Advanced life support


Positioning the parturient from supine to the left lateral tilt position (supine-to-tilt) may not effectively displace the gravid uterus, but turning from the left lateral position to the left lateral tilt position (left lateral-to-tilt) may keep the gravid uterus displaced and prevent aortocaval compression. Fifty-one full-term parturients were randomly placed in the left lateral position, supine-to-tilt and left lateral-to-tilt positions using a Crawford wedge. Femoral vein area, femoral vein velocity, femoral artery area, pulsatility index, resistance index and right arm mean arterial blood pressure and heart rate were recorded. Our results showed a lower mean (SD) femoral vein area (82.2 (14.9) vs 96.2 (16.4) mm²), a lower pulsatility index (3.83 (1.3) vs 5.8 (2.2)), a lower resistance index (0.93 (0.06) vs 0.98 (0.57)), a higher femoral artery area (33.3 (3.8) vs 30.9 (4.4) mm²) and a higher femoral vein velocity (7.9 (1.2) vs 6.1 (1.6) cm.s⁻¹) with left lateral-to-tilt when compared with supine-to-tilt (all p < 0.001). Our results suggest that moving a full-term parturient from the full left lateral to the lateral tilt position may prevent aortocaval compression in full-term parturients more efficiently than when positioning the parturient from a supine to left lateral tilt position.

ANZCOR Guideline 11.10: Resuscitation in special circumstances


Airway management is of major importance in prehospital emergency care. Bag-valve mask (BVM) ventilation and endotracheal intubation (ETI) have been shown to be difficult, especially when caregivers are inexperienced. Alternative methods have been studied, and supraglottic devices have been shown to provide reasonable ease of placement and effective ventilation in manikin studies and anaesthetised patients. First responders (FR) are employed by many emergency medical services (EMS) to shorten initiation of emergency care, and they are trained to provide basic CPR including BVM and use of automated external defibrillators (AED) in case of out-of-hospital cardiac arrest (OHCA). The aim of this research was to study the feasibility of manikin-trained first responders (FR) using a laryngeal tube (LT) as a primary airway method during cardiac arrest. We trained 300 FRs to use a LT during OHCA. The FRs used a LT in 64 OHCA cases. The LT was correctly placed on the first attempt in 46/64 cases (71.9%) and on the second attempt in 13/64 cases (20.3%). Insertion was reported as being easy in 55/64 cases (85.9%). Median insertion time was 23.1 s, with a range of 3.240 s. We found that after manikin training, the FRs inserted the LT and performed adequate ventilation with a reasonable success rate and insertion time.

ANZCOR Guideline 11.6: Equipment & techniques in adult ALS

3. Maze R, Le May MR, Hibbert B, So DY, et al., The impact of therapeutic hypothermia as adjunctive therapy in a regional primary PCI

ANZCOR Research updates August 2012
Therapeutic hypothermia (TH) is associated with improved neurologic outcomes in comatose survivors of out-of-hospital cardiac arrest (OHCA). There are currently limited data on the outcomes of patients presenting with resuscitated OHCA in the setting of ST-segment elevation myocardial infarction (STEMI). We conducted a retrospective study to determine the outcomes of patients treated with therapeutic hypothermia (TH) for OHCA in a large regionalized STEMI program. Methods: Patients referred for primary PCI and TH between July 2004 and April 2011 were identified from the University of Ottawa Heart Institute STEMI database. The primary endpoint was survival to hospital discharge with sufficient neurologic recovery to enable discharge home. Results: Among 2467 consecutive patients referred for primary PCI, we identified 50 patients treated with TH following OHCA. Forty-nine underwent PCI, of which 47 (96%) received a stent. Median door-to-balloon time was 113 min (IQR 91,151). Patients with good neurologic recovery were younger, mean 51.4 ± 8.6 years versus 64.5 ± 12.1, p < 0.001, and had higher baseline creatinine clearance, 70 ± 19 mL/min/1.73 m² versus 53 ± 23 mL/min/1.73 m², p = 0.007. The primary endpoint of survival with sufficient neurologic recovery to enable discharge home was reached in 30 patients (60%). Four survivors required levels of assistance that precluded discharge home. Conclusions: Therapeutic hypothermia in conjunction with primary PCI is associated with a favorable neurologic outcome in the majority of STEMI patients surviving OHCA. Our results suggest that TH is an important adjunctive therapy for STEMI patients suffering OHCA.

ANZCOR Guideline 11.8: Therapeutic hypothermia after cardiac arrest


This is the first study to identify the factors associated with hyperventilation during actual cardiopulmonary resuscitation (CPR) in the emergency department (ED). Methods: All CPR events in the ED were recorded by video from April 2011 to December 2011. The following variables were analysed using review of the recorded CPR data: ventilation rate (VR) during each minute and its associated factors including provider factors (experience, advanced cardiovascular life support (ACLS) certification), clinical factors (auscultation to confirm successful intubation, suctioning, and comments by the team leader) and time factors (time or day of CPR). Results: Fifty-five adult CPR cases including a total of 673 min sectors were analysed. The higher rates of hyperventilation (VR > 10/min) were delivered by inexperienced (53.3% versus 14.2%) or uncertified ACLS provider (52.2% versus 10.8%), during night-time (61.0 versus 34.5%) or weekend CPR (53.1% versus 35.6%) and when auscultation to confirm successful intubation was performed (93.5% versus 52.8%) than not (all p < 0.0001). However, experienced (25.3% versus 29.7%; p = 0.448) or certified ACLS provider (20.6% versus 31.3%; p < 0.0001) could not deliver high rate of proper ventilation (VR 8–10/min). Comment by the team leader was most strongly associated with the proper ventilation (odds ratio 7.035, 95% confidence interval 4.512–10.967). Conclusions: Hyperventilation during CPR was associated with inexperienced or uncertified ACLS provider, auscultation to confirm intubation, and night-time or weekend CPR. And to deliver proper ventilation, comments by the team leader should be given regardless of providers’ expert level.

ANZCOR Guideline 5.0: Breathing

ANZCOR Guideline 11.1.1: CPR for ALS providers


Recent resuscitation guidelines have been altered to prioritize chest compression over airway management and have strongly advocated the
placement of a supraglottic airway (SGA) instead of an endotracheal tube (ETT) in cardiac arrest. The recent article by Segal et al. has suggested that supraglottic devices impedes cerebral blood flow by obstruction of the carotid arteries. We present a series of magnetic resonance images demonstrating the anatomic placement of an Air-Q SGA during routine anaesthesia. A middle aged male presented for MRI of brain and spine related to cervical radiculopathy. Due to claustrophobia the study was performed under general anaesthetic with the placement of an Air-Q SGA with the cuff filled with gadolinium. Consent was obtained for the use of the images for management and teaching purposes. The Aurora Institutional Review Board considered this study exempt from IRB oversight. The figure below illustrates our findings. The vertical extent of the cuff of the SGA ranged from the inferior endplate of the second cervical vertebra to the level of the C6/7 intervertebral disc. The maximal horizontal width of the Air-Q was 6 cm at the level of the C4 vertebra. On review of all the available images, there appears to be no focal loss in calibre in the dimensions or in the shape of the common carotid artery and its major terminal branches.

ANZCOR Guideline 11.6: Equipment & techniques in adult ALS

6. Phelan MP, Ornato JP, Peberdy MA and Hustey F, Appropriate Documentation of Confirmation of Endotracheal Tube Position and Relationship to Patient Outcome from In-Hospital Cardiac Arrest. Resuscitation. 2012; Online first (1 September) 
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.


Continuing compressions during a defibrillation shock has been proposed as a method of reducing pauses in cardiopulmonary resuscitation (CPR) but the safety of this procedure is unproven. The medical examination gloves worn by rescuers play an important role in protecting the rescuer yet

ANZCOR Guideline 11.6: Equipment and techniques in adult ALS


Clinical trials of therapeutic hypothermia (TH) after cardiac arrest excluded patients with persistent hemodynamic instability after return of spontaneous circulation (ROSC), and thus equipoise may exist regarding use of TH in these patients. Our objective was to determine if therapeutic hypothermia (TH) is associated with worsening hemodynamic instability among patients who are vasopressor-dependent after ROSC. Methods: We performed a prospective observational study in vasopressor-dependent post-cardiac arrest patients. Inclusion criteria were age >17, non-trauma cardiac arrest, comatose after ROSC, and persistent vasopressor dependence. The decision to initiate TH (33 - 34°C) was made by the treating physician. We measured cumulative vasopressor index (CVI) and mean arterial pressure (MAP) every 15 min during the first 6 h after ROSC. The outcome measures were change in CVI (primary outcome) and MAP (secondary outcome) over time. We graphed median CVI and MAP over time for the treated and not treated cohorts, and used propensity adjusted repeated measures mixed models to test for an association between TH induction and change in CVI or MAP over time. Results Seventy-five post-cardiac arrest patients were included (35 treated; 40 not treated). We observed no major differences in CVI or MAP over time between the treated and not treated cohorts. In the mixed models we found no statistically significant association between TH induction and changes in CVI or MAP. Conclusion: In patients with vasopressor-dependency after cardiac arrest, the induction of hypothermia was not associated with a decrease in mean arterial pressure or increase in vasopressor requirement.

