Advanced life support


Epinephrine and vasopressin are the only vasopressors associated with return of spontaneous circulation (ROSC). While current guidelines recommend rapid and frequent vasopressor administration during cardiac arrest, delays in their administration in the out-of-hospital setting remain a concern. Objective. This study evaluated delays in vasopressor administration and their effect on field ROSC. Methods. This retrospective review included all adult patients who experienced cardiac arrest of medical origin and received field resuscitative efforts among 10 emergency medical services (EMS) systems. Data were abstracted from the EMS medical record and included response time intervals, calculated first-dose and inter-dosing intervals of vasopressors, and ROSC. Data were analyzed using Mann-Whitney tests, chi-square tests, and t-tests, survival analysis, and logistic regression, with p ≤ 0.05 indicating significance. Results. A total of 660 cardiac arrest patients were enrolled in the study. The mean EMS response time was 8.8 minutes; 52.7% of patients had witnessed cardiac arrests, 46.2% received bystander cardiopulmonary resuscitation (CPR), 23.0% had shockable initial rhythms, and 19.5% experienced field ROSC. In total, 1,913 doses of epinephrine and 111 doses of vasopressin were administered, with mean and 90th-percentile scene arrival–to–first drug intervals of 9.5 and 17 minutes, respectively. The mean and 90th-percentile inter-dosing intervals were 6.1 and 10 minutes, respectively. Patients experiencing ROSC had shorter scene arrival–to–first drug intervals than those without ROSC (8.1 vs. 9.8 min, p < 0.01), but there was no difference in the mean inter-dosing interval (6.8 vs. 6.0 min, p = 0.57). In the logistic regression analysis of ROSC, the adjusted odds ratio for call receipt–to–first drug interval ≤10 minutes was 1.91 (p = 0.04). Patients receiving advanced airway control prior to vasopressor administration were less likely to have a call receipt–to–first drug interval within 10 minutes (4.0% vs. 17.3%, p < 0.01) and were less likely to attain ROSC (15.7% vs. 25.4%, p < 0.01). Conclusion. The interval between scene arrival and first administration of vasopressors is significantly shorter among patients who experience ROSC compared with those who do not. Airway control procedures delay vasopressor administration and reduce the likelihood of ROSC. Although the inter-dosing intervals of most patients were not consistent with current recommendations, there was no difference in the mean inter-dosing times between those who achieved ROSC and those who did not.


Compression pauses may be particularly harmful following the electrical recovery but prior to the mechanical recovery from cardiopulmonary arrest. Methods and results: A convenience sample of patients with out-of-hospital cardiac arrest (OOHCA) were identified. Data were exported from defibrillators to define compression pauses, electrocardiogram rhythm, PetCO2, and the presence of palpable pulses. Pulse-check episodes were randomly assigned to a derivation set (one-third) and a validation set (two-thirds). Both an unweighted and a weighted receiver–operator curve (ROC) analysis were performed on the derivation set to identify optimal thresholds to predict ROSC using heart rate and PetCO2.
sequential decision guideline was generated to predict the presence of ROSC during compressions and confirm perfusion once compressions were stopped. The ability of this decision guideline to correctly identify pauses in which pulses were and were not palpated was then evaluated. A total of 145 patients with 349 compression pauses were included. The ROC analyses on the derivation set identified an optimal pre-pause heart rate threshold of > 40 beats min⁻¹ and an optimal PetCO₂ threshold of > 20 mmHg to predict ROSC. A sequential decision guideline was developed using pre-pause heart rate and PetCO₂ as well as the PetCO₂ pattern during compression pauses to predict and rapidly confirm ROSC. This decision guideline demonstrated excellent predictive ability to identifying compression pauses with and without palpable pulses (positive predictive value 95%, negative predictive value 99%). The mean latency period between recovery of electrical and mechanical cardiac function was 78 s (95% CI 36–120 s). Conclusions: Heart rate and PetCO₂ can predict ROSC without stopping compressions, and the PetCO₂ pattern during compression pauses can rapidly confirm ROSC. Use of a sequential decision guideline using heart rate and PetCO₂ may reduce unnecessary compression pauses during critical moments during recovery from cardiopulmonary arrest.

Hanging is an infrequent but devastating cause of out-of-hospital cardiac arrest (OHCA). We determine the characteristics and outcomes of hanging-associated OHCA in Melbourne Australia. Methods: A 10-year retrospective case review of all adult hangings (aged ≥16 years) associated with OHCA, was conducted using data from the Victorian Ambulance Cardiac Arrest Registry. Results: Between 2000 and 2009, the emergency medical service (EMS) attended 33 178 adult OHCAs of which 1321 (4%) had hanging as the aetiology. The median age (IQR) of hanging-associated OHCA cases was 39 (29–51) years and 1162 were men (88%). The first recorded rhythm by EMS was asystole seen in 1276 (75.5%) patients, pulseless electrical activity (PEA) in 38 (13.4%) cases and ventricular fibrillation in 7 cases (0.5%). EMS attempted resuscitation in 208 (15.7%) patients of whom 61 (29.3%) achieved return of spontaneous circulation (ROSC) and were transported, and 7 (3.3%) survived to hospital discharge. Hanging-associated OHCA were younger (median (IQR) 38 (29–51) years versus 74 (61–82) years, p<0.001), less likely to have a shockable rhythm (0.5% vs 17.2%, p<0.001), receive bystander cardiopulmonary resuscitation (14.1% vs 25.5%, p<0.001) or an attempted resuscitation by EMS (15.7% vs 36.1%, p<0.001) compared with OHCA cases with an aetiology of ‘presumed cardiac’ arrest. Multivariable logistic regression identified factors associated with EMS decision to attempt resuscitation; the adjusted OR (95% CI) for ‘presence of bystander cardiopulmonary resuscitation’ was 15.8 (10.70–23.30) and for ‘witnessed arrest’ was 5.26 (1.17–23.30). Conclusion: Attempted resuscitation was not always futile with a survival of 3.3%. A preventive focus is needed.

Out-of-hospital cardiac arrest (OHCA) is a common cause of death. In spite of recurring updates of guidelines, the survival of patients with OHCA was essentially unchanged from the mid 1970s to the mid 2000s, averaging 7.6% for all OHCA and 17.7% for OHCA due to ventricular fibrillation. In the past, changes in one's approach to resuscitation had to await the semi-decennial publications of guidelines. Following approved guidelines (at times based on consensus), survival rates of patients with OHCA were extremely variable, with only a few areas having good results. An alternative approach to improving survival is to use continuous quality improvement (CQI), a process often used to address public health problems. Continuous quality improvement advocates that one obtain baseline data and, if not optimal, make changes and continuously re-evaluate the results. Using CQI, we instituted cardio-cerebral resuscitation as an alternative approach and found significant improvement in
survival of patients with OHCA. The changes we made to the therapy of patients with primary OHCA, called cardio-cerebral resuscitation, were based primarily on extensive experimental laboratory data. Using cardio-cerebral resuscitation as a model for CQI, neurologically intact survival of patients with OHCA in ventricular fibrillation improved in 2 rural counties in Wisconsin, from 15% to 39%, and in 60 emergency medical systems in Arizona, to 38%. By advocating chest compression only CPR for bystanders of patients with primary OHCA and encouraging the use of cardio-cerebral resuscitation by emergency medical systems, survival of patients with primary cardiac arrest in Arizona increased over a 5-year period from 17.7% to 33.7%. We recommend that all emergency medical systems determine their baseline survival rates of patients with OHCA and a shockable rhythm, and consider implementing the CQI approach if the community does not have a neurologically intact survival rate of at least 30%.


It is unclear whether advanced airway management such as endotracheal intubation or use of supraglottic airway devices in the prehospital setting improves outcomes following out-of-hospital cardiac arrest (OHCA) compared with conventional bag-valve-mask ventilation. OBJECTIVE: To test the hypothesis that prehospital advanced airway management is associated with favorable outcome after adult OHCA. DESIGN, SETTING, AND PARTICIPANTS: Prospective, nationwide, population-based study (All-Japan Utstein Registry) involving 649,654 consecutive adult patients in Japan who had an OHCA and in whom resuscitation was attempted by emergency responders with subsequent transport to medical institutions from January 2005 through December 2010. MAIN OUTCOME MEASURES: Favorable neurological outcome 1 month after an OHCA, defined as cerebral performance category 1 or 2. RESULTS: Of the eligible 649,359 patients with OHCA, 367,837 (57%) underwent bag-valve-mask ventilation and 281,522 (43%) advanced airway management, including 41,972 (6%) with endotracheal intubation and 239,550 (37%) with use of supraglottic airways. In the full cohort, the advanced airway group incurred a lower rate of favorable neurological outcome compared with the bag-valve-mask group (1.1% vs 2.9%; odds ratio [OR], 0.38; 95% CI, 0.36-0.39). In multivariable logistic regression, advanced airway management had an OR for favorable neurological outcome of 0.38 (95% CI, 0.37-0.40) after adjusting for age, sex, etiology of arrest, first documented rhythm, witnessed status, type of bystander cardiopulmonary resuscitation, use of public access automated external defibrillator, epinephrine administration, and time intervals. Similarly, the odds of neurologically favorable survival were significantly lower both for endotracheal intubation (adjusted OR, 0.41; 95% CI, 0.37-0.45) and for supraglottic airways (adjusted OR, 0.38; 95% CI, 0.36-0.40). In a propensity score-matched cohort (357,228 patients), the adjusted odds of neurologically favorable survival were significantly lower both for endotracheal intubation (adjusted OR, 0.45; 95% CI, 0.37-0.55) and for supraglottic airways (adjusted OR, 0.36; 95% CI, 0.33-0.39). Both endotracheal intubation and use of supraglottic airways were similarly associated with decreased odds of neurologically favorable survival. CONCLUSION AND RELEVANCE: Among adult patients with OHCA, any type of advanced airway management was independently associated with decreased odds of neurologically favorable survival compared with conventional bag-valve-mask ventilation. Full text available at: http://jama.jamanetwork.com/article.aspx?articleid=1557712


