. They postulated that when in-home bystanders are men (spouses), chest compressions might be more effective (deep enough) owing to their physical size and ability compared with women. Also, the chance of a successful defibrillation might be increased in women owing to their smaller heart and thoracic volume. However, although this study brings to light important revelations about resuscitation of OHCA, it does not address these revelations and their implications from the perspective of resuscitating men who have had a cardiac arrest. Approximately two thirds of all OHCAs occur in the home, and the majority of people who have had a cardiac arrest are men, who are most likely to receive CPR from their spouses (often older women). Therefore, to increase the overall survival from OHCA, these revelations and their implications need to be addressed to improve resuscitation among men who have had an in-home OHCA. Evidence strongly suggests that
bystander CPR is only effectively applied outside the home and only when provided by men.

Letter


To the Editor: Severe sepsis is common, often fatal, and results in a large burden on the health care system. As the population ages, national estimates project more than 1 million new cases of severe sepsis annually in the United States, with a mortality rate between 20% and 40%. Modern advances in severe sepsis treatment, such as early, goal-directed therapy, may reduce multi-organ failure and death by up to 20% through time-sensitive recognition and resuscitation. Given this lifesaving potential, multiple international societies and the Institute for Healthcare Improvement have endorsed strategies for early hospital-based diagnosis and resuscitation of severe sepsis—strategies that often originate in the emergency department.

And yet, the initial medical contact for many of these patients does not occur in the hospital or emergency department, but rather when emergency medical services (EMS) respond in the out-of-hospital setting. In other time-sensitive conditions such as myocardial infarction, severe trauma, or cardiac arrest, EMS diagnosis and care can make a lifesaving difference. Thus the paradigm of moving diagnosis, triage, and care to the out-of-hospital setting has convincing precedence. Does severe sepsis afford another opportunity for meaningful EMS involvement? Preliminary evidence does suggest that emergency department processes of care may be more efficient for severe sepsis patients who arrive after EMS transport...

Letter


Little is known about the presenting features of acute ischemic and hemorrhagic stroke in children presenting to the emergency department (ED). Yet, initial clinical assessment is a key step in the management pathway of stroke. We describe the presentation in the ED of children with confirmed acute ischemic and hemorrhagic stroke subtypes. Methods: We conducted a retrospective descriptive case series of consecutive patients aged 1 month to younger than 18 years and presenting to a single-center tertiary ED with radiologically confirmed acute ischemic stroke or hemorrhagic stroke during a 5-year period. Patients were identified by medical record search with International Classification of Diseases, 10th Revision codes for hemorrhagic stroke and through the hospital stroke registry for acute ischemic stroke. Signs, symptoms, and initial management were described. Results: Fifty patients with acute ischemic stroke and 31 with hemorrhagic stroke were identified. Mean age was 8.7 years (SD 5.2), and 51% were male. Fifty-six percent were previously healthy. Median time from onset of symptoms to ED presentation was 21 hours (interquartile range 6 to 48 hours) for acute ischemic stroke and 12 hours (interquartile range 4 to 72 hours) for hemorrhagic stroke. Acute ischemic stroke presented with symptoms of focal limb weakness (64%; 95% confidence interval [CI] 49% to 77%), facial weakness (60%; 95% CI 45% to 73%), and speech disturbance (46%; 95% CI 31% to 60%). Few patients with acute ischemic stroke presented with vomiting and altered mental status. Most patients with acute ischemic stroke had a Glasgow Coma Scale (GCS) score of 14 or greater (86%; 95% CI 73% to 94%) and presented with at least 1 focal neurologic sign (88%; 95% CI 73% to 98%). Hemorrhagic stroke presented with headache (73%; 95% CI 54% to 87%), vomiting (58%; 95% CI 40% to 75%), and altered mental status (48%; 95% CI 30% to 67%). GCS score in hemorrhagic stroke...
was less than 14 in 38% and less than 8 in 19% (95% CI 7% to 37%). Less than one third of patients had focal limb weakness, facial weakness, or slurred speech. Nineteen percent of patients with hemorrhagic stroke were intubated in the ED and admitted to the ICU. None of the acute ischemic stroke patients were intubated in the ED, and 4% were admitted to the ICU. Conclusion: Diagnosis of stroke in children with acute ischemic stroke and hemorrhagic stroke was delayed. Acute ischemic stroke presented mainly with focal findings; hemorrhagic stroke, with headache, vomiting, and mental status change.


Background: Mortality from acute myocardial infarction is influenced by the speed at which reperfusion therapy is delivered. In the UK, prehospital thrombolysis (PHT), administered by paramedics, has been developed to improve call to needle (CTN) times. Recently, it has been shown in randomised trials that mortality can be further reduced by primary percutaneous coronary intervention (PPCI). This project was developed to assess current ST-elevation myocardial infarction practice in a district general hospital and to prepare paramedics for PPCI.

Methods: Data were collected prospectively over a 12-month period for all patients who received thrombolysis for a presumed myocardial infarct. The primary outcome measures for each case were who delivered the thrombolysis, either the paramedic crew or the hospital, and if the patient did not receive PHT the reason why not. Secondary outcome measures included the CTN time.

