

Management of major trauma

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Abstract

Trauma remains one of the leading causes of mortality and morbidity in the UK, is the primary cause of mortality in the first four decades of life and has a significant impact on the economy of the nation. Despite this, many reports have detailed suboptimal care of these patients in the UK.

This article will review these reports, discuss the changes occurring in the organization of the care of major trauma and describe the anaesthetic management of this important group of patients.

Keywords Anaesthetic management; lethal triad of trauma; organization; trauma management

Major trauma reports

In recent years there have been a number of reports into trauma care and organization within England. In 2007 a National Confidential Enquiry into Patient Outcome and Death (NCEPOD) report *Trauma: Who Cares?* found a number of failings in provision of trauma care¹ with 60% of major trauma patients receiving a standard of care that was 'less than good practice'. Although there has been some criticism of this paper, it was the latest in a long line of reports showing the same issues. A number of recommendations were made in order to improve the management of the severely injured patient. These included organizational change, the need for consultant-led trauma teams, the provision of timely computed tomography (CT) scanning and recommendations on paediatric care and transfers.

The NCEPOD report was backed up by a 2010 National Audit Office (NAO) report *Major trauma care in England*,² which found the same failings, and noted that, despite the previous reports,

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Learning objectives

After reading this article you should be able to:

- discuss the key organizational changes to trauma care in the UK
- describe ways to prevent the lethal triad of trauma
- list anaesthetic priorities in the care of the major trauma patient

there had been little action taken to improve trauma care with significant variations remaining in survival rates for major trauma between hospitals. The recommendations made by the National Audit Office have resulted in the re-arrangement of trauma services in England, with the development of trauma networks, starting in London (April 2010) and rolling out to the rest of England by 2012.

Both the NCEPOD and NAO reports cover pre-hospital and hospital care for major trauma patients. However, pre-hospital care is discussed on pages 377–379 of this issue and so will not be mentioned here.

Organization of major trauma services

National and regional

In 2009 a National Clinical Director for Trauma was appointed to oversee the care of the major trauma patient, including implementation of regional trauma networks in England. In London this was implemented in April 2010, with four hospitals in the Greater London area being designated as major trauma centres (MTC). The intention is that the majority of the population will live within 45 minutes of a MTC and will be transported there directly by ambulance if severely injured. Less severely injured patients will be taken to designated trauma units (TU), which will also be involved in the stabilization of the very sick patient, should it be judged they would not get to the MTC alive. One notable paradigm shift is that the patient will be considered as belonging to the network and a 'send and call policy' will be adopted, rather than the present system of referring hospitals calling around to find beds, which leads to unnecessary delay.

Within a trauma centre

Each hospital receiving major trauma cases should have a consultant led trauma team available at all times. NCEPOD found that in 23.5% of cases where an SHO was the team leader there was inappropriate initial management, compared to 3.1% of cases where a consultant was the team leader.¹ This is likely to result in a change in working practices for consultants, with more consultant cover needed out of hours, which is when trauma is more likely to present.

Within trauma teams roles should be assigned and each member should be aware of their place in the team. The team leader should then be able to stand back and take overall control of the situation and review the 'bigger picture'. If the team leader becomes involved in specific tasks then oversight of the whole trauma may be lost. A scribe should be present to record physiological data and interventions given and the timings of both of these.

CT scanning is recommended for major trauma, where the patient is stable enough for transfer and does not require immediate, life-saving surgery for haemorrhage control. National Institute for Health and Clinical Excellence (NICE) guidelines for head injury state that a head CT should be performed within an hour of arrival at the accident and emergency (A&E) department³ and NCEPOD recommend that all required CT scans be carried out at the same time in order to minimize trips to CT. In order to reduce delays, ideally, the CT scanner should be co-located in A&E.

The trauma patient will have input from many specialties, therefore a care coordinator will be needed for each, to ensure that there is a unified approach to their management. Whilst outside the scope of this paper, fundamental to this is the co-ordination of rehabilitation services to enable the patient to return to normal living.

Clinical aspects of initial management

Airway and breathing

The trauma airway is difficult. The NCEPOD report found that one in eight patients arrive in hospital with either a completely or partially obstructed airway¹ and in 7% of the cases airway management was felt to be unsatisfactory. There is an increased incidence of difficulty maintaining the airway, and also of difficult views at laryngoscopy. Therefore the anaesthetist attending a trauma call should be senior.