ANZCOR Guideline 11.8: Therapeutic hypothermia after cardiac arrest
the electrical characteristics of these gloves are unknown. This study examined the response of medical examination gloves to defibrillation voltages. Methods Part 1 of this study measured voltage - current curves for a small sample (8) of gloves. Part 2 tested more gloves (460) to determine the voltage required to produce a specific amount of current flow. Gloves were tested at two current levels: 0.1 mA and 10 mA. Testing included four glove materials (chloroprene, latex, nitrile, and vinyl) in a single layer and double-gloved. Results All gloves tested in part 1 allowed little current to flow (<1 mA) as the voltage was increased until breakdown occurred, at which point current flow increased precipitously. In part 2, 118 of 260 (45%) single gloves and 93 of 120 (77%) double gloves allowed at least 0.1 mA of current flow at voltages within the external defibrillation voltage range. Also, 6 of 80 (7.5%) single gloves and 5 of 80 (6.2%) double gloves allowed over 10 mA. Conclusions: Few of the gloves tested limited the current to levels proven to be safe. A lack of sensation during hands-on defibrillation does not guarantee that a safety margin exists. As such, we encourage rescuers to minimize rather than eliminate the pause in compressions for defibrillation.

ANZCOR Guideline 11.1.1: CPR for ALS providers


We performed a randomised controlled crossover study to investigate whether charging in anticipation of a potentially shockable rhythm shortens total and hands-off time between the 2-min CPR cycles compared with the ERC 2010G recommendation of rhythm check before defibrillator charging. Physician volunteers (certified ERC ALS providers) performed the two protocols on mannequins in a random order as in Figure 1. The sign test was used as significance test and the study was powered accordingly. The number of participants included (significance level 0.05) was 6 (1 woman and 5 men; mean age 32.5 (SD 2.0) years). Defibrillator charging before rhythm check reduced total time and hands-off time between two CPR cycles (p = 0.03 for both). With ERC 2010G, the time with compressions during defibrillator charging was 5.8 s (SD 2.1) and the number of chest compressions during defibrillator charging was 11.5 (SD 2.8). The absolute difference in hands-off time was relatively short. However, the number of interruptions in chest compressions was reduced from two to one, and the shortened compression cycle during defibrillator charging with about 12 compressions was avoided. With ERC 2010G, the recommendation changed from 15 to 30 compressions per compression cycle since a ratio of 30 compressions to 2 ventilations was expected to provide the best compromise between circulation and ventilation. The absolute difference in the time interval between two cycles was larger than the difference in hands-off time and this may be as important as the difference in hands-off time since the compressions given during defibrillator charging may be less effective than those provided during the CPR cycles. Importantly, these compressions, likely to be less effective, are given before shock is attempted and may thus decrease the chance of successful defibrillation. In conclusion, defibrillator charging before rhythm check compared to the ERC 2010G significantly shortened the total time and hands-off time between CPR cycles.

ANZCOR Guideline 11.1.1: CPR for ALS providers

Studies on humeral placement of the EZ-IO (Vidacare, Shavano Park, TX, USA) have shown mixed results. We performed a study to determine the first-attempt success rate at humeral placement of the EZ-IO by paramedics among prehospital adult cardiac arrest patients. Methods: A retrospective cohort analysis of data prospectively collected over a 9-month period. Data are a subset extracted from a prehospital cardiac arrest study. The cohort consisted of adult cardiac arrest patients in whom the EZ-IO placement was attempted in the humerus by paramedics. Choice of vascular access was at the discretion of the paramedic; options included tibial or humeral EZ-IO and intravenous. Primary outcome is the percentage of successful placements (stable, flow, without extravasation) on first attempt. Secondary outcomes are overall successful placement, complications, and reason for failure. Data were collected during a post cardiac arrest interview. Results: Humeral intraosseous (IO) access was attempted in 61% (n = 247) of 405 cardiac arrests evaluated with mean age of 63 (±16) years, 58% male. First-attempt successful placement was 91%. Successful placement was 94%, considering the second attempts. In the unsuccessful attempts, 2% reported obesity as the cause, 1% reported stable placement without flow, and 2% reported undocumented causes for failure. There were also 2% reports of successful placement.
Conclusions: The results of this study suggest a high degree of paramedic proficiency in establishment of IO access in the proximal humerus of the out-of-hospital cardiac arrest. Few complications suggest that proximal humeral IO access is a reliable method for vascular access in this patient population.

ANZCOR Guideline 11.5: Medications in adult ALS

To investigate whether titration of inspired oxygen can be achieved through adjustment of oxygen flow into a self-inflating resuscitation bag with a reservoir of a type used in standard ambulance practice. Methods: In a series of bench experiments, oxygen was delivered via a flow meter to a 1500 ml self-inflating resuscitation bag with a 2500 ml reservoir bag and connected to a test lung. The oxygen concentration delivered to the test lung by manual inflation of the resuscitation bag was measured using an anaesthetic machine while the delivered tidal volume was measured using a spirometer. The delivered oxygen concentration was measured at flows of 0.5, 2, 6, 12 and 15 litres per minute for tidal volumes of 300, 600, and 900 ml with bag inflation rates of 10, 20 and 30 per minute. Results: A wide range of delivered oxygen concentrations ranging between 24% and 99.5% were achieved with different oxygen flows, tidal volumes, and inflation rates. Overall, the mean delivered oxygen concentration increased significantly with each of the increments of oxygen flow tested (p < 0.001 for all comparisons). Conclusions: Effective titration of oxygen delivery can be achieved using adjustment of oxygen flow with a standard self-inflating resuscitation bag and reservoir.

Basic life support

The aim of this study was to test the hypothesis that all blunt trauma patients, presenting with a Glasgow coma scale (GCS) score of 15, without intoxication or neurological deficit, and no pain or tenderness on log-roll can have any thoracolumbar fracture excluded without imaging. Materials and Methods: All patients diagnosed with a thoracolumbar fracture presenting to the emergency department of a major trauma centre and having an initial GCS score of 15 were included in the study. Variables collected included type of fracture, mechanism of injury, the presence of pain or tenderness on log-roll, ethanol levels and prehospital opioid analgesia. Results: There were 536 patients with thoracolumbar fractures, of which 508 (94.8%) patients had either pain, tenderness or had received prehospital opioid analgesia. A small subgroup of 28 (5.2%) patients who received no prehospital opioid analgesia, did not complain of pain and had no tenderness to the thoracolumbar spine elicited on log-roll. This subgroup was significantly older (p=0.033) and a high proportion of patients (64.3%) had a concurrent fracture of the cervical spine. Within this subgroup, a clinically significant unstable thoracic fracture was present in three patients, with all three patients exhibiting symptoms and signs of neurological injury or having a concurrent cervical vertebral fracture. Conclusions: In this population of blunt trauma patients with a GCS score of 15, not under the influence of alcohol or prehospital morphine administration, the absence of pain or tenderness on log-roll can exclude a clinically significant lumbar vertebral fracture, but does not exclude a thoracic fracture.

ANZCOR Guideline 9.1.6: Management of a suspected spinal injury

**observational study.** Lancet. 2012; Early online publication (5 Sept)

During in-hospital cardiac arrests, how long resuscitation attempts should be continued before termination of efforts is unknown. We investigated whether duration of resuscitation attempts varies between hospitals and whether patients at hospitals that attempt resuscitation for longer have higher survival rates than do those at hospitals with shorter durations of resuscitation efforts. Methods: Between 2000 and 2008, we identified 64,339 patients with cardiac arrests at 435 US hospitals within the Get With The Guidelines—Resuscitation registry. For each hospital, we calculated the median duration of resuscitation before termination of efforts in non-survivors as a measure of the hospital's overall tendency for longer attempts. We used multilevel regression models to assess the association between the length of resuscitation attempts and risk-adjusted survival. Our primary endpoints were immediate survival with return of spontaneous circulation during cardiac arrest and survival to hospital discharge. Findings: 31,198 of 64,339 (48.5%) patients achieved return of spontaneous circulation and 9,912 (15.4%) survived to discharge. For patients achieving return of spontaneous circulation, the median duration of resuscitation was 12 min (IQR 6—21) compared with 20 min (14—30) for non-survivors. Compared with patients at hospitals in the quartile with the shortest median resuscitation attempts in non-survivors (16 min [IQR 15—17]), those at hospitals in the quartile with the longest attempts (25 min [25—28]) had a higher likelihood of return of spontaneous circulation (adjusted risk ratio 1.12, 95% CI 1.06—1.18; p<0.0001) and survival to discharge (1.12, 1.02—1.23; 0.021).

Interpretation: Duration of resuscitation attempts varies between hospitals. Although we cannot define an optimum duration for resuscitation attempts on the basis of these observational data, our findings suggest that efforts to systematically increase the duration of resuscitation could improve survival in this high-risk population.

ANZCOR Guideline 8: Cardiopulmonary resuscitation
ANZCOR Guideline 10.5: Legal and ethical issues related to resuscitation


Aim: To design the core algorithm of a high-temporal resolution rhythm analysis algorithm for automated external defibrillators (AEDs) valid for adults and children. Records from adult and paediatric patients were used all together to optimize and test the performance of the algorithm.

Methods: A total of 574 shockable and 1126 non-shockable records from 1379 adult patients, and 57 shockable and 503 non-shockable records from 377 children aged between 1 and 8 years were used. The records were split into two groups for development and testing. The core algorithm analyses ECG segments of 3.2 s duration and classifies the segments as non-shockable or likely shockable combining a time, slope and frequency domain analysis to detect normally conducted QRS complexes.

