

ABSTRACTS

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Reduced quality of in vitro clot formation with gelatin based plasma substitutes

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We investigated the physical properties of blood clot formed in vitro when fresh blood was diluted with gelatin based colloid solutions compared with crystalloid controls over a wide range of dilutions. Both of the colloid solutions tested were found to produce clots that had reduced weight and reduced shear modulus (using thromboelastography) compared with controls. These differences were statistically significant [$P < 0.01$ for 4% succinylated gelatin ("Gelofusine") and $P < 0.001$ for 3.5% polygeline ("Haemaccel")]. No changes were found in the haematological composition of these clots, suggesting that the gelatin based colloid solutions may alter their physical structure. This theory is supported by finding normal consumption of fibrinogen with no evidence of fibrin degradation. Scanning electron microscopy showed that the fibrin formed a less extensive mesh in the presence of the gelatin based colloids. Conventional screening using coagulation times only detects changes up to the formation of a coagulum, and does not assess clot quality. While many workers have documented reduction in clot quality with the various dextran and hydroxyethyl starch infusions, we have found no similar studies on gelatin based colloids. Further work is being conducted to ascertain if this occurs in vivo, as these solutions are frequently used in patients who require full haemostatic competence.

The effect of full paramedic ALS activities on survival from adult out-of-hospital cardiac arrest

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Out-of-hospital cardiac arrest is the leading cause of sudden death in the United Kingdom. The components of early access, basic life support, and early defibrillation have all been shown to affect outcome. The beneficial effect of defibrillation by standard ambulance crews (EMT-Ds) and paramedics has been described, but in the United Kingdom the additional contributions made by ALS techniques including intubation, IV tech-

niques, and drug administration are not known. *Methods* - 412 out-of-hospital cardiac arrests were prospectively studied during the period 1 June 1994 to 31 May 1995. Data was entered onto a standard database using the Utstein template. *Results* - 62% of patients were treated by paramedics. The periarrest events, including whether the arrest was witnessed, bystander CPR, and the primary ECG rhythm, were similar in the patients treated by EMT-Ds and paramedics. For the entire study group, no improvement could be shown in outcome for the group treated by paramedics and receiving ALS interventions. For patients with the presenting rhythm of ventricular fibrillation, all outcome measures including restoration of spontaneous circulation (58% v 41%), survival to hospital admission (50% v 30%), and discharge from hospital (20% v 9%) were better in the patients treated by EMT-Ds. Call-response intervals were identical for EMT-Ds and paramedics. The time spent at scene (27 v 16 min) and time from call to A&E department arrival (45 v 36 min) were significantly longer for paramedics ($P < 0.0001$). *Conclusions* - There is no benefit in terms of outcome from paramedics using ALS techniques including tracheal intubation, controlled ventilation, IV access, and drug treatment following out-of-hospital cardiac arrest.

Endotoxin translocation and cytokine production in a pig model of haemorrhage and injury

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Multiple organ failure remains the main cause of death from major trauma after the first 24 hours. This may be the result of a generalised inflammatory response, which is stimulated by the translocation of organisms and/or endotoxin from the gut. Our aim was to investigate how haemorrhage and nerve stimulation (mimicking injury) affect blood flow to the gut and gut mucosal barrier function, assessed by the presence of an endotoxaemia. Young Large White pigs (15-32 kg) were anaesthetised with alphadolone/alphaxolone (15 mg·kg⁻¹·h⁻¹) and allocated to one of three groups: haemorrhage alone (30% estimated total blood volume at 1%·min⁻¹; HA); an identical haemorrhage on a background of bilateral brachial nerve stimulation (HNS); control (untreated) (CTRL). After a 30 min shock period (HA, HNS), the shed blood was reinfused and animals of all groups monitored for a further 3 h. Blood was sampled from the portal vein for assays of endotoxin, tumour

necrosis factor (TNF), and interleukin 6 (IL-6). CTRL animals were stable throughout. Gut blood flow fell after haemorrhage in HA and HNS. After resuscitation gut flow was partly restored in HNS, then showed a progressive decline, but was fully restored and maintained in HA. Endotoxin levels in portal blood remained low in CTRL throughout the study. In HA and HNS, endotoxin levels diverged from CTRL 1 h after resuscitation, reaching 68(SEM 29) pg·ml⁻¹ in HA and 100(35) pg·ml⁻¹ in HNS 2 h later compared to 35(11) pg·ml⁻¹ in CTRL at the same time. Cytokine results show that in this model the production of TNF and IL-6 is stimulated, with TNF preceding IL-6. Thus haemorrhage and/or nerve stimulation ("injury") reduce gut blood flow and impair mucosal barrier function, leading to an endotoxaemia and the production of proinflammatory cytokines.

