Sacred cows: milking the controversies in resuscitation

The eleven articles about resuscitation in this issue of *Hospital Medicine* are the products of a session of the joint Royal Society of Medicine, Association of Academic Health Centers and University of Maryland meeting on 20–22 September 2004 titled *Terrorism and Trauma: a transatlantic perspective*, held at the University of Maryland School of Medicine, Baltimore, USA. The remarkable thing about these papers is that they challenge some of the most basic tenents of common practice for trauma patient management.

PRIMARY RESUSCITATION; ARGUMENTS FOR AND AGAINST

Arguments are presented for not intubating critically ill or injured patients in the field, for using air not oxygen for resuscitation, maintaining low blood pressure rather than normotension, keeping trauma victims cold, not giving blood or attempting definitive surgical repair.

The supporting evidence for these approaches is intriguing because it goes against the grain of convention and the edicts of advanced trauma life support (ATLS) protocols promulgated by the American College of Surgeons. While the benefits of the protocol-based ATLS approach have clearly improved trauma patient management across the world, this re-assessment with evidence presented for and against is timely.

Many practices promoted through ATLS, such as the emergency airway and fluid management protocols, are outdated and perhaps even harmful. The pendulum of acceptable clinical practice needs to swing to the extreme, so that the middle-ground shift can be appreciated. These articles do just that.

INTUBATION

What are the surprises in these controversies? First, regarding field intubation, both Wigginton et al (2005) and Floccare and Cushman (2005) agree that training of US pre-hospital providers in field airway management techniques is inadequate. Neither Pepe nor Floccare's group, in Texas and Maryland respectively, consider use of the laryngeal mask airway (Laryngeal Mask Company LTD, Cyprus), Combitube (Kendall–Sheridan, Life Assist Inc, Rancho Cordova, USA), or the perilaryngeal airway (Cobra PLA, Engineered Medical System Inc, USA) as an alternative to intubation. Perhaps pre-hospital provider training in the use of these adjuncts would, in many patients, avoid the risks of emergency intubation, while maintaining the benefits of spontaneous respiration through an unobstructed airway.

What is needed to resolve the intubation questions are the results of a prospective randomized trial of field emergency tracheal intubation in comparison to airway adjuncts, currently underway in southeastern Australia (M Fitzgerald, personal communication, 2004).

HOT OR COLD?

The hot or cold debate centres around whether the total body or only the brain should be cooled and to what extent. What was skirted around was the clinical dilemma of when to re-warm, when to keep cool, when to institute cooling and how rapidly to cool. The Safar Resuscitation Centre approach is early, rapid and extreme cooling as proposed by Tischerman (2005). Andrews (2005) describes cooling the patient later in an in-hospital course (in the critical care unit) proposing a lesser degree of hypothermia, and localized to the brain.

The risk–benefit ratio of induced hypothermia with aortic occlusion in extreme exsanguination (as proposed by the Safar group) is advantageous. What else could buy the time necessary to find and occlude the source or sources of major haemorrhage while protecting the brain? Recent data in hypoxic neonates suggest that hypothermia can significantly improve neurological outcome, even up to 3 hours after asphyxia during birth (Gluckman, 2005). Whether independent moderate brain cooling is technically feasible for long enough to change neurological outcome remains uncertain and the mechanism of benefit of hypothermia on cell apoptotic processes is not well defined.

OXYGEN PROVISION

Surely the anxiom, 'if a little is good, a lot must be better', applies to oxygen in injured patients? Not so, says Rosenthal (2005), Oxygen should be titrated like any other drug to the dose that is required to treat the disease. If hypoxaemia (ascertained by pulse oximetry) does not occur with use of air alone, why give oxygen? He presents preliminary evidence, supported by others (Davis et al, 2004), that partial pressures of oxygen higher than 100 mmHg are harmful to neurological outcome. Dutton (2005), reaping the benefits of hindsight regarding World War I management, advocates deliberate hypotension to stop blood pressure rising before bleeding is controlled. Singer (2005) on the other hand takes the middle road, recommending that we monitor stroke volume, haematocrit and oxygen saturation and don't overdo the blood-pressure elevation.