Results: The algorithm correctly identified 98% of non-shockable segments, 97.5% in adults and 98.4% in children, and identified 99.5% of shockable segments as likely shockable, 100% in adults and 96% in children. When likely shockable segments were further analysed in terms of regularity, spectral content and heart rate to form a complete rhythm analysis algorithm the overall specificity increased to 99.6% and the sensitivity was 99.1%.

Conclusion: Paediatric and adult rhythms can be accurately diagnosed using 3.2 s ECG segments. A single algorithm safe for children and adults can simplify AED use, and its high temporal resolution shortens pre-shock pauses, which may contribute to improve resuscitation outcome.

ANZCOR Guideline 7 - AED

Updated life-support guidelines were published by the European Resuscitation Council (ERC) in 2010, increasing the required depth and rate of chest compression delivery. This study sought to determine the impact of these guidelines on rescuer fatigue and cardiopulmonary resuscitation (CPR) performance. Methods: 62 Health science students performed 5 min of conventional CPR in accordance with the 2010 ERC guidelines. A SkillReporter manikin was used to objectively assess temporal change in determinants of CPR quality. Participants subjectively reported their end-fatigue levels, using a visual analogue scale, and the point at which they believed fatigue was affecting CPR delivery. Results: 49 (79%) participants reported that fatigue affected their CPR performance, at an average of 167 s. End fatigue averaged 49.5/100 (range 0–95). The proportion of chest compressions delivered correctly decreased from 52% in min 1 to 39% in min 5, approaching significance (p=0.071). A significant decline in chest compressions reaching the recommended depth occurred between the first (53%) and fifth (38%) min (p=0.012). Almost half this decline (6%) was between the first and second minutes of CPR. Neither chest compression rate, nor rescue breath volume, were affected by rescuer fatigue. Conclusion: Fatigue affects chest compression delivery within the second minute of CPR under the 2010 ERC guidelines, and is poorly judged by rescuers. Rescuers should, therefore, be encouraged to interchange after 2 min of CPR delivery. Team leaders should be advised to not rely on rescuers to self-report fatigue, and should, instead, monitor for its effects.

ANZCOR Guideline 6: Compressions

Objective: Bystander CPR improves survival in patients with out-of-hospital cardiac arrest (OHCA). For adult sudden collapse, bystander chest compression-only CPR (COCPR) is recommended in some circumstances by the American Heart Association and European Resuscitation Council. However, adults who arrest from non-cardiac causes may also receive COCPR. Because rescue breathing may be more important for individuals suffering OHCA secondary to non-cardiac causes, COCPR is not recommended for these cases. We evaluated the relationship of lay rescuer Compression-only CPR (COCPR) and survival after OHCA from non-cardiac causes. Methods: Analysis of a statewide Utstein-style registry of adult OHCA, during a large scale campaign endorsing COCPR for OHCA from presumed cardiac cause. The relationship between lay rescuer CPR (both conventional CPR and COCPR) and survival to hospital discharge was evaluated. Results: Presumed non-cardiac aetiologies of OHCA accounted for 15% of all cases, and lay rescuer CPR was provided in 29% of these cases. Survival to hospital discharge occurred in 3.8% after conventional CPR, 2.7% after COCPR, and 4.0% after no CPR (p = 0.85). The proportion of patients receiving COCPR was much lower in the cohort of OHCA from respiratory causes (8.3%) than for those with presumed cardiac OHCA (18.0%; p < 0.001). Conclusions: In the setting of a campaign endorsing lay rescuer COCPR for cardiac OHCA, bystanders were less likely to perform COCPR on OHCA victims who might benefit from rescue breathing.

ANZCOR Guideline 8: Cardiopulmonary resuscitation

In real cardiopulmonary resuscitation (CPR), noise can arise from instructional voices and environmental sounds in places such as a battlefield and industrial and high-traffic areas. A feedback device using a flashing light was designed to overcome noise-induced stimulus saturation during CPR. This study was conducted to determine whether ‘flashlight’ guidance influences CPR performance in a simulated noisy setting. Materials and methods: We recruited 30 senior medical students with no previous experience of using flashlight-guided CPR to participate in this prospective,
simulation-based, crossover study. The experiment was conducted in a simulated noisy situation using a cardiac arrest model without ventilation. Noise such as patrol car and fire engine sirens was artificially generated. The flashlight guidance device emitted light pulses at the rate of 100 flashes/min. Participants also received instructions to achieve the desired rate of 100 compressions/min. CPR performances were recorded with a Resusci Anne mannequin with a computer skill-reporting system. Results: There were significant differences between the control and flashlight groups in mean compression rate (MCR), MCR/min and visual analogue scale. However, there were no significant differences in correct compression depth, mean compression depth, correct hand position, and correctly released compression. The flashlight group constantly maintained the pace at the desired 100 compressions/min. Furthermore, the flashlight group had a tendency to keep the MCR constant, whereas the control group had a tendency to decrease it after 60 s. Conclusion: Flashlight-guided CPR is particularly advantageous for maintaining a desired mean compression rate during hands-only CPR in noisy environments, where metronome pacing might not be clearly heard.

Education, implementation and teams

Safety experts and national guidelines recommend disclosing harmful medical errors to patients. Communicating with patients and families about errors respects their autonomy, supports informed decision making, may decrease malpractice costs, and can enhance patient safety. Yet existing disclosure guidelines may not account for the difficulty in discussing out-of-hospital errors with patients. Emergency medical services (EMS) providers operate in unpredictable environments that require rapid interventions for patients with whom they have only brief relationships. EMS providers also have limited access to patient medical data and risk management resources, which can make conducting disclosure conversations even more difficult. In addition, out-of-hospital errors may be discovered only after the transition of care to the inpatient setting, further complicating the question of who should disclose the error. EMS organizations should support the disclosure of out-of-hospital errors by fostering a nonpunitive culture of error reporting and disclosure, as well as developing guidelines for use by EMS systems.
ANZCOR Guideline 10.5: Legal and ethical issues related to resuscitation

Survival after out-of-hospital cardiac arrest (OHCA) is influenced by each link in the chain of survival. On the Danish island of Bornholm (population 42,000, area 588 km²) none survived an OHCA in 2001 - 2003. Therefore, we designed a multifaceted community-based approach aiming at strengthening each link in the chain of survival. The purpose of this study was to evaluate the effect of implementation of the intervention on bystander basic life support (BLS) rates and survival to hospital discharge after OHCA. Methods: Laypersons completed 24-min DVD-based-self-instruction BLS courses in schools and workplaces or 4-h BLS/automated external defibrillator (AED) courses. The local television station had broadcasts about resuscitation. The ambulance personnel were trained and the staff at the island hospital completed BLS courses or more advanced courses. Results: During 2 years 9226 people (22% of the population) completed the short course and 2453 (6% of the population) completed the 4-h course. The number of AEDs increased from 3 to 147. The bystander BLS rate for OHCAs with a presumed cardiac aetiology (N = 96, incidence 114/100,000 person-years) was 47% [95% CI 30, 50] and for witnessed OHCAs (N = 35) it increased significantly from 22% (2004)
to 74% [95% CI 58, 86]. The AEDs were deployed in 9 cases. Survival to discharge for all-rhythms OHCA was 5.4% [95% CI 2, 12], and for witnessed ventricular fibrillation (N = 17) 18% [95% CI 5, 42]. Conclusion: Strengthening all links in the chain of survival was associated with significant increases in bystander BLS rates and survival after OHCA on a rural island.

ANZCOR Guideline 10.1: BLS Training


Adult basic life support refresher training using voice feedback manikins has been shown to be feasible, but the superiority of this strategy over instructor-led (IL) refresher training for nurses in a hospital has not been studied in randomized trials. Objectives: To study if adult basic life support refresher training for nurses in a self-learning (SL) station using a voice feedback manikin is more effective than instructor led (IL) training. Methods: A Resusci-Anne Skills Station (Laerdal, Norway) was installed in a small room. A total of 235 nurses were randomized to SL or IL training. After 1 month and after 7 months, the proportions of nurses achieving a mean compression depth of 38 - 51 mm, a mean compression rate of 80 - 120/min, incomplete release of at least 5 mm and a mean ventilation volume of 400 -1000 ml were compared between the SL and IL groups. Results: After 1 month, the proportion of nurses with any incomplete release of at least 5 mm was significantly lower in the SL group (23 of 54 nurses, 43%) compared with the IL group (33 of 47 nurses, 70%) (P=0.005). After 7 months, a lower proportion of nurses achieved a depth of 38 - 51 mm in the SL group (13 of 45 nurses, 29%) compared with the IL group (25 of 45 nurses, 56%) (P=0.01). For the other outcome parameters, no differences between SL and IL training could be demonstrated. Conclusions: This randomized trial in a real-life setting showed that more nurses achieved adequate compression depth, 7 months after IL refresher training compared with training in a SL station. Further research is needed to improve the efficacy of this SL training strategy.