On attending a trauma patient, a rapid assessment of the airway should be carried out looking for any signs of current or potential airway obstruction. High-flow oxygen should be given. If there is any indication for definitive airway protection then this should be carried out using a rapid sequence induction (RSI) technique. Even if the patient was starved at the time of the accident, they may have swallowed blood and other detritus afterwards. If cervical spine protection measures are in place then protection of the cervical spine should be continued with manual in line stabilization during intubation. One person should be assigned to carry out this procedure and nothing else until the airway is secured and the collar and blocks are replaced. The hard collar should be undone to allow mouth opening and cricoid pressure to be carried out during the rapid sequence induction.

Choice of drug for rapid sequence induction remains with the anaesthetist carrying out the procedure. Major trauma patients may be haemodynamically unstable and dose of induction agent should take this into account and be reduced as appropriate. In general however, it is safer to use a familiar drug more slowly and at a lower dose than it is to use an unfamiliar drug for the first time in a major trauma situation, whatever the perceived haemodynamic benefits may be.

Anaesthetists attending trauma calls should also be familiar with the equipment available in the emergency department, including difficult airway equipment. In recent years a number of alternative laryngoscope devices including videolaryngoscopy have become available and there is some evidence that these improve the view at laryngoscopy in difficult airways and trauma patients. However, as before, the first use of these devices should not be in a trauma situation.

When carrying out an RSI in a trauma patient it is important that all personnel involved in the procedure know their own role and the role of those around them, both during the procedure and for any complications arising. This means having a plan if

intubation is difficult or impossible and ensuring the 'can't intubate, can't ventilate' guidelines are familiar, which will usually be the use of a LMA as a rescue device and cricothyroidotomy should this fail. In the anticipated difficult airway (eg neck trauma) it is wise to have an ENT surgeon scrubbed to perform an emergency tracheostomy. As management of the team is vital, it maybe helpful to adopt a checklist approach (as many pre-hospital systems do) (Box 1 and Figure 1).

Other considerations at the time of rapid sequence induction and intubation include:

- The length of the tube, especially in burns patients where significant swelling may occur. In these patients the endotracheal tube should be uncut.
- Securing the endotracheal tube. In head injury patients the tube should be secured by tapes, to reduce the chance of venous

Great North Air Ambulance Service pre-rapid sequence induction challenge-response checklist

Pre-oxygenation taking place.....	Check
Adequate oxygen	Check
Baseline observations	Check
Cannula connected to fluid and runs easily.....	Check
Suction	
Working.....	Check
Back-up suction available.....	Check
Airway adjuncts (or escape ventilation)	
Guedel airway.....	Check
Two nasopharyngeal airways.....	Check
Ventilator or BVM connected to oxygen.....	Check
Emergency cricothyroidotomy kit.....	Check
Tape or tie (of appropriate length).....	Check
Heat and moisture exchanger (HME).....	Check
Endotracheal tube	
Size chosen.....	Check
Cuff tested.....	Check
Drugs	
Induction agent dose chosen.....x mg	Check
Suxamethonium dose chosen.....x mg	Check
Drug giver briefed	Check
Angle piece or catheter mount.....	Check
Monitoring , including ECG, NIBP, SpO ₂ ETCO ₂	Check
Stethoscope	Check
Elastic bougie chosen.....	Check
Laryngoscope blade size chosen and bulb working.....	Check
Syringe 10 ml for cuff.....	Check
In-line immobilizer briefed.....	Check
Cricoid pressure person briefed.....	Check