BLOOD ADMINISTRATION

Blood administration to bleeding patients was considered, like mother-

hood and apple pie, to be good. Hess (2005) argues the case for red blood cell (RBC) transfusion by showing the safety and benefit of uncrossmatched group O RBC given in the first hour after trauma in severely injured patients. However, both Thomas (2005) and Hess agree that most trauma patients do not need blood. Thomas, arguing against blood transfusion, provides the evidence that transfusion increases the risk of development of multiorgan failure, and other non-infectious and infectious complications.

The data from Jehovah's Witness patients who refuse blood shows that mortality is no different until haemoglobin concentration decreases below 5.3 g/dl in comparison with patients given haemoglobin (Gould et al, 2002).

Shock Trauma Centre (Baltimore) data show that, among 147 patients who received more than 10 units RBC, those with an injury severity score (ISS) of 30 survived with RBC transfusion, whereas many of those with an ISS 35 or greater died despite transfusion (Como et al, 2004). Data such as these can validate the benefits of RBC given early to patients with severe trauma.

SURGERY

The need to perform bowel anastomoses, close the abdomen after surgery, or to fix a fractured bone definitively is discussed by Scalea (2005) and Mannion (2005). Scalea believes that, *in extremis*, damage control abdominal surgery is life-saving. Although the evidence is scientifically weak, the procedure is now widely used in major trauma centers. Damage control is the process of rapid evaluation, control of major vascular injuries and use of abdominal packs, fibrin bandages (mesh and fibrin glue), abdomen closure with a towel and vacuum seal to allow quantification of fluid losses. No bowel anastomoses are performed, the gastrointestinal tract is stapled closed and fixed later at a planned re-laparotomy after secondary resuscitation guided by invasive monitoring.

In his paper on orthopaedic salvage surgery, Mannion identifies the control of pelvic instability as fundamental to haemorrhage control and trauma patient resuscitation. Pelvic embolization, packing or external fixator may all be used.

Soft tissue injury and movement of bones causes detrimental mediator release resulting in multiorgan failure. This can be avoided by rapid debridement and avoidance of traction for fracture management. In many circumstances primary limb amputation with the stump left open is recommended as the best option.

CONCLUSIONS

Knowing what is best for the trauma patient in the critical minutes after injury is the priority research effort for traumatology. It should not be confined to innovations within the walls of trauma centres, but must reach back to the point of injury. Rapid non-invasive injury diagnosis, predictions of need for life-saving interventions and organ-specific injury mediator detection must occur in the field. Early detection will reduce uncertainty and maximize the resuscitation team's opportunity to reverse the processes of dying from injury.

The articles in this issue identify the need for studies and significant change from current initial resuscitation practices including reduced oxygen, blood pressure, temperature and surgery. After the bleeding is controlled and dead tissue debrided, secondary resuscitation becomes the life-saver. HM

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KEY POINTS

- Initial trauma patient hospital resuscitation practices are long overdue for reassessment. These reassessments include the need for oxygen, blood, normotension and definitive surgical repair practices.
- Field management with tracheal intubation is required in a select few patients, but in others with spontaneous respiration, airway adjuncts to allow unobstructed breathing may be better.
- Cooling the brain or total body will reduce oxygen consumption and apoptotic processes that impair neurological and other organ outcomes, but it remains unclear when to keep a trauma patient cool, institute cooling or cool rapidly, and when to rewarm.
- Keeping oxygen saturations 98–99%, systolic blood pressure around 100 mmHg until bleeding is controlled, limiting use of O rhesus red cells to the severely injured, and performing only essential haemorrhage control, debridement and facture fixation surgery are the new paradigms of trauma patient primary resuscitation.
- Future efforts need to collect and analyse pre-hospital non-invasive data, proteomic, genomic, organ-specific and systemic injury mediator release, to allow rapid injury diagnosis, improved field triage and trauma centre preparedness.