Objectives: External laryngeal manipulation (ELM) is commonly used to facilitate laryngeal view during direct laryngoscopy. We evaluated the effectiveness of the newly modified bimanual laryngoscopy, which involves a direct guidance of an assistant’s hand by a laryngoscopist, to
optimize laryngeal exposure during direct laryngoscopy compared with conventional bimanual laryngoscopy. Methods: A total of 78 adult patients were included. Patients were randomly allocated to 1 of 2 groups: group C (ELM using conventional bimanual laryngoscopy) or group M (ELM using the modified bimanual laryngoscopy). The difference in percentage of glottic opening scores after the application of ELM, the number of ELM attempts, and the time taken to obtain the best laryngeal view during ELM were recorded. Results: The differences in the percentage of glottic opening score before and after the initial attempt of ELM significantly improved in-group M compared with group C (40% [30%-50%] vs 30% [15%-35%], median [interquartile range], respectively; P < .001). The success rate of achieving the best laryngeal view on the first attempt was higher in-group M than in-group C (87% vs 36%, respectively; P < .001). The time taken for obtaining the best laryngeal view after the first ELM attempt was significantly shorter in-group M than in-group C (3 [3-4] vs 7 [4-8] seconds, median [interquartile range], respectively; P < .001).

Conclusion: The modified bimanual laryngoscopy is more effective for obtaining the optimal laryngeal view on the first attempt compared with the conventional bimanual laryngoscopy.


Objectives: There is little information on geriatric emergency airway management. We sought to describe intubation practices and outcomes for emergency department (ED) geriatric and younger patients in Japan. Method: We formed the Japanese Emergency Airway Network, a consortium of 11 medical centers, and prospectively collected data on ED intubations between 2010 and 2011. All patients 18 years or older who underwent emergent airway management were included in our study. Patients were divided into 2 groups: 18 to 64-year olds and 65 years or older. We present descriptive data as proportions with 95% confidence intervals (CI). Results: The database recorded 3277 patients (capture rate 96%), and 3178 met the inclusion criteria. Of 3178 patients, 1844 (58%) were 65 years or older, 1334 (42%) were 18 to 64 years old, 809 (25%) were 80 years or older, and 407 (50%) of them were in the state of cardiac arrest. The geriatric group, compared to the younger group, had a higher success rate on the initial attempt (71% vs 64%; difference 7%; 95% CI 4%-10%;) and in 2 attempts (90% vs 88%; difference 3%; 95% CI 1%-5%) or less. There was no significant difference in the adverse event rates by age group (difference 0%; 95% CI −2% to 3%). Conclusion: In our multicenter study involving a large geriatric population, we found that geriatric patients were intubated with a higher success rate, compared to younger patients. These data provide implications for the geriatric ED airway practice that may lead to better patient-centered emergency care.


Fibreoptic intubation remains a key technique for the management of difficult intubation. We randomly compared the second generation single-use Ambu® aScope™ 2 videoscope with a standard re-usable flexible intubating fibrescope in 50 tracheal intubations in patients with a difficult airway simulated by a semirigid collar. All patients’ tracheas were intubated successfully with the aScope 2 or the re-usable fibrescope. The median (IQR [range]) time to intubate was significantly longer with the aScope 2 70 (55–97 [41–226]) s vs 50 (40–59 [27–175]) s, p = 0.0003) due to an increased time to see the carina. Quality of vision was significantly lower with the aScope 2 (excellent 24 (48%) vs 49 (98%), p = 0.0001; good 22 (44%) vs 1 (2%), p = 0.0001; poor 4 (8%) vs 0, p = 0.12) but with no difference in the subjective ease to intubate (easy score of 31 (62%) vs 38 (76%), p = 0.19; intermediate 12 (24%) vs 7 (14%), p = 0.31; difficult 7 (14%) vs 5 (5%), p = 0.76). The longer times to
intubate and the poorer scores for quality of vision do not support the use of the single-use aScope 2 videoscope as an alternative to the reusable fibroscope.


Outcome prediction for out-of-hospital cardiac arrest (OHCA) is of medical, ethical, and socioeconomic importance. We hypothesized that blood ammonia may reflect tissue hypoxia in OHCA patients and conducted this study to evaluate the prognostic value of ammonia for the return of spontaneous circulation (ROSC). Methods: This prospective, observational study was conducted in a tertiary university hospital between January 2008 and December 2008. The subjects consisted of OHCA patients who were sent to the emergency department (ED). The primary outcome was ROSC. The prognostic values were calculated for ammonia levels and the partial pressure of ammonia (pNH3), and the results were depicted as a receiver operating characteristics curve with an area under the curve. Results: Among 119 patients enrolled in this study, 28 patients (23.5%) achieved ROSC. Ammonia levels and pNH3 in the non-ROSC group were significantly higher than those in the ROSC group (167.0 μmol/L vs 80.0 μmol/L, P < .05; 2.61 × 10−5 vs 1.67 × 10−5 mm Hg, P < .05, respectively). The predictive capacity of area under the curve for ammonia and pNH3 for non-ROSC was 0.85 (95% confidence interval, 0.75-0.95) and 0.73 (95% confidence interval, 0.61-0.84), respectively. The multivariate analysis confirmed that ammonia and pNH3 are independent predictors of non-ROSC. The prognostic value of ammonia was better than that of pNH3. The cutoff level for ammonia of 84 μmol/L was 94.5% sensitive and 75.0% specific for predicting non-ROSC with a diagnostic accuracy of 89.9%. Conclusions: Hyperammonemia on ED arrival is independently predictive of non-ROSC for OHCA patients. The findings may offer useful information for clinical management.


The aim of the study was to assess the effects of positioning the head on a support on “head position angles” to optimally open the upper airway during bag-valve mask ventilation. Methods: We ventilated the lungs of anesthetized adults with a bag-valve mask and the head positioned with (n = 30) or without a support (n = 30). In both groups, head position angles and ventilation parameters were measured with the head positioned in (1) neutral position, (2) in a position deemed optimal for ventilation by the investigator, and (3) in maximal extension. Results: Between groups (“head with/without a support”) and between head positions within each group, head position angles and ventilation parameters differed (P < .0001, respectively). However, head position angles and ventilation parameters between head positions differed less “with a support” (P < .001), and ventilation parameters improved with a support compared with the head-without-a-support group (P <.001). Conclusions: In the head-with-a-support group, when compared with the head-without-a-support group, head position angles differed less, indicating a decreased potential for failure during bag-valve mask ventilation with the head on a support. Moreover, in the head-with-a-support group, ventilation parameters differed less between head positions, and ventilation improved. These findings suggest a potential benefit of positioning the head on a support during bag-valve mask ventilation.

11. Oh J, Lim T, Chee Y, Kang H, et al. Videographic Analysis of Glottic View With Increasing Cricoid Pressure Force. Ann Emerg Med 2013; Online first (8 January): Cricoid pressure may negatively affect laryngeal view and compromise airway patency, according to previous studies of direct laryngoscopy, endoscopy, and radiologic imaging. In this study, we assess the effect of cricoid pressure on laryngeal view with a
video laryngoscope, the Pentax-AWS. Methods: This cross-sectional survey involved 50 American Society of Anesthesiologists status I and II patients who were scheduled to undergo elective surgery. The force measurement sensor for cricoid pressure and the video recording system using a Pentax-AWS video laryngoscope were newly developed by the authors. After force and video were recorded simultaneously, 11 still images were selected per 5-N (Newton; 1 N = 1 kg·m·s−2) increments, from 0 N to 50 N for each patient. The effect of cricoid pressure was assessed by relative percentage compared with the number of pixels on an image at 0 N. Results: Compared with zero cricoid pressure, the median percentage of glottic view visible was 89.5% (interquartile range [IQR] 64.2% to 117.1%) at 10 N, 83.2% (IQR 44.2% to 113.7%) at 20 N, 76.4% (IQR 34.1% to 109.1%) at 30 N, 51.0% (IQR 21.8% to 104.2%) at 40 N, and 47.6% (IQR 15.2% to 107.4%) at 50 N. The number of subjects who showed un-worsened views was 20 (40%) at 10 N, 17 (34%) at 20 and 30 N, and 13 (26%) at 40 and 50 N. Conclusion: Cricoid pressure application with increasing force resulted in a worse glottic view, as examined with the Pentax-AWS Video laryngoscope. There is much individual difference in the degree of change, even with the same force. Clinicians should be aware that cricoid pressure affects laryngeal view with the Pentax-AWS and likely other video laryngoscopes.