Box 1

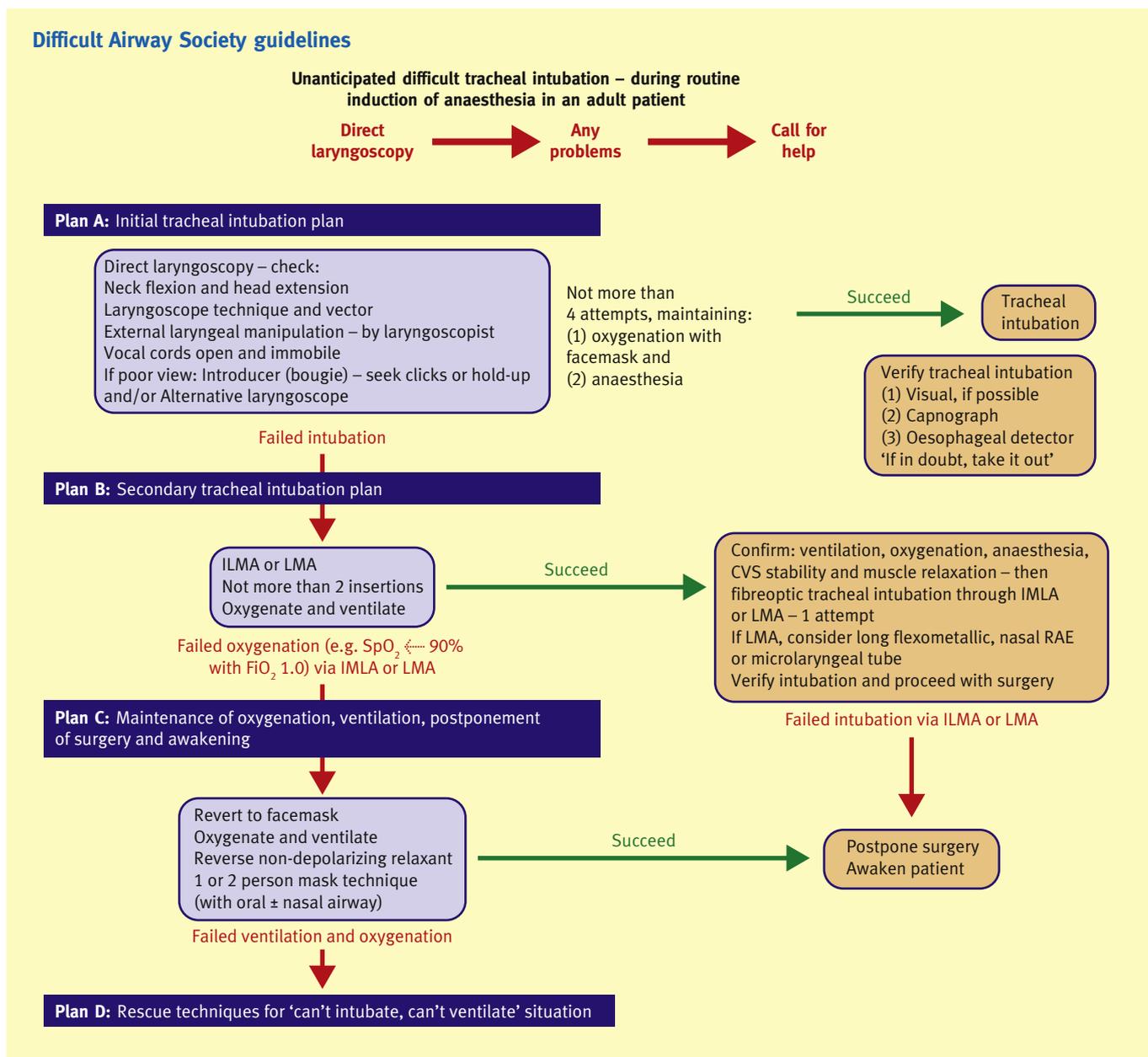


Figure 1

obstruction from ties. However in burns patients or those with significant facial injuries tapes may not stick and the endotracheal tube will need to be tied in place.

- Haemodynamic instability is likely to be worse immediately post-induction and having fluids running at the time of induction with the ability to give a rapid bolus as well may be necessary. Having inotropic or vasoconstrictor drugs ready and one person assigned to give them if required should also be considered.

- The patient will need to be ventilated post-intubation. The ventilator available in the resuscitation room should be familiar and checked prior to RSI.

Circulation

In the military environment, in the last 8 years, the use of tourniquets to control massive haemorrhage has become commonplace⁴ and this has led to the ABC approach being changed to the

CABC approach, with C being catastrophic haemorrhage control. Whilst most civilian trauma in the UK is not penetrating, it is possible that this approach to trauma will increase in the civilian environment over the next few years as uncontrolled haemorrhage is one of the leading causes of potentially preventable post-traumatic death (see *Anaesthetic Priorities in Prehospital Trauma Care* on pp 377–379 of this issue).

Massive haemorrhage due to trauma is associated with poor tissue perfusion, multi-organ dysfunction and death. Approximately one-third of trauma patients have a coagulopathy on admission and this subset of patients has a worse outcome than those with no coagulopathy. Coagulopathy is one part of the lethal triad of trauma (Figure 2), with the others being acidosis and hypothermia. All of these should be considered and appropriately managed to help prevent trauma related deaths.