Capnography in non-intubated, spontaneously breathing patients in an emergency room setting

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Expiratory capnography is commonly used in anaesthetic practice to detect problems such as oesophageal intubation, apnoea, hyperventilation, and airway obstruction. It is not routinely used to monitor non-intubated, spontaneously breathing patients. We examined the feasibility of using capnography to monitor self ventilating patients. *Methods* - Patients admitted to the resuscitation room were assessed for widespread expiratory wheeze. This was taken as evidence of airway obstruction. Patients without wheeze were used as controls. Expiratory capnograms were obtained. The traces were analysed for basic morphology and, when appropriate, to determine the slope ratio (SR) between phase 1 (S1) and phase 2 (S2) of the curve. *Results* - 38 patients with a variety of clinical conditions, causing potential or actual respiratory impairment, were studied. All patients tolerated the capnogram cannulae. 12 patients had no clinical evidence of airway obstruction. All showed capnograms of normal morphology. 11 were analysed further. The mean value for SR was 7.57 (SEM 0.18; 95% CI 6.37 to 8.77). 26 patients had airway obstruction. The capnograms showed obstructive, "shark's fin", morphology. 14 were analysed to determine SR. The mean value was 31.9 (SEM 4.46; 95% CI 22.9 to 40.8). There is a significant difference in the mean value for

SR between the two groups ($P < 0.0005$). *Conclusions* – (1) Capnography is possible in spontaneously breathing patients; (2) capnography curve analysis identifies airway obstruction in spontaneously breathing patients; (3) further work is required to correlate curve indices to degree of airway obstruction.

Evaluation of the effect of colloid (Haemaccel) on the bleeding time in trauma patients

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Anecdotal reports suggest that trauma patients who receive Haemaccel have an increased bleeding tendency. The aim of this study was to compare the effects of resuscitation with a crystalloid (Ringer's lactate) to a colloid (Haemaccel) on the bleeding time. 25 consecutive patients who presented to the Johannesburg Hospital were recruited. All patients had received blunt or penetrating trauma, required fluid resuscitation (secondary), were over the age of 16 and had reached the trauma unit within 2 h of injury. The pre-hospital resuscitation (primary) was in accordance with the ATLS guidelines and included the use of Ringer lactate as the sole plasma expander. On arrival a bleeding time (Simplate type II method) and a full coagulation screen were obtained. The patients were then randomised to receive either Ringer lactate or Haemaccel until the resuscitation was complete, indicated by stable vital signs. The volume of fluid infused and a post secondary resuscitation bleeding time and coagulation screen were obtained. Both groups had similar bleeding times following pre-hospital resuscitation. Following secondary resuscitation the Haemaccel group had a significant increase ($P < 0.05$, Mann-Whitney U Test) in bleeding time of 5.5 (2.8 to 7.3) min [median (interquartile range)] compared to those treated with crystalloid, 2.3 (1.1 to 2.5) min from respective pre-secondary resuscitation bleeding times of 6.0 (3.6 to 7.5) and 5.3 (4.5 to 6.8) min. The thrombin, prothrombin, and partial thromboplastin times were not significantly altered in either group following resuscitation. The platelet count was noted to be reduced in both groups. This was not, however, clinically significant. These results indicate that the Haemaccel produces a greater increase in bleeding time than Ringer lactate; the mechanism for this remains unclear.

Effect of moderate head injury on trauma outcome

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In multisystem trauma, injury to specific body systems may alter the pathophysiological response to injury. This in turn may adversely affect outcome. To examine the effect of injury to the central nervous system on the survival after

multiple trauma, we carried out an analysis of the UK major trauma outcome study database. Moderate brain injury was defined using the 1990 revision of the abbreviated injury scale as a score of 3. The study population included 2717 patients with multisystem trauma, of whom 378 had a moderate brain injury and 2339 had no head injury. We compared mortality rates for both groups in the presence of increasing injury severity (ISS 16–50). In addition we also examined the effect of age and pre-existing diseases in the two groups. The mortality rate for moderate brain injury in isolation was also examined. The results show an increased mortality rate in the brain injured group for all three confounding factors. Logistic regression analysis was performed to determine the remaining effect of moderate brain injury having accounted for age, pre-existing diseases, and injury severity. Moderate brain injury in isolation is associated with a very low mortality rate (4.7%). However, moderate brain injury associated with multiple trauma was found to almost double the risk of death [odds ratio 1.96 (95% confidence interval 1.48 to 2.59)]. This is an important observation as 50% of trauma deaths have an associated head injury. In future, with a better the understanding of the pathophysiology of head injury together with the introduction of neuroprotective agents, it may be possible to improve outcome.