Results: 153 patients received thrombolysis over the time period (99 men, 54 women, mean age 66±15 years). Of this group, 55 patients received PHT (35.9%) with a median CTN time of 36 min (inter-quartile range (IQR) 30, 42 min). The commonest reason for exclusion from receiving PHT was that the patient's history did not fit the eligibility criteria (25% of cases).

Conclusions: Paramedics are able to deliver PHT promptly and safely. With the focus now on PPCI, it is anticipated that not only will paramedics be able to select patients for delivery to a heart attack centre for PPCI, they will be selecting many more patients for this treatment than have up to now received PHT.

Case series: Guideline 14: ACS

Education & ethics in resuscitation


In 2003 the International Liaison Committee on Resuscitation published a consensus document on education in resuscitation that strongly recommended that “...instruction in CPR [cardiopulmonary resuscitation] be incorporated as a standard part of the school curriculum.” The next year the American Heart Association (AHA) recommended that schools “...establish a goal to train every teacher in CPR and first aid and train all students in CPR” as part of their preparation for a response to medical emergencies on campus. Since that time there has been an increased interest in legislation that would mandate that school curricula include training in CPR or CPR and automated external defibrillation. Laws or
curriculum content standards in 36 states (as of the 2009 to 2010 school year) now encourage the inclusion of CPR training programs in school curricula. The language in those laws and standards varies greatly, ranging from a suggestion that students “recognize” the steps of CPR to a requirement for certification in CPR. Not surprisingly, then, implementation is not uniform among states, even those whose laws or standards encourage CPR training in schools in the strongest language. This statement recommends that training in CPR and familiarization with automated external defibrillators (AEDs) should be required elements of secondary school curricula and provides the rationale for implementation of CPR training, as well as guidance in overcoming barriers to implementation.

Education / guideline

The purpose of this study is to compare the cardiopulmonary resuscitation (CPR) team dynamics and performance between a conventional simulation-training group and a script-based training group. Methods: This was a prospective randomised controlled trial of educational intervention for CPR team training. Fourteen teams, each consisting of five members, were recruited. The conventional group (C) received training using a didactic lecture and simulation with debriefing, while the script group (S) received training using a resuscitation script. The team activity was evaluated with checklists both before and after 1 week of training. The videotaped simulated resuscitation events were compared in terms of team dynamics and performance aspects. Results: Both groups showed significantly higher leadership scores after training (C: 58.2±9.2 vs 67.2±9.5, p=0.007; S: 57.9±8.1 vs 65.4±12.1, p=0.034). However, there were no significant improvements in performance scores in either group after training. There were no differences in the score improvement after training between the two groups in dynamics (C: 9.1±12.6 vs S: 7.4±13.7, p=0.715), performance (C: 5.5±11.4 vs S: 4.7±9.6, p=0.838) and total scores (C: 14.6±20.1 vs S: 12.2±19.5, p=0.726). Conclusion: Script-based CPR team training resulted in comparable improvements in team dynamics scores compared with conventional simulation training. Resuscitation scripts may be used as an adjunct for CPR team training.

Education

Flexible-learning first aid courses are increasingly common due to reduced classroom contact time. This study compared retention of first aid knowledge and basic life support (BLS) skills three months after a two-day, classroom-based first aid course (STD) to one utilizing on-line theory learning at home followed by one day of classroom training (FLEX). Methods: In this prospective randomized controlled trial, 256 participants with internet access and no first aid related training for at least five years were randomly allocated to a STD or FLEX course. Assessment was conducted immediately after training and again three months later. Each participant was allocated a theory and a BLS score, which were summed and averaged to create an equally-weighted ‘combined score’ of first aid knowledge and skills. Results: There was no significant difference in theory scores between the STD and FLEX groups immediately after training and after three months. STD participants had significantly higher BLS scores immediately after training (p = 0.001) and three months later (p = 0.046). Males had significantly higher BLS scores after training (p < 0.001), but not three months later (p = 0.2). Participants older than 46 years had significantly lower BLS scores than
younger participants (p < 0.001). There was no significant difference in combined scores between the STD and FLEX groups or between genders, education or age groups either immediately after training or three months later. Conclusion: After replacing one day of classroom-based training with on-line theory training, there was no significant difference in the first aid competencies of the study population, as measured by an equally weighted combined score of basic life support and first aid theory.

