The consultant in trauma resuscitation and anaesthesia

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In the UK, major trauma has a peak incidence between 16 and 20 years of age and is the leading cause of death under 40 years. It is increasingly recognized in the elderly, with patients over 65 yr accounting for a third of the caseload and half of the deaths in severely injured patients. Most out-of-hospital trauma deaths are related to airway and bleeding,1 both areas of expertise for anaesthetists. Anaesthetists are also key providers of care in head injury, the leading cause of death within hospital. It is surprising that there are so few consultant anaesthetic posts with specific responsibility for major trauma care. Anaesthetists still have to travel abroad to gain concentrated experience in this field, undertaking recognized trauma fellowships or working within the armed forces in areas of conflict.

Effective trauma networks provide a seamless transition from the pre-hospital to the rehabilitation phase, using validated indicators to track performance.1 Robust evidence from Victoria State, Australia, indicates that integrated, centralized care increases survival and reduces the overall burden to society. The improvements have been attributed to better pre-hospital care and the use of damage control resuscitation (DCR).2

The UK’s poor performance has been highlighted repeatedly in the last 20 years by organizations such as the Royal College of Surgeons of England,3,4 the National Confidential Enquiry on Patient Outcomes and Death (NCEPOD), and the National Audit Office.5 Consultant involvement in major trauma cases has often been delayed or absent. Major trauma mortality in the UK has lagged behind that in the USA. With the formal institution of major trauma networks in England in 2012, there is an opportunity to catch up and excel.

Historical development of trauma anaesthesia

Ever since anaesthesia emerged as a distinct specialty, anaesthetists have continued to specialize and diversify. Many have developed an interest in acute trauma care. Anaesthetists played a key role in the Birmingham Accident Hospital, which opened in 1941 and was widely regarded as the forerunner of modern major trauma centres. The International Trauma Anesthesia and Critical Care Society was formed in 1988 in Baltimore, where fellowships in trauma anaesthesia have attracted British anaesthetists ever since. At the same time, anaesthetists made up a quarter of the multidisciplinary trauma team leaders (TTLs) at the largest major trauma centre in Canada in Toronto. In 1991, anaesthetists and emergency physicians (EPs) in Stoke-on-Trent shared a similar TTL rota, halving major trauma mortality over the next 7 yr6 and demonstrating comparable outcomes in benchmarking studies with well-respected centres in Portland7 and Melbourne.8

Elsewhere in the UK, anaesthetists have worked voluntarily in pre-hospital care in charity-based schemes affiliated to the British Association for Immediate Care (BASICS) or in motor-sport and mountain rescue teams. The London Air Ambulance has provided funded posts for trainees from anaesthetics, emergency medicine, and surgery for many years. Other emergency air ambulances in England and Scotland now use anaesthetists, though mainly in their flexible time, separate from contracted responsibilities in their base hospitals. Specialist fellowships in trauma anaesthesia have been slow to emerge, but are being developed in Birmingham, London, and Swansea.

In France, anaesthetists led the establishment of the national pre-hospital care system, the Service d’Aide Médicale Urgente (SAMU). In Germany, anaesthetists have responded to motor vehicle crashes in fast response vehicles for decades.

Anaesthesia and DCR in recent military conflicts

Recent conflicts in Iraq and Afghanistan have provided military anaesthetists with invaluable experience in the resuscitation, transfer, anaesthesia, and intensive care of combat injuries. Although the injury patterns differ from those seen in common civilian practice, the principles of care are the same. The implementation of DCR in conjunction with organizational innovation has contributed to excellent outcomes.9,10 Care has been led and delivered at a consultant level. Human factors training and improvements in logistics have allowed the resuscitation of patients with injuries previously considered...
unsurvivable. A consistent approach has been developed along the pathway from the battlefield to definitive care. Regular training exercises in the lulls between periods of intense activity have reinforced the benefits of working in close-knit teams exposed to high volumes of severe trauma. Team practice in preparation for future patients is something that civilian practice needs to find time to incorporate.

Team training courses are emerging in the NHS, often developed by military medical personnel returning to civilian practice. The Trauma Resuscitation Education and Training (TREATS) Course, developed in Swansea, is an excellent example. This embraces concepts such as horizontal resuscitation, Formula-1 pit stop logistics, and crew resource management. It is aimed at all clinicians attending trauma calls and seeks to promote core knowledge, efficiency, and safety. Another course that instils leadership skills and systematic thinking in a team setting is the European Trauma Course.