Objectives: To determine the rate of appropriate documentation of endotracheal tube (ET) position confirmation in the American Heart Association's Get With the Guidelines-Resuscitation (GWTG-R) and to determine whether outcomes of patients who experience in-hospital cardiac arrest differ in relation to documentation rate. Design: Analysis of data from the GWTG-R, a prospective observational registry of in-hospital cardiac arrest and resuscitation. Setting: Database containing clinical information from the 507 hospitals participating in the GWTG-R. Patients: Adults resuscitated after in-hospital cardiac arrest. Measurements: The rate of appropriate documentation of ET position confirmation, defined as the use of capnography or an esophageal detector device (EDD); relationship between appropriate documentation of ET position confirmation and return of spontaneous circulation (ROSC) or survival to hospital discharge. Proportions with 95% CI are reported for prevalence data. Binary logistic regression was used to determine the relationship between appropriate documentation of ET position confirmation and outcome (ROSC, survival to hospital discharge). Adjusted and unadjusted odds ratios are reported. Main results: Of the 176,054 patients entered into the GWTG-R database, 75,777 had an ET placed. For 13,263 (17.5%) of these patients, ET position confirmation was not documented in the chart. Auscultation alone was documented in 19,480 (25.7%) cases. Confirmation of ET position by capnography or EDD was documented in 43,034 (56.8%) cases. ROSC occurred in 39,063 (51.6%), and 13,474 (17.8%) survived to discharge. Patients whose ET position was confirmed by capnography or EDD were more likely to have ROSC (adjusted OR 1.229 [1.179, 1.282]) and to survive to hospital discharge (adjusted OR 1.093 [1.033, 1.157]). Conclusion: Documentation of ET position confirmation in patients who experience cardiac arrest is suboptimal. Appropriate documentation of ET position confirmation in the GWTG-R is associated with greater likelihood of ROSC and survival to hospital discharge.

Study objective: To assess whether using interventions such as laryngeal mask airways (LMA) and IO lines lead to improved resuscitation in a simulated cardiac arrest when compared to standard methods of endotracheal intubation (ETI) and central line placement. Methods: Emergency Medicine residents at a single academic center were grouped into teams of four. Each team participated in two simulated ventricular fibrillation
cardiac arrests using a high fidelity simulator. Peripheral IV access was unobtainable. Only ETI supplies and a central line kit were available in one case (control) and in the other case those supplies were replaced by an LMA and an EZ-I0 drill kit (experimental). Groups were randomized to which set up they were given first. Data examined included time to airway placement, duration and success rate of airway placement, time to vascular access, time to defibrillation, and percent hands off time. Results: 44 residents in 11 teams participated. Mean time to airway was shorter in the experimental group (122.8 seconds (s) vs. 265.6 s, p = 0.001). Mean duration of airway attempt was also shorter (7.6 s vs. 22.7 s, p = 0.002). Time to access was shorter in the experimental group (49.0 s vs. 194.6 s, p < 0.001). Time to defibrillation and percent hands off time did not significantly differ between the two groups. Conclusion: Use of an LMA and an IO device led to significantly faster establishment of an airway and vascular access in a simulated cardiac arrest. The variation in devices did not affect time to defibrillation or percent hands off time.


We compared the McGrath® Series 5 videolaryngoscope with the Macintosh laryngoscope in a simulated difficult airway, using manual in-line stabilisation in 88 anaesthetised patients of ASA physical status 1-2. The primary outcome was laryngoscopic view. Secondary outcomes included rates of successful tracheal intubation and complications. A Cormack and Lehane grade-1 or -2 view was found in all patients when using the McGrath compared with 45 (51%, p < 0.0001) using the Macintosh laryngoscopes. The mean (SD) percentage of glottic opening was 82 (23)% using the McGrath compared with 13 (23)% using the Macintosh (p < 0.0001). In 66 out of 88 patients (75%), the McGrath improved the glottic view by one to three grades compared with the Macintosh (p < 0.001). Intubation of the trachea was successful in all patients using the McGrath, while the Macintosh was successful in 26 (59%, p < 0.001). There was no significant difference in the complication rates between the devices.

Basic life support


Aim: To determine whether cardiopulmonary resuscitation (CPR) performance is influenced by a rescuer's preferred side of approach. Methods: Eighty-three first-year healthcare students were enrolled in a prospective randomised crossover study comparing chest compression quality during uninterrupted chest compression CPR after approach from both their preferred and non-preferred sides. Results: Chest compression quality was not dependent on rescuers' sidedness preference; neither mean compression rate and depth nor hand positioning differed between sides of approach. Conclusions: No link exists between the side from which a rescuer approaches, or prefers to approach, a casualty and chest compression quality.

Education, implementation and teams

Family witnessed resuscitation is the practice of enabling patients’ family members to be present during resuscitation. Research is inconsistent as to the effectiveness or usefulness of this initiative. **Aim:** To evaluate the performance of two scales that assess perceptions of family witnessed resuscitation among a sample of health professionals, in an Australian non-teaching hospital, and explore differences in perceptions according to socio-demographic characteristics and previous experience. **Design:** Descriptive, replication study, using a cross-sectional survey. **Method** An anonymous survey was distributed to 221 emergency department clinicians. Socio-demographic characteristics and perceptions of family witnessed resuscitation using the Family Presence Risk–Benefit and Family Presence Self-confidence Scales were assessed. Exploratory factor analysis was used to evaluate the performance of the scales. Results One hundred and fourteen doctors and nurses returned the survey (response rate of 51.6%). Both Scales were found to have a single factor structure and a high level of internal consistency. Approximately two-thirds of participants considered that family presence was a right of patients and families, and almost a quarter of respondents had invited family presence during resuscitation on more than five occasions. We found no significant differences in scale scores between doctors and nurses. **Conclusion:** Our findings confirm the validity of the Family Presence Risk–Benefit and Family Presence Self–Confidence Scales in the Australian context, and highlight the need to support clinicians in the provision of family witnessed resuscitation to all families.


The American Academy of Pediatrics Section on Emergency Medicine’s Simulation Interest Group developed a survey targeting pediatric emergency medicine (PEM) fellowship program directors to assess the use of high-fidelity simulation (HFS) in PEM fellow training. **Methods:** Content experts in simulation and in PEM developed a 38-item Internet-based questionnaire that was distributed to PEM program directors via e-mail through www.surveymonkey.com. **Results:** Seventy-seven percent (51/66) of PEM program directors in the United States and Canada responded to the survey. Sixty-three percent of programs incorporate HFS in PEM fellowship training. For programs with HFS, the most frequent uses of HFS include (1) decision making for trauma resuscitations (97%, 31/32) and medical emergencies (91%, 29/32), and for the application of advanced life support (84%, 27/32); (2) technical skills: intubation (100%, 31/31), bag-mask ventilation (94%, 29/31), cardioversion/defibrillation (90%, 28/31), and difficult airway management (84%, 26/31). Of program directors without simulation, a majority valued simulation for PEM fellow training, and 59% (11/19) plan on expanding efforts. Perceived barriers to an active simulation program exist: lack of financial support (79%, 15/19), lack of simulator equipment (74%, 14/19), lack of a dedicated physical space (68%, 13/19), and insufficiently experienced simulation faculty (58% 11/19). **Conclusions:** Sixty-three percent of PEM fellowship programs integrate HFS-based activities. The majority of PEM fellowship program directors value the role of HFS in augmenting clinical experience and documenting procedural skills. Regional simulation centers are one possible solution to offer HFS training to fellowships with limited financial support and/or lack of experienced simulation faculty.


Prehospital emergency medicine is a challenging discipline characterized by a high level of acuity, a lack of clinical information and a wide range of clinical conditions. These factors contribute to the fact that prehospital emergency medicine is a high-risk discipline in terms of medical errors. Prehospital use of Computerized Decision Support System (CDSS) may be a way to increase patient safety but very few studies evaluate the effect in prehospital care. The aim of the present study is to evaluate a CDSS. **Methods:** In this non-blind block randomized, controlled trial, 60
ambulance nurses participated, randomized into 2 groups. To compensate for an expected learning effect the groups was further divided in two groups, one started with case A and the other group started with case B. The intervention group had access to and treated the two simulated patient cases with the aid of a CDSS. The control group treated the same cases with the aid of a regional guideline in paper format. The performance that was measured was compliance with regional prehospital guidelines and On Scene Time (OST). Results: There was no significant difference in the two group's characteristics. The intervention group had a higher compliance in the both cases, 80% vs. 60% (p < 0.001) but the control group was complete the cases in the half of the time compare to the intervention group (p < 0.001). Conclusion: The results indicate that this CDSS increases the ambulance nurses' compliance with regional prehospital guidelines but at the expense of an increase in OST.