Education


Current computerised self-learning (SL) stations for Basic Life Support (BLS) are an alternative to instructor-led (IL) refresher training but are not intended for initial skill acquisition. We developed a SL station for initial skill acquisition and evaluated its efficacy. Methods: In a non-inferiority trial, 120 pharmacy students were randomised to IL small group training or individual training in a SL station. In the IL group, instructors demonstrated the skills and provided feedback. In the SL group a shortened Mini Anne(TM) video, to acquire the skills, was followed by Resusci Anne Skills Station software (both Laerdal, Norway) with voice feedback for further refinement. Testing was performed individually, respecting a seven-week interval after training for every student. Results: One hundred and seventeen participants were assessed (three drop-outs). The proportion of students achieving a mean compression depth 40-50mm was 24/56 (43%) IL vs. 31/61 (51%) SL and 39/56 (70%) IL vs. 48/61 (79%) SL for a mean compression depth >=40 mm. Compression rate 80-120/min was achieved in 49/56 (88%) IL vs. 57/61 (93%) SL and any incomplete release (>=5 mm) was observed in 31/56 (55%) IL and 35/61 (57%) SL. Adequate mean ventilation volume (400-1000 ml) was achieved in 29/56 (52%) IL vs. 36/61 (59%) SL. Non-inferiority was confirmed for depth and although inconclusive, other areas came close to demonstrate it. Conclusions: Compression skills acquired in a SL station combining video-instruction with training using voice feedback were not inferior to IL training.

Education


The aim of the study reported here was to address the need to assess and train teamwork and non-technical skills in the context of Resuscitation. Specifically, we sought to develop a tool that is feasible to use and psychometrically sound to assess team behaviours during cardiac arrest resuscitation attempts. Methods: To ensure validity, reliability, and feasibility, the Observational Skill based Clinical Assessment tool for Resuscitation (OSCAR) was developed in 3 phases. A review of the literature leading to initial tool development was followed by an assessment of face and content validity, and finally a thorough reliability assessment, using Cronbach’s [alpha] to assess internal consistency and intraclass correlation to assess inter-rater reliability. Results OSCAR was developed methodically, and tested for face and content validity.
Cronbach’s [alpha] results ranged from 0.736 to 0.965 demonstrating high internal consistency, and intraclass correlation results ranged from 0.652 to 0.911, all of which are strongly significant and indicate good inter-rater reliability. Conclusion: On the basis of our results, we conclude that OSCAR is psychometrically robust, scientifically sound, and clinically relevant. We have developed the Observational Skill-based Clinical Assessment tool for Resuscitation (OSCAR) for the assessment of non-technical skills in Resuscitation teams. We propose the use of this tool in simulation and real Cardiac Arrest Resuscitation attempts to assess, guide and train non-technical skills to team members, to improve patient safety and maximise the chances of successful resuscitation.

Education


It has been reported as an ethical problem within prehospital emergency care that ambulance professionals administer physiologically futile cardiopulmonary resuscitation (CPR) to patients having suffered cardiac arrest to benefit significant others. At the same time it is argued that, under certain circumstances, this is an acceptable moral practice by signalling that everything possible has been done, and enabling the grief of significant others to be properly addressed. Even more general moral reasons have been used to morally legitimize the use of futile CPR: That significant others are a type of patient with medical or care needs that should be addressed, that the interest of significant others should be weighed into what to do and given an equal standing together with patient interests, and that significant others could be benefited by care professionals unless it goes against the explicit wants of the patient. In this article we explore these arguments and argue that the support for providing physiologically futile CPR in the prehospital context fails. Instead, the strategy of ambulance professionals in the case of a sudden death should be to focus on the relevant care needs of the significant others and provide support, arrange for a peaceful environment and administer acute grief counselling at the scene, which might call for a developed competency within this field.

Ethics


Health care professionals provide services to patients. They elicit a description of patients’ problems (the chief complaint and history), examine patients for physical findings, make decisions about diagnostic tests, interpret test results, recommend treatments, perform procedures, organize care, and advocate. In addition, clinicians provide counseling and emotional support for patients and their families. Professionalism dictates that the same high standard of care should be delivered with each interaction (ie, all patients should be treated the same). However, anyone on the front lines of clinical medicine knows that there is considerable variation in the way patients interact with their health care professionals. At one extreme are patients who communicate well, understand their problems, are able to make decisions, adhere to diagnostic and treatment plans, are pleasant, and express gratitude for the services they receive. At the other end of the spectrum are patients who cannot express themselves clearly, have difficulty making decisions, do not follow any clinical plan, or who are unpleasant, hostile, and belligerent. Because clinicians are human, it might be expected that their reaction to the variations in patients’ behavior may influence the care they deliver. Much has been written on identifying and developing coping strategies for treating difficult patients to ensure they do not receive substandard care. In this Commentary, we examine the flipside of the issue and ask the following question: “Do nice patients (and those with nice families) receive better care?”
There is a substantive difference in the experience of individuals who provide medical care in the out-of-hospital setting and the experience of those who provide similar care in the hospital or other clinical settings. Furthermore, physicians who provide medical direction for EMS personnel have a clinical and oversight relationship with EMS personnel. This relationship uniquely qualifies EMS medical directors to provide expert opinions related to care provided by non-physician EMS personnel. Physicians without specific EMS oversight experience are not uniformly qualified to provide expert opinion regarding the provision of EMS. This resource document reviews the current issues in expert witness testimony in cases involving EMS as these issues relate to the unique qualifications of the expert witness, the standard of care, and the ethical expectations.

**Ethics**

And.....a solution to a prehospital and emergency department problem?

[Link to free full text of this paper: http://www.cjem-online.ca/v2/n1/p47](http://www.cjem-online.ca/v2/n1/p47)