Into bed with Auntie: a multicentre evaluation of the BBC "999" CPR training roadshow

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Objective – To evaluate the skill levels of volunteers 6 months after training by the BBC "999" roadshow scheme using a test which attempts to recreate the unpreparedness and stress of a true cardiac event. *Background* – The provision of bystander cardiopulmonary resuscitation (CPR) has been shown to improve survival from out-of-hospital cardiac arrest. As a result, citizen CPR has become an accepted part of the overall strategy to reduce mortality from ischaemic heart disease. Television is an effective way of generating large cohorts of volunteers for training. However, the results of such training have previously gone unrecorded or have been tested too soon after training, or in a way which allowed prior revision or practice. *Methods* – We developed the "Cardiff video cold call" test, validated it against ERC guidelines and ensured its robustness by minimising intra- and interobserver variation. We then applied it to a nationwide systematic sample of 280 people in nine United Kingdom cities drawn from our database of 7584 BBC trained individuals. The test sample received an unsolicited home visit and without warning were required to perform manikin CPR while being videoed (only 9.1% refused). These videos were then analysed for effectiveness and safety using the new test. *Results* – 33 trainees (11.8%) were able to perform

effective CPR but of these 14 (5%) performed one or more elements in a way that was deemed to be potentially harmful. Thus only 19 trainees (6.8%) were able to 6 months to provide safe and effective CPR. In addition large numbers of subjects failed to shout for help, to assess the status of the casualty effectively, or to alert the ambulance service. Significantly better performances were recorded by those under 44 years old ($P < 0.05$), those who had attended a subsequent CPR course ($P < 0.0001$) and those confident in their initial ability ($P < 0.005$). Females were significantly less likely to perform procedures in a harmful way ($P < 0.005$). *Conclusions* – Television is an effective means of generating large training cohorts. Volunteers will cooperate with video cold call testing. Such testing attempts to be a realistic creation of the stress and lack of forewarning that would surround a real event. Under such conditions CPR performance is very disappointing. However, subsequent repeat training greatly improves performance. We intend to work with the BBC in improving the effectiveness of their welcome initiative. In particular it is important to resolve whether poor performance is related to poor training, poor retention or both.

A comparison of glucagon and glucose in prehospital hypoglycaemia

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At present ambulance crews in Devon and Cornwall treat hypoglycaemia with intramuscular glucagon. This study was to investigate whether using intravenous glucose would shorten the duration of hypoglycaemia. The trial consisted of two phases. In the first phase, hypoglycaemia was treated by giving 1 mg of glucagon intramuscularly, according to current protocols. In the second phase patients were treated with 50 ml of 50% glucose given intravenously. If intravenous access was not secured, glucagon was given. There were nine patients in phase one and 20 in phase two. The symptoms, initial Glasgow coma score, and Glucostix readings were similar in the two groups, as was the time between ambulance arrival and diagnosis of hypoglycaemia. Five patients in the second group required glucagon because of failed intravenous cannulation. The mean duration of hypoglycaemia from diagnosis to full orientation in phase one was 35.6 min (range 17–100 min) and in phase two, 14.3 min (4–24 min). This was statistically significant ($P < 0.05$). In those patients in phase two actually treated with glucose (ie, excluding those who required glucagon because of failed cannulation) the mean duration of hypoglycaemia was 10.5 min. Following injection of glucose, the mean time to full orientation was 4.8 min (0.5–14 min), compared to a mean of 26.8 min (15–70 min) following glucagon. Thus there was a significant reduction in the duration of hypoglycaemia with the prehospital use of intravenous glucose; it is envisaged that local ambulance protocols will be revised to take this into account.