Paramedic education has been undergoing major development in Australia in the past 20 years, with many different educational programmes being developed across all Australian jurisdictions. This paper aims to review the current paramedic education programmes in Australia to identify the similarities and differences between the programmes, and the strengths and challenges in these programmes. A literature search was performed using six scientific databases to identify any systematic reviews, literature reviews or relevant articles on the topic. Additional searches included journal articles and text references from 1995 to 2011. The search was conducted during December 2010 and November 2011. Included in this review are a total of 28 articles, which are focused around five major issues in paramedic education: (i) principle on paramedic programmes and the involvement of industry partners; (ii) clinical placements; (iii) contemporary methods of education; (iv) needs for specific programmes within paramedic education; and (v) articles related to the accreditation process for paramedic programmes. Paramedic programmes across Australian universities vary with many different practices, especially relating to clinical placements in the field. The further advances of the paramedic education programmes should aim to respond to population change and industry development, which would enhance the paramedic profession across Australia.

It is unclear whether the basic life support (BLS) and advanced life support (ALS) pre-hospital termination of resuscitation (TOR) rules developed in North America can be applied successfully to patients with out-of-hospital cardiac arrest (OHCA) in other countries. Objectives: To assess the performance of the BLS and ALS TOR in Japan. Methods Retrospective nationwide, population-based, observational cohort study of consecutive OHCA patients with emergency responder resuscitation attempts from 1 January 2005 to 31 December 2009 in Japan. The BLS TOR rule has 3 criteria whereas the ALS TOR rule includes 2 additional criteria. We extracted OHCA patients meeting all criteria for each TOR rule, and calculated the specificity and positive predictive value (PPV) of each TOR rule for identifying OHCA patients who did not have neurologically favorable one-month survival. Results During the study-period, 151,152 cases were available to evaluate the BLS TOR rule, and 137,986 cases to evaluate the ALS TOR rule. Of 113,140 patients that satisfied all three criteria for the BLS TOR rule, 193 (0.2%) had a neurologically favorable one-month survival. The specificity of BLS TOR rule was 0.968 (95% CI: 0.963–0.972), and the PPV was 0.998 (95% CI: 0.998–0.999) for predicting lack of neurologically favorable one-month survival. Of 41,030 patients that satisfied all five criteria for the ALS TOR rule, just 37 (0.1%) had a neurologically favorable one-month survival. The specificity of ALS TOR rule was 0.981 (95% CI: 0.973–0.986), and the PPV was
0.999 (95% CI: 0.998–0.999) for predicting lack of neurologically favorable one-month survival. Conclusions: The prehospital BLS and ALS TOR rules performed well in Japan with high specificity and PPV for predicting lack of neurologically favorable one-month survival in Japan. However, the specificity and PPV were not 1000 and we have to develop more specific TOR rules.


Aim: To undertake a review of the quantitative research literature, to determine emergency staff and public attitudes, to support the implementation and practice of family presence during resuscitation in the emergency department. Background: FPDR although endorsed by numerous resuscitation councils, cardiac, trauma and emergency associations, continues to be topical, the extent to which it is implemented and practiced remains unclear. Review methods A review of the quantitative studies published between 1992 and October 2011 was undertaken using the following databases: CINAHL, Ovid Medline, PSYCHINFO, Pro-Quest, Theses Database, Cochrane, and Google Scholar search engine. The primary search terms were ‘family presence’, and ‘resuscitation’. The final studies included in this paper were appraised using the Critical Appraisal Skills Programme criteria. Results Fourteen studies were included in this literature review. These included quantitative descriptive designs, pre and post-test designs and one randomized controlled trial (RCT). The studies were divided into three main research areas; investigation of emergency staff attitudes and opinions, family and general public attitudes, and four papers evaluating family presence programs in the emergency department. Studies published prior to 2000 were included in the background. Conclusion: FPDR in the emergency department is well recognised and documented among policy makers, the extent in which it is implemented and practiced remains unclear. Further research is needed to assess how emergency staff are educated and trained in order to facilitate family presence during resuscitation attempts.

Paediatric advanced life support


Objectives: There is a paucity of data examining nationwide population-based incidences and outcomes of pediatric out-of-hospital cardiac arrest. The objective of this study is to describe the detailed characteristics of pediatric out-of-hospital cardiac arrest by scholastic age category and to evaluate the impact of bystander cardiopulmonary resuscitation and public access-automated external defibrillators on the 1-month survival and favorable neurological status of pediatric out-of-hospital cardiac arrest patients. Design: A nationwide, population-based, observational study. Setting: Nationwide emergency medical system in Japan. Patients: Out-of-hospital cardiac arrest patients aged <= 18 yr. Measurements and Main Results: We identified 7,624 pediatric out-of-hospital cardiac arrest patients (<= 18 yr old) from a nationwide population-based out-of-hospital cardiac arrest database in Japan from 2005 to 2008 and stratified them into five categories by scholastic age. The overall rates of 1-month survival and favorable neurological outcomes were 11.0% and 5.1%, respectively. Bystander cardiopulmonary resuscitation resulted in a significant improvement in both 1-month survival (odds ratio 2.81; 95% confidence interval 2.30-3.44) and favorable neurological outcomes (odds ratio 4.55; 95% confidence interval 3.35-6.18). Performing public access-automated external defibrillators had a significant effect.
on the 1-month survival rate (odds ratio 3.51; 95% confidence interval 1.81-6.81) and favorable neurological outcomes (odds ratio 5.13; 95% confidence interval 2.64-9.96). Conclusions: This study demonstrated that bystander cardiopulmonary resuscitation and public access-automated external defibrillators had a significant impact on the outcomes of pediatric out-of-hospital cardiac arrest. The improved survival associated with bystander cardiopulmonary resuscitation and public access-automated external defibrillators are clinically important and are of major public health importance for school-aged out-of-hospital cardiac arrest patients.


Accurate measurement of temperature in the emergency room is important for diagnosis as well as investigating a patient. Various noninvasive methods thermometry are available today, but there is no consensus on the most accurate method of thermometry. Study Objective: The present study was conducted to compare different methods of temperature measurement available in the emergency room, that is, rectal, axillary, and temporal artery and tympanic membrane. Design: This was a cross-sectional observational study Patients: Fifty febrile and 50 afebrile children aged 2 to 12 years attending the pediatric emergency room of a tertiary care hospital were included. Temperatures were measured using rectal, axillary, tympanic (right and left), and temporal artery thermometers and were compared. Results: All the temperatures correlated well with rectal temperature, with temporal artery temperature showing the best correlation (correlation coefficients, 0.99 in the febrile and 0.91 in the afebrile group). Conclusions: Temporal artery thermometry has the potential to replace rectal thermometry in a busy emergency room setting.


Objective: To determine whether an 18-month vanguard phase, in the Therapeutic Hypothermia after Pediatric Cardiac Arrest trials, confirmed study feasibility and patient safety, a prerequisite to continued funding by the sponsor. Design: Randomized controlled trial. Setting: Pediatric intensive care and pediatric cardiac care units in 15 clinical sites in the United States and Canada. Patients: Children aged 48 hrs to 18 yrs of age, with return of circulation after cardiac arrest. Interventions: Therapeutic hypothermia vs. therapeutic normothermia. Measurements and Main Results: The first 15 of 20 potential sites to obtain Institutional Review Board and subcontract approvals were selected as vanguard sites. Institutional Review Board approvals were obtained 92 days (median, interquartile range 65–114) and subcontracts signed 34 days (interquartile range 20–48) after distribution. Sites screened subjects at 13 days (interquartile range 9–21) and enrolled the first subjects 64 days (interquartile range 13–154) after study launch. The recruitment milestone was reached 4 months ahead of schedule, with no safety concerns identified. Overall recruitment in this ongoing trial remains on target. Conclusions: The Therapeutic Hypothermia after Pediatric Cardiac Arrest vanguard phase proved beneficial for the investigators and funding agency. Because complex multicenter trials are rarely ready to launch when grant funds are received, the vanguard allowed time to refine the protocol and recruitment approaches. Competition for vanguard positions led to expedient Institutional Review Board and subcontract completion. Early success and sustained momentum contributed to recruitment at or above goals. Financial risks to the sponsor were minimized by tying funding for the full trial to achieving pre-specified milestones. A vanguard phase may be a desirable strategy for the successful conduct of other complex clinical trials.

Nearly all global mortality in children younger than 5 years (99%) occurs in developing countries. The leading causes of mortality in children younger than 5 years worldwide, pneumonia and diarrhoeal illness, account for 1.396 and 0.801 million annual deaths, respectively. Although important advances in prevention are being made, advanced life support management in children in developing countries is often incomplete because of limited resources. Existing advanced life support management guidelines for children in limited-resource settings are mainly empirical, rather than evidence-based, written for the hospital setting, not standardised with a systematic approach to patient assessment and categorisation of illness, and taught in current paediatric advanced life support training courses from the perspective of full-resource settings. In this Review, we focus on extension of higher quality emergency and critical care services to children in developing countries. When integrated into existing primary care programmes, simple inexpensive advanced life support management can improve child survival worldwide.

Urgent analgesia is essential for all children who present in severe pain, but difficulties in obtaining venous access can delay the use of adequate opiate analgesia. Intranasal diamorphine (IND) is now in use in around 60% of emergency departments and is the preferred choice of analgesia as reported by both parents and healthcare professionals. While IND has similar efficacy to intramuscular morphine in children, no study has compared its use against the current gold standard, intravenous morphine (IVM).