ANZCOR Guideline 10.1: BLS training


The optimal strategy to retrain basic life support (BLS) skills on a manikin is unknown. We analysed the differential impact of a video (video group, VG), voice feedback (VFG), or a serial combination of both (combined group, CG) on BLS skills in a self-learning (SL) environment. Methods: Two hundred and thirteen medicine students were randomly assigned to a VG, a VFG and a CG. The VG refreshed the skills with a practice-while-watching video (abbreviated Mini Anne™ video, Laerdal, Norway) and a manikin, the VFG with a computer-guided manikin (Resusci Anne Skills Station™, Laerdal, Norway) and the CG with a serial combination of both. Each student performed two sequences of 60 compressions, 12 ventilations and three complete cycles of BLS (30:2). The proportions of students achieving adequate skills were analysed using generalised estimating equations analysis, taking into account pre-test results and training strategy. Results: Complete datasets were obtained from 192 students (60 VG, 69 VFG and 63 CG). Before and after training, ≥70% of compressions with depth ≥50 mm were achieved by 14/60 (23%) vs. 16/60 (27%) VG, 24/69 (35%) vs. 50/69 (73%) VFG and 19/63 (30%) vs. 41/63 (65%) CG (P < 0.001). Compression rate 100–120/min was present in 27/60 (45%) vs. 52/60 (87%) VG, 28/69 (41%) vs. 44/69 (64%) VFG and 27/63 (43%) vs. 42/63 (67%) CG (P = 0.05). Achievement of ≥70% ventilations with a volume 400–1000 ml was present in 29/60 (49%) vs. 32/60 (53%) VG, 32/69 (46%) vs. 52/69 (75%) VFG and 25/63 (40%) vs. 51/63 (81%) CG (P = 0.001). There was no between-groups difference for complete release. Conclusions: Voice feedback and a sequential combination of video and voice feedback are both effective strategies to refresh BLS skills in a SL station. Video training alone only improved
compression rate. None of the three strategies resulted in an improvement of complete release.

ANZCOR Guideline 10.1: BLS Training

22. Ong MEH, Quah JLJ, Annathurai A, Noor NM, et al., Improving the quality of cardiopulmonary resuscitation by training dedicated cardiac arrest teams incorporating a mechanical load-distributing device at the emergency department. Resuscitation. 2012; Online first (17 August)

Objective: Determine if implementing cardiac arrest teams trained with a ‘pit-crew’ protocol incorporating a load-distributing band mechanical CPR device (Autopulse™ ZOLL) improves the quality of CPR, as determined by no-flow ratio (NFR) in the first 10 min of resuscitation.

Methods: A phased, prospective, non-randomized, before–after cohort evaluation. Data collection was from April 2008 to February 2011. There were 100 before and 148 after cases. Continuous video and chest compression data of all study subjects were analyzed. All non-traumatic, collapsed patients aged 18 years and above presenting to the emergency department were eligible. Primary outcome was NFR. Secondary outcomes were return of spontaneous circulation (ROSC), survival to hospital admission and neurological outcome at discharge. Main results: After implementation, mean total NFR for the first 5 min decreased from 0.42 to 0.27 (decrease = 0.15, 95% CI 0.10–0.19, p < 0.005), and from 0.24 to 0.18 (decrease = 0.06, 95% CI 0.01–0.11, p = 0.02) for the next 5 min. The mean time taken to apply Autopulse™ decreased from 208.8 s to 141.6 s (decrease = 67.2, 95% CI, 22.3–112.1, p < 0.005). The mean CPR ratio increased from 46.4% to 88.4% (increase = 41.9%, 95% CI 36.9–46.9, p < 0.005) and the mean total NFR for the first 10 min decreased from 0.33 to 0.23 (decrease = 0.10, 95% CI 0.07–0.14, p < 0.005). Conclusion: Implementation of cardiac arrest teams was associated with a reduction in NFR in the first 10 min of resuscitation. Training cardiac arrest teams in a ‘pit-crew’ protocol may improve the quality of CPR at the ED.


Among patients successfully resuscitated from out-of-hospital cardiac arrest (OHCA) and admitted to California hospitals, we examined how the placement of a do not resuscitate (DNR) order in the first 24 h after admission was associated with patient care, procedures and in-hospital survival. We further analyzed hospital and patient demographic factors associated with early DNR placement among patients admitted following OHCA.

Methods: We identified post-OHCA patients from a statewide California database of hospital admissions from 2002 to 2010. Documentation of patient and hospital demographics, hospital interventions, and patient outcome were analyzed by descriptive statistics and multiple regression models to calculate odds ratios and 95% confidence intervals. Results Of 5212 patients admitted to California hospitals after resuscitation from OHCA, 1692 (32.5%) had a DNR order placed in the first 24 h after admission. These patients had decreased frequency of cardiac catheterization (1.1% vs. 4.3%), blood transfusion (7.6% vs. 11.2%), ICD placement (0.1% vs. 1.1%), and survival to discharge (5.2% vs. 21.6%, all p-values < 0.0001). There was wide intrahospital variability and significant racial differences in the adjusted odds of early DNR orders (Asian, OR 0.67, 95% CI 0.48, 0.95; Black, OR 0.49, 95% CI 0.35, 0.69). Conclusions: Early DNR placement is associated with a decrease in potentially critical hospital interventions, procedures, and survival to discharge, and wide variability in practice patterns between hospitals. In the absence of prior patient wishes, DNR placement within 24 h may be premature given the lack of early prognostic indicators after OHCA.

ANZCOR Guideline 10.5: Legal and ethical issues related to resuscitation

24. Yang C-W, Yen Z-S, McGowan JE, Chen HC, et al., A systematic review of retention of adult advanced life support knowledge and
Advanced life support (ALS) guidelines are widely adopted for healthcare provider training with recommendations for retraining every two years or longer. This systematic review studies the retention of adult ALS knowledge and skills following completion of an ALS course in healthcare providers. Methods: We retrieved original articles using Medline, CINAHL, Cochrane Library, and PubMed, and reviewed reference citations to identify additional studies. We extracted data from included articles using a structured approach and organized outcomes by evaluation method, and knowledge and skills retention. Results: Among 336 articles retrieved, 11 papers were included. Most studies used multiple-choice questionnaires to evaluate knowledge retention and cardiac arrest simulation or other skills tests to evaluate skills retention. All studies reported variable rates of knowledge or skills deterioration over time, from 6 weeks to 2 years after training. Two studies noted retention of knowledge at 18 months and up to 2 years, and one reported skills retention at 3 months. Clinical experience, either prior to or after the courses, has a positive impact on retention of knowledge and skills. Conclusion: There is a lack of large well-designed studies examining the retention of adult ALS knowledge and skills in healthcare providers. The available evidence suggests that ALS knowledge and skills decay by 6 months to 1 year after training and that skills decay faster than knowledge. Additional studies are needed to help provide evidence-based recommendations for assessment of current knowledge and skills and need for refresher training to maximize maintenance of ALS competency.

Paediatric advanced life support

The objective of this study was to describe the demographics of out-of-hospital cardiac arrests (OOHCAs) in children younger than 18 years and characteristics associated with survival among these children in New York City (NYC). Methods: A prospective observational cohort of all children younger than 18 years with OOHA in NYC between April 1, 2002, and March 31, 2003. Data were collected from prehospital providers by trained paramedics utilizing a previously validated telephone interview process. Data included Pediatric Utstein core measures and critical prehospital time intervals. Analyses utilized descriptive statistics and bivariate association with survival. Results: Resuscitation was attempted on 147 pediatric OOHA patients in NYC during the study period; outcome data were collected on these patients. The median age was 2 years; most (58%) were male. The majority of arrests occurred at home (69%). Lay bystanders witnessed 33% of all OOHA; 68% of witnesses were family members. Bystander cardiopulmonary resuscitation (CPR) was performed on 30% of children. Median emergency medical services response time was 3.6 minutes (range, 0.4, 14.4 minutes). Initial rhythm was as follows: ventricular fibrillation, 2%; asystole, 50%; pulseless electrical activity, 9.5%; other rhythms, 11.6%; no rhythm recorded, 26%. Survival was 4% to hospital discharge and was present only among witnessed arrests (6/58 witnessed vs 0/70 unwitnessed, P < 0.05). Conclusions: Pediatric OOHA survival rate is low. Witnessed arrest was the most important determinant of survival. Ventricular fibrillation was an uncommon rhythm measured by emergency medical services. The majority of arrests occurred at home. The rate of bystander CPR was low. Strategies to increase the rate of bystander CPR for children, especially by family members, are needed.

Quick and safe airway management is essential during paediatric cardiopulmonary resuscitation (CPR); tracheal intubation (TI) is considered the
definitive method for airway control during advanced CPR. Method: A randomized crossover trial study was performed to test the ability of paediatric residents to intubate the trachea of manikins by means of standard direct laryngoscopy during continuous chest compressions (CCC). They were asked to perform tracheal intubation (TI) in manikins assisted by standard laryngoscopes (Miller and Macintosh) according to age, while a colleague delivered CCC. Primary endpoints were the rate of successful placement of the tube in the trachea and the duration of the TI in seconds. To assess the subjective opinion about the difficulty of the procedure, participants were asked to rate it on a visual analogue scale (VAS) with a score from 0 (extremely easy) to 10 (extremely difficult). Results: In the infant scenario, the median (IQR) time to TI was 28.2 (20.4–34.4) seconds. Seven of 23 participants required more than 30 seconds to perform TI, two of them requiring more than 45 seconds and one, more than one minute. In the child scenario, the median (IQR) time to TI was 20.2 (18.6–25.1) seconds. In three of 23 cases, the time required was longer than 30 seconds, one of them requiring more than 45 seconds, and another one, more than one minute. Median (IQR) VAS score was 4 (2-6) in the infant scenario and 3 (0-6) in the child scenario. Conclusion: In simulated infant and child CPR scenarios, most of paediatric residents were able to intubate the trachea during CCC, however, some of the participants failed to achieve TI in less than 30 seconds. Our results suggest that, at least in infants, specific TI training during chest compressions should be encouraged or, alternatively, a brief chest compressions stop (less than 30 seconds) should be considered in order to assure the success of TI and CPR. These results should be confirmed with data obtained from real patients.