The concept of damage control surgery (DCS) was described more than 20 years ago. It was initially applied to complex, life-threatening abdominal wounds, but has since been generalized to other injuries. After initial resuscitation, rapid abbreviated surgery takes place to control bleeding and to limit soiling from faecal matter or other body fluids. The patient is taken to the ICU for ongoing physiological stabilization after surgical procedures that should be limited to less than 90 min. Emphasis is placed on avoiding the lethal triad of acidosis, hypothermia, and coagulopathy. Packs may be left in place, bowel wounds stapled temporarily without attempting anastomosis, and the abdomen left open to prevent abdominal compartment syndrome. Definitive repair may be deferred for several days.

More recently, the concept of DCS has been extended to DCR. DCR is an over-arching concept that incorporates DCS as a subset. It is a systematic approach from the point of wounding to definitive treatment to minimize blood loss, maintain tissue oxygenation, and optimize survival. Haemostatic resuscitation, including the use of tourniquets, pelvic splints, simple pressure dressings, local haemostatic dressings, permissive hypotension, and anti-fibrinolytic agents (tranexamic acid) is combined with a massive transfusion (MT) protocol that enables blood, plasma, and platelets to be administered promptly and in defined ratios (e.g. 1:1:1). DCS or, increasingly, ‘damage control radiological intervention’ takes place simultaneously with other DCR measures. CT scanning is generally required to identify injuries and guide the choice between surgical and radiological intervention. It is the imaging modality of choice in severely injured patients. It is no longer automatically contra-indicated in unstable patients, though immediate surgery will still sometimes be the most appropriate decision.

While vasopressors can be justified in some cases of spinal cord or traumatic brain injury, crystalloids, non-blood-product colloids, and vasopressors are generally avoided in DCR. Drug doses are modified in shocked or exsanguinating patients, sometimes by an order of magnitude. The use of repeated, small increments of fentanyl during permissive hypotension and of ketamine for the induction of anaesthesia is becoming standard practice, even in the presence of a head injury. Avoiding the adverse effects of hypothermia remains an obsession.

**Trauma resuscitation anaesthesia as a distinct subspecialty**

The catalyst for the development of a new role for anaesthetists in major trauma care in the UK has undoubtedly been the formal introduction of major trauma networks in England, though it may also have been influenced by the emergence of pre-hospital emergency medicine (PHEM). PHEM has been approved by the GMC as a sub-specialty in anaesthesia, emergency medicine, intensive care, and acute internal medicine. It requires 12 months full-time training over 12–24 months, starting at ST5 level or above. The Intercollegiate Board for Training in Pre-Hospital Emergency Medicine is responsible for training and assessment. The first trainees will complete the formal PHEM training programme in 2015. However, PHEM training per se will not provide high-volume trauma experience.

To justify a separate subspecialty of trauma resuscitation and anaesthesia (TRA), the training programme, and ongoing clinical practice as a consultant must provide concentrated clinical experience in the management of severely injured patients. The experience during training must be broad, including pre-hospital care, emergency department (ED) reception, inter-hospital transfer and intensive care, and also anaesthesia for emergency surgical and radiological intervention and for complex reconstructive surgery. Within the training programme, there should be an emphasis on human factors and logistic thinking. The trainee should also gain an appreciation of the importance of rehabilitation and of the impact that major trauma has on patients and their families.

A good understanding of critical care of the multiply injured patient is an essential part of TRA training, although as a consultant, the TRA specialist is unlikely to be able combine the post with intensive care medicine because of on-call incompatibilities. Nevertheless, many critically ill trauma patients need to return to the operating theatre and the TRA consultant must be able to provide seamless care.

TRA specialists should have an opportunity to continue to practice pre-hospital care as a consultant. In the future, this will require PHEM accreditation. Pre-hospital responsibility is best embedded within the job plan rather than in ad hoc, spare time sessions.

In some MTCs, TRA consultants may act as TTLs in the ED in a combined role with other specialists (e.g. EPs). However, it is unwise to have too many TTLs, as individual experience becomes diluted—if there are 500 major trauma cases per year in an MTC and 20 TTLs, each will only treat one case every 2 weeks. It is also worth reflecting on the ‘hands-off’ role of the TTL, in which practical skills should be left to others, potentially limiting practical skill maintenance.