Methods: IND was introduced to the Royal Aberdeen Children's Hospital on 24 December 2009. A retrospective case series was constructed to compare its clinical performance with its predecessor IVM. Three unexplored factors were investigated: time to opiate analgesia, the requirement for further analgesia when still in the emergency department and the effect of simple co-analgesia (eg, paracetamol/ibuprofen) on these requirements. Results: 297 patients were eligible for the study (147 IND, 150 IVM) over a 28-month period. There was a non-significant trend to a longer median time to administration of analgesia in patients receiving IND (p=0.170). Patients who received IND were less likely to require further analgesia (p<0.001). Both groups were less likely to require further analgesia when simple co-analgesia was given (p=0.049). Conclusion: The authors found no significant difference in time to administration of analgesia between agents, but a learning curve has been identified. Sustained effort should be placed on the use of simple co-analgesia. The clinical performance of IND compares favourably with IVM in children with severe pain, and it remains an appropriate preferred agent.

Reperfusion therapy reduces both morbidity and mortality in myocardial infarction, but the effectiveness depends on how fast the patient receives treatment. Despite the time-dependent effectiveness of reperfusion therapy, many patients with myocardial infarction have delays in seeking medical care. The aim of this study was to describe pre-hospital delay in a first myocardial infarction among men and women with and without diabetes and to describe the association between pre-hospital delay time and diabetes, sex, age, symptoms and size of residential area as a proxy for distance to hospital. METHODS: This population-based study was based on data from 4266 people aged 25--74 years, with a first
myocardial infarction registered in the Northern Sweden MONICA myocardial infarction registry between 2000 and 2008. RESULTS: The proportion of patients with delay times \( \geq 2 \) h was 64% for patients with diabetes and 58% for patients without diabetes. There was no difference in delay time \( \geq 2 \) h between men and women with diabetes. Diabetes, older age and living in a town or rural areas were factors associated with pre-hospital delay times \( \geq 2 \) h. Atypical symptoms were not a predictor for pre-hospital delay times \( \geq 2 \) h, OR 0.59 (0.47; 0.75). CONCLUSIONS: A higher proportion of patients with diabetes have longer pre-hospital delay in myocardial infarction than patients without diabetes. There are no differences in pre-hospital delay between men and women with diabetes. The largest risk difference for pre-hospital delay \( \geq 2 \) h is between women with and without diabetes. Diabetes, older age and living in a town or rural area were predictors for pre-hospital delay \( \geq 2 \) h.

Full text available at: http://www.biomedcentral.com/content/pdf/1471-2261-13-6.pdf


Objective: To quantify the association between exposure to higher temperatures and the risk of myocardial infarction at an hourly temporal resolution. Design: Case-crossover study. Setting: England and Wales Myocardial Ischaemia National Audit Project (MINAP) database. Participants: 24 861 hospital admissions for myocardial infarction occurring in 11 conurbations during the warmest months (June to August) of the years 2003-09. Main outcome measure: Odds ratio of myocardial infarction for a 1°C increase in temperature. Results: Strong evidence was found for an effect of heat acting 1-6 hours after exposure to temperatures above an estimated threshold of 20°C (95% confidence interval 16°C to 25°C). For each 1°C increase in temperature above this threshold, the risk of myocardial infarction increased by 1.9% (0.5% to 3.3%, P=0.009). Later reductions in risk seemed to offset early increases in risk: the cumulative effect of a 1°C rise in temperature above the threshold was 0.2% (−2.1% to 2.5%) by the end of the third day after exposure. Conclusions: Higher ambient temperatures above a threshold of 20°C seem to be associated with a transiently increased risk of myocardial infarction 1-6 hours after exposure. Reductions in risk at longer lags are consistent with heat triggering myocardial infarctions early in highly vulnerable people who would otherwise have had a myocardial infarction some time later (“short term displacement”). Policies aimed at reducing the health effects of hot weather should include consideration of effects operating at sub-daily timescales.

Full text available at: http://www.bmj.com/content/345/bmj.e8050.pdf%2Bhtml


The benefit of blood transfusion in patients with myocardial infarction is controversial, and a possibility of harm exists. Methods: A systematic search of studies published between January 1, 1966, and March 31, 2012, was conducted using MEDLINE, EMBASE, CINAHL, Scopus, Web of Science, and Cochrane Central Register of Controlled Trials databases. English-language studies comparing blood transfusion with no blood transfusion or a liberal vs restricted blood transfusion strategy were identified. Two study authors independently reviewed 729 originally identified titles and abstracts and selected 10 for analysis. Study title, follow-up period, blood transfusion strategy, and mortality outcomes were extracted manually from all selected studies, and the quality of each study was assessed using the strengthening Meta-analysis of Observational Studies in Epidemiology checklist. Results: Studies of blood transfusion strategy in anemia associated with myocardial infarction were abstracted, as well as all-cause mortality rates at the longest available follow-up periods for the individual studies. Pooled effect estimates were calculated with random-effects models. Analyses of blood transfusion in myocardial infarction revealed increased all-cause mortality associated with a strategy
of blood transfusion vs no blood transfusion during myocardial infarction (18.2% vs 10.2%) (risk ratio, 2.91; 95% CI, 2.46-3.44; P < .001), with a weighted absolute risk increase of 12% and a number needed to harm of 8 (95% CI, 6-17). Multivariate meta-regression revealed that blood transfusion was associated with a higher risk for mortality independent of baseline hemoglobin level, nadir hemoglobin level, and change in hemoglobin level during the hospital stay. Blood transfusion was also significantly associated with a higher risk for subsequent myocardial infarction (risk ratio, 2.04; 95% CI, 1.06-3.93; P = .03).

Conclusions: Blood transfusion or a liberal blood transfusion strategy compared with no blood transfusion or a restricted blood transfusion strategy is associated with higher all-cause mortality rates. A practice of routine or liberal blood transfusion in myocardial infarction should not be encouraged but requires investigation in a large trial with low risk for bias.


Emergency medical services (EMS) are critical in the treatment of ST-segment elevation myocardial infarction (STEMI). Prehospital system delays are an important target for improving timely STEMI care, yet few limited data are available. Methods: Using a deterministic approach, we merged EMS data from the North Carolina Pre-hospital Medical Information System (PreMIS) with data from the Reperfusion of Acute Myocardial Infarction in Carolina Emergency Departments—Emergency Response (RACE-ER) Project. Our sample included all patients with STEMI from June 2008 to October 2010 who arrived by EMS and who had primary percutaneous coronary intervention (PCI). Prehospital system delays were compared using both RACE-ER and PreMIS to examine agreement between the 2 data sources. Results Overall, 8,680 patients with STEMI in RACE-ER arrived at a PCI hospital by EMS; 21 RACE-ER hospitals and 178 corresponding EMS agencies across the state were represented. Of these, 6,010 (69%) patients were successfully linked with PreMIS. Linked and notlinked patients were similar. Overall, 2,696 patients were treated with PCI only and were taken directly to a PCI-capable hospital by EMS; 1,750 were transferred from a non-PCI facility. For those being transported directly to a PCI center, 53% reached the 90-minute target guideline goal. For those transferred from a non-PCI facility, 24% reached the 120-minute target goal for primary PCI. Conclusions: We successfully linked prehospital EMS data with inhospital clinical data. With this linked STEMI cohort, less than half of patients reach goals set by guidelines. Such a data source could be used for future research and quality improvement interventions.


The Thrombolysis in Myocardial Infarction (TIMI) score has shown use in predicting 30-day and 1-year outcomes in emergency department (ED) patients with potential acute coronary syndrome. Few studies have evaluated the TIMI score in risk stratifying patients selected for the ED observation Unit (EDOU). Risk stratification of patients in this group could identify those at risk for significant cardiac events. Our goal was to evaluate TIMI use for risk stratification in this population and compare outcomes among differing scores. Methods A prospective observational study with 30-day telephone follow-up for a 12 month period. Baseline data, outcomes related to EDOU stay, admission, and 30-day outcomes were recorded. TIMI scores were calculated for each patient placed in EDOU. TIMI score was not utilized in the decision to place patients in observation. Results N = 552. Composite outcomes recorded were myocardial infarction, revascularization, or death either during the EDOU stay, inpatient admission, or the 30-day follow-up. Eighteen composite outcomes were recorded: stent (12 patients), coronary artery bypass graft (3 patients), myocardial infarction and stent (2 patients), and myocardial infarction, and coronary artery bypass graft (1 patient). Distribution by TIMI score was: 0 (102 patients), 1 (196), 2 (142), 3 (72), 4 (27), and 5 (5). Risk of composite outcome increased by score: 0 (1%), 1 (2.6%), 2
(2.1%), 3 (6.9%), 4 (11.1%), and 5 (20%). Those with an intermediate risk score (3-5) were also more likely to require admission (15.4% vs 9.8%, P = .048). Conclusion: The TIMI risk score may serve as an effective risk stratification tool among chest pain patients selected for EDOU placement. Patients with intermediate-risk by TIMI may be considered for inpatient admission and/or more aggressive evaluation and therapy.