27. Sutton RM, French B, Nishisaki A, Niles DE, et al., American Heart Association Cardiopulmonary Resuscitation Quality Targets are Associated with Improved Arterial Blood Pressure During Pediatric Cardiac Arrest. Resuscitation. 2012; Online first (5 September) Aim: To evaluate the association between cardiopulmonary resuscitation (CPR) quality and hemodynamic measurements during in-hospital pediatric cardiac arrest. We hypothesized that AHA recommended CPR rate and depth targets would be associated with systolic blood pressures ≥ 80 mmHg and diastolic blood pressures ≥ 30 mmHg. Methods: In children and adolescents < 18 years of age who suffered a cardiac arrest with an invasive arterial catheter in place, a CPR monitoring defibrillator collected CPR data which was synchronized to arterial blood pressure (BP) tracings. Chest compression (CC) depths were corrected for mattress deflection. Generalized least squares regression estimated the association between BP and CPR quality, treated as continuous variables. Mixed-effects logistic regression estimated the association between systolic BP ≥ 80 mmHg/diastolic BP ≥ 30 mmHg and the AHA targets of depth ≥ 38 mm and/or rate ≥ 100/min. Results: Nine arrests resulted in 4,156 CCs. The median mattress corrected depth was 32 mm (IQR 28–38); median rate was 111 CC/min (IQR 103–120). AHA depth was achieved in 1090/4156 (26.2%) CCs; rate in 3441 (83.7%). Systolic BP ≥ 80 mmHg was attained in 2516/4156 (60.5%) compressions; diastolic ≥ 30 mmHg in 2561/4156 (61.6%). A rate ≥ 100/min was associated with systolic BP ≥ 80 mmHg (OR 1.32; CI95 1.04, 1.66; p = 0.02) and diastolic BP ≥ 30 mmHg (OR 2.15; CI95 1.65, 2.80; p < 0.001). Exceeding both (rate ≥ 100/min and depth ≥ 38 mm) was associated with systolic BP ≥ 80 mmHg (OR 2.02; CI95 1.45, 2.82; p < 0.001) and diastolic BP ≥ 30 mmHg (OR 1.48; CI95 1.01, 2.15; p = 0.042). Conclusions: AHA quality targets (rate ≥ 100/min and depth ≥ 38 mm) were associated with systolic BPs ≥ 80 mmHg and diastolic BPs ≥ 30 mmHg during CPR in children

ANZCOR Guideline 12.2: ALS for infants & children: diagnosis & initial management

28. Tunik MG, Richmond N, Treiber M, Skomorowsky A, et al., Pediatric Prehospital Evaluation of NYC Respiratory Arrest Survival (PHENYCS). Ped Emerg Care. 2012;28(9):859-63 Objective: The objective of this study was to describe the demographics, epidemiology, and characteristics associated with survival of children younger than 18 years who had an out-of-hospital respiratory arrest (OOhRA) during a 1-year period in a large urban area. Methods: A prospective observational cohort of consecutive children younger than 18 years with OOHRA cared for by the New York City 911 emergency medical services
(EMS) system from April 12, 2002, to March 31, 2003. Following resuscitative efforts, data were collected from prehospital providers by trained paramedics using a previously validated telephone interview process. Data included Pediatric Utstein core measures and critical prehospital time intervals. Analyses used descriptive statistics and bivariate association with survival.

Results: Resuscitation was attempted on 109 OOHRAs during the study period. The median age was 7 years, 52% were male. Lay bystanders witnessed 56%. Most occurred at home (77%). Witnesses were family members in 59%. Bystander cardiopulmonary resuscitation (CPR) was performed in 31% of all respiratory arrests (RAs). A chronic medical condition existed in 28%. Median EMS response time was 4.4 minutes (range, 0' 12 min). Overall survival was 79% to hospital discharge. Time interval to EMS arrival, witnessed arrest, bystander CPR, and ventilation method were not associated with survival.

Conclusions: Most OOHRAs occurred at home, and bystander CPR occurred infrequently. The majority of children in OOHRA survived. Strategies to increase the rate of bystander CPR, especially by family members, are needed. Out-of-hospital RAs are a large proportion of all arrests in children. Future studies of pediatric arrest should include RA as well as cardiac arrest.

**Acute coronary syndromes**


High-sensitivity troponin assays facilitate the rapid exclusion of acute myocardial infarction (AMI). However, elevated results are also seen in other conditions causing myocardial injury. Serial measurements increase the specificity for AMI, helping to rapidly identify patients for whom revascularisation may be appropriate. In this study, we explore a strategy for rapidly excluding AMI in symptomatic patients using serial high-sensitivity troponin measurements. Main findings: (1) all patients presenting more than 3h after symptom onset with a negative result had a second negative result; (2) AMI was excluded in all patients with two results falling below the lower limit of detection of a standard troponin assay by 8h post-symptom onset.

ARC Guideline 14.1: Presentation with ACS


Objective: To determine whether evaluation of resting myocardial CT perfusion (CTP) from coronary CT angiography (CTA) datasets in patients presenting with chest pain (CP) to the emergency department (ED), might have added value to coronary CTA. Design, setting: 76 Patients (age 54.9 y±13; 32 (42%) women) presenting with CP to the ED underwent coronary 64-slice CTA. Myocardial perfusion defects were evaluated for CTP (American Heart Association 17-segment model) and compared with rest sestamibi single-photon emission CT myocardial perfusion imaging (SPECT-MPI). CTA was assessed for >50% stenosis per vessel. Results: CTP demonstrated a sensitivity of 92% and 89%, specificity of 95% and 99%, positive predictive value (PPV) of 80% and 82% and negative predictive value (NPV) of 98% and 99% for each patient and for each segment, respectively. CTA showed an accuracy of 92%, sensitivity of 70.4%, specificity of 95.5%, PPV 67.8%, and NPV of 95% compared with SPECT-MPI. When CTP findings were added to CTA the PPV improved from 67% to 90.1%. Conclusions: In patients presenting to the ED with CP, the evaluation of rest myocardial CTP demonstrates high diagnostic performance as compared with SPECT-MPI. Addition of CTP to CTA improves the
The electrocardiographic (ECG) diagnosis of ST-segment elevation myocardial infarction (STEMI) represents a challenge to all health care providers, particularly so for the novice ECG interpreter. We have developed, and present in this article, a 4-step algorithm that will detect STEMI in most instances in the prehospital and other non-emergency department (ED) settings. The algorithm should be used in adult patients with chest pain or equivalent presentation who are suspected of STEMI. It inquires as to the presence of ST-segment elevation as well as the presence of STEMI confounding/mimicking patterns; the algorithm also makes use of reciprocal ST-segment depression as an adjunct in the ECG diagnosis of STEMI. If STEMI is detected by this algorithm, then management decisions can be made based upon this ECG diagnosis. If STEMI is not detected using this algorithm, then we can only note that STEMI is not 'ruled in' importantly, STEMI is not 'ruled out'. In fact, more expert interpretation of the ECG will be possible once the patient (and/or the ECG) arrive in the ED where ECG review can be made with the more complex interpretation used by expert physician interpreters.

Out-of-hospital cardiac arrest has a poor prognosis. The main aetiology is ischaemic heart disease. Aim: To make a systematic review addressing the question: 'In patients with return of spontaneous circulation following out-of-hospital cardiac arrest, does acute coronary angiography with coronary intervention improve survival compared to conventional treatment?' Methods: Peer reviewed articles written in English with relevant prognostic data were included. Comparison studies on patients with and without acute coronary angiography were pooled in a meta-analysis. Results: Thirty-two non-randomised studies were included of which 22 were case-series without patients with conservative treatment. Seven studies with specific efforts to control confounding had statistical evidence to support the use of acute coronary angiography following resuscitation from out-of-hospital cardiac arrest. The remaining 25 studies were considered neutral. Following acute coronary angiography, the survival to hospital discharge, 30 days or six months ranged from 23% to 86%. In patients without an obvious non-cardiac aetiology, the prevalence of significant coronary artery disease ranged from 59% to 71%. Electrocardiographic findings were unreliable for identifying angiographic findings of acute coronary syndrome. Ten comparison studies demonstrated a pooled unadjusted odds ratio for survival of 2.78 (1.89; 4.10) favouring acute coronary angiography. Conclusion: No randomised studies exist on acute coronary angiography following out-of-hospital cardiac arrest. An increasing number of observational studies support feasibility and a possible survival benefit of an early invasive approach. In patients without an obvious non-cardiac aetiology, acute coronary angiography should be strongly considered irrespective of electrocardiographic findings due to a high prevalence of coronary artery disease.

Aims: Admitting patients directly to a heart attack center (HAC) catheter laboratory for primary percutaneous coronary intervention (PPCI) bypassing
the emergency department (ED) might be beneficial in delivering treatment of ST-elevation myocardial infarction with superior outcome. Methods: In this analysis, the clinical outcome of service redesign of the PPCI pathway from ED triggered to a direct catheter laboratory HAC access was assessed in 361 consecutive patients with ST-elevation myocardial infarction treated with a PPCI. Results: A total of 200 patients were admitted via the ED, and 161 were admitted directly to the HAC. Door-to-balloon times and call-to-balloon times were significantly better in the HAC group (median [interquartile range] door-to-balloon times and call-to-balloon times were 39 [26, 53] and 106 [91, 132] minutes, respectively) in comparison with the ED group (82 [49,120; P < .0001] and 130 [103, 164] minutes, respectively [P = .0005]). A non-significant trend to a lower 30-day (5% in the HAC group and 6% in the ED group) and 17-month (8% in HAC group and 11% in ED group) mortality was seen in the HAC group (P = .63). Composite end point analysis of left ventricular ejection fraction less than 50%, thrombolysis in myocardial infarction grades 0 and 1, and myocardial blush scores 0 and 1 showed that a significantly higher number of patients in the ED group experienced at least 1 of the composite events in comparison with the patients in the HAC group (P = .01). Conclusion: A direct-access catheter laboratory (HAC) model of PPCI bypassing the ED should be the favored approach to service delivery with superior outcome.