In MTCs, the TRA should maintain a dedicated response to major trauma, rather than having simultaneous responsibility for other patients. Their presence at major trauma calls delivers unrivalled expertise for hands-on practical skills in airway and shock management, pain relief, and sedation. It makes sense...
for TRA consultants to start hands-on and then to assume overall leadership during ongoing DCR, while surgeons or interventional radiologists focus on their own hands-on tasks.

The ED resuscitation room is a portal of entry rather than a place of emergency surgical or radiological intervention: patients at high risk need to move on promptly. With the increasing sub-specialization of surgery and the engagement of multiple surgical teams, the TRA consultant is well placed to lead decision-making with the various surgeons on whether to proceed to DCS or early total care, depending on the patient’s physiological status and its trajectory.

In the UK, TRA consultant posts have been developed in the University Hospital of North Staffordshire (UHNS), the MTC serving the North West Midlands and North Wales. Currently, there are six posts with a planned expansion to a maximum of 8–10 within the next year. The optimum number represents a balance between sustainability and the maintenance of expertise. The following description shows how the TRA model of care emerged locally and helps to set a framework for future development elsewhere.

Since the 1990s, two to three consultant anaesthetists at UHNS, working on a 1-in-6 rota, have shared the TTL role with EPs. When UHNS became an MTC in 2012, it was envisaged that the system would continue, but with a limit on the total number of TTLs in order to maintain individual expertise. By this time, the number of ED seniors had already increased to 15 (with a long-term plan to provide more than 20) and they now all wanted to act as TTLs. The dilemma was addressed by separating the roles, but without abandoning the excellent working relationship between the two specialties. Far from being a compromise, this has allowed the partnership to continue in a two-consultant trauma reception team, utilizing the strengths of both specialties. The EPs act as the hands-off TTL when the patient arrives. The TRA consultants are able to deliver immediate hands-on practical skills on major trauma calls and then assume the leadership role for emergency intervention.

In addition to their role in ED resuscitation and emergency intervention in the operating theatre or interventional radiology suite, the TRAs in UHNS have dedicated time in pre-hospital care, and also providing anaesthesia for orthopaedic trauma, CEPOD, and other lists. It is important to maintain a balance between the need to maintain core anaesthetic skills and to provide sufficient time for resuscitation commitments in hospital and in the field. This is achievable with 8–10 consultants and a team job plan to cover leave.

Shared leadership in the ED is part of a wider model of sequential partnerships along the major trauma pathway at UHNS. This approach can be illustrated by a ‘trauma care triangle’ (Fig. 1). The base of the triangle represents ‘specialist intervention’ and emphasizes surgical expertise as the bedrock of major trauma care. The left side represents ‘anatomical diagnosis’ and alludes to the role played by EPs and radiologists in initial diagnosis. The remaining side represents ‘physiological control’ and acknowledges the place of TRA, intensive care specialists, and other anaesthetists along the early pathway. The centre of the triangle represents the sequence of ‘coordination’.

In the authors’ centres the TRA consultants now have the most concentrated experience of all the consultants in the
MTC. In one of these centres pre-hospital commitments are due to include a formal arrangement to cover air ambulance duties in partnership with NHS Wales and the proposed Welsh Pre-Hospital Enhanced Care Service. This new service is modelled on the UK Military Medical Emergency Response Team (MERT) and the Scottish EMRTS service. The air ambulance and rapid response vehicle will carry packed red blood cells and freeze dried plasma with the facility to warm both these fluids and the patient. Advanced tools such as video laryngoscopy, ultrasound for extended focused abdominal sonography in trauma (eFAST) and venous access, and iStat for blood gas measurement are being incorporated in the business plan. The service is due to become operational later this year.

**Conclusion**

Many anaesthetists are attracted to emergency trauma care during their training, but few opportunities yet exist in the UK for specific training leading to a dedicated consultant-level post. With the advent of major trauma networks in the UK, new possibilities are arising. A framework for a new sub-speciality of TRA is emerging. It promises to be a challenging but rewarding development. It is clear that anaesthetists have a pivotal role to play in the advancement of major trauma care. The work will be a mix of practical and leadership skills that demands a sound knowledge base and a keen understanding of human factors. It will take place in a range of different environments within and outside hospital. It will involve considerable out-of-hours working and will require an ability to assume responsibility and make critical decisions in time-limited circumstances. It will not suit all anaesthetists, but for those with an affinity for major trauma care, it will be unrivalled.

**References**

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