Objective: To determine the rate of major adverse cardiac events (MACE) in patients assessed in an emergency department (ED) for chest pain with a non-ischaemic ECG, Thrombolysis in Myocardial Infarction (TIMI) score of 0 and initial troponin I (TnI) ≤99th centile. Methods: This was a sub-study of a prospective observational study of adult patients with potentially cardiac chest pain who underwent evaluation for acute coronary syndrome in an urban teaching hospital. Adult patients with non-traumatic chest pain were eligible for inclusion. Those with ECG evidence of acute ischaemia or an alternative diagnosis were excluded. Data collected included demographic, clinical, ECG, biomarker and outcome data. Low risk was defined as a TIMI risk score of 0 and initial TnI ≤99th centile. Primary outcome of interest was defined as MACE within 7 days. MACE included death, cardiac arrest, revascularisation, cardiogenic shock, arrhythmia, and prevalent (cause of presentation) and incident (occurring within the follow-up period) myocardial infarction (MI). Analysis was by descriptive and clinical performance analyses. Results: 651 patients were studied of whom 215 met the low risk criteria. There was one MACE in this group (0.47%, 95% CI 0.08% to 2.6%)—a revascularisation within 7 days without prevalent MI. Negative predictive value of low risk classification was 99.5% (95% CI 97% to 100%) at both 7 and 30 days. Negative likelihood ratio, weighted by prevalence, was 0.005 at both intervals. Conclusion: Risk stratification for early discharge based on ECG, TIMI score of 0 and presentation TnI ≤99th centile appears to identify a group at very low risk of MACE. Research to prospectively validate this is warranted.


It is unknown whether unstable angina (UA) results in previously non-detectable low-level myocardial necrosis. We compared the pattern of myocardial necrosis between patients with UA, acute myocardial infarction (AMI), and non-cardiac chest pain (NCCP) using 3 high-sensitive cardiac troponin (hs-cTn) assays. Methods: In a multicenter study, we enrolled 842 unselected patients with acute chest pain in the emergency department. Roche hs-cTnT, Beckman Coulter hs-cTnI, and Siemens hs-cTnI were determined in a blinded fashion at presentation and after 1, 2, 3, and 6 hours. The final diagnosis was adjudicated by 2 independent cardiologists. Results: A change in hs-cTn of ≥2 ng/L within the first hour after presentation as assessed with Roche hs-cTnT, Beckman Coulter hs-cTnI, and Siemens hs-cTnI was observed in 26%, 31%, and 32% of patients with UA (n = 115) compared with 91%, 92%, and 96% in patients with AMI (n = 120) and 12%, 23%, and 16% in patients with NCCP (n = 415; P < .001 for all comparisons between UA and AMI, P > .05 for all comparisons between UA and NCCP). In patients with UA, such a 1-hour change in hs-cTn of ≥2 ng/L was associated with an increased risk of death or AMI during the 30-day follow-up (P = .003, .03, .03) and 2-year follow-up (P < .001, .002, and .006). Conclusions: In marked contrast to patients with AMI, most patients with UA do not exhibit relevant hs-cTn changes. The minority of UA with hs-cTn changes, however, has a significantly worse short- and long-term outcome.

Prior studies indicate that a subset of patients diagnosed as having ST-segment elevation myocardial infarction (STEMI) will have an initial non-diagnostic electrocardiogram (ECG) during evaluation. However, the timing of diagnostic ECG changes in this group is unknown. Our primary aim was to describe the timing of ECG diagnosis of STEMI in patients whose initial ECG was non-diagnostic. Secondarily, we sought to compare the delivery of American College of Cardiology/American Heart Association guidelines-based care and in-hospital outcomes in this group compared with patients diagnosed as having STEMI on initial ECG. Methods We analyzed data from 41,560 patients diagnosed as having STEMI included in the National Cardiovascular Data Registry ACTION Registry-GWTG from January 2007 to December 2010. We divided this study population into 2 groups: those diagnosed on initial ECG (N = 36,994) and those with an initial non-diagnostic ECG that were diagnosed on a follow-up ECG (N = 4,566). Results In general, baseline characteristics and clinical presentations were similar between the 2 groups. For patients with an initial non-diagnostic ECG, 72.4% (n = 3,305) had an ECG diagnostic for STEMI within 90 minutes of their initial ECG. There did not appear to be significant differences in the administration of guideline-recommended treatments for STEMI, in-hospital major bleeding (P = .926), or death (P = .475) between these groups. Conclusions: In a national sample of patients diagnosed as having STEMI, 11.0% had an initial non-diagnostic ECG. Of those patients, 72.4% had a follow-up diagnostic ECG within 90 minutes of their initial ECG. There did not appear to be clinically meaningful differences in guidelines-based treatment or major inhospital outcomes between patients diagnosed as having STEMI on an initial ECG and those diagnosed on a follow-up ECG.


Aims: Dynamic risk models update the risk profile of ST-elevation myocardial infarction (STEMI) patients over the acute period following the event and have implications to clinical practice and research. Methods and Results: Multivariable survival models were developed in 5,745 STEMI patients undergoing primary percutaneous coronary intervention (PCI) enrolled in the APEX-AMI trial to predict 90-day mortality from 4 clinically relevant times: baseline, 2 hours, 24 hours, and 96 hours. Culprit coronary thrombolysis in myocardial infarction flow grade, 30-minute post-PCI worst-lead ST-elevation residual, and in-hospital clinical events were considered in the models. The 90-day mortality was 4.7%; the cumulative proportion of mortality occurring within 2, 24, and 96 hours was 8%, 22%, and 40% respectively. Relative to the baseline risk factors, age and systolic blood pressure remained highly ranked in the post-baseline models. However, the relative importance of heart rate, Killip class, and creatinine declined, whereas markers of coronary reperfusion and in-hospital events (shock, congestive heart failure) became increasingly influential. The c-index increased from 0.819 at baseline to 0.847 at 96 hours. Over the forecasting periods, the proportion of “low-risk” <1.1% 90-day mortality) patients increased from 20% to 49%. This approach derived from an unfolding series of models reveals the shifting levels of mortality risk from baseline to 96 hours. Conclusion: This novel approach in STEMI patients undergoing primary PCI demonstrates the dynamic nature of risk over time and may prove useful in understanding risk and in clinical decision making.
This article describes the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach to classifying the direction and strength of recommendations. The strength of a recommendation, separated into strong and weak, is defined as the extent to which one can be confident that the desirable effects of an intervention outweigh its undesirable effects. Alternative terms for a weak recommendation include conditional, discretionary, or qualified. The strength of a recommendation has specific implications for patients, the public, clinicians, and policy makers. Occasionally, guideline developers may choose to make “only-in-research” recommendations. Although panels may choose not to make recommendations, this choice leaves those looking for answers from guidelines without the guidance they are seeking. GRADE therefore encourages panels to, wherever possible, offer recommendations.

Study objective: This study evaluates the accuracy of emergency department (ED) triage respiratory rate measurement using the usual care method and a new electronic respiratory rate sensor (BioHarness, Zephyr Technology Corp.), both compared to a criterion standard measurement. Methods: This is a cross-sectional study with convenience sampling conducted in an urban academic adult ED, including 3 separate respiratory rate measurements performed at ED triage: usual care measurement, electronic BioHarness measurement, and criterion standard measurement. The criterion standard measurement used was defined by the World Health Organization as manual observation or auscultation of respirations for 60 seconds. The resultant usual care and BioHarness measurements were compared with the criterion standard, evaluating accuracy (sensitivity and specificity) for detecting tachypnea, as well as potential systematic biases of usual care and BioHarness measurements using a Bland Altman analysis. Results Of 191 analyzed patients, 44 presented with tachypnea (> 20 breaths/min). Relative to criterion standard measurement, usual care measurement had a sensitivity of 23% (95% confidence interval [CI] 12% to 37%) and specificity of 99% (95% CI 97% to 100%) for tachypnea, whereas BioHarness had a sensitivity of 91% (95% CI 80% to 97%) and specificity of 97% (95% CI 93% to 99%) for tachypnea. Usual care measurements clustered around respiratory rates of 16 and 18 breaths/min (n=144), with poor agreement with criterion standard measurement. Conversely, BioHarness measurement closely tracked criterion standard values over the range of respiratory rates. Conclusion: Current methods of respiratory rate measurement at ED triage are inaccurate. A new electronic respiratory rate sensor, BioHarness, has significantly greater sensitivity for detecting tachypnea versus usual care method of measurement.

Massachusetts became the first state in the nation to ban ambulance diversion in 2009. It was feared that the diversion ban would lead to increased emergency department (ED) crowding and ambulance turnaround time. We seek to characterize the effect of a statewide ambulance diversion ban on ED length of stay and ambulance turnaround time at Boston-area EDs. Methods: We conducted a retrospective, pre-post observational analysis of 9 Boston-area hospital EDs before and after the ban. We used ED length of stay as a proxy for ED crowding. We
compared hospitals individually and in aggregate to determine any changes in ED length of stay for admitted and discharged patients, ED volume, and turnaround time. Results No ED experienced an increase in ED length of stay for admitted or discharged patients or ambulance turnaround time despite an increase in volume for several EDs. There was an overall 3.6% increase in ED volume in our sample, a 10.4-minute decrease in length of stay for admitted patients, and a 2.2-minute decrease in turnaround time. When we compared high- and low-diverting EDs separately, neither saw an increase in length of stay, and both saw a decrease in turnaround time. Conclusion: After the first statewide ambulance diversion ban, there was no increase in ED length of stay or ambulance turnaround time at 9 Boston-area EDs. Several hospitals actually experienced improvements in these outcome measures. Our results suggest that the ban did not worsen ED crowding or ambulance availability at Boston-area hospitals.