ANZCOR Guideline 14.3 ACS - Reperfusion strategy


There are limited safety and effectiveness data comparing glycoprotein IIb/IIIa inhibitors in the setting of primary percutaneous coronary intervention. In this substudy of the Harmonizing Outcomes With Revascularization and Stents in Acute Myocardial Infarction (HORIZONS-AMI) trial, the clinical and bleeding outcomes of eptifibatide versus abciximab were evaluated in patients with ST-segment elevation myocardial infarction who underwent percutaneous coronary intervention. Three-year clinical outcomes of patients in the heparin plus glycoprotein IIb/IIIa inhibitor arm were compared according to treatment with abciximab (n = 907) versus eptifibatide (n = 803). Adjudicated end points included major adverse cardiovascular events (MACEs; mortality, re-infarction, ischemia-driven target vessel revascularization, or stroke), major bleeding, and net adverse clinical events (MACEs or major bleeding). Propensity score matching was used to identify 1,342 matched cases (671 each in the abciximab and eptifibatide groups). Multivariate analysis was performed in the entire cohort and the propensity-matched groups. At 3-year follow-up, eptifibatide and abciximab resulted in non-significantly different rates of major adverse cardiovascular events (MACEs) (18.3% vs 19.6%, hazard ratio [HR] 0.93, 95% confidence interval [CI] 0.74 to 1.16, p = 0.51), major bleeding (10.7% vs 11.9%, HR 0.90, 95% CI 0.67 to 1.19, p = 0.44), and net adverse clinical events (24.5% vs 25.5%, HR 0.96, 95% CI 0.79 to 1.17, p = 0.69). Similarly, at 3 years by multivariate analysis, there was no statistically significant difference between abciximab and eptifibatide for net adverse clinical events (HR 0.89, 95% CI 0.73 to 1.09, p = 0.27), MACEs (HR 0.96, 95% CI 0.77 to 1.20, p = 0.73), and major bleeding (HR 1.05, 95% CI 0.78 to 1.41, p = 0.75). The propensity-matched groups also had similar outcomes. In conclusion, abciximab and eptifibatide have comparable bleeding risks and clinical efficacy in primary percutaneous coronary intervention.

ANZCOR Guideline 14.2: ACS - Initial medical therapy


Background: When acute coronary syndrome (ACS) cannot be ruled out, emergency department (ED) patients with chest pain are admitted for in-hospital observation because of the risk of complications such as arrhythmia and acute heart failure. A study was undertaken to compare the ability
of three risk prediction models to identify patients at a very low risk of complications. Methods: 559 consecutive patients with chest pain presenting to the ED and admitted for a suspicion of ACS were prospectively included. Predefined in-hospital complications were recorded and the risk predictions of the Global Registry of Acute Coronary Events (GRACE) risk score, the Freedom-from-Events (FFE) risk score and the Goldman rule were compared using receiver operating characteristics (ROC) curves. Results: Of the 559 patients, 140 had ACS and 32 had at least one complication. The GRACE score was superior to the FFE score in predicting the risk of complications (area under ROC curve 0.76 (95% CI 0.68 to 0.85) vs 0.69 (95% CI 0.60 to 0.79), p=0.021) whereas the Goldman rule (area under ROC curve 0.60; 95% CI 0.49 to 0.72) was inferior to both the GRACE and FFE scores. With the GRACE score set to a negative predictive value of 100% (95% CI 96% to 100%), 108 patients (19.3%) at almost no risk of complications could have been correctly identified in the ED. Conclusion: The GRACE and FFE scores are able to predict low complication risks in patients with chest pain admitted for suspected ACS, but only the GRACE score may be able to identify a significant number of patients at almost no risk of complications. A larger multicentre study is needed to confirm the possibility of using the GRACE score to identify patients suitable for assessment without monitoring.

ANZCOR Guideline 14.1: Presentation with ACS


The aim of this study was to evaluate the additional predictive value of serum potassium (SK) to Thrombolysis In Myocardial Infarction (TIMI) risk score for malignant ventricular arrhythmias (MVA) in patients within 24 hours of acute myocardial infarction (AMI). Methods: This was a 6-year retrospective study. The receiver operating characteristic curve was used to evaluate the predictive value of SK and TIMI risk score for MVA attack. In addition, SK-modified TIMI risk score was created by incorporating SK information into the usual score; the accuracy of new score was compared with that of the usual TIMI risk score by comparing the area under the receiver operating characteristic curves (AUC). Results: Among the 468 patients enrolled, the incidence of MVA 24 hours after AMI was 9.4%, and it was higher in the hypokalemia group compared with that of the normokalemic group (27.3% vs 7.5%, P < .001; odds ratio, 4.594; 95% confidence interval [CI], 2.159-9.774). A significant predictive value of SK was indicated by AUC of 0.787 (95% CI, 0.747-0.823, P < .01). Serum potassium remained a predictor of MVA after being adjusted by the variables in TIMI risk score. The AUC of TIMI risk score in relation to MVA was 0.586 (95% CI, 0.54-0.631; P = .0676). The incorporation of SK into TIMI risk score improved its predictive value for MVA attack (AUC = 0.66; 95% CI, 0.568-0.753; P < 0.001), with significant difference between AUC of the new score and that of the original risk score (Z = 2.474, P = .013). Conclusions: Serum potassium on admission to the emergency department may be used as a valuable predictor and could add predictive information to some extent to TIMI risk score for MVA attack during 24-hour post-AMI.

ANZCOR Guideline 14.1 - Presentation with ACS

37. Venturini JM, Stake CE and Cichon ME, Prehospital Point-of-Care Testing for Troponin: Are the Results Reliable? Prehosp Emerg Care. 2012; Online first (22 August)

Swift assessment of patients presenting with chest pain results in faster treatment and improved outcomes. Allowing ambulance crews to use point-of-care (POC) devices to measure cardiac troponin I levels during transport of patients to the emergency department (ED) may result in earlier diagnosis of acute myocardial infarction, particularly in those patients without ST-segment elevation. The ability of POC devices to measure cardiac troponin I levels reliably in a moving ambulance has not previously been tested. Objective. This study was conducted to determine whether POC devices operated in a moving ambulance reliably duplicate the measurement of cardiac troponin I levels obtained by POC devices in the ED.

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Methods. Blood samples were obtained in the ED and the hospital from patients reporting chest pain or other cardiac complaints. Troponin I assays were then performed in a moving ambulance using two POC devices. The POC devices were placed on flat surfaces in the rear of the ambulance. The ambulance driver was instructed to keep the ambulance moving in traffic while each assay was completed. A variety of routes were taken. Each set of two assays was completed entirely during a single simulated run. The results of the two assays performed in the moving ambulance were then compared with the results of the control assay, which was performed simultaneously in the ED on the same sample. Results. Forty-two whole-blood samples underwent troponin I assays in a moving ambulance. Thirteen (30.9%) assays were positive. One (2.4%) was excluded because of cartridge error. Two (4.8%) were excluded because of interfering substance. No significant difference in whole-blood troponin results was found between the assays performed in the moving ambulance and those performed in the ED (intraclass correlation coefficient 0.997; 95% confidence interval 0.994 to 0.998; p < 0.005). Conclusions. When used in a moving ambulance, the POC device provided results of cardiac troponin I assays that were highly correlated to the results when the device was used in the ED. The feasibility, practicality, and clinical utility of prehospital use of POC devices must still be assessed.

ANZCOR Guideline 14.1: Presentation with ACS

**Neonatal resuscitation**


Aim: Auscultation and palpation are recommended methods of determining heart rate (HR) during neonatal resuscitation. We hypothesized that: (a) detection of HR by auscultation or palpation will vary by more than ±15 BPM from actual HR; and (b) the inability to accurately determine HR will be associated with errors in management of the neonate during simulated resuscitation. Subjects and methods: Using a prospective, randomized, controlled study design, 64 subjects participated in three simulated neonatal resuscitation scenarios. Subjects were randomized to technique used to determine HR (auscultation or palpation) and scenario order. Subjects verbalized their numeric assessment of HR at the onset of the scenario and after any intervention. Accuracy of HR determination and errors in resuscitation were recorded. Errors were classified as errors of omission (lack of appropriate interventions) or errors of commission (inappropriate interventions). Cochran’s Q and chi square test were used to compare HR detection by method and across scenarios. Results: Errors in HR determination occurred in 26, 48% of initial assessments and 26, 52% of subsequent assessments overall. There were neither statistically significant differences in accuracy between the two techniques of HR assessment (auscultation vs palpation) nor across the three scenarios. Of the 90 errors in resuscitation, 43 (48%) occurred in association with errors in HR determination. Conclusions: Determination of heart rate via auscultation and palpation by experienced healthcare professionals in a neonatal patient simulator with standardized cues is not reliable. Inaccuracy in HR determination is associated with errors of omission and commission. More reliable methods for HR assessment during neonatal resuscitation are required.