A comparison of two local anaesthetic techniques for acute anterior shoulder dislocation

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Intra-articular local anaesthetic (IALA) and a suprascapular nerve block (SSNB) were used to provide analgesia for patients presenting to accident and emergency (A&E) with acute anterior glenohumeral dislocations. There were seven patients in each group. The male to female ratios and the mean ages were comparable for both groups. The mean pain score before each procedure was 8.42(SD 1.13) for the IALA patients and 8.57(1.13) for the SSNB group. An arthrogram was performed in all the IALA patients to confirm the intra-articular location of the local anaesthetic. There was a statistically significant decrease in pain scores in the IALA and SSNB patients to 0.28(0.49) and 5.71(1.25) ($P < 0.001$) respectively at second pain assessment, 15 min after the technique had been employed. The IALA provided excellent analgesia in all patients, while the SSNB failed to provide analgesia in one patient. Four SSNB patients required supplemental Entonox because of pain experienced during the reduction procedure. All reductions were successful but two patients in each group required intravenous sedation or analgesia to facilitate reduction. There were no complications from either procedure. We conclude that while a suprascapular nerve block provides analgesia in the majority of patients with anterior shoulder dislocations, it does not reduce pain to the desired level for comfortable reduction. Intra-articular local anaesthetic is a quick and simple technique which provides excellent analgesia without the cardio-respiratory side effects of intravenous sedation/analgesia and it permits prompt discharge from A&E once reduction has been achieved.

"Death below the line" – threshold for treatment of patients with paracetamol overdose

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The National Poisons Centres publish nomograms to identify patients considered at risk of hepatotoxicity from paracetamol overdose. Above the standard treatment line there is a 60% risk of serious liver damage (AST > 1000 IU/litre). The

King's liver unit has seen four patients in the past two years with paracetamol levels judged below this treatment line, not treated with N-acetylcysteine, who subsequently died of acute liver failure. In a postal survey 60 accident and emergency (A&E) consultants were asked to choose a treatment plan for a patient who had taken a paracetamol overdose 4 h previously; 30 were given a 4 h level of 0.9 mmol/litre and 30 a level of 1.1 mmol/litre. The survey results (table) show inconsistent management of patients below the treatment line.

To see if consultants' opinions mirror a confusion in clinical practice, the biochemistry results from overdose patients seen in King's A&E over a 10 month period were retrospectively analysed. 268 patients had paracetamol detected in their blood; 16 had levels greater than 1.33 mmol/litre; 26 had levels between 0.7 and 1.33 mmol/litre, considered below the treatment line, but 13 were in fact treated. Two patients were sent home with blood levels of 1.1 mmol/litre untreated. With the exact timing of an overdose difficult to establish and a potentially dangerous period existing when the nomogram curve is at its steepest (blood levels of 0.7–1.33 mmol/litre, 4–8 h postingestion), a 1 h error can disguise a level that is actually above the treatment line, putting a patient at risk of serious liver damage. We recommend that all patients with levels > 1.0 mmol/litre, regardless of the time of the overdose, are given intravenous N-acetylcysteine, and that those with levels between 0.7 and 1.0 mmol/litre have a level repeated after 2 h. From our study only two to three patients extra per month need to be treated to prevent missing patients who may go on to develop acute liver failure.

The use of ultrasound in the non-invasive detection of changes in the renal circulation in response to blood loss using an animal model

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Using a continuous haemorrhage model, eight anaesthetised swine were bled 1 ml·kg⁻¹·min⁻¹ for 30 min. The resistance index (RI) of the main renal artery, interlobar vessels, and arcuate vessels increased significantly. Cortical Doppler signals were lost in four animals at a mean arterial pressure of 26 mm Hg. After reinfusion of blood, and normal saline only, the RI of the interlobar vessels was significantly different from baseline readings. Ultrasound non-invasively showed changes in regional blood flow within the kidney in response to hypovolaemic shock.

Formal assessment of training of senior house officers in A&E – who, why, and how?

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Senior house officers (SHOs) in accident and emergency (A&E) departments are at the metaphorical front door of the hospital, assessing and caring for the acutely ill patients presenting to hospital. The majority of their clinical practice is independent. Consequently it is of the utmost importance to reassure the responsible consultant that formal training in A&E medicine and assessment of that training occur. Assessment of clinical competence is acknowledged to be difficult. We introduced an integrated assessment package into two large A&E departments to assess the clinical skills and knowledge of SHOs in A&E. This package included an objective structured clinical examination (OSCE), an MCQ paper, data interpretation, and a structured interview with the responsible consultant. There was a statistically significant positive correlation between all components of the assessment. The package was acceptable to both SHOs and assessors and was considered to be an appropriate test of clinical skills. We feel that formal assessment of SHOs in A&E is valuable to both the trainees and the responsible consultant.