Study aim: Adherence to Advanced Trauma Life Support (ATLS) protocol has been associated with improved management of injured patients. The objective of this study is to determine factors associated with delayed and omitted ATLS primary and secondary survey tasks at a level 1 pediatric trauma center. Methods: Video recorded resuscitations of 237 injured patients < 18 years old obtained over a four month period at our hospital were evaluated to assess completeness and timeliness of essential tasks in the primary and secondary survey of ATLS. Multivariate analyses were performed to identify features associated with decreased ATLS performance. Results: Primary survey findings were stated less often in patients with burn injuries compared to those with blunt injuries (RR = 1.72; 95% CI: 1.26–2.35) and less often during the overnight shift [11 PM–7 AM] (RR = 1.22; 95% CI: 1.02–1.46). Secondary survey findings were verbalized less often in patients with penetrating injuries (RR = 2.30; 95% CI: 1.06–5.00). Time to statement of primary surveys findings was delayed in patients with burn injuries (HR = 0.69; 95% CI: 0.48–0.98) and among those transferred from another hospital. Completeness and timeliness of ATLS task performance were not associated with age or injury severity score. Conclusions: Mechanism of injury and hospital factors are associated with incomplete and delayed primary and secondary surveys. Interventions that address deficient ATLS adherence related to these factors may lead to a reduction in errors during this critical period of patient care.


Objective: Most of the fractures and dislocations are reduced in the emergency setting. Many drugs are available for procedural sedation and analgesia in the emergency department (ED); however, the adverse effects are still a common problem. The aim of our study was to compare the 2 drug combinations. Method We performed a prospective, randomized, double-blinded, placebo-controlled trial of patients presenting to the ED after a traumatic event and required urgent reduction either for a fracture or dislocation. Patients were randomized to midazolam-fentanyl (MF) group or ketamine–low-dose midazolam (KM) group. Hypoxia, duration of hypoxia, need for oxygen, time to onset of sedation, recovery time, pain scores during reduction, and sedation depth were set as primary outcome measures and were recorded. Results A total of 498 patients who presented to ED with extremity injury and required closed reduction were assessed; 130 of them were approached for eligibility and 69 patients were excluded. The remaining 61 patients were randomized to either KM group (n = 31) or MF group (n = 30). Hypoxia and duration of hypoxia were significantly lower in the KM group compared with the MF group. Patients in the KM group reported significantly lower pain scores during reduction; however, adverse effects were higher compared with MF group. Conclusion: Both drug combinations can be effectively
used for procedural sedation and analgesia; however, with lower risk for hypoxia and lower pain scores, KM combination stands as a reasonable choice for orthopedic interventions in the emergency unit.


Study objective: Parenteral benzodiazepines or antipsychotics are often used to manage acute agitation in emergency department (ED) settings in which alternative strategies have failed or are not feasible. There are scant data comparing parenteral medication regimens. We aim to determine the efficacy and safety of intravenous droperidol or olanzapine as an adjunct to intravenous midazolam for rapid patient sedation.

Methods: We undertook a randomized, double-blind, placebo-controlled, double-dummy, clinical trial in 3 EDs (August 2009 to March 2011). Adult patients (n=336) requiring intravenous drug sedation for acute agitation were randomized to receive a saline solution (control), droperidol (5 mg), or olanzapine (5 mg) bolus. This was immediately followed by incremental intravenous midazolam boluses (2.5 to 5 mg) until sedation was achieved. The primary outcome was time to sedation. Secondary outcomes were need for "rescue" drugs and adverse events. Results: Three hundred thirty-six patients were randomized to the 3 groups. Baseline characteristics were similar across groups. The differences in medians for times to sedation between the control and droperidol and control and olanzapine groups were 4 minutes (95% confidence interval [CI] 1 to 6 minutes) and 5 minutes (95% CI 1 to 6 minutes), respectively. At any point, patients in the droperidol and olanzapine groups were approximately 1.6 times more likely to be sedated compared with controls: droperidol and olanzapine group hazard ratios were 1.61 (95% CI 1.23 to 2.11) and 1.66 (95% CI 1.27 to 2.17), respectively. Patients in the droperidol and olanzapine groups required less rescue or alternative drug use after initial sedation. The 3 groups' adverse event profiles and lengths of stay did not differ. Conclusion: Intravenous droperidol or olanzapine as an adjunct to midazolam is effective and decreases the time to adequate sedation compared with midazolam alone.


Emergency medical dispatch systems are used to help categorize and prioritize emergency medical services (EMS) resources for requests for assistance. Objective: We examined whether a subset of Medical Priority Dispatch System (MPDS) codes could predict patient outcomes (emergency department [ED] discharge versus hospital admission/ED death). Methods: This retrospective observational cohort study analyzed requests for EMS through a single public safety answering point (PSAP) serving a mixed urban, suburban, and rural community over one year. Probabilistic matching was used to link subjects. Descriptive statistics, 95% confidence intervals (CIs), and logistic regression were calculated for the 107 codes and code groupings (9E vs. 9E1, 9E2, etc.) that were used 50 or more times during the study period. Results: Ninety percent of PSAP records were matched to EMS records and 84% of EMS records were matched to ED data, resulting in 26,846 subjects with complete records. The average age of the cohort was 46.2 years (standard deviation [SD] 24.8); 54% were female. Of the transported patients, 70% were discharged from the ED, with nine dispatch codes demonstrating a 90% or greater predictive power. Three code groupings had more than 60% predictive power for admission/death. Subjects aged 65 years and older were found to be at increased risk for admission/death in 33 dispatch codes (odds ratio [OR] 2.0 [95% confidence interval 1.3–3.0] to 19.6 [5.3–72.6]). Conclusions: A small subset (8% of codes; 7% by call volume) of MPDS codes were associated with greater than 90% predictive ability for ED discharge. Older adults are at increased risk for admission/death in a separate subset of MPDS codes, suggesting that age criteria may be useful to identify higher-acuity patients within the MPDS code. These
findings could assist in prehospital/hospital resource management; however, future studies are needed to validate these findings for other EMS systems and to investigate possible strategies for improvements of emergency response systems.


We derive a prediction rule to identify children at very low risk for intra-abdominal injuries undergoing acute intervention and for whom computed tomography (CT) could be obviated. Methods: We prospectively enrolled children with blunt torso trauma in 20 emergency departments. We used binary recursive partitioning to create a prediction rule to identify children at very low risk of intra-abdominal injuries undergoing acute intervention (therapeutic laparotomy, angiographic embolization, blood transfusion for abdominal hemorrhage, or intravenous fluid for ≥2 nights for pancreatic/gastrointestinal injuries). We considered only historical and physical examination variables with acceptable interrater reliability.

Results: We enrolled 12,044 children with a median age of 11.1 years (interquartile range 5.8, 15.1 years). Of the 761 (6.3%) children with intra-abdominal injuries, 203 (26.7%) received acute interventions. The prediction rule consisted of (in descending order of importance) no evidence of abdominal wall trauma or seat belt sign, Glasgow Coma Scale score greater than 13, no abdominal tenderness, no evidence of thoracic wall trauma, no complaints of abdominal pain, no decreased breath sounds, and no vomiting. The rule had a negative predictive value of 5,028 of 5,034 (99.9%; 95% confidence interval [CI] 99.7% to 100%), sensitivity of 197 of 203 (97%; 95% CI 94% to 99%), specificity of 5,028 of 11,841 (42.5%; 95% CI 41.6% to 43.4%), and negative likelihood ratio of 0.07 (95% CI 0.03 to 0.15). Conclusion: A prediction rule consisting of 7 patient history and physical examination findings, and without laboratory or ultra-sonographic information, identifies children with blunt torso trauma who are at very low risk for intra-abdominal injury undergoing acute intervention. These findings require external validation before implementation.


The authors present an overview of the current evidence and management recommendations for evaluation and treatment of adults with acute ischemic stroke. The intended audiences are prehospital care providers, physicians, allied health professionals, and hospital administrators responsible for the care of acute ischemic stroke patients within the first 48 hours from stroke onset. These guidelines supersede the prior 2007 guidelines and 2009 updates. Methods—Members of the writing committee were appointed by the American Stroke Association Stroke Council’s Scientific Statement Oversight Committee, representing various areas of medical expertise. Strict adherence to the American Heart Association conflict of interest policy was maintained throughout the consensus process. Panel members were assigned topics relevant to their areas of expertise, reviewed the stroke literature with emphasis on publications since the prior guidelines, and drafted recommendations in accordance with the American Heart Association Stroke Council’s Level of Evidence grading algorithm. Results—The goal of these guidelines is to limit the morbidity and mortality associated with stroke. The guidelines support the overarching concept of stroke systems of care and detail aspects of stroke care from patient recognition; emergency medical services activation, transport, and triage; through the initial hours in the emergency department and stroke unit. The guideline discusses early stroke evaluation and general medical care, as well as ischemic stroke, specific interventions such as reperfusion strategies, and general physiological optimization for cerebral resuscitation. Conclusions—Because many of the recommendations are based on limited data, additional research on treatment of acute ischemic stroke remains urgently needed.