ANZCOR Guideline 13.3: Assessment of the newborn infant

**General papers**

*ANZCOR Research updates August 2012*

Objective: To determine the greenhouse gas emissions associated with the energy consumption of Australian ambulance operations, and to identify the predominant energy sources that contribute to those emissions.

Methods: A two-phase study of operational and financial data from a convenience sample of Australian ambulance operations to inventory their energy consumption and greenhouse gas emissions for 1 year. State- and territory-based ambulance systems serving 58% of Australia's population and performing 59% of Australia's ambulance responses provided data for the study. Results: Emissions for the participating systems totalled 67 390 metric tons of carbon dioxide equivalents. For ground ambulance operations, emissions averaged 22 kg of carbon dioxide equivalents per ambulance response, 30 kg of carbon dioxide equivalents per patient transport and 3 kg of carbon dioxide equivalents per capita. Vehicle fuels accounted for 58% of the emissions from ground ambulance operations, with the remainder primarily attributable to electricity consumption. Emissions from air ambulance transport were nearly 200 times those for ground ambulance transport.

Conclusion: On a national level, emissions from Australian ambulance operations are estimated to be between 110 000 and 120 000 tons of carbon dioxide equivalents each year. Vehicle fuels are the primary source of emissions for ground ambulance operations. Emissions from air ambulance transport are substantially higher than those for ground ambulance transport.


Objectives: Delays in the clinical handover of patient care from emergency medical services (EMS) to the ED because of ED crowding are a substantial problem for many EMS systems. This study was conducted to quantify handover delays experienced by the Ambulance Service of New South Wales (ASNSW), and to investigate patient and system factors associated with handover delay.

Methods: A retrospective study of EMS dispatch and ambulance patient care records was conducted for all patients transported by ASNSW in January/April/July/October 2009. Patient characteristics and time intervals were summarised using descriptive statistics, with handover delay categorised as <30 min, 30–60 min and ≥60 min. Times are reported as HH:MM:SS. Partial proportional odds models were used to investigate factors associated with delays. Results: Of 141 381 transports, 12.5% of patients experienced a handover delay of 30–60 min, and 5% a delay of ≥60 min. The median handover interval was 00:15:46 (IQR 00:08:58–00:24:52, maximum 08:43:13). Patients transported to large hospitals were more likely to experience a delay of ≥30 min (odds ratio [OR] 14.57, 95% CI 11.41–18.60) or ≥60 min (OR 15.75, 95% CI 12.27–20.23) than those transported to small hospitals. Patients in major cities were more likely to experience delays than those in other areas, and patients ≥65 years were more likely to experience delays than those <16 years. Delays were most likely in winter. Cardiac and major trauma patients had the lowest likelihood of experiencing delays. Conclusions: Handover delays are relatively common at the EMS/ED interface in New South Wales, and are most pronounced at large hospitals, in urban areas and during winter.


Alcohol intoxicated individuals account for a significant proportion of emergency department care and may be eligible for care at alternative sobering facilities. This pilot study sought to examine intermediate-level emergency medical technician (EMT) ability to identify intoxicated individuals who may be eligible for diversion to an alternative sobering facility.

Methods: Intermediate-level EMTs in an urban fire department completed patient
assessment surveys for individual intoxicated patients between May and August 2010. Corresponding patient medical records were retrospectively reviewed for diagnosis, disposition, and blood alcohol content. Statistical analysis was conducted to determine correlates of survey response, diagnosis, and disposition; and survey sensitivity and specificity were calculated. Results One hundred ninety-seven patient transports and medical records were analyzed. Emergency medical technicians indicated 139 patients (71%) needed hospital-based care, and 155 patients (79%) had a primary ethanol diagnosis. Fourteen patients (7%) were admitted to the hospital, and EMTs identified 93% of admitted patients as requiring hospital-based care. Overall sensitivity and specificity of the survey were 93% (95% confidence interval, 66.1-99.8) and 40% (95% confidence interval, 33.3-47.9), respectively. Conclusion: Intermediate-level EMTs may be able to play an important role in facilitating triage of intoxicated patients to alternate sobering facilities.

Damage control resuscitation (DCR) conveys a survival advantage in patients with severe haemorrhage. The role of restrictive fluid resuscitation (RFR) when used in combination with DCR has not been elucidated. We hypothesize that RFR, when used with DCR, conveys an overall survival benefit for patients with severe hemorrhage. METHODS: This is a retrospective analysis from January 2007 to May 2011 at a Level I trauma center. Inclusion criteria included penetrating torso injuries, systolic blood pressure less than or equal to 90 mm Hg, and managed with DCR and damage control surgery (DCS). There were two groups according to the quantity of fluid before DCS: (1) standard fluid resuscitation (SFR) greater than or equal to 150 mL of crystalloid; (2) RFR less than 150 mL of crystalloid. Demographics and outcomes were analyzed. RESULTS: Three hundred seven patients were included. Before DCS, 132 (43%) received less than 150 mL of crystalloids, grouped under RFR; and 175 (57%) received greater than or equal to 150 mL of crystalloids, grouped under SFR. Demographics and initial clinical characteristics were similar between the study groups. Compared with the SFR group, RFR patients received less fluid preoperatively (129 mL vs. 2,757 mL; p < 0.001), exhibited a lower intraoperative mortality (9% vs. 32%; p < 0.001), and had a shorter hospital length of stay (13 vs. 18 days; p = 0.02). Patients in the SFR group had a lower trauma intensive care unit mortality (5 vs. 12%; p = 0.03) but exhibited a higher overall mortality. Patients receiving RFR demonstrated a survival benefit, with an odds ratio for mortality of 0.69 (95% confidence interval, 0.37, 0.91). CONCLUSION: To the best of our knowledge, this is the first civilian study that analyzes the impact of RFR in patients managed with DCR. Its use in conjunction with DCR for hypotensive trauma patients with penetrating injuries to the torso conveys an overall and early intraoperative survival benefit.

Intravenous (IV) line placement is an important prehospital advanced life support skill, but IV success rates are variable among providers. Little is known about what factors are associated with successful IV placement, limiting the ability to develop benchmarks for skill maintenance, such as requiring a specific number of IV placements per year. Objective. We aimed to identify whether first-pass IV success was associated with the number of attempted or successful previous IV attempts. We hypothesized that IV success is associated with the number of successful IV placements in the preceding year. Methods. We retrospectively studied 800 consecutive charts with an IV attempt from 11 suburban and rural emergency medical services (EMS) agencies over a one-month period. Cases involving pediatric patients (age <18 years) and those with incomplete data were excluded. Success of the first IV attempt was identified. Potential predictor variables were collected and analyzed by univariate logistic regression, including patient age, systolic blood pressure, history of IV drug abuse or renal disease, traumatic event, catheter
size, and location of IV attempt, as well as the individual provider's numbers of total and successful IV attempts in the preceding year. Variables significantly associated with IV success at the p < 0.10 level were included in a multivariate regression model using a p-value of 0.05. Results. Of 602 cases meeting the study criteria, 469 (77.9%) had a successful first-pass IV placement. Significantly associated with IV success in the univariate regression were patient age (p = 0.054), trauma (p = 0.074), IV catheter size (p < 0.001), IV location (p = 0.056), and the number of previous successful IV attempts (p = 0.039), whereas the number of total previous IV attempts was not significantly associated (p = 0.871). In the multivariate logistic regression model, only IV catheter size had a significant association (p < 0.001), with a larger-bore IV catheter size associated with higher success. Conclusion. In this retrospective study, larger IV catheter size, but not the prehospital providers' previous year's experience, was associated with successful IV placement in adult patients. These data fail to support requirements for a minimum number of yearly IV placements by full-time paramedics to improve success rates.

The purpose of this analysis was to determine whether there is an association between type of emergency medical services (EMS) medical direction and local EMS agency practices and characteristics specifically related to emergency response for acute cardiovascular events. Methods. We surveyed 1,292 EMS agencies in nine states. For each cardiovascular prehospital procedure or practice, we compared the proportion of agencies that employed (full- or part-time) medical directors with the proportion of agencies that employed volunteer medical directors. We also compared the proportion of EMS agencies who reported direct interaction between emergency medical technicians (EMTs) and their medical director within the previous four weeks with the proportion of agencies who reported no direct interaction. Chi-square tests were used to assess statistical differences in proportion of agencies with a specific procedure by medical director employment status and medical director interaction. We repeated these comparisons using t-tests to evaluate mean differences in call volume. Results. The EMS agencies with prehospital cardiovascular response policies were more likely to report employment of a paid medical director and less likely to report employment of a volunteer medical director. Similarly, agencies with prehospital cardiovascular response practices were more likely to report recent medical director interaction and less likely to report absence of recent medical director interaction. Mean call volumes for chest pain, cardiac arrest, and stroke were higher among agencies having paid medical directors (compared with agencies having volunteer medical directors) and agencies having recent medical director interaction (compared with agencies not having recent medical director interaction). Conclusions. Our study demonstrated that EMS agencies with a paid medical director and agencies with medical director interaction with EMTs in the previous four weeks were more likely to have prehospital cardiovascular procedures in place. Given the strong relationship that both employment status and direct interaction have with the presence of these practices, agencies with limited resources to provide a paid medical director or a medical director that can be actively involved with EMTs should be supported through partnerships and other interventions to ensure that they receive the necessary levels of medical director oversight.