Fluid replacement during uncontrolled haemorrhage: evidence for hypotensive resuscitation and use of crystalloid

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Hypotensive resuscitation is well established in cases of ruptured aortic aneurysm. Recently similar goals of resuscitation have been proposed for patients with uncontrolled haemorrhage from torso injuries, following clinical trials. The evidence for this argument and the work leading up to it, including data from clinical trials of the MAST suit, swine haemorrhage research, and assessment of hypertonic solutions, was examined. Computer modelling of the initial 2 h of haemorrhage has allowed these and other previously non-comparable data to be assessed, and has enabled consistencies in the the speed and quantity of Starling's transcapillary refill to be quantified for the first time. Haemodilution with different fluids shows that crystalloid is not distributed between the extracellular and intravascular space according to a fixed 3:1 ratio, but that the distribution is determined by the individual's physiological state. Our work shows improved retention of these infusions in severe hypotension, and increased losses from the intravascular space in moderate hypotension and normotension; colloids have more constant distribution kinetics. We suggest that if the goal of fluid resuscitation in uncontrolled haemorrhage is to maintain essential organ perfusion and avoid normotension, then crystalloids are more likely to achieve this and could be

Treatment plan	0.9 mmol/litre level % choosing this treatment	1.1 mmol/litre level % choosing this treatment
No treatment	48.1	31.8
Activated charcoal	18.5	9.1
Repeat blood level	7.4	18.2
IV N-acetylcysteine	25.1	40.9

considered as partly self regulating volume expanders. While uncertainty remains over the ideal goal of resuscitation under these conditions, the early use of colloids could be harmful by increasing red cell and clotting factor washout, and preventing clot stabilisation.

Analysis of the care of patients with fractured neck of femur at 30 British hospitals: does timeliness of admission and treatment affect outcome?

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In 1989 the Royal College of Physicians (RCP) recommended that hip fracture patients spend no more than 1 h in accident and emergency (A&E) departments and receive operative treatment within 24 h of admission. This study assesses whether the RCP guidelines are being followed nationally and examines the relation between early admission/treatment and outcome. The Clinical Standard Advisory Group studied urgent and emergency admissions to 30 hospitals throughout Great Britain for one week in 1993. Information on 129 patients with hip fractures is presented here. The 99 female and 30 male patients had an average age of 84 years (range 69–98 years). The likelihood of death was three times greater for males. Those under 85 were twice as likely to be at home at 29 d (relative risk (RR) = 1.78), although age had no effect on mortality (RR = 0.71).

Long delays in the A&E department suggested an association with mortality (RR = 1.76). Operation within 24 h of admission was associated with high mortality (RR = 3.84). Sixteen of the 18 "out of hours" operations occurred within the first 24 h of admission and the remaining two within 48 h. The risk of death associated with out of hours operations compared with procedures performed on routine lists was 39.5. These results suggest that RCP guidelines for the care of patients with fractured neck of femur are not being met. Risk of death was increased nearly 40-fold if patients were operated on during emergency out of hours lists, even when this meant earlier operation. This study suggests that the RCP recommendations are amended to state that hip fracture patients are placed on routine operating lists without exception and, where possible, within 24 h of admission.

Simple non-invasive assessment of cardiac output by Doppler ultrasound

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Following blood loss, heart rate shows a biphasic response, and blood pressure is well maintained until a late stage; however, cardiac output (stroke volume \times heart rate) falls progressively. Heart rate and blood pressure are therefore unsatisfactory measures for assessing blood loss, while stroke volume is most suitable. Using

ultrasound, stroke volume may be measured as the product of the systolic velocity integral of aortic blood flow (stroke distance), and aortic cross sectional area:

$$\text{Stroke volume} = \text{stroke distance} \times \text{aortic cross sectional area} \quad (1)$$

Stroke volume is normalised for variation of body size by dividing by body surface area to give stroke index:

$$\text{Stroke volume/body surface area} = \text{stroke index} \quad (2)$$

But instead of body surface area, the area of part of the body which is representative of the whole – the aortic cross sectional area – could be used for adjustment for body size. By rearrangement of equation (1):

$$\text{Stroke volume/aortic cross sectional area} = \text{stroke distance} \quad (3)$$

Stroke distance, which may be measured directly, is therefore already normalised for body size. Since it is closely related to stroke index (compare equations 2 and 3) it is possible to use stroke distance instead of stroke index as an absolute measure of cardiac output or for following serial changes. Stroke distance is physiologically meaningful, and may be measured in the emergency room using simple, portable, non-imaging equipment; the technique is quickly learned. Because it is without risk and tolerated so well, the measurement may be carried out repeatedly, and in the sickest patients; reproducibility is satisfactory. *Conclusions* – Stroke distance meets the need for a simple emergency room measure of cardiac output, and should prove helpful in the assessment and management of blood loss.