Full text available at: http://stroke.ahajournals.org/content/early/2013/01/31/STR.0b013e318284056a.full.pdf+html

The choice of the optimal benzodiazepine to treat prehospital status epilepticus is unclear. Lorazepam is preferred in the emergency department, but concerns about non-refrigerated storage limits emergency medical services (EMS) use. Midazolam is increasingly popular, but its heat stability is undocumented. Objective. This study evaluated temperature-dependent degradation of lorazepam and midazolam after 60 days in the EMS environment. Methods. Lorazepam or midazolam samples were collected prior to (n = 139) or after (n = 229) 60 days of EMS deployment during spring–summer months in 14 metropolitan areas across the United States. Medications were stored in study boxes that logged temperature every minute and were stored in EMS units per local agency policy. Mean kinetic temperature (MKT) exposure was derived for each sample. Drug concentrations were determined in a central laboratory by high-performance liquid chromatography. Concentration as a function of MKT was analyzed by linear regression. Results. Prior to deployment, measured concentrations of both benzodiazepines were 1.0 relative to labeled concentration. After 60 days, midazolam showed no degradation (mean relative concentration 1.00, 95% confidence interval [CI] 1.00–1.00) and was stable across temperature exposures (adjusted R$^2$ –0.008). Lorazepam experienced little degradation (mean relative concentration 0.99, 95% CI 0.98–0.99), but degradation was correlated to increasing MKT (adjusted R$^2$ 0.278). The difference between the temperature dependence of degradation of midazolam and lorazepam was statistically significant (T = –5.172, p < 0.001). Conclusions. Lorazepam experiences small but statistically significant temperature-dependent degradation after 60 days in the EMS environment. Additional study is needed to evaluate whether clinically significant deterioration occurs after 60 days. Midazolam shows no degradation over this duration, even in high-heat conditions.


Population estimates projects a significant increase in the geriatric population making elderly trauma patients more common. The geriatric trauma patients experience higher incidence of pre-existing medical conditions, impaired age-dependent physiologic reserve, use potent drugs and suffer from trauma system related shortcomings that influence outcomes. To improve adjustments for older age in pre-hospital assessment and care, several initiatives should be implemented. Decision-makers should make system revisions and introduce advanced point-of-care initiatives to improve outcome after trauma for the elderly.


The use of ondansetron in children with vomiting after a head injury has not been well studied. Concern about masking serious injury is a potential barrier to its use. Objective: The aim of this study was to evaluate the use of ondansetron in children with head injury and symptoms of vomiting in the pediatric emergency department (PED) and its effect on return rates and masking of more serious injuries. Design/Methods: Visits to two Pediatric EDs (PEDs) from 2003 to 2010 with a diagnosis of head injury were evaluated retrospectively. Patients discharged home after a head computed tomography (CT) are the primary cohort for the study. A logistic regression model was used to analyze ondansetron's effects on the likelihood of return to the PED within 72 hours for persistent symptoms. A secondary analysis was performed on patients with a diagnoses of head injury who did not receive a head CT and were discharged. Results: A total of 6311 patients had a diagnosis of head injury, had a head CT
performed, and were discharged from the PED. The use of ondansetron increased significantly from 3.7% in 2003 to 22% in 2010 (P < .001). After controlling for demographic/acuity differences, receiving ondansetron in the PED was associated with a lower likelihood of returning within 72 hours (0.49, 95% confidence interval [0.26-0.92]). In patients with head injury who did not have a head CT performed and were sent home, the use of ondansetron in the PED was not associated with an increased risk of missed diagnoses. Conclusion: Ondansetron use in children with a CT scan who are dispositioned home is relatively safe, does not appear to mask any significant conditions, and significantly reduces return visits to the PED.


Objective: Beneficial effects of IV tissue plasminogen activator (tPA) in acute ischemic stroke are strongly time-dependent. In the Pre-Hospital Acute Neurological Treatment and Optimization of Medical care in Stroke (PHANTOM-S) study, we undertook stroke treatment using a specialized ambulance, the stroke emergency mobile unit (STEMO), to shorten call-to-treatment time. Methods: The ambulance was staffed with a neurologist, paramedic, and radiographer and equipped with a CT scanner, point-of-care laboratory, and a teleradiology system. It was deployed by the dispatch center whenever a specific emergency call algorithm indicated an acute stroke situation. Study-specific procedures were restricted to patients able to give informed consent. We report feasibility, safety, and duration of procedures regarding prehospital tPA administration. Results: From February 8 to April 30, 2011, 152 subjects were treated in STEMO. Informed consent was given by 77 patients. Forty-five (58%) had an acute ischemic stroke and 23 (51%) of these patients received tPA. The mean call-to-needle time was 62 minutes compared with 98 minutes in 50 consecutive patients treated in 2010. Two (9%) of the tPA-treated patients had a symptomatic intracranial hemorrhage and 1 of these patients (4%) died in hospital. Technical failures encountered were 1 CT dysfunction and 2 delayed CT image transmissions. Conclusions: The data suggest that prehospital stroke care in STEMO is feasible. No safety concerns have been raised so far. This new approach using prehospital tPA may be effective in reducing call-to-needle times, but this is currently being scrutinized in a prospective controlled study.

And...an egg a day won’t hurt your heart, but evolution is reducing our intelligence …


Objective: To investigate and quantify the potential dose-response association between egg consumption and risk of coronary heart disease and stroke. Design: Dose-response meta-analysis of prospective cohort studies. Data sources: PubMed and Embase prior to June 2012 and references of relevant original papers and review articles. Eligibility criteria for selecting studies: Prospective cohort studies with relative risks and 95% confidence intervals of coronary heart disease or stroke for three or more categories of egg consumption. Results: Eight articles with 17 reports (nine for coronary heart disease, eight for stroke) were eligible for inclusion in the meta-analysis (3 081 269 person years and 5847 incident cases for coronary heart disease, and 4 148 095 person years and 7579 incident cases for stroke). No evidence of a curve linear association was seen between egg consumption and risk of coronary heart disease or stroke (P=0.67 and P=0.27 for non-linearity, respectively).
The summary relative risk of coronary heart disease for an increase of one egg consumed per day was 0.99 (95% confidence interval 0.85 to 1.15; P=0.88 for linear trend) without heterogeneity among studies (P=0.97, I²=0%). For stroke, the combined relative risk for an increase of one egg consumed per day was 0.91 (0.81 to 1.02; P=0.10 for linear trend) without heterogeneity among studies (P=0.46, I²=0%). In a subgroup analysis of diabetic populations, the relative risk of coronary heart disease comparing the highest with the lowest egg consumption was 1.54 (1.14 to 2.09; P=0.01). In addition, people with higher egg consumption had a 25% (0.57 to 0.99; P=0.04) lower risk of developing hemorrhagic stroke. Conclusions: Higher consumption of eggs (up to one egg per day) is not associated with increased risk of coronary heart disease or stroke. The increased risk of coronary heart disease among diabetic patients and reduced risk of hemorrhagic stroke associated with higher egg consumption in subgroup analyses warrant further studies.

Full text available at: http://www.bmj.com/content/346/bmj.e8539.pdf%2Bhtml


Human intelligence and behaviour require optimal functioning of a large number of genes, which requires enormous evolutionary pressures to maintain. A provocative hypothesis published in a recent set of Science and Society pieces published in the Cell Press journal Trends in Genetics suggests that we are losing our intellectual and emotional capabilities because the intricate web of genes endowing us with our brain power is particularly susceptible to mutations and that these mutations are not being selected against in our modern society.

"The development of our intellectual abilities and the optimization of thousands of intelligence genes probably occurred in relatively non-verbal, dispersed groups of peoples before our ancestors emerged from Africa," says the papers' author, Dr. Gerald Crabtree, of Stanford University. In this environment, intelligence was critical for survival, and there was likely to be immense selective pressure acting on the genes required for intellectual development, leading to a peak in human intelligence.

From that point, it's likely that we began to slowly lose ground. With the development of agriculture, came urbanization, which may have weakened the power of selection to weed out mutations leading to intellectual disabilities. Based on calculations of the frequency with which deleterious mutations appear in the human genome and the assumption that 2000 to 5000 genes are required for intellectual ability, Dr. Crabtree estimates that within 3000 years (about 120 generations) we have all sustained two or more mutations harmful to our intellectual or emotional stability. Moreover, recent findings from neuroscience suggest that genes involved in brain function are uniquely susceptible to mutations. Dr. Crabtree argues that the combination of less selective pressure and the large number of easily affected genes is eroding our intellectual and emotional capabilities.

But not to worry. The loss is quite slow, and judging by society's rapid pace of discovery and advancement, future technologies are bound to reveal solutions to the problem. "I think we will know each of the millions of human mutations that can compromise our intellectual function and how each of these mutations interact with each other and other processes as well as environmental influences," says Dr. Crabtree. "At that time, we may be able to magically correct any mutation that has occurred in all cells of any organism at any developmental stage. Thus, the brutish process of natural selection will be unnecessary."