Aim: To identify what 10 - 11-year-old children do and do not learn during a 10 minute session teaching the recovery position, with a view to suggesting possible improvements in training. Methods: Participants were 148 boys and 144 girls. Before intervention, safety knowledge was assessed in a pencil and paper test. 198 children were taught the recovery position at a safety education centre. Three months later, their attempts to leave a casualty in a safe position were observed, and compared with the attempts of 94 children who had not received training. Results: 19% of the control group and 31% of trained children successfully placed a casualty in the recovery position. Only two of the seven standard routine moves
were used by more than 50% of trained children, namely raise the casualty’s leg to a flexed position, roll the casualty on to his/her side. Even when performed, these and other individual moves were often not integrated into an effective routine. Conclusions: The implication is that in a short session it is over-ambitious to attempt to teach a complex routine. It is more realistic to focus on a few moves which are easily learnt. The present results suggest that these should be flexing the leg and rolling the casualty on to his/her side. In this study, simply improving the participants’ performance of these two moves could increase the number of learners who are successful from less than a third to nearly 50%.

This study evaluated the reliability of patient-completed medication reconciliation forms (MRs) compared with pharmacy-generated lists and determined if there was a difference in concordance when patients completed the forms from memory compared with when they brought a separate list or pill bottles. Methods: We prospectively enrolled patients with completed MRs. Research assistants contacted the patient’s pharmacy to determine medications filled in the prior 3 months, which was compared with the MR. Discrepancies and the method by which the patient completed the MR (memory, list, or pill bottles) were recorded. Results: Three hundred fifteen patients were enrolled. Thirty-three percent made errors of omission (reported by pharmacy, but not on MR), 12.7% made errors of addition (reported on MR, but not by pharmacy), 18.1% made both types of errors, and 36.3% made no errors. Patients with errors were on 5.6 medications compared with 3.6 medications for those without errors (P < 0.0001). Those completing the MR from a list made 2.3 errors compared with 1.2 for those completing from memory and 1.8 for those completing from their pill bottles (P < 0.001). Of 390 medications omitted from patient lists, 16% were cardiac medications, 13% were neuropsychiatric agents, and 9.5% were narcotics. Conclusions: Thirty-six percent of patients were able to provide a medication list that matched their pharmacy-prescribed drugs. More errors were noted from patients taking more medications and from those completing their MR from a separate list.

Studies of sudden cardiac death (SCD) demonstrate overwhelmingly poor outcomes regardless of the population or intervention studied. Although SCD is a complex critical illness that is understood poorly, it is clear that outcomes are influenced by timely provision of high-quality, specific interventions. However, there is considerable heterogeneity within this group of patients with regard to the cause of SCD, comorbidities, and duration of the cardiac arrest event that can be difficult to identify during the course of resuscitation. These variables can have a significant bearing on outcomes and efficacy of treatment. For example, compression-only bystander cardiopulmonary resuscitation (CPR) may not be ideal for all subgroups of patients experiencing SCD. In addition, a proportion of SCD patients have a significant coronary artery lesion and benefit from percutaneous coronary intervention (PCI). Finally, post–ventricular fibrillation cardiac arrest patients may respond better to therapeutic hypothermia (TH) than those with other rhythms before the return of spontaneous circulation (ROSC)...

Objective: To assess the agreement between noncontact infrared thermometer (noncontact) with infrared tympanic thermometer (tympanic) and electronic axillary thermometer (axillary) in an adult emergency department population. Materials and methods: This is a single-center, cross-sectional, prospective trial carried out in a Joint Commission accredited private hospital in Turkiye. All consecutive patients above 16 years were included in the study. The agreements between three methods were analyzed by Bland–Altman analysis with MedCalc 11.0.4 statistical software.
Results: Body temperatures were measured on 400 patients (48% were men, mean 35.9±17.3°C). Mean noncontact, tympanic, and axillary measurements (±SD) were 37.22±1.03, 36.72±0.95, and 36.91±0.96°C, respectively, whereas Intraclass Correlation Coefficient of all measurements was 0.892 (95% confidence interval 0.821–0.929). Binary comparisons between body temperature measurements produced mean differences Δ axillary–tympanic, Δ axillary–noncontact, and Δ tympanic–noncontact as 0.5±0.63, 0.2±0.71, and 0.31±0.61°C, respectively. However, the agreement limits for axillary and noncontact was between −1.2 and 1.6°C; −1.74 and 0.74°C for tympanic and noncontact, and −1.52 and 0.9°C for tympanic and noncontact. Conclusion: There is a lack of agreement between body temperature measurements by noncontact, tympanic, and axillary in the adult emergency department population. The easy application may lead noncontact to be the preferable method for healthcare providers but large agreement limits should be considered.


Purpose: We tested the hypothesis that the motor component of the Glasgow Coma Scale (GCS) conveys most of the predictive information of triage scores (Triage Revised Trauma Score [T-RTS] and the Mechanism, GCS, Age, arterial Pressure score [MGAP]) in trauma patients. Method: We conducted a multicenter prospective observational study and evaluated 1690 trauma patients in 14 centers. We compared the GCS, T-RTS, MGAP, and Trauma Related Injury Severity Score (reference standard) using the full GCS or its motor component only using logistic regression model, area under the receiver operating characteristic curve, and reclassification technique. Results: Although some changes were noted for the GCS itself and the Trauma Related Injury Severity Score, no significant change was observed using the motor component only for T-RTS and MGAP when considering (1) the odds ratio of variables included in the logistic model as well as their discrimination and calibration characteristics, (2) the area under the receiver operating characteristic curve (0.827 ± 0.014 vs 0.831 ± 0.014, P = .31 and 0.863 ± 0.011 vs 0.859 ± 0.012, P = .23, respectively), and (3) the reclassification technique. Although the mortality rate remained less than the predetermined threshold of 5% in the low-risk stratum, it slightly increased for MGAP (from 1.9% to 3.9%, P = .048). Conclusion: The use of the motor component only of the GCS did not change the global performance of triage scores in trauma patients. However, because a subtle increase in mortality rate was observed in the low-risk stratum for MGAP, replacing the GCS by its motor component may not be recommended in every situation.

And….eat more chocolate, work fewer shifts and, disappointingly, drink more non-alcoholic wine


Cardiovascular disease is the leading cause of death in industrialised nations and is associated with high costs. Hence, identifying cost-effective measures to prevent such a disease and its risk factors that are palatable remains a top priority for public health. Modifiable lifestyle factors including dietary habits have been recognised as a cornerstone in the prevention of cardiovascular disease. Among healthy food groups, beneficial effects of whole grains, fruits and vegetables, nuts and low sodium intake on heart disease have been well documented, perhaps, partially due to a high content of flavonoids of those foods. Cocoa and dark chocolate are a natural source of flavonoids and consumption of dark chocolate may confer cardiovascular benefits. However, there are limited and inconsistent …

Objective: To synthesise the association of shift work with major vascular events as reported in the literature. Data sources Systematic searches of major bibliographic databases, contact with experts in the field, and review of reference lists of primary articles, review papers, and guidelines.

Study selection: Observational studies that reported risk ratios for vascular morbidity, vascular mortality, or all cause mortality in relation to shift work were included; control groups could be non-shift (“day”) workers or the general population. Data extraction: Study quality was assessed with the Downs and Black scale for observational studies. The three primary outcomes were myocardial infarction, ischaemic stroke, and any coronary event. Heterogeneity was measured with the I² statistic and computed random effects models.

Results: 34 studies in 2 011 935 people were identified. Shift work was associated with myocardial infarction (risk ratio 1.23, 95% confidence interval 1.15 to 1.31; I²=0) and ischaemic stroke (1.05, 1.01 to 1.09; I²=0). Coronary events were also increased (risk ratio 1.24, 1.10 to 1.39), albeit with significant heterogeneity across studies (I²=85%). Pooled risk ratios were significant for both unadjusted analyses and analyses adjusted for risk factors. All shift work schedules with the exception of evening shifts were associated with a statistically higher risk of coronary events. Shift work was not associated with increased rates of mortality (whether vascular cause specific or overall). Presence or absence of adjustment for smoking and socioeconomic status was not a source of heterogeneity in the primary studies. 6598 myocardial infarctions, 17 359 coronary events, and 1854 ischaemic strokes occurred. On the basis of the Canadian prevalence of shift work of 32.8%, the population attributable risks related to shift work were 7.0% for myocardial infarction, 7.3% for all coronary events, and 1.6% for ischaemic stroke.

Conclusions: Shift work is associated with vascular events, which may have implications for public policy and occupational medicine.


Experimental studies have shown a potential blood pressure (BP) lowering effect of red wine polyphenols, while the effects of ethanol and polyphenols on BP in humans are not yet clear. Objective: The aim of the present work was to evaluate the effects of red wine fractions (alcoholic and non-alcoholic) on BP and plasma nitric oxide (NO) in subjects at high cardiovascular risk. Methods and Results: Sixty-seven men at high cardiovascular risk were studied. After a 2-week run-in period, subjects were randomized into three treatment periods in a cross-over clinical trial, with a common background diet plus red wine (30g alcohol/d), the equivalent amount of dealcoholized red wine, or gin (30g alcohol/d), lasting 4 weeks each intervention. At baseline and after each intervention, anthropometrical parameters, BP and plasma NO were measured. Systolic and diastolic BP decreased significantly after the dealcoholized red wine intervention and these changes correlated with increases in plasma NO. Conclusions: Dealcoholized red wine decreases systolic and diastolic BP. Our results point out through a NO-mediated mechanism. The daily consumption of dealcoholized red wine could be useful for the prevention of low to moderate hypertension.