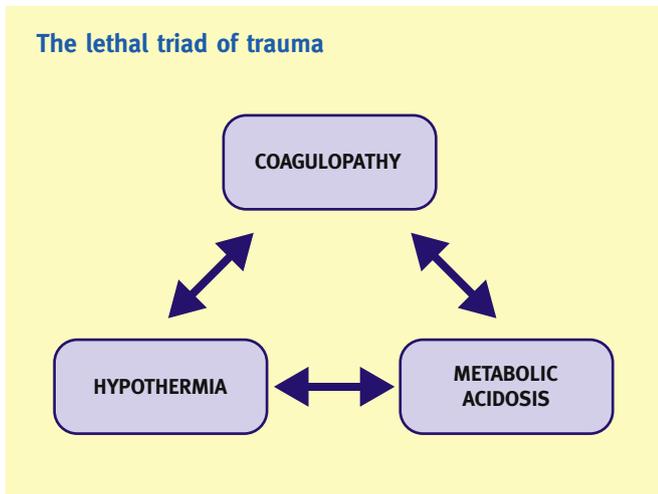


Figure 2

Recent guidelines on the management of bleeding following major trauma⁵ make recommendations on the use of near patient testing. This includes the use of focused abdominal sonography for trauma (FAST) or CT to identify free abdominal fluid and the use of near-patient testing for coagulopathy using thromboelastography (TEG) or rotational thromboelastometry (ROTEM). The use of these tests has also been shown to provide early prediction for the need for massive transfusion and to allow early correction of coagulopathy, leading to a reduction in need for blood products.

Correction of coagulopathy associated with trauma will need a range of blood products. The principle of 1:1 use of red cells and fresh frozen plasma is now widely accepted for cases of major haemorrhage. To correct trauma coagulopathy, platelets and cryoprecipitate are also likely to be needed. The correction of hypocalcaemia and the use of tranexamic acid are also now recommended in cases of massive transfusion.⁵

Hypothermia also contributes to coagulopathy of trauma and patients should have wet clothing removed as soon as possible after arrival and then be covered with warm, dry blankets. The use of warming mattresses and hot air warming devices should also be considered. Fluids used for trauma resuscitation should be warmed, especially when being given fast. Devices such as the Level 1 rapid infuser will both warm and provide pressure to drive flow. Care should be taken when using devices such as this not to over transfuse. If a rapid infusion device is being used one

member of the trauma team should be assigned to run it and keep a close record of what fluid is used and in what quantity. This information should then be fed back to the team leader.

Management of major trauma continues to develop, both from an organizational and a clinical perspective. The development of trauma networks within the UK and creation of trauma centres will change the structure of trauma management over the next few years. The development and trials of new clinical devices will hopefully allow better management and care for trauma patients within the trauma centres and the experience of trauma management from the military over the last few years may also shape the development of these services. ◆

REFERENCES

- 1 Trauma: Who cares? A report of the National Confidential Enquiry into Patient Outcome and Death; 2007.
- 2 Major trauma care in England. Report by the Comptroller and Auditor General. National Audit Office, 5 February 2010.
- 3 Head injury: triage, assessment, investigation and early management of head injury in infants, children and adults. National Institute for Health and Clinical Excellence, 2007.
- 4 Brodie S, Hodgetts TJ, Ollerton J, McLeod J, Lambert P, Mahoney P. Tourniquet use in combat trauma: UK military experience. *J R Army Med Corps* 2007; **153**: 310–3.
- 5 Rossaint R, Bouillon B, Cerny V, et al. Management of bleeding following major trauma: an updated European guideline. *Critical Care* 2010; **14**: R52.

FURTHER READING

- Bathory I, Frasca P, Kern C, Schoettker P. Evaluation of the GlideScope for tracheal intubation in patients with cervical spine immobilisation by a semi-rigid collar. *Anaesthesia* 2009; **64**: 1337–41.
- Black JM. Emergency use of the Airtraq in traumatic asphyxia. *Emerg Med J* 2007; **24**: 509–10.
- Leemann H, Lustenberger T, Tavling P, et al. The role of rotation thromboelastometry in early prediction of massive transfusion. *J Trauma Injury Infection and Critical Care* 2010; **69**: 1403–9.
- MacLeod JB, Lynn M, McKenney MG, Cohn SM, Murtha M. Early coagulopathy predicts mortality in trauma. *J Trauma* 2003; **55**: 39–44.
- Schochl H, Forster L, Woidke R, Solomon C, Voelckel W. Use of rotation thromboelastometry (ROTEM) to achieve successful treatment of polytrauma with fibrinogen concentrate and prothrombin complex concentrate. *Anaesthesia* 2010; **65**